Sida Evaluation 96/21

The Electricity Sector in Mozambique

Support to the Sector by Norway and Sweden

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Sida Evaluation 96/21
Commissioned by Sida, Department for Infrastructure and Economic Cooperation, ENETEL

Printed in Stockholm, Sweden
ISBN 91 586 7364 4
ISSN 1401-0402

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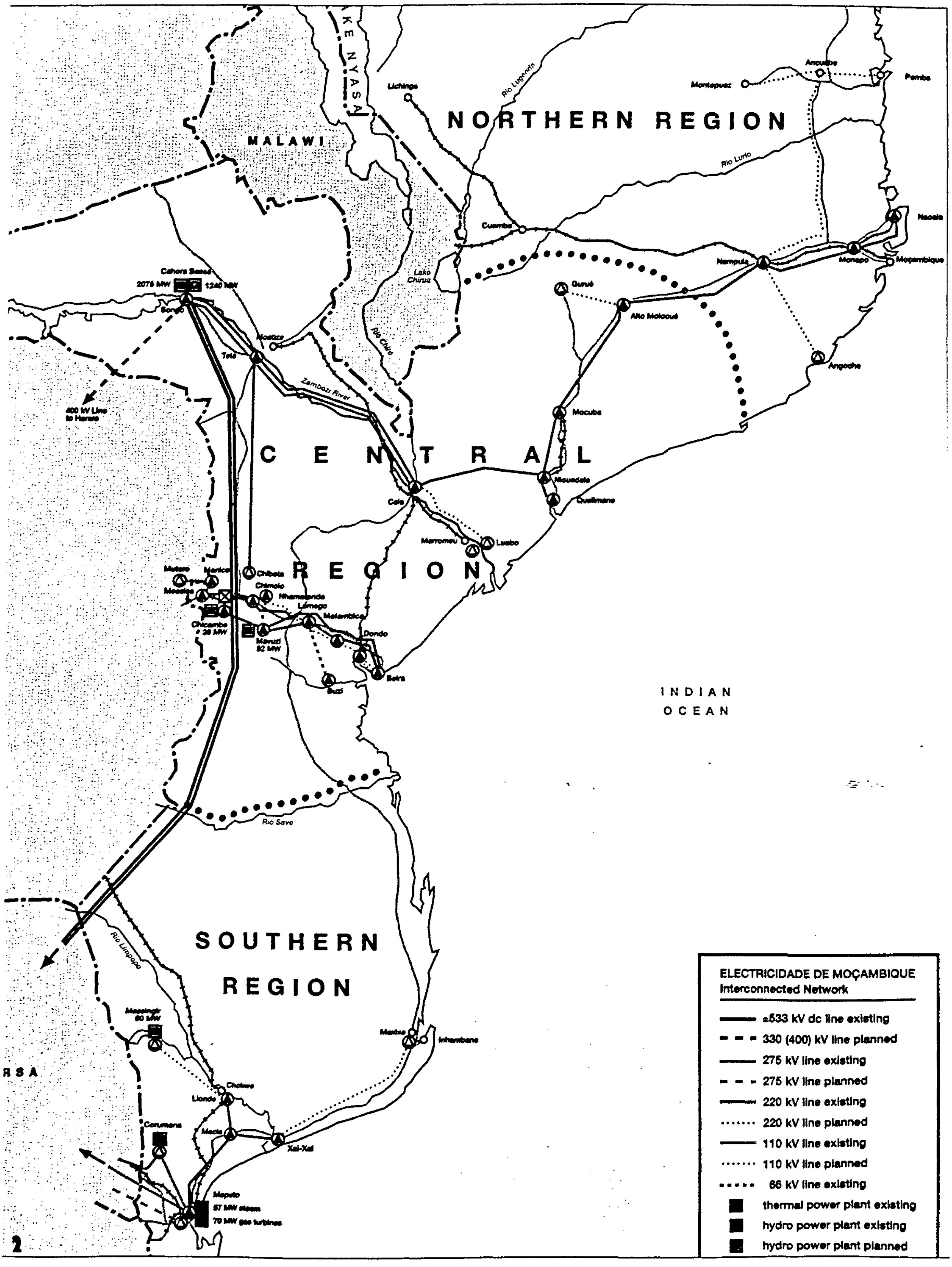

NORTHERN REGION
CENTRAL REGION
SOUTHERN REGION
MALAWI
LAKE NYASA
INDIAN OCEAN
RSA
Rio Lugenda
Rio Lurio
Zambezi River
Lake Chirua
Rio Chire
Rio Save
Rio Limpopo
Lichinga
Montepuez
Ancuabe
Pemba
Nacala
Moçambique
Monapo
Nampula
Cuamba
Gurué
Alto Molocué
Angoche
Mocuba
Nicoadala
Quelimane
Caia
Marromeu
Luabo
Cahora Bassa
2075 MW
1240 MW
Songo
Tete
400 kV Line to Harare
Mutare
Manica
Chibata
Chimoio
Nhamatanda
Lamego
Dondo
Beira
Buzi
Chicamba 38 MW
Mavuzi 52 MW
Massingir 60 MW
Chokwe
Lionde
Corumana
Macia
Xai-Xai
Maxixe
Inhambane
Maputo
57 MW steam
70 MW gas turbines
ELECTRICIDADE DE MOÇAMBIQUE
Interconnected Network
±533 kV dc line existing
330 (400) kV line planned
275 kV line existing
275 kV line planned
220 kV line existing
220 kV line planned
110 kV line existing
110 kV line planned
66 kV line existing
thermal power plant existing
hydro power plant existing
hydro power plant planned

TABLE OF CONTENT

ABBREVIATIONS AND ACRONYMS

Organisations:

AfDB	African Development Bank
BADEA	Arab Bank for Development in Africa
EDM	Electricidade de Moçambique
EDP	Electricidade de Portugal
ESCOM	Electricity Supply Commission of Malawi
Eskom	Electricity Supply Commission of South Africa
HCB	Hidroeléctrica de Cahora Bassa
NORAD	Norwegian Agency for Development Cooperation
SAPP	Southern Africa Power Pool
SEB	Swaziland Electricity Board
SHER	Sociedade Hidroeléctrica do Revué
SIDA	Swedish International Development Authority
ZESA	Zimbabwe Electricity Supply Authority
WB	World Bank

Currencies:

MT	Mozambican Metical (pl. meticais)
NOK	Norwegian Kroner
SEK	Swedish Kronor
ZAR	South African Rand

Terms for capacity, energy and voltage:

1 kW	Kilowatt = 1000 Watt (W)
1 MW	Megawatt, 1000 kW, 1 million Watt
1 kWh	Kilowatthour = 1000 watthours (Wh)
1 MWh	Megawatthour = 1000 kWh
1 GWh	Gigawatthour = 1000 MWh = 1 million kWh
1 TWh	Terawatthour = 1000 GWh = 1 million MWh = 1 billion kWh
V	Volt
kV	Kilovolt = 1000 V

Other terms:

CIS	Customer Information System
CTM	Central Térmica do Maputo
GOM	Government of Mozambique
HVAC	High-voltage Alternating Current
HVDC	High-voltage Direct Current
LCN	Linha Centro Norte
MIS	Management Information System
RSA	Republic of South Africa
s/s	Substation

EXECUTIVE SUMMARY

Description of the power sector situation

This report forms the electricity sector review prepared for NORAD (Norwegian Agency for Development Cooperation) and SIDA (Swedish International Development Authority) for the purposes of their consideration of future support to the electricity sector of Mozambique. The study was commissioned jointly by NORAD and SIDA The Norwegian consulting firm Norplan A.S was chosen to carry out the work and the consulting team included power system engineering expertise from ARKTECH AB and financial and economic expertise from Swedish Development consulting partners ab.

The national electricity enterprise "Electricidade de Moçambique" - EDM - was established in 1977 to take over all the various electric power utilities operating in Mozambique at that time. EDM was given exclusive and sole responsibility for generation, transmission and distribution of electricity in the country (regime de exclusive). The monopoly role of EDM persists until passage of the draft Law on Electricity (expected in 1995).

The draft Law on Electricity is technically well designed. Some points of substance could still be improved, but none are of critical significance. The main thrust of the Law is to open up for a diversified participation in electricity sector activities under a system of licensing, while maintaining a special position and a special responsibility for EDM. The licensing system will be managed and overseen by a National Electricity Council instructed by the Minister of Mineral Resources and Energy.

As a result of the debilitating war since the early 1980s until the peace was restored in 1992, the decline of domestic power consumption mirrored a parallel decline in economic development. The technical installations were exposed to sabotage and the main objective in this period became to maintain a reliable electricity supply to the major urban and semi-urban population centres and centres for economic activities.

EDM's financial performance has gradually deteriorated to a point where it can no longer cover its operating costs without subsidies in the form of foreign aid. The emergency and civil war related rationale for the generous flow of aid to the power sector no longer prevails. EDM must therefore ensure that revenues are increased and costs decreased to levels where the enterprise can service their present loan commitments, borrow for future investments, and provide a reasonable return on existing assets.

With this background, an institutional reform and restructuring process of the power sector is now taking place. A draft Law on Electricity is expected to pass the National Assembly in the near future, and new draft statutes for EDM have been prepared in accordance with the Law on Public Enterprises which has been in force since 1991.

The NORAD and SIDA supported programmes represent a well composed package of grant assistance which is vital in the much needed restructuring and institutional development

programme of EDM. The main activities in this support are designated Institutional Development, Training, Technical Assistance and Loss Reduction.

In this connection it is important to observe that the NORAD and SIDA programmes have been provided on a long term basis and given EDM a relatively stable and predictable basis. They may even unwittingly have contributed towards continued aid-dependence and relieved the organisation of the pressure of necessity to change. It is the Review Team's impression that the new situation with a prospect of autonomy has injected some business spirit and understanding of needs into management. The best service NORAD and SIDA can do to EDM is to direct the support so as to ensure that this process does not loose momentum.

The result of these efforts is that EDM is now on the way to becoming a self-sustained, commercially oriented enterprise, but **will not be able to achieve this without continued support** for another 2-4 years allowing for a "band of uncertainty". Basis for this assessment is given in the points i) - iii) below.

The support should be contingent upon unremitting follow-up from EDM's management of the on-going programmes for institutional development, loss reduction and tariff increases. The team considers important that the progress of the programmes and activities is focused on measurable results that should be reflected in the operation plan.

A few selected global indicators of performance demonstrate the improvement in EDM's efficiency which has taken place. The increasing **number of consumers in relationship to number of employees** is a clear indication that the training and institutional development has had a positive impact on the administrative efficiency. The comprehensive reduction of **forced supply outages and the average length of these outages** indicates better efficiency in operation and maintenance in spite of the fact that some of this may be attributed to post-war impacts. **Losses measured in energy and economic terms** is another important indicator, and here there is much room for improvement. The doubling of the collection ratio of electricity bills in Beira, which is essentially more than can be accounted to load and tariff increases, is an undisputable improvement, while the Northern and Southern regions seems to be lagging behind. **The number of expatriates in EDM**, either as employees of EDM or members of the consultants' teams, are still at a very high level representing 1.3 % of the EDM staff which is a considerable portion of the professional qualified staff. However, the development of the **professional categories at EDM** shows that the portion of local skilled staff has increased considerably, from 14.5 % in 1987 to 36 % in 1994 of the total staff which can be attributed to the training activities.

In spite of the improvements in EDM's efficiency during the recent years, there is still much room for further improvement.

In the short term up to 1998 EDM can expect to receive a threefold boost to its financial viability, namely:

i) Availability of 200 MW recall power from Cahora Bassa
The reconstruction of the Cahora Bassa HVDC line to Johannesburg is in progress, and should be completed in early 1998 barring unforeseen

circumstances. Recall power from Cahora Bassa at a price of about 1 UScents/kWh will then replace the present import.

ii) Reduction in today's losses
EDM should reasonably expect to cut today's disproportionate technical and non-technical losses by at least a third over the next three years. Since energy costs at that time will be modest, technical losses are of relatively lesser urgency. What is most important to reduce, are billing and collection losses. This requires strong follow up of the work in progress.The progress so far does not confirm that this reduction in losses is achievable over the indicated time span especially as there remain uncertainties with the implementation of the billing system and routines.

iii) Boost to tariffs
Gradual tariff increases of nearly 50 per cent are suggested in EDM's Financial Restructuring Plan, which has been approved by the Ministry. Future annual tariff increases, will probably be made by the Ministry on EDM's recommendation. As these increases are crucial for EDM's recovery, decisive action is required from the Ministry, even though such action may be politically difficult.

With the repair of the Cahora Bassa line, no more new generation capacity will be needed in Mozambique for a good many years.

EDM's projects for selling part of the recall power to Malawi and/or Swaziland are by nature business ventures which should be expected to stand on their own. If they can not, there is no reason they should be supported by development funds which could be put to better use in distribution.

Recommendations

Continued programme support to EDM for another 2-4 years
The Review Team is in general agreement with both the direction and the content of the current NORAD and SIDA programmes, and recommends continued support oriented towards structural change and efficiency improvement activities for another 2-4 years.

Improved focus on measurable results
The Team consider it important that the future progress of the programmes focuses on key activities in relation to the global objectives for EDM. Results should be measurable by specific performance parameters against pre-determined targets and time schedules. Choosing the loss reduction activities as an example, losses on not billed consumers, or losses on collection of bills are two local parameters describing activities within the Loss Reduction Project of SIDA and the Institutional Development Project of NORAD respectively. Improvements in both contribute to the reduction of administrative losses, which again should be detectable in the operating income and the annual rate of return.

Formulation of objectives in financial terms for the loss reduction activities
The loss reduction activities incorporated in the Loss Reduction Project(SIDA) and the Institutional Development Project (NORAD) should be extended and coordinated in time and

activity to obtain best possible effect. Management-, administrative-, information - and control routines as well as training activities are relevant in this context. Objectives should be reformulated in financial parameters instead of in terms of activity.

Replacing software system design with off-the-shelf systems
The decision to replace the General Ledger System by a standard off-the-shelf system should without delay be followed by a similar change to off-the-shelf system for the Customer Information and Billing System.

Phasing out extraneous activities in the Technical Assistance Project
Regarding Technical Assistance on Transmission and Distribution financed by SIDA, the Review Team recommends continued support to this project, but phasing it out over the next three years. Inputs in the form of short-term visiting specialists and resident advisers are envisaged in order to strengthen the capabilities in the fields of system protection, maintenance planning and management, and distribution planning. The project should concentrate on the core objectives for each activity and as early as possible phase out extraneous activities such as operating aircraft, managing vehicle fleet and financing consumables and spare parts.

Continued assistance to training and training thrust towards commercial operations
The Review Team recommends that the SIDA training assistance to the Training Centre Activities is continued initially on a similar level as under the present agreement, i.e. mainly in the form of support to the training management. The NORAD-funded training component is similarly recommended to be maintained to support the management training and the thrust to train personnel in the administrative and commercial operations and routines.

Continued support to commodity assistance under disciplined budget frames
The commodity assistance from NORAD, which was initiated due to special circumstances - frequent destruction and damage to the distribution system - would be very helpful also in the continuation provided it is always restricted to the amount budgeted and not burdened with additional items such as happened in 1994 with the financing of the 33 kV line to Angoche. By maintaining the discipline that this is a limited resource, this item will fill the dual function of providing EDM with a much needed pool of material for work that EDM itself can undertake, and facing EDM with a real need to prioritizing.

A INTRODUCTION

This report forms the electricity sector review prepared for NORAD (Norwegian Agency for Development Cooperation) and SIDA (Swedish International Development Authority) for the purposes of their consideration of future support to the electricity sector of Mozambique and, to provide an independent overview and assessment of the electricity sector at present (Terms of Reference, see appendix) . The study was commissioned jointly by NORAD and SIDA The Norwegian consulting firm Norplan A.S was chosen to carry out the work and the consulting team included power system engineering expertise from ARKTECH AB and financial and economic expertise from Swedish Development consulting partners ab.

The report is based on material supplied by EDM, NORAD and SIDA. Additional data and information was collected during a field study in March 1995 when Maputo, Beira, and Corumana hydropower station were visited by Bo Andreasson, Steinar Grongstad, Vidkunn Hveding and Ralph Kårhammar (hereafter referred to as the Review Team).

Mozambique, which covers 801,000 sq. km and had a 1992 population of 16.6 million[1], remained a Portuguese colony until 1975. During colonial times Mozambique's economy was based on essentially three types of activities, namely to supply a large part of the labour for the mining industry in South Africa, to provide Portugal's industry with mainly agricultural raw materials and, finally, to serve as the transit area for the mineral and other products produced in South Africa and Rhodesia.

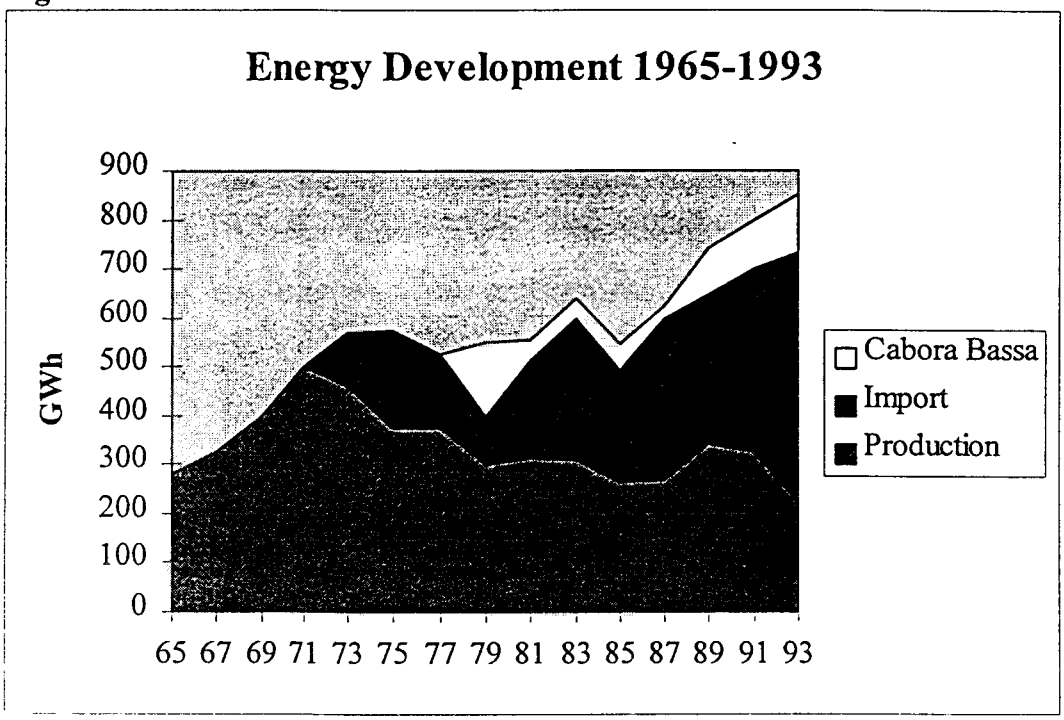
There was little industrial development in Mozambique prior to the 1960s when fiscal and other policies, introduced by the government of Portugal, led to a rapid expansion of the European population and of import substituting industries that were concentrated to a few urban centres. The new policies also encouraged foreign investments and Mozambique, as a result, entered the 70s with a relatively modern and diversified industrial structure, although highly import dependent. Electric power production almost tripled during the 60s to reach a peak of 550 GWh in 1972 when the struggle for independence started affecting the economy. Thereafter it started declining and the gap was filled mainly by imports, but eventually also by deliveries from Cabora Bassa chiefly to northern Mozambique after Linha Centro Norte (LCN) came into operation.

At the time of independence Mozambique's international currency reserves were extremely low. The Mozambican share of the power from the Cahora Bassa hydropower plant, would therefore make possible for the country to supply its industry with power without incurring major foreign exchange costs. It was an important part of a strategy aiming at not only political, but also economic independence. The civil war, however, which started only a few years after the independence, shattered those plans, and the wheeling of power from Cahora Bassa to the South of Mozambique became impossible when sabotage put the DC link permanently out of operation in 1984. Instead of playing the catalytic role as it was hoped, energy became an economic drain as domestic production declined and costly imports had to replace the cheap power from Cahora Bassa. Domestic production based on local thermal plants, had to be maintained in areas periodically isolated from the grid due to sabotage, or in

[1]Anuário Estatístico 1992.Direcção Nacional de Estatística.

areas not accessible with new lines due to the security situation. This increased the country's dependence on imports of fuel and exacerbated the foreign exchange shortage. The graph shown below illustrates the continuous decline of domestic production and the increased dependence on imports from South Africa.

Figure A



The decline of domestic power consumption mirrored a parallel decline in economic development, also a result of the debilitating civil war which ravaged large areas of the country-side and precluded industrial and agricultural production, as a result of continuous attacks on domestic land transportation. By the mid 1980s the economy was characterised by severe shortages of virtually all imported goods, the closure of a large part of the import substituting industries, an entirely artificial exchange rate and extensive foreign aid dependence. A gradual change in policies towards the end of the decade caused a modest resurgence in growth which was followed by a decline in the early 1990s as a structural adjustment programme with market-oriented policies coincided with a severe drought. The resulting decline in growth in combination with a population growth rate of 2.5 per cent per year led to a drastic decline in GNP per capita of about 15 per cent for the entire period. The decline in GNP also reflects a drastic fall in industrial output which, by 1994, was less than 50 per cent of its 1981 level. The table below shows the economic development in the period 1987 to 1992.

Table 1.1: Selected macro economic aggregates[2]

	1987	1988	1989	1990	1991	1992
Real GNP growth (%)	1.9	2.8	2.7	-1.3	0.0	-5.0
Real GNP growth per capita (%)	-0.7	0.2	0.1	-3.9	-2.6	-7.6
Currency depreciation (%)	616	83	41	25	54	69

[2] Anuário Estatístico 1992

The peace process, which started in 1992 had led to a slow-down in hostilities by 1993. After a cease fire and a peace accord the process eventually led to multi-party elections in October 1994 and was followed by the formulation of a National Reconstruction Plan. Its main target lies on refugees and emergency rehabilitation works.

The economic decline led to a rapid increase in aid dependence. Aid not only filled the external trade balance gap but it also compensated for the short-fall in domestic production of foodstuffs and other necessities. Several donor countries in addition, provide grant funds to cover part of the states current account deficit. By 1994 foreign aid accounted for approximately 60 per cent of GNP, a situation which cannot be sustained for very long. Hence it is critically important for the Mozambican economy to grow by increasing production, productivity and exports. Mozambique has a diverse endowment of mainly unexploited energy resources and the economy might in the long term receive an important boost from exports and other income from the utilisation of hydropower resources in the Zambeze Basin in particular depending on regional demand, availability of risk capital, etc.

B THE CURRENT SITUATION

1 The Electricity Sector in a National Perspective

1.1 Sector Organisation

The structure of Government organization in the electricity sector reflects a functional separation in three levels.

- the political level (the Ministry)
- the government agency level
- the operative level

1.1.1. The Ministry

The Ministry responsible for the electricity sector was until recently the Ministry of Industry and Energy. In the Government reorganization after the elections of 1994, energy was transferred to the Ministry of Mineral Resources which was already responsible for coal and hydrocarbons.

The new "Ministry of Mineral Resources and Energy" thus carries the responsibility for the whole energy sector.

1.1.2. Government agencies

A "National Directorate of Energy" was established in 1976 as a department in the Ministry of Industry and Commerce, and was apparently reestablished in 1985 in the then Ministry of Industry and Energy. The functions of the Directorate focus on the development and implementation of an integrated energy policy, including coordination of the activities of autonomous institutions responsible to the Ministry.

The Directorate currently has only a small staff of three professionals, and, apparently due to the "crisis management" role of EDM in the electricity sector, it has so far played only a modest role. The reorientation of the Ministry and the autonomous, commercial role of EDM give reason to expect that the role of the Directorate will expand in the future.

The draft Law on Electricity shortly to be presented to the National Assembly provides for the establishment of a "National Electricity Council" to act in the role of independent regulator for the electricity sector, on the basis of policy instructions from the Minister. The Council will establish regulations grant licenses (concessions), approve tariffs, establish control on safety and on conduct of licensees, etc.

1.1.3. The operative level, EDM

The national electricity enterprise "Electricidade de Mocambique" - EDM - was established in 1977 to take over the various then existing electric power utilities and to take responsibility

for generation, transmission and distribution of electricity in the country "in exclusivity" (regime de exclusive). The monopoly role of EDM has persisted and persists until passage of the draft Law on Electricity" (below) which opens access for others, in principle, under a system of licensing. There is little likelihood however for any significant activity of others (generation, transmission and distribution in the country) in the near future. The basis for this assessment is; i) little private long-term investment capital in the country; ii) weak financial position of the provinces, and; iii) foreign investors' interest to invest depends on guaranteed sale of produced electricity to EDM.

A special case is the Cahora Bassa power company: The "Hidroeléctrica de Cahora Bassa, SARL" - incorporated in Songo as a Mozambican company, with Portuguese state-owned or state-controlled majority participation - owns and operates the Cahora Bassa power station in the Zambezi River and the portion of the HVDC transmission line to Johannesburg that runs on Mozambican territory. The power station was designed exclusively for export to South Africa. Of the 5 generators of 415 MW each, one is intended to be held in reserve, while the capacity of the others is exported on contract to Eskom, except for 200 MW reserved for sale to EDM ("recall power").

1.2 Development Objectives

The National Reconstruction Plan of 1993 makes no explicit reference to electrification, notwithstanding its vital importance for social as well as economic development.

The election manifesto i 1994, of the governing party Frelimo, sets out however, some specific objectives for the energy sector:

a) Reconstruction of the HVDC line between Cahora Bassa and Apollo S/S in South Africa
b) Urgent rehabilitation of other energy infrastructure
c) Continued strengthening of the national grid to supply provincial capitals and urban centres
d) Reduce gradually the use of firewood in urban zones to avoid degradation of the environment, and to undertake efforts towards electrification of an additional 35,000 households in urban and periurban zones
e) Undertake efforts towards substitution of imported fuels by indigenous energy sources

The draft Law of Energy [15] sets out the objectives of the energy sector in article 4 as follows (quotation):

a) to bring out the value of existing resources and contribute to the economic and social development process of the country and of the region;
b) to extend the electrical energy network to the entire national territory, taking into account the possibilities and resources available;
c) to assure the supply of electrical energy of quality and under competitive terms to consumers;

d) to improve the quality of life, guaranteeing the ecological balance and the conservation and preservation of the environment

e) to guarantee the participation of the public and private sectors;

Article 4 of the draft decree by the Cabinet [14] on transformation of EDM to a Public Enterprise state that EDM has, as its main objective, the establishment and operation of the public service for the production, transport, distribution and marketing of electrical energy in Mozambique, aiming at the promotion and satisfaction of the demands of the social and economic development of the community. Article 4 of the draft statutes [13] sets out in detail the objectives of the public service entrusted to EDM.

1.3 Significance of Electricity Supply

Despite some anomalies, the link between energy demand and GDP is well established. Energy consumption per capita rises very rapidly when standard of living rises, especially when there is any money available in the households beyond that needed for the absolutely basic needs of subsistence. Electricity is a vital prerequisite in any modern economy. The availability of a reliable power supply at reasonable cost is important for economic growth and development.

The development of Mozambique's hydroelectric resources is a key component of the country's development strategy. The efficient development of the country's cheap hydroelectric resources, in particular in the Zambezi Basin, can contribute not only to meeting its internal power needs, but through developing a surplus trade balance in conventional energy, mobilizing resources to address Mozambique's development needs.

However, the short-term critical issues regarding the electricity infrastructure in Mozambique today, is rehabilitation of major assets after extensive destruction during the war, and the increase of the sector efficiency by restructuring and commercialization. Experience in general over the last decade has demonstrated that it is virtually impossible to improve performance without undertaking reform. Underpricing of electricity, coupled with weak institutional capacity, have frustrated the achievement of Mozambique's power sector performance targets. Limited human and financial resources have been concentrated on maintaining a certain level of supply and reliability in spite of sabotage as well as importing power to replace inaccessible resources in Cahora Bassa.

Major investments made such as Cahora Bassa Hydopower Plant and Linha Centro Norte, have been underexploited for many years. At the same time less than 6 % of the population has access to electricity (estimated from the number of household consumers and the number of households, see also chapter 2.2). The lack of electricity is a barrier when it comes to income generating activities requiring electrical motors, welding equipment etc. Electricity has normally also positive effects on social life and education (availability of lighting), on health (keeping vaccines fresh, conditions at hospitals and clinics), and on environment especially around urban areas where the demand on woodfuel may exceed an acceptable level of protection of soil.

1.4 Legal Framework

By the Law Decree no. 38/77 of August 1977, EDM was established and given sole responsibility for generation, transmission and distribution of electricity in the country. Under the decree the existing electricity services at a national level and in a number of districts and municipalities were taken over by EDM.

The organisation and functioning of EDM, but not its objective and its monopoly position, was affected by the Law no. 2/81 on State Enterprises., with no major change however in the way EDM would operate.

The Law no. 17/91 on Public Enterprises calls for further changes in the status and the organisational principles of EDM as an enterprise.

A draft "Law on Electricity" has been prepared by a task force appointed by the Ministry of Industry and Energy in cooperation with EDM, and is expected to be presented to the newly elected National Assembly by the Minister of Mineral Resources and Energy.

The draft Law appears to be technically well designed. The main thrust of the Law is to open up for a diversified participation in electricity sector activities (generation, transmission, distribution) under a system of licensing, while maintaining a special position and a special responsibility for EDM.

For instance, in the case of an application for a license, EDM will have first refusal right to carry out the proposed activity if EDM can provide the same service on more favourable terms for the consumer.

Some points of substance could still be improved in the draft Law, but none are of critical significance. Among these are:

- Ideally, EDM should also be subjected to the general licensing system (license of concession), so as to be governed by the same rules. As far as EDM is exempted from the requirements of a license, it is not clear to which extent the regulatory and control provisions of the Law will apply to EDM (for instance in the case of tariff control).

- The National Electricity Council should have fewer members. The large number appears to have resulted from an excessive emphasis on interest representation.

The licensing system will be managed and overseen by a National Electricity Council instructed by the Minister. The proposed role of the Council is specified in Article 11 of the draft Law. The specification (points a - o) comprises the typical normal functions given to a Regulator.

Important prerequisites for a successful financial recovery of EDM are the establishment of the Energy Law and the statutes of EDM to provide a stable and rational basis for the utility operation and clarification on the issue of government equity in EDM.

1.5 Tariffs

Studies have been undertaken (1991) at EDM to ascertain which level of tariffs would be necessary to ensure the commercial viability of the enterprise in the near future. The study, designated Financial Restructuring Study was carried out in 1991 with support from the World Bank and executed with professional assistance from Coopers & Lybrand. On basis of the recommendations made, EDM proposed a new tariff structure in January 1992 which was approved by the Government.

The conclusions also indicated that a gradual increase to an average level of 11 cents USD per kWh would be required by 1998. As this appears to be above what could be the affordability level and as such politically unacceptable, an agreement seems to have been reached in principle, on a gradual increase from the present level of 5 cents to 9.5 cents by 1998.

The new tariff structure introduced uniform tariffs across the country, and provisions are made to eliminate cross-subsidization by the larger users (MV/HV) in favour of household consumers.

Apparently, it still remains to assess major aspects of the tariff system related to structure, types and level, which has to be addressed in further studies of the electricity tariffs as indicated by an ESMAP study of Mozambique in 1993.

It is not quite clear who will formally decide the tariffs under the new legal regime. In the draft Statutes, the EDM Board of Directors is empowered only "to propose tariffs". Under the draft Law on Electricity, the tariffs of licencees shall have to be approved by the National Electricity Council, but then EDM is not required to have a licence. It thus seems that in the end, the tariffs of EDM will be decided by the Minister on recommendation from the Board of EDM.

This will be a crucial decision for the commercial viability of EDM and, as increases will most likely be made on an year-to-year basis, it will attract considerable political attention.

2 Present Electricity Supply

2.1 Cabora Bassa

The "Hidroeléctrica de Cahora Bassa, SARL" or HCB (Portuguese and South African investors) started construction of the large hydropower station and dam on the Zambeze river in 1994. HCB was granted a "contract of concession" in 1975 by the Transitional Government of Mozambique for the construction and operation of the power plant and the associated transport system. The concession cannot be withdrawn until the end of the third business year after the debts incurred for the development have been cleared, including amortization of equity capital at the discount rate of the Central Bank plus 1 percentage point. At termination, all assets will revert to the Republic of Mozambique.

The supply contracts from 1969 concerning the development, were renegotiated and new agreements signed in May, 1984. Basis for the contracts was a **Main Agreement** entered into

by the Governments of Mozambique, Portugal and South Africa, in which the Governments agreed to cooperate regarding the working of the Cahora Bassa Project. The Main Agreement shall be in force until the date of the termination of the main Supply Contract.

In the main Supply Contract, HCB agreed to supply to Eskom at the Apollo Substation, Johannesburg, a maximum of 1450 MW, later to be increased to 1470 MW. Out of this, 90 MW (corresponding to 95 MW at Cahora Bassa) would be reserved for supply to EDM, with an option for EDM to increase this in steps to 200 MW referred Cahora Bassa (Eskom has recently confirmed the obligation of 200 MW).

The supply contract shall remain in force for 32 years from its signature, except that it will be extended for the length of time it may not have been implemented because of force majeure.

In a separate contract Eskom agrees to supply to EDM, from Eskom's system at the border in the south, an amount of 73 MW, with options for EDM to request increased supply within the total of 200 MW reserved in the main Supply Contract (the balance of the 200 MW being then available in the north).

Under still another contract, EDM will pay to Eskom a transmission charge of 300,000 ZAR per month (for the transmission on the Eskom system to the border).

Eskom's undertaking to supply power in the south remains even if the supply from Cahora Bassa is interrupted, in which case EDM shall pay in accordance with the ruling Eastern Transvaal Undertaking Tariff A, plus a reduced transmission charge (Eskom has recently offered to EDM a slightly more favourable price, in accordance with the proposed pricing in the Southern African Power Pool, SAPP).

The Cahora Bassa Project, when completed would become one of the world's largest hydroelectric developments with an installation of 5 generating sets, each 415 MW totalling 2075 MW. The last set was commissioned in the late 1970s. A 1420 km dual ± 533 kV DC transmission line was constructed to transmit the power to the Apollo substation outside Johannesburg. From South Africa a 275 kV transmission line connects EDM's southern system to Eskom's main grid.

From 1981, just after a short period of regular operation, the DC line became subject to sabotage. In 1984 further efforts to repair the line were abandoned. At the cessation of hostilities, it appeared that about 50 per cent of the transmission poles were damaged and that many areas were mined. Financial arrangements and contracts to rehabilitate transmission lines are now about to be finalised and work is expected to be completed by 1998. Deliveries can then resume and Mozambique would be able to dispose of electricity corresponding to 200 MW at a cost of USD 0.01 per kWh which represents the cost of transmission only. This would allow Mozambique to replace all electricity it currently imports from South Africa and to export the remaining capacity. Potential buyers are Malawi and Swaziland. An agreement pending approval from the governments opens for technical cooperation between the major power companies in the Southern African Region, and is expected to lead to the creation of a electricity spot market (SAPP). The re-commissioning of the transmission line in 1998 , represents prospects of considerable economic proportions as to the utilisation of the 200 MW firm power:

Table 2.1:Prospective Utilisation of the 200 MW from Cahora Bassa

Item	MW
Current domestic consumption north Mozambique	20
Replacement of current imports to south Mozambique	100
Assumed increase in consumption up to 1998	25
At disposal as firm power	55
Total	200

Provided that the 220 kV line connection between Matambo s/s and the central system is in operation at that time, excessive power from Mavuzi and Chicamba power stations and the production at Corumana, eventually combined with spot market purchases to refine casual power into firm power, can be added to the excess firm power from Cahora Bassa and sold at a good contract price to Swaziland, Malawi or other potential bulk customers. It must be added as well that the earmarked power capacity from Cahora Bassa for South Africa and EDM's share constitutes the corresponding capacity of 4 generating units in operation. The fifth unit should be operational for part of the year (casual power), and this energy may also wholly or partly be refined to high-priced contract sales.

An agreement made between HCB, EDM and Eskom releases 500 MW of Eskom's share for export to Zimbabwe until year 2003. The 420 kV AC transmission line is already in the implementation stage, and commissioning is planned for late 1997.

2.2 EDM's Power System

During the last couple of years EDM has been facing a situation with rapid growth (13-14 per cent) in household deliveries and a 10 % decrease of sales to medium- and high- voltage customers (mainly industrial consumers) as a consequence of the economic recession. The number of MV/HV consumers shrank from about 880 in 1990 to 750 in 1993 due to disconnection and cease of industrial activity. The overall consumption of electricity has increased annually by 5-6 per cent. It is anticipated that the trend of 5 % annual growth will continue in the short term, doubling the present load within 2010. The system peak demands for the north, central and south regions were 22 MW, 32.9 MW and 96 MW respectively in 1993. The various load forecasts made is enveloped by a low and a high scenario resulting in a system load demand for Mozambique of 238 MW respectively 460 MW in year 2010.

The present number of customers is 146,000 an the number is increasing every year by 4,000 to 5,000. The WB (World Bank) and BADEA (Arab Bank for Development in Africa) financed customer connection programmes will add to the annual increase. Table 2.2 shows the growth in customers in recent years and table 2.3 shows number of customers distributed over the 3 regions for 1993 and corresponding billed consumption is shown in tables 2.4 and 2.5.

Table 2.2: Increase in no. of consumers since 1987

Year	1987	1989	1991	1993
No. of consumers	106,228	116,062	127,260	136,328

Table 2.3: No. of consumers distributed on tariffs and regions 1993

Region\ tariff	MV/HT	Domestic	General	Total
North	99	31,927	4396	36,423
Central	287	12,980	2970	16,237
South	360	70,165	13,143	83,668

Table 2.4: Total billed consumption (MWh/year) distributed on tariffs and regions 1993

Region\ tariff	MV/HT	Domestic	General	Total
North	34,508	40,188	22,352	97,048
Central	71,652	28,154	15,501	115,308
South	159,464	217,098	95,354	471,916

Table 2.5: Average billed consumption (kWh/year) per consumer distributed on tariffs and regions 1993

Region\ tariff	MV/HT	Domestic	General
North	348,566	1259	5085
Central	249,659	2123	5219
South	442,956	3094	7255

The total number of households in Mozambique is about 2 million and the degree of electrification hence is 5-6 %.

EDM has been able to exploit only a part of the quantity available from Cahora Bassa, supplying the LCN. In 1993 the quantity constituted 118 GWh representing a maximum demand of 22 MW or about 10 % of the Mozambican share. Table 2.6 shows the energy balance in 1993.

Table 2.6: Energy balance in 1993 by region (MWh)

Category	Region	North	Central	South
Production	Thermal	22,760	412	24,010
	Hydro	3,683	168,596	4159
	Total	**26,443**	**169,008**	**28,169**
Import/export	Import	760	126	509,979
	Export		1394	
	Net import	**760**	**-1268**	**509,979**
From Cahora Bassa		**118,091**		
Total supply		**145,294**	**167,740**	**538,148**
Consumption	Billed	**98,285**	**117,284**	**477,048**
Losses[3]		**47,009 (32%)**	**50,456 (30%)**	**61,100 (11%)**

[3]Comprise technical losses and unbilled consumption. Losses due to unpaid bills add considerably to the above figures. Measurements and calculations made during the Loss Reduction Programme (SIDA) indicate that technical losses and unbilled consumption (mainly referred to household) are 37.5 % in the Maputo area.There is no obvious explanation to this big gap between the loss figures.

The technical installations in each region consists of:

The Northern System:
The Northern System covers in principal the provinces north of Zambeze River including Tete, Zambézia, Nampula, Niassa and Cabo Delgado and districts just south of Zambeze River supplied from Caia s/s which has been out of operation since its complete destruction by sabotage in 1985.

The main network system consists of 1756 km 220 kV transmission lines and the 110 kV transmission line Nampula - Monapo - Nacala. LCN from Songo s/s via Matambo- Caia - Nicuadala (with a T-off to Quelimane) - Mocuba - Alto Molócue - Nampula - Monapo to Nacala was constructed during the nineteen eighties, and has repeatedly been exposed to sabotage. LCN was financed from Sweden and France.

The 220 kV interconnector Matambo - Chibata was constructed before independence. The line has not been in operation because the works were never completed on the 220/110 kV Chibata s/s and the short 110 kV line connection to the central system.

The isolated systems of Lichinga and Cuamba are supplied from small hydropower plants (respectively 0.6 MW and 1 MW) financed by NORAD and commissioned in 1984 (Lichinga) and 1989 (Cuamba).

Angoche has recently been connected to the system by the construction of a 33 kV sub-transmission line from Nampula (financed by NORAD under commodity assistance).

Other population concentrations like Montepuez and Pemba are isolated and relying entirely on electricity supplied by diesel generating plants until plans for constructing a line from Nampula are carried out. At Nacala and Nampula, EDM has diesel installations with a nominal capacity of 27 MW, but most of the generators are out of operation. There are also some diesel installations at Angoche, Quelimane and Mocuba.

The Central System
The Central System comprises the geographical areas of Manica and Sofala Provinces. The main system components consists of the 110 kV line between Beira and Chimoio and the two hydropower plants near Chimoio; Chicamba (38 MW), commissioned in 1968, and downstream of Chicamba, the Mavuzi (52 MW), commissioned in 1955-57. The transmission capacity is limited, but will be increased by reestablishing the parallel 110 kV line to Beira and rehabilitating the section Mavuzi - Nhamatanda. Rehabilitation works are also necessary at Mavuzi s/s. The concrete dam at Chicamba, creating a major reservoir, is leaking and early actions are needed.

In 1988 a gas turbine of 12 MW, financed by SIDA, was installed in Beira to secure the electricity supply to Beira and the economic activities related to the Beira Corridor. The system is interconnected to the Zimbabwe grid over a 110 kV, 40 MW line to the town of

Mutare on the Zimbabwe side. The EDM-ZESA contract is restricted to the exchange of casual power if required by any party.

The Southern System

The Southern System consists of the 275 kV line (85 km) from Maputo (Infulene) to the Eskom system at Komatiport. The 110 kV line to the Corumana hydropower station and from there to Komatiport, represents a secondary connection between the EDM and the Eskom systems. The Corumana hydropower station (14 MW), financed by NORAD and SIDA, was commissioned in 1992 (see section 7.4).

The creation of the Southern 110 kV network started in 1984 and interconnects now Maputo, Chokwe and Xai-Xai.

At CTM (Maputo Thermal Power Station) there are installed three gas turbines totalling 78.5 MW (effective capacity 64 MW). Since June 1993, when the new power contract agreement between EDM and Eskom came into force, the coal-fired units at CTM (dependent on import of coal) have not been in operation. The contract introduces a fixed amount of power (MW) which is payable according to a monthly booking made by EDM one month ahead. The contract has special provisions for the maximum demand and for punitive payments if the agreed quantities are exceeded. Energy is paid according to the consumption. The rates are favourable compared to the earlier contract where payment was based on monthly measured maximum demand. The contract requires a disciplined load management by EDM to avoid punitive payments.

2.3 Adequacy and Reliability

The maximum demands in 1993 in the Northern, Central and Southern systems were, according to Relatório Anual de Estatística [47]:

Table 2.7 : Maximum demand 1993:

System	Maximum demand	Compared to 1992	Power factor
Southern system	96 MW	- 4MW	0.65
Central system	32.9 MW	+ 1.4MW	0.48
Northern system	22 MW	+ 2 MW	0.64

The system "maximum demand" on the LCN, supplied by Cahora Bassa, was only 22 MW in 1993, constituting a small fraction of the transmission capacity of the 220 kV line. Consequently there is no capacity problems of the main system in the foreseeable future. The system reliability is however a major concern due to the length of the line and the fact that the major part of the load is found at the opposite end of the infeed.

A report [4] produced by EDM's Relay Protection Group provides statistics and fault analysis of the causes of disturbances during the last four years for the LCN. The statistics refer to two sections (220 kV) of the LCN totalling 553 km. During these 4 years, 203 trippings occurred.

69% were single phase faults. The preliminary conclusion of what caused these trippings was the growth of trees under the lines. A summary of the statistics is shown in table 2.8.

Table 2.8: Forced outages in LCN

Year	Number of faults	Faults per 100 km /year	Lost energy (MWh/year)	Time of unavailability of LCN (hrs)
1990	72	13.02	2862	274
1991	22	5.30	255	24
1992	73	15.84	1803	154
1993	36	7.10	764	59

Compared to the NORDEL grid average of 1 fault per 100 km and year, and the average of 1-2 faults per 100 km and year on the 220 kV line Zimbabwe-Botswana, the figures are high, but explainable due to the lack of bush clearing.

During the war in Mozambique between 1984-1992 several substations and line sections were attacked and damaged. During this time, mainly preliminary repairs were carried out to restore supply as quickly as possible. Since the peace now is restored EDM can carry out a more permanent rehabilitation programme. Bush clearing is one of the urgent corrective measures.

Compensation equipment is necessary to stabilize the system in operation. It is understood that the equipment (SVC) installed originally is damaged.

In the central main system, the generation capacity of the two hydropower stations in Chimoio can accommodate the load for many years. The interconnection of the Northern and Central systems over the 220 kV line Matambo - Chibata will provide reserve for the generation in Chimoio. However, the present transmission capacity of the 110 kV system is restricted, but will be improved considerably by rehabilitating the parallel 110 kV line which has been out of operation during the war time.

Regarding the reliability of the supply in the Central system, the operational figures of the gas station in Beira provide a good indication (table 2.9):

Table 2.9 : Operation of the 12 MW gas generating station in Beira

Year	Starts No.	Operation Hours	Generation MWh
1994	27	14	70.1
1993	26	66	421.3
1992	41	47	248.6
1991	23	45	249.6
1990	43	117	973.1
1989	95	524	4592.4

In Beira, a large number of interruptions is attributed to the poor condition of the "SHER" substation, which is being rehabilitated at the moment (SIDA support). The low power factor in the central system is illustrated in table 2.7. The varying load in the substations along the Beira Corridor results in considerable voltage variations, particularly in Beira. According to the Beira Corridor Authority the large cranes in the port of Beira have had a high frequency of trippings due to voltage variations. Implementation of adequate voltage control measures (compensation), would seem to be urgently required.

The power supply to the Southern system depends on import from Eskom. The reliability of the supply depends on the single 275 kV line Komatiport - Infulene and the Eskom system. Emergency supply can be managed by Corumana hydropower station (12 MW, normally operated as a peak-lopping station) and the gas turbine units at CTM (64 MW)

Relatório Anual de Estatística (1993) by the Operational Area of Maputo [5], provides the fault information (no. of outages and time) on the 275 kV line and the distribution network of Maputo area:

Table 2.10: Faults Statistics for the Southern System

	1990	1991	1992	1993
Transmission lines:				
Eskom line 275 kV (nos)	94	185	46	84
hrs	2001	1339	103	17
Distribution network:				
Aerial network (nos)	1956	1907	1130	944
(hrs)	6148	2189	1058	791
Cable network (nos)	753	1022	385	206
hrs	1262	863	351	127

The number and length of outages on the 275 kV is considerably reduced since 1990. There is also a general trend to improved reliability in the distribution network, possibly reflecting both improved EDM efficiency and improved standard in the distribution network. Sufficient selectivity in the protection systems to eliminate and isolate faults and also reduce the times of outages remains a problem.

3 EDM - Current Situation and Capabilities

3 1 Financial Performance of EDM

3.1.1 Current Financial Situation

EDM is technically bankrupt because the value of the foreign loans used to finance its assets has increased as a result of devaluations without a corresponding increase in the book value of assets. This leaves the enterprise with a negative capital which signifies that the liabilities exceeds the assets. However, as long as EDM generates sufficient funds for covering its expenses, this will not necessarily affect its operations. EDM has in fact operated with a negative capital for several years, but the discrepancy between asset value and liabilities has increased during the last years as a consequence of the large devaluations in those years, in

combination with a sharp increase in foreign borrowings to finance investments in generation, transmission and distribution system facilities for the purpose of restoring the damaged power system infrastructure and expanding mainly transmission capacity.

However, EDM has also experienced cash flow problems on a continuous basis mainly due to high technical and other losses, resulting from metering problems, theft, late payments or non-payments of consumer bills etc. The resulting effects of the war continue to effect the financial situation. It is mainly a need for comprehensive maintenance, repair and rehabilitation of facilities and relatively high cost of imported electric power. Another factor that has exacerbated the situation is the inadequacy of recent years tariff increases to match increased costs most of which are foreign exchange related. Although tariffs have been increased during the past three years, these increases have not matched the increases in costs.

A major improvement in the financial situation will occur from 1998 when the HVDC link from Cabora Bassa to South Africa is back in operation. This will result in a reduction in the cost of energy supplied through replacement of more costly imports from Eskom, South Africa, and present thermal power utilisation.

The financial position or EDM is summarised in the balance sheets in table 3.1.

The accounts, which are in current Metical (MT), reflect the issue related to currency depreciation. While the Metical was devalued at the rate of approximately 80 per cent in 1993, the fixed assets value remained essentially unchanged. Of the increase in the value of long-term loans, which was MT 1,060 million, 78 per cent or MT 830 million was a consequence of devaluation. During the last two years the value of the long-term loans has increased by a total of MT 1.15 billion while the assets which these loans have financed, have remained unchanged in value.

Continued devaluations, which is part of the economic policies under the structural adjustment programme currently carried out in Mozambique, would thus serve to deplete EDM of its capital unless assets are revalued. The latter is normal procedure in most economies with rapid inflation and currency depreciation. The issue of the discrepancy between loan and asset values can also be solved by converting part of the loans to capital, which would be possible since some are grants to Mozambique which have been recorded as loans in the books of EDM. This is further discussed below under Financial Restructuring.

Table 3.1 Balance Sheet (Billion Meticais)

ASSETS	Dec 31, 1992	Dec 31, 1993
Current assets		
Cash and bank accounts	12.3	20.0
Accounts receivable	24.7	88.7
Inventories	21.4	49.8
Other current assets	67.5	72.8
	125.9	231.3
Fixed Assets		
Power generation	121.0	109.3
Power transmission	279.1	387.5
Power distribution	27.3	27.5
Civil works and other assets	22.4	27.4
Gross fixed assets	449.8	551.7
Less accumulated depreciation	-47.9	-80.6
Net fixed assets	401.9	471.1
Work in progress	152.0	133.1
TOTAL ASSETS	679.8	835.5
LIABILITIES AND OWNERS´ INTEREST		
Current liabilities		
Accounts payable	38.8	100.3
Other liabilities	15.1	20.8
Total current liabilities	53.9	121.1
Long-term loans	1274.8	2334.4
Owners' Interest		
Initial capital	2.2	2.2
Investment reserve[4]	134.0	168.0
Accumulated losses	-379.1	-785.0
Loss for the year	-405.9	-1005.4
	-648.8	-1620.0
LIABILITIES AND OWNERS INTEREST	679.8	835.5

Current assets, on the other hand, increased at a rate that surpassed that of currency depreciation, i.e. by more than 80 per cent. This increase illustrates another problem facing EDM, namely that of inadequate attention to metering, billing and collection. The increase in current assets is principally due to a 350 per cent increase in receivables which by the end of 1993 had reached a level corresponding to almost 50 per cent of sales revenue. Receivables had, in other words, increased from 20 per cent of sales corresponding to a collection period of 2.4 months to 50 per cent or 6 months collection period. The dominant part is with respect to private subscribers which, by the end of 1993, owed EDM a total of MT 86.6 billion.

The extra capital tied up by EDM on account of this extension of credits to its customers amounted to MT 55 billion or USD 15 million. Of the total increase in current assets (MT 105 billion) between 1992 and 1993 more than half, or MT 61.5 billion, was financed by way

[4]Donations and Government subventions for investment purposes

of increased accounts payable, mainly payments for imported electricity. The amount due to the South African power supplier Eskom increased from MT 18 billion in 1992 to MT 55 billion in 1993, a part of which, however, reflects devaluation. The rest was financed with increased long-term loans.

3.1.2 Current Operating Results

The Profit and Loss Statements for the same years, which are contained in the table below, show that sales increased by 36.6 per cent in nominal terms. In constant prices this corresponded to a decline in the order of 24 per cent. Operating costs increased at the rate of 52 per cent in nominal terms with the consequence that the real operating result declined substantially. In order to maintain the value of its operating result EDM should have generated a surplus of MT 55 billion as compared to the result of MT 27.9 billion.

Table 3.2: Profit and Loss Statement (MT billion)

Item	1992	1993
Sales revenue	121.2	165.6
Imported power	-39.5	-60.7
Cost of Cabora Bassa power	-0.6	-5.5
Cost of domestic power generation	-17.4	-19.8
Staff cost	-14.5	-23.7
Other operating and administrative costs	-18.4	-28.0
Operating result	30.8	27.9
Depreciation	-33.9	-52.8
Interest and other financial costs	-80.8	-150.0
Result after depreciation and financial costs	-83.9	-174.9
Exchange rate differences	-322.0	-830.5
Net loss	-405.9	-1005.4
Cash flow (result after depreciation and financial costs plus depreciation)	-50.0	-122.7

EDM's 1992 and 1993 sales revenue was respectively 678 and 703 GWh while production was 881 and 829 GWh. The difference[5] were losses of technical nature (mainly transmission losses) but also losses because of tampering with meters, theft and possibly fraud and corruption. The losses, which are discussed more in detail in Chapter 4, would thus appear to range between 20 and 30 per cent, corresponding in value to around MT 36 billion in 1993 and MT 30 billion. All but some 5 to 8 per cent of those losses should be recoverable and a program to achieve this has been initiated.

The 1993 sales price of power corresponded to around 6.5 UScents/kWh at the exchange rate that prevailed at the end of the year. If, as is normal, distribution cost are assumed to correspond to about one third of the value and transmission costs to 0.5 - 1.0 UScents/kWh the production value of power would equal 4 - 4.5 UScents/kWh which is likely to be

[5] Excepting energy for street lighting which is not billed.

considerably below the marginal cost of production also in very large generating systems[6]. This implies that new generating capacity would likely not be economically and financially viable at the price that prevails in Mozambique at present.

The operating and administrative costs comprise mainly those of electricity imported from South Africa for Maputo and the southern region of Mozambique. The total for this item increased significantly between 1992 and 1993 as South African electricity replaced power previously produced by a coal fired plant in Maputo, which was closed down in early 1993 following a renegotiation of the cost of South African deliveries (see Figure A). The renegotiated agreement with South African Eskom provides for an average cost of equivalent 2.7 UScents/kWh whereas the cost of the electricity delivered by Hidroelectrica de Cabora Bassa (HCB) amounts to 0.7 UScents/kWh. The latter is payable in Meticais whereas the Eskom deliveries are payable in convertible currency.

Depreciation has been charged at the annual rate of approximately 10 per cent of the book value. Although the economic life of the assets is likely to exceed 10 years the provision for depreciation is nevertheless likely to understate the real cost of replacement of assets, since replacement values would be significantly higher than the book values used. An asset revaluation project is now about to start. The project is financed by NDF (Nordic Development Fund).

Financial costs, chiefly interest, increased at the rate of devaluation between 1992 and 1993. The average interest rate payable on the debt corresponded to 6.4 per cent for both 1993 and 1992. There are two types of loans, those which constitute a grant to the State which have been onlent to EDM at rates of interest varying between 4 and 8 per cent and those which are repayable for which EDM is liable to reimburse the Ministry of Finance the actual amount of interest and repayments. In case of the latter loans the interest varies between 2 and 7 per cent. Virtually all loans have long grace periods of between five and ten years. A list of all loans is included in section 3.3 (table 3.4).

Even though the debt service is low, given the concessionary nature of many loans, EDM has only been able to honour a small fraction of its capital cost obligations. The cash flow deficit corresponded to almost 80 per cent of debt service in 1993, up from 60 per cent in 1992.

3.1.3 Contribution towards EDM's Recurrent Expenditures

EDM's annual reports do not include any of the aid used to support EDM's recurrent expenditures. This aid, which has been provided mainly by Norway and Sweden, has been substantial. It comprises essentially three types of support referred to as Commodity Assistance, Institutional Development and Training, Studies, etc. The latter category would include the support granted by Sweden which, in addition, has provided funds for rehabilitation of substations in the power system. Table 3.3 shows the total amount of Scandinavian support according to data provided by NORAD and SIDA respectively (see also chapter 5):

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[6]The World Bank and other multi-lateral banks typically use border prices for electric power in the order of USc 7 - 9 UScents/kWh to reflect the marginal cost of production in large systems.

Table 3.3 NORAD and SIDA support in current programme period[7]

	Unit	1993	1994	1995	1996	Total
NORAD [8]	NOK million	66.7	85.3	49.4	12.6	214.0
SIDA[9]	SEK million	15.9	21.1	45.0	-	82.0

The value of the Norwegian and Swedish support expressed in Meticais or US dollars depends on the rate of exchange at the date of disbursement. Data on this has proven difficult to extract from the records. However, using the average exchange rate that prevailed during 1993, the current account support can be estimated to have corresponded to approximately USD 12 to 13 million or MT 45 billion. This represents a volume of support that is quite substantial in relation to EDM's sales revenue and other cost of operation. Without this level of support EDM would have shown an operating loss for 1993 and possibly only a break even operating result for 1992. In 1993 and particularly in 1994 the level of Norwegian support increased compared to the tentative budget of the agreement, whereas that of SIDA remained constant.

In the audit report concerning the annual accounts of 1993, the auditors express criticism of the internal controls of EDM[10]. This led to the creation, in 1994, of a new department within EDM for internal auditing. This review has identified some inconsistencies with respect to the accounts, which may be eliminated in the future with better procedures for internal auditing. These inconsistencies concern mainly depreciation charges and do not effect the conclusions as regards to operations.

3.2 Financial Restructuring Process

In order to transform EDM into a limited liability company, its capital base would have to be restored. This is the main focus of the Financial Recovery Plan prepared by Norconsult on

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[7] NORAD and SIDA's support to the transmission line Cahora Bassa during the period is not included in the above figures.

[8] Actual spending 1993 and 1994, revised budget 1995 and 1996 for the programme period 1993-96.

[9] Budget for the programme period 1993-95.

[10] The auditors of EDM, Ernst & Young, express severe criticism of the internal control systems and they conclude that significant problems exist in non-existent confirmation on bank accounts and consumers' accounts, insufficient stock taking, absence of overall physical inventory, no direct confirmation on bank loans. They state that "we are unable to give and must therefore refrain from giving an opinion on the attached financial statements of Electricidade de Moçambique, E.E." This means that the financial situation of EDM may not be fully and correctly reflected in the figures in table 3.1, but it serves as an indicator of the development over the last few years. The audit report is dated December 9, 1994 and it concludes with a positive remark on the performance in 1994: "Without affecting the above conclusion, we wish to stress the fact that in 1994 the company has taken steps to eliminate some of the situations that limited the scope of our work and led to us being unable to give an opinion on the financial statements."

EDM's behalf and approved by the Ministry of Finance. The Plan consists of a number of steps that, in combination, are intended to lead EDM to a profitable and sustainable financial situation. Major elements of the plan are:

- new organisational form for EDM; that of a limited liability or joint stock company
- a new decentralised and target-oriented management structure
- a new tariff structure with indexing
- improvement of the accounting system including procedures for asset revaluation
- a new billing system and introduction of budget follow up procedures
- a stock management system
- establishment of a Commercial Department with focus on customer relations and revenue collection
- analysis of equity and liability structure of the new company
- increased operating efficiency through staff reductions and reduced thermal plant operation
- accelerating the access to Cahora Bassa power for the southern region, including Maputo.
- increased reliability of power supply by reinforcement and rehabilitation of the networks

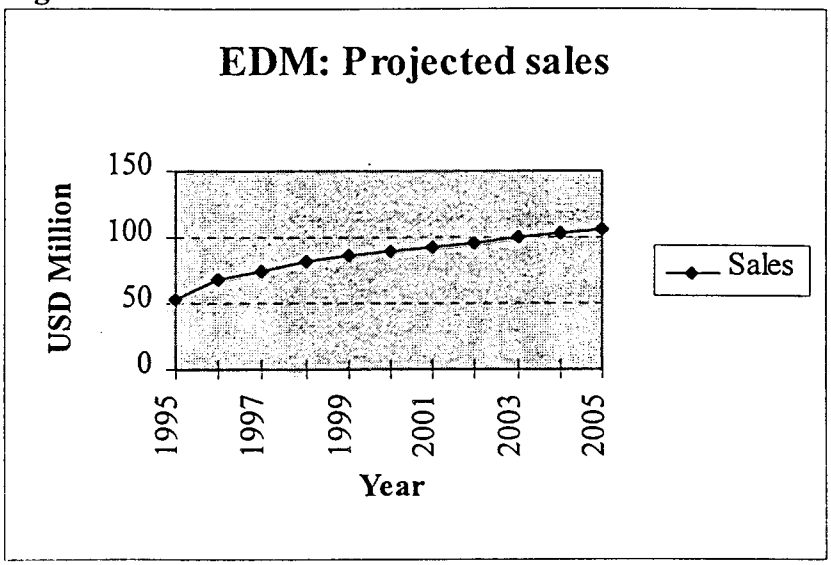
The Financial Recovery Plan resulted from a Financial Restructuring Study, which Coopers & Lybrand completed in 1994. It contained a number of steps and a time schedule for the implementation of the plan as well as an assessment of future investment capital needs, which could serve as a basis for establishing a relevant debt/equity ratio for the new company. To this end, the study applied a 10 year planning horizon. Financial restructuring was assumed to come into effect as of December 31, 1994 but if the required decisions were taken no later than May 1995 it would, according to the financial manager of EDM, be possible to start as of this date with a restructured balance sheet.

The following are Coopers & Lybrand's recommendations with respect to the main issues to be resolved in the course of the financial restructuring process:

- tariffs to be linked to currency depreciation, e.g. expressed in MT converted from US cents
- sales growth assumption to be based on 1993 forecast (see Figure 3.1) and investments in necessary transmission and distribution system to match expected sales growth
- assumed terms for investment financing to be 10 years repayment, 2 years grace and 8% annual interest
- remaining old debts to carry no interest and to be repaid gradually when the Cahora Bassa supply is restored
- receivables to be reduced from 160 days to 60 days over a period of five years
- revaluation of fixed assets value

The projected sales revenue, which serves as the basis for the cash flow projections of the Plan are as shown in Figure 3.1 next page:

Figure 3.1.



EDM's balance sheets records all contributions from the government to EDM as loans, regardless of whether an agreement of repayment existed or not. In course of the Financial Restructuring Study, it was established that a large number of loans were in fact owners contributions i.e., not subject to repayment. The auditors with reference to the principle of caution, have entered all such contributions as loans, however, and they have also charged the profit and loss account with accrued interests and accrued exchange rate losses on the loans. The effect on the balance sheet of a transfer of part of the "loans" to capital, would be for the ensuing reduction of accrued interests and exchange rate losses to correspond to almost the entire amount of losses accumulated up until 1993. This implies that the financial situation for EDM would be much better than what can be concluded from the official balance sheets. Table 3.3 shows all the long terms loans of EDM.

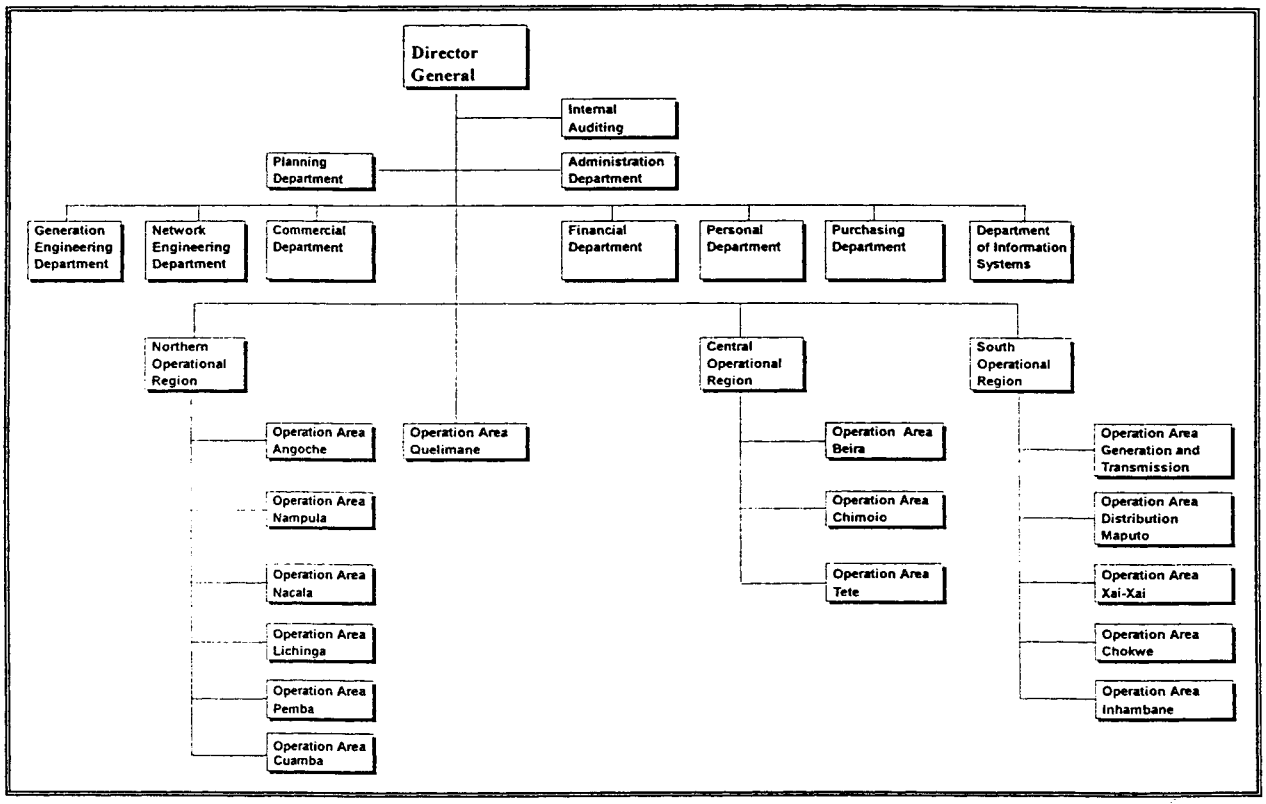
Table 3.4. EDM: Long term loans

Project	Financier	Original amount (million	Interest rate %	Repaym term years	Grace years	Balance March 1995 (million)
Maputo turbine gas station	CFD	FRF 78	1.5/2	30 years	10 years	FRF 67.2
Maputo substation	KFW	DEM 12	8	25	5	DEM 6.9
New centre Inhambane	DANIDA	DKK 2	5	5	2	DKK 1.6
Beira-SE6 subst renovation	SIDA	SEK 40	8	30	5	SEK 3.0
Nampula substation	KFW	DEM 12	8	25	5	DEM 0.1
Rehabilitation	World Bank	SDR 7.4	1.75/7.9	20	5	SDR 6.5
Rural electrification	World Bank	SDR 3.4	7.65	20	5	SDR 0.3
Rural electrification	NFD	SDR 1.9	1.75	20	5	SDR 0.3
Maputo diesel power station	FAD	USD 4	1	50	10	USD 4.0
Electricity I	FAD	FUA 15.8	4	25	10	FUA 0.1
Rehab Mavuzi Hydropower	CFD	FRF 4	5	10	3	FRF 4.0
Zimbabwe Interconnection	NORAD	NOK 93	4	35	6	
-"-	Exportfinans	NOK 23.2	7	10	-	
-"-	CFD	FRF 60	2	24	9	
-"-	SIDA	SEK 65	4	35	6	
-"-	NORAD	NOK 93	4	35	6	

3.3 Organisational Structure

The structured strategic planning process in EDM is now developing and as a result, organisational changes have already taken place. New units like the Internal Auditing and the Commercial Department are established, and the field activities are grouped in three Operational Regions. The management indicates that the development of objectives and sub-objectives, and strategies to pursue the objectives, will result in further adjustments of the organisation. EDM's present organisation structure (March 1995) is shown in figure 3.2:

Figure: 3.2: Organisational Chart of EDM (March 1995)



The organisation of the field activities into the Northern, Central and Southern Regions, reflects the three separate grids of EDM. The Regions are each headed by a Regional Director reporting directly to the EDM General Manager. The decision regarding the future position of the operational area of Quelimane is still pending. Meanwhile it is operating as a separate unit reporting directly to the GD . Future integration between the grids may have impacts on the geographical extent of responsibilities and organisation of the regional structure.

The regions are given a substantial autonomy in day-to-day activities, being responsible for operation and maintenance of the generation and network system, as well as the commercial operations and customer services.

3.4 Human Resources Situation and Training

3.4.1 EDM staff

Around 1980, a well equipped training centre, with 6 classrooms and modern training facilities was established for technical training and a comprehensive technical training programme has been carried out, supported by the SIDA and NORAD programmes. There has been relatively little support for the administrative side of the company, but in the past two years there has been a change, with secretarial and computer training for the administrative staff. Training activities with special focus on the commercial sector is now being scheduled .

The Personnel Department has recently been reorganised, merging the personnel administration department and the training department into a Department of Personnel Administration.

EDM has, according to the management, achieved a good minimum level of skill and education which is a good foundation for the future. Training and education is considered a very important issue. The total number of employees has been reduced from over 3,500 in 1987 to 2,900 in 1994 (table 3.5). During the same period, the proportion of unskilled personnel has been halved, from 40 percent to 21 percent. The professional beginners' category has remained at the level of about 45 percent and the number of skilled personnel has increased from 15 percent to 35 percent during this seven year period. During the coming year it is planned to reduce the staff further to about 2500. Among the measures to be taken are early retirement, as well as elimination of functions that can be hired from private companies, as for instance, security arrangements.

Table 3.5 shows the relative changes of staff in the different personnel categories during the last 7 years.

Table 3.5. Development of professional categories at EDM

Categories at EDM	1987	1991	1994
High level technicians	0.5%	1.3%	2.0%
Highly qualified personnel	3.2%	5.9%	7.0%
Qualified personnel	10.8%	23.8%	27.0%
Professional beginners	45.5%	46.0%	43.0%
Non-qualified personnel	40.0%	23.0%	21.0%

The ratio of the number of consumers to the number of employees, has increased more than the corresponding reduction in number of employees, as shown in table 3.6.

Table 3.6 Ratio consumers to employees

Year	1987	1991	1993
No. Employees	3,556	3,086	2,839
No. Consumers	106,228	127,260	136,328
Ratio	30	41	48

The increasing ratio expresses a positive development of the efficiency of the organisation and it does not deviate essentially from other utilities in the region, which are struggling with low efficiency.

3.4.2 Expatriates

The following expatriate personnel are presently working in EDM's organisation:

The Norconsult team personnel financed by NORAD comprised of 6 advisers; Adviser Management Information and Informatics (3), Financial Adviser Maputo, Commercial Adviser , and Stock Management Adviser. Financial Adviser Beira has just completed his assignment.

The SwedPower team personnel financed by SIDA (12) and NDF(1) comprised of a pilot, Fleet Manager (vehicles), Purchase (book-keeper), Chief Adviser, and advisers in the following disciplines: General Operation (2), Loss Reduction (2), Maintenance, Protection, Distribution, Training, and Financial.

Expatriates engaged directly by EDM and partly financed through the NORAD personnel Fund: 18 persons with various qualifications working in technical and administrative positions.

Consequently, the expatriates constitute 1.3 % compared to the number of EDM staff.

3.4.3 Training Activities

Since 1981, NORAD and SIDA have financed a large number of training activities at the EDM Training Centre. The SIDA financed courses cover many different fields, with the concentration on technical courses related to network and substations and language courses. Training activities financed by NORAD have contributed to the build-up of the training centre, basic training courses and hydropower training during the 1980s. At the beginning of this programme period (1993), the two financing agencies and EDM, agreed that SIDA should emphasize more on technical training, while NORAD should concentrate on managerial and institutional training. This arrangement started to be effective from 1994, when the NORAD-supported engagement of EDP-INTERNEL was switched from technical training to management courses. Basic management training started to be conducted involving EDM managers at all Department levels. and this activity is planned to continue in 1995.

Table 3.7 shows in summary the SIDA-supported training centre activities during the period 1990 to 1994.

The total number of participants is 450 persons that has attended 903 courses in totally 7,615 man weeks. The average length of internal education for those 450 employees is 17 weeks per person. Most of the educated staff is still staying with the company. The number that has left is very small.

Table 3.7: Training Centre activites 1990-1994 in technical disciplines and language training. Number of participant and education length in manweeks

	Non-qualifies		Prof. beginners		Qualified		Highly qualif.		High level techn	
Course	No.	Man weeks	No.	Man weeks	No.	Man weeks	No.	Man weeks	No.	Man weeks
Basic course	1	14	58	812	46	644	2	28		
Comp. course transm.			11	198	17	306				
Comp. course distrib.			32	576	11	198	1	18		
Advanced course transm			11	187	31	527	1	17		
Advanced course distrib			12	204	26	442	6	102		
Upgrading course transm.					38	798	6	126		
Upgrading course distrib			1	21	19	399	4	84		
Linesmen course distrib	5	15	37	111	26	78	7	21		
Cable courses	9	9	22	22	26	26	6	6		
Linesmen course transm.	15	45	33	99	10	30	4	12		
Personal safety	46	28	67	40	46	28	28	17		
Spec training control equip					5	95	4	76	2	38
Spec training maint					5	110	5	110		
Spec training tele					1	33	6	198	1	33
Gen. English 1					16	48	9	27		
Gen. English 2 +					13	65	8	40	5	25
Middle management					8	16	5	10	1	2
Instructor training					20	40	10	20	4	8
Maintenance of batteries	2	2	1	1	13	13	6	6		
Gen. English 2 (Chimoio)			3	18	4	24	5	30		
Preparatory course (Chimoio)	4	48	12	144	4	48				
Number of participants	82		300		385		123		13	
Total no. of man weeks		161		2433		3968		948		106
Average man weeks/particip.		2.0		8.1		10.3		7.7		8.2
No. of trained staff	58		177		159		43		13	

3.5 Administrative Efficiency

The information systems of EDM are in great need of revision and integration. There are six main computerized software systems, none of them integrated with any other: financial system, consumer information and billing system, stock management system, fleet management system, personnel system and fixed asset system. Communication with the regions is another area in great need of improvement in order to support the decentralisation process. However, the public telecommunication systems in Mozambique does hold a present standard that is prohibitive to think about using it for electronic data transmission. Financial information, operations statistics etc. is sent on a floppy disk once a month, which is far from satisfactory.

The budget procedures have been improved during the past two years. The process started with the preparation of ten year plans for the company, structured in a way that was natural, dividing the operation in regions and in power generation, transmission and distribution. The next step was to prepare a one year budget involving the departments and regions and using the same structure as was used in the long term plan. This was done for the budget for 1995. The next step in the process is to establish a new general ledger system that can encompass

the new structure and present follow up data compared to budget. A tailor-made system was contracted from ICL already in 1992. The development of the system has faced a lot of problems. The efforts and the money laid down has not resulted in an applicable product, and EDM has consequently absolved itself from any further liability with respect to the contract. A decision whether to buy a new general ledger and budget control system will be made soon (Agresso).

A new billing and customer information system was bought from ICL in 1992. It was originally a standard system, but during negotiations the contract was transformed into a tailor-made system. The implementation has been delayed and the system is today only partly operational. It is understood that in the billing part of the system which is operational, inefficient design of the software has lead to capacity problems particularly apparent for the major consumer concentration in south. NORAD has supported efforts to rescue the system with the help of Norconsult. In December 1994 Norconsult came to the conclusion that the ICL system will never work. A letter with this conclusion was sent to the managing director of EDM. Norconsult recommended to scrap the ICL-system and to acquire a new off-the-shelf system for billing and consumer information.

It is worth noting that Coopers & Lybrand has been consultant to EDM regarding the customer information system, the general ledger system, and the financial restructuring plan. In view of the less than acceptable quality of services provided by the consultant, it is understandable that EDM has engaged the firm Ernst and Young as their financial consultant.

The more serious aspects of the software systems failure, are the delays experienced in developing routines and control measures, which have reduced the administrative efficiency and the effect of the NORAD-financed Institutional Development Project, slowing down for instance, the improvement in loss reduction and collection of bills. The information systems incorporated should have provided data for timely management reporting and more precise basis for decision-making, as well as data for technical and budget planning.

4 EDM Strategies and Plans

4.1 Overall strategies

The draft documents for the legal and regulatory framework awaiting approval by the National Assembly states that EDM has as main objective, the establishment and operation of the public service of the production, transport, distribution and marketing of electrical energy in Mozambique, aiming at a profitable result of the operation.

As part of the NORAD financed "Institutional Development in EDM", a programme with strategic planning seminars has started. During the seminars short-term and long-term goals with associated action plans have been discussed, and EDM has on this basis developed a provisional set of objectives and targets.

The EDM's strategies are comprised of the substitution of energy import with hydropower and the reduction of deforestation near the major population centres. It is therefore imperative to

reach the major centres as soon as possible with supply from the grid and to increase the reliability of the power supply.

During the war a lot of people moved to the towns and they are now gradually returning to the countryside. It is a priority to rehabilitate the existing networks in these areas with particular emphasis on peri-urban and rural areas with concentrated populations.

4.2 Plans for Generation, Transmission and Distribution

EDM sees the near future as a period with high activity within rehabilitation and extension of the network aiming at improved power reliability and high load growth to cover increased demand from raised production within all sectors of the society. The increased demand will be created by medium to small scale electricity deliveries to domestic consumers.

The following are EDM's priority projects:

Extension of the Southern system to Inhambane by constructing a 110kV overhead line Xai-Xai - Inhambane, in order to replace diesel generated electricity with less expensive grid supply. DANIDA has already made a financial commitment towards supporting the project which will probably start next year

Extension of the Northern grid from Nampula to Ancube (110 kV) and further to Pemba and Montepuez (110 or 33 kV) which is supplied by diesel stations today.

Interconnecting the Central and Northern Systems by constructing the 220/110 kV Chibata s/s and the 12 km 110 kV line from Chibata to Nhamatanda. Equipment for the substation has been stored for twenty years, and is assumed to be incomplete.

Connect Gurué, Cuamba and Lichinga to the Northern system (LCN). Equipment for the first 110 kV section Alto Molocue - Gurué is stored in Quelimane (indicated 100 % of the conductors, and 70 % of the steel). Previously pledged Italian financing has fallen through. EDM is contemplating to build a 33 kV line from Gurué to Cuamba and Lichinga (320 km).

The Mbahu Hydropower Project (2 MW) for supply of Lichinga district, has been studied to feasibility level. Updated costs (1993) are USD 20 million, with an additional USD 3 million for the transmission and distribution lines.

Alto Malema Hydropower Project (80 MW) was originally estimated to USD 110 million (price level 1993). Reconsiderations of key specifications made by EDM indicate a lower construction cost. The project site is near to the railway and the LCN.

Electricity 1 and Electricity 2 has financing from AfDB which is made available to EDM by a government onlending agreement. USD 18 million is available under **Electricity 1** for investments in the network system in Maputo and Beira areas. In Maputo area, the plans include a new 66 kV substation with 11 circuits (SF6) at CTM, two 66 kV lines up to the future Matola s/s, a 66 kV line to Boane s/s and another to Machava s/s. At Beira, the investments comprise rehabilitation and extension of substations including four 22/6.6 kV

substations (mainly civil works, new switchgear, protection and measurement, and 70 metalclad or brickbuilt s/s of different sizes up to 630 kV. When the onlending agreement for **Electricity 2** is completed, the USD 27 million will be used for rural electrification in the Southern Region, including:

- 110 kV line from Macia to Xinavane and 110/33 kV S/S at Xinavane.
- 66 kV from Boane to Salamanca, a 66/33 kV S/S at Salamanca, 33 kV to Ponta Malongane and Ponta d' Ouro, sea cable to Inhaca, and 33 kV supply lines to Changalane agricultural area and to the limestone quarry supplying the cement factory
  Rehabilitation of the old 33 kV from Boane to Namaacha

Customer connection programmes are financed by the Arab Bank for Development in Africa (BADEA) making available a loan of USD 3.5 million for customer connections and repair and extension of MT/LT in rural areas in Maputo, Chimoio and Beira. A World Bank Project comprising connection of 40,000 new consumers throughout the country, which was supposed to start 1989, has been delayed due to the war situation. The first phase of this project, comprising 6,000 households, has now started.

Hydropower projects with regional implications include the large hydropower project in Zambeze River, Mepanda Uncua (1600 MW) and Cahora Bassa II (550 MW). Studies of various projects have shown these to be particularly viable provided that the market is available.

Transmission projects of regional character comprise:

- Rehabilitation of the **HVDC link from Songo s/s to Apollo s/s** in South Africa providing for a 1600 MW transfer of power from Cahora Bassa. 200 MW belongs to EDM as recall power at a price of about 1USc. Financial negotiations are at an advanced stage and the rehabilitation of the line is anticipated to take 3 years
- **A new 420 kV AC link from Songo s/s to Harare, Zimbabwe**(initially to be operated at 330 kV). The capacity of the line is 500 MW. Under present contractual arrangements, power will be provided by HCB until 2003 from the quota reserved for Eskom. Thereafter a new agreement will be necessary. Project implementation has started.
- **A second 275 kV line from South Africa (Eskom) to Maputo** to improve the reliability. The intention is to build this line via Swaziland, providing an opportunity for EDM to sell 50 MW of excess power to SEB.
- **A new 220 kV line from Songo s/s to Lilongwe, Malawi.** Another new 220 kV line from Lilongwe to Pensulo in Zambia creates an additional corridor for regional power transfer.

4.3 Organisational Changes

The decree and the statutes, fundamental in formalizing EDM's status as a public enterprise with appurtenant legal framework, are still awaiting decision. The new Energy Law is expected to be presented to the National Assembly this first half of 1995. Meanwhile, the EDM is proceeding with its restructuring process in accordance with the new law on public enterprises (1991), under the guidance of the Minister of Mineral Resources and Energy.

EDM is still in the middle of the restructuring process, where many essential aspects remain to be clarified. The strategy planning process is extremely important in this connection. At

present there is no clear overall plan for EDM's organisation, and EDM's department objectives do not provide a fully coherent and logic picture as to the development of the organisation.

4.4 Management Systems and Operations

EDM started in 1992 a comprehensive development programme for improvement of overall and sectorial management and economic control of the company. A continuation of this programme was included in the NORAD electricity sub-sector agreement for the period 1993-1996.

This included the recruitment of 5 consultants to work in different departments and operational areas and also the expenses for implementation of the management information system, as well as related minor studies. All recruited consultants were supposed to have a Mozambican counterpart and a considerable part of their work was to be allocated to the training of the Mozambican staff. Among the premises assumed, there were operational new computerised systems for accounting/general ledger, and customer information and billing, at the time of the arrival of the consultants to start their work. The preparatory work with specifications of the two systems and later, the contract with ICL, seems not to be up to standard. In both cases Coopers & Lybrand was the consultant to EDM. ICL has neither been able to deliver satisfac-tory products with the consequence that EDM still is lacking a fully operational system.

Additional systems acquired is the new Assets and Stock Management System (SMS) within the Purchasing Department and the Personnel Management System (PMS). The systems are used by EDP and both are now in operation. About 70 % of the stocks are now registered in the SMS. The PMS is already managing the monthly payments of salaries, while data entries to the personnel information part continues. When the data entries are completed in the near future, the system will also be an invaluable tool for personnel planning and analysis of training activities.

A fleet management system has been installed to manage all transport equipment and vehicles. It was delivered by Crown Agencies and has been characterized as too sophisticated for the needs of EDM. The system is in operation.

4.5 Reduction of Losses

Projects in this field are financially supported by NORAD and SIDA. NORAD's involvement comprises loss reduction in billing and collection (administrative losses) as a part of the Institutional Development Project and a Demand-Side-Management Project, Power by Saving.

The loss problem consists of two different parts: technical losses in the transmission and distribution system and administrative losses due to unbilled consumption and unpaid bills. Regarding the financial aspects of loss reduction, technical losses relate to costs of the acquired power (import or production), while the administrative losses refer to not paid consumption. At the present tariffs and import costs to Maputo, reduced administrative power

losses are twice the value per kWh as reduced technical losses. This ratio will be 9:1 when EDM increase its tariffs to the agreed 9.5 UScents and the Cahora Bassa power is available in Maputo in 1998. The more urgent loss reduction efforts are consequently related in ensuring that all consumption is billed and to reduce electricity bill collection losses.

The SIDA-financed loss reduction project concentrates on technical losses, due to load factors and condition of the network and energy losses, due to incorrect or non-existing metering. However, pilot studies in the Maputo area, for the purpose of determining the level of different losses, suggest that non-technical factors are the dominant reasons for losses. In 1994, in the span of one week , in the Jardim area, total losses defined as the difference between measured energy at the substation and billed energy corresponded to 33.4 per cent, of which technical losses accounted for 4.6 per cent and street lighting consumption which is not billed, for 5.2 per cent. The remaining non-technical losses were 23.6 per cent. To arrive at the total loss, electricity bill collection losses have to be added. In the annual reports of 1992 and 1993, three to four per cent of the annual turnover was written off as uncollectable. This would bring total losses close to 40 per cent which is extremely high.

EDM's aggregate statistics suggests that nation-wide losses corresponded to 30 per cent of deliveries in 1992, but to only 18 per cent in 1993. It should be added to this, however, uncollectable bills which have been very high in the past. In the 1993 account, 11 per cent of receivables corresponding to 6.8 per cent of sales, was set aside as a provision for doubtful debtors.

Data on magnitude and the origin of losses as presented in tables 4.1-4.3, are collected from Relatorio Anual de Estatistica and the investigations made by SwedPower:

Table 4.1 Energy losses -1993 (figures in GWh/year)

	1992		1993	
Total energy(production,import)	805.1		852.6	
Energy exported	9.3		1.4	
Transmission losses	44.3	(5.5%)	37.7	(4.4%)
Gross available	751.7		813.5	
Substation losses & auxiliary	24.7	(3.1%)	35.2	(4.1%)
Available for distribution	727.0		778.4	
Distribution losses	48.5	(6.0%)	85.7	(10.1%)
Billing	678.5		692.6	
Total losses & auxiliary	117.5	(14.6%)	158.6	(18.6%)

Table 4.2 Losses in the regions - 1993 (GWh/year)

	Northern Region		Central Region		Southern Region	
Transmission losses	16.8	(11.6%)	9.8	(5.8%)	11.1	(2.1%)
S/S losses	7.4	(5.1%)	21.2	(12.5%)	5.4	(1.0%)
Distribution losses	22.8	(15.7%)	19.5	(11.5%)	44.6	(8.3%)

Table 4.3 Pilot Study (SwedPower) : Losses in Maputo - 1994

	PT123 s/s	Maputo s/s
Measured energy MWh	680,000MWh	319,756MWh
Invoiced energy MWh	453,000MWh	200,000MWh
Non-invoiced energy (MWh)	227,000	119,756
Percent	33.4 %	37.5%
Street lighting	5.2 %	1.1%
Technical losses	4.6 %	1.8%
Non-tech. losses	23.6 %	34.6%

Tables 4.1 to 4.3 indicate some inconsistencies in the data and the levels of distribution losses reported in EDM's statistics and SwedPower's findings.

It is interesting to note that in January 1995 in EDM's Southern Region 16% (12,000) of the consumers were billed by an average (some of them were always billed on an average), 4% (3,000) were not billed any consumption and 2% (1,500) of the installations did not have any consumers "connected".

In Beira Operational Area, the local management has succeeded to achieve considerable results in loss reduction. Beira is a relatively small electricity market with about 13,000 customers within the central region. With coordinated actions through the loss chain from the interface to the consumer and to the collection routines, losses have been reduced from some 30 percent to about the half in 1994. The losses are defined as the difference between measured output from the substations and collected bills. The accrued cash collections in meticais has more than doubled in 1994 compared to 1993.

4.6 Energy Efficiency and Demand-Side-Management

A Norwegian consultant prepared in 1994 a report on end-user energy efficiency (Power by Saving) . The report discusses the concept and resource potential of demand-side-management in EDM based on the consumer investigations made during the project.

The recommendations made comprise a number of actions embracing the organisational aspect and routines, demo-projects, information, assistance to the customer etc. It is concluded that progress on demand-side-management requires development of the Customer Services System and the Customer Information and Billing System, and are as such decided to be made part of the Institutional Development Project.

5. Sector Development Assistance

The energy sector in Mozambique has attracted support from a number of countries with experience in developing and operating hydropower and thermal power plants, as well as in transmission and distribution systems. Co-operation is taking place on a bilateral level or through the World Bank and the various SADC organisations.

The following is a brief summary of the principal aspects of the last three years' development assistance to the energy sector in Mozambique.

Norwegian assistance consists of commodity assistance, institutional development support and administrative training. The present agreement, signed on December 1, 1992 covers the period 1993 to 1996. The original tentative budget for the period, and revised allocation of funds as per February, is shown below:

		NOK million	
		Original budget	Revised per Feb. 1995
-	Commodity assistance	127.5	139.1
-	Institutional development	32.4	41.5
-	Training	10.0	9.9
-	Personnel fund	2.0	2.6
-	Rural electrification	1.5	0.3
-	Power by saving	0.6	1.7
-	Studies,meters etc	0	6.3
-	Unallocated funds	18.0	12.6
		192.0	214.0

Swedish assistance. The Swedish specific agreement on energy sector support covers a period of three years (July 1, 1992 to June 30, 1995) and comprises training and technical assistance, support for loss reduction project, rehabilitation of sub-stations and financing a gas turbine station in Beira. The preliminary distribution of funds of the agreement, signed on May 27, 1992 is as follows:

		SEK million
-	Technical assistance on transmission/distribution	33.8
-	Loss reduction project	4.3
-	Improvement of EDM main store in Maputo	0
-	EDM Training Centre activities	17.0
-	Finalising of substation SE6	10.7
-	Renovation of Beira Substation	18.0
-	Evaluation	2.9
-	Contingencies	3.3
		90.0

Besides the sector agreements of NORAD and SIDA, the following current programmes and project are being financed by other international financing institutions(IFI):

African Development Bank(AfDB) is financing the Electricity 1 (USD 18 million) and Electricity 2 (USD 27 million) programmes, totalling USD 45 million made available to EDM through on-lending agreements between the Government of Mozambique and EDM. The programmes comprise rehabilitation and extension of transmission, sub-transmission and distribution systems in the Central and Southern regions (see also section 4.2, para 7).

World Bank (WB) is supporting the household connection programme with a credit of USD 15 million. A part of that is also expected to be used in the rehabilitation of some distribution networks.

Arab Bank for Development in Africa (BADEA) has recently made available a credit of USD 3.5 million for rehabilitation and extension of HV/LV networks, and for customer connections in Maputo, Beira and Chimoio.

Nordic Development Fund (NDF) is providing technical assistance to the Financial Department of EDM, i.e. one adviser.

Danish (DANIDA) financing has been based on selected projects. DANIDA provided financial support for telecommunication equipment in 1990 and earlier, the diesel power plant in Inhambane. It is anticipated that Danish financing will make possible the construction of the 110 kV line to Inhambane, the substation installations and some low voltage distribution networks.

German (KfW) assistance is normally decided on a one year basis. In more recent times KfW has provided a 4-year training for diesel power station technicians and is presently participating in the rehabilitation of CTM and Nampula s/s with grants totalling DM 24 million.

France (CFD) has participated in financing the rehabilitation of Mavuzi power plant (sabotaged during the war), a new gas turbine at CTM in 1991 (FF 78 million), and some spare parts (FF 3 million). There are no on-going engagements for the moment.

United Kingdom (ODA) has financed the recent rehabilitation of one of the gas turbines (Rolls Royce, 1968) at CTM and has earlier provided funds for the Technical Cooperation Training Programme (management training programme). There are not any new engagements by ODA at the moment.

The electricity sector of Mozambique, which is synonymous with EDM, is supported by more than ten countries and institutions. This was justified in the past by the destruction and extra cost caused by the civil war. This is no longer the situation. On the basis of moderate cost hydropower, the sector should be able to stand on its own, and to generate surpluses for funding its own expansion. The generous provision of development aid has not resulted in a conscious and cost efficient sector. Lack of cooperation and coordination among donors has made much of the development to be donor-led and thereby led to an aid dependence on the part of EDM which, unless checked, could spell problems for the sector in the future.

While the NORAD and SIDA support, in contrast to the more project oriented assistance from other donors, has provided on a long term basis and given EDM a relatively stable and predictable basis, it may nevertheless have contributed towards continued aid dependence and relieved the organisation of the pressure of necessity to change. It is the Review Team's impression that the new situation with a prospect of autonomy has injected some business spirit and understanding of needs into EDM management. The best service NORAD and SIDA can do to EDM is to direct the support so as to ensure that this hopeful process does not loose momentum.

It has become apparent that although EDM now has obtained trained technicians, the present organisation of EDM does not allow an efficient use of this expertise. A change in this area will be helped by external assistance. The emphasis of the future training will require a shift from providing training in pure technical terms, to achieving operating functions inside EDM. Although such training is more difficult, due to the inherent differences in management cultures, there are experience from other countries which suggest that properly designed technical assistance programmes can produce "role models" for modern technical management culture within the auspices of technical organisations such as EDM.

C ASSESSMENTS

6 Assessment of Strategies and Plans

6.1. Review of Regional Cooperation

EDM has been an active participant in the activities of SADCC, since 1992 SADC - Southern African Development Community -, since the early eighties when the organization was set up. The formation of a sub-sector committee in SADCC in 1989 was on an initiative from EDM, and thoroughly revitalized the cooperation in the electricity as well as the petroleum sectors.

The major international projects of EDM - the Cahora Bassa to Zimbabwe connection which is in progress as well as the planned interconnections to Malawi and to Swaziland, have all been worked out in close cooperation with SADC. SADC's studies help to ensure that these projects fit naturally into the emerging Southern African Grid.

In 1994 the electric power utilities of SADC member countries were invited to participate in the formation of a Southern African Power Pool - SAPP for short.

The idea for a pool had been taken up in SADCC in 1984 during a seminar in which the Nordel model was presented, and was further emphasized in a presentation to the SADCC Energy Ministers' Seminar in 1991 on the SADCC Project AAA 3.8. "Inter-Utility Power Exchange". The idea was now (1994) taken up by the four SADC utilities most immediately concerned, from South Africa, Botswana, Zimbabwe and Zambia, and also SNEL of Zaïre, on the basis that these utilities will shortly have a strong North-South HV linkage with each other. A series of meetings were held during 1994 to work out the modalities of the Pool arrangement, resulting in drafts of an Inter-Governmental Memorandum of Understanding an Inter-Utility Memorandum of Understanding and an Operating agreement.

What is proposed is a relatively "loose" pool, with no commitment of resources as such to the pool and no central authority (Central Dispatch) to direct transactions and use of resources. In SAPP, the exchange of services (capacity, energy, technical services) would be agreed freely among the member utilities - with the exception of emergency support and wheeling, which are obligatory services. SAPP would provide, through the Operating Agreement, the framework of rules and standardized terms within which this exchange of services among a number of participants in an interconnected network can function in an orderly fashion.

As an instrument of coordination, SAPP would have a Coordination Centre, with duties of monitoring pool operations, gathering and maintaining information and advising pool members, but with no executive authority.

The Operating Agreement would impose such minimum requirements on member utilities facilities and technical standards that are necessary to avoid undue burdens on other members or on the system as such - in particular, a sufficient load carrying capacity to meet their own peak obligations.

EDM has taken a positive attitude to the proposed SAPP and intends to join it. However, the discussions within SADC have brought out a need for some further refinements to the proposed arrangements, discussions to which EDM has been an active contributor. There is also some difference within SADC as to whether SNEL should be included at this stage.

6.2 EDM Overall Strategies in Relation to Goals

From the provisional objectives prepared on the EDM department level, it appears that EDM wish to realize a strategy of a customer-driven organisation, increase the efficiency of the technical and financial operations and improve the return on existing assets. While targeting specifically necessary and sound issues like the tariffs, the computerized systems and repairs/rehabilitation of technical installations to exploit the available resources, the organisational aspects are not subject to an equally specific plan of action This central and classic organisational dilemma need to be addressed immediately to avoid endangering the efficiency and results of the restructuring process and implementation of routines.

6.3 Assessment of institutional and organisational development

6.3.1 Institutional Framework

The formal framework for the new EDM as a public enterprise, whose activity is fundamentally ruled by private law and managed as "private enterprise based on criteria of financial profitability", is pending approval by the National Assembly. However, EDM is proceeding to transform the organisation along the objectives laid down in the draft cabinet decree [14] and draft statutes [13] and in accordance with the Law no. 17/91 on Public Enterprises. Strategic discussions are progressing and some organisational changes have been implemented already, including establishment of the auditing and commercial units.

An approval of the legal framework by the National Assembly, will assumably mean a firmer drive also in the restructuring process. Delaying the decision shall not benefit the ongoing process. The regulating role of the National Electricity Council has to be established and may be anticipated ,through its function, to monitor and encourage the efficiency improvement of EDM.

Neither is it quite clear who will formally decide the tariffs under the new legal regime (see also section 1.5), but it seems , by inference, that they will be decided by the Minister. This will be a crucial decision for the commercial viability of EDM and, as the decision on increases will most likely be made on a year-to-year basis, it will attract considerable political attention.

Within the new legal and regulatory regime it is important that the Ministry, the National Electricity Council and EDM, have balanced and clear roles to play. Regarding the two first institutions, it may be expressed some uncertainty whether they may have the necessary

resources to take on the work required. This is an essential issue in a situation where EDM in reality is in a monopolistic role lacking the natural environment of competition.

6.3.2 EDM's Organisation

Obviously, major aspects remain to be clarified during the strategy work. The subordinate objectives which should clarify responsibilities and priorities on department levels and guide the restructuring process through the organisation, are not yet concluded. Defining the role of the regional (local) units and the Commercial Department is critical in this context. The commercialisation of EDM and focusing on the customers are clarified concepts in the strategy development. A logical extension of these concepts is to ensure that the parts of the organisation that are directly handling the sales and the customer relationship, the Operational Regions, also have the authority and responsibility to do so, which is not yet the case.

It is obvious that the reporting lines to the General Director are excessively by long today, see figure 3.1. A central coordination responsibility of the regional operations has been discussed, but is not yet clarified, and one obvious option is to assign this responsibility to the newly established Commercial Department, which has not yet had its scope of activity properly defined. There is a close physical linkage between regional operations, consumer relations and the commercial functions. Only direct penetration into the operation, with short lines of communication and responsibility, can ensure an efficient functioning of the commercial operations.

It is the impression of the Review Team that the natural impulse in organisations to resist changes is less dominant in EDM than elsewhere. However, the restructuring process needs an external pressure and external support to keep up momentum. The active participation in the process by the responsible Ministry - the Ministry of Mineral Resources and Energy - will certainly be required, particularly as the natural environment of competition is lacking.

6.4 Assessment of Administrative Efficiency

The administrative efficiency of EDM is improving. The areas in need of focus in the near future are bill collection and loss reduction activities. To broaden the competence of middle management, continuous internal training is of great importance.

An aspect with serious implications within the context of development of the commercial activities, is the data processing and information systems. As the present problems relate mostly to the Accounting System and the Customer Information and Billing System, the assessments are confined to these two computerized systems.

When the decision to modernize and improve the data systems was taken in 1992, the organisational implications were probably underestimated. At this time, a new institutional framework of EDM was, but vaguely, conceived. Inadequate specifications are partly due to the lack of a clear and detailed organisational concept. Choosing off-the-shelf systems with established routines would have been appropriate in this situation although it must be

admitted that the more modern systems built on a decentralised concept, relational database, SQL interface etc have been developed during the recent years.

However, the present situation is that the General Ledger System has not been accepted by EDM. Only the billing part of the Customer Information System is in operation, but with defects and capacity restrictions that necessitate an early replacement anyway. In addition, the lack of systems which function properly, represents serious problems in the development of efficient routines and support to the institutional development. Without new systems (off-the-shelf with a proved performance record) both for accounting and customer operations, it is not possible to reach the goals incorporating efficient commercial operations and improved customers relations. Development of a management reporting structure (also called Management Information System, MIS) which should ensure appropriate basis for timely and correct decisions, suffer by the same. Resources made available through the NORAD agreement (institutional), and to some degree also through the SIDA agreement (loss reduction), cannot be efficiently utilized for the main tasks. Time is being spent on problems which should not exist, and time is being spent because of undefined routines and lack of data.

The Review Team agrees with the conclusions and recommendations of Norconsult in what concerns billing and consumer information system. The Team notes, however, that the risks attended with tailor-made systems, in this case further amplified by incomplete specifications, should have led to a different approach. It is the opinion of the Review Team that further efforts should not be spent on neither the General Ledger, nor the Customer Information and Billing Systems. Both systems should without delay be replaced by off-the-shelf systems with a proven record.

6.5 Assessment of the Financial Performance of EDM

It can be concluded that EDM's financial performance has gradually deteriorated to a point where it can no longer cover its operating costs without subsidies in the form of foreign aid and that the emergency and civil war related rationale for the generous flow of aid to the power sector no longer prevails. EDM must therefore ensure that revenues are increased and costs decreased to levels where the enterprise can service loans, both with respect to existing assets and for future investments. This will require actions on several fronts. The repair of the DC transmission line from Cabora Bassa to South Africa is one essential prerequisite for the return to financial health of EDM. From 1998, when the line is expected to be recommissioned, the southern region can be supplied at a cost of approximately 1 UScents per kWh or less than one third of today's cost. This would reduce the annual cost to EDM of bulk power by about USD 13 million or MT 45 billion at the 1993 exchange rate for the Metical.

A second measure by which financial performance could be substantially improved would be reduction of non-technical losses caused by insufficient metering and by inadequate billing and collection routines and systems. This problem is mainly concentrated to Maputo. In the case of the 1993 operations, a reduction of losses of 15 per cent would have increased revenues and profits by MT 25 billion corresponding to USD 7 million.

A third aspect of a financial recovery should be a tariff structure that would ensure, firstly, that income would cover increased cost of debt service resulting from devaluations and, secondly, that tariffs would reflect the marginal costs of production in the long-term.

A fourth element of a financial resuscitation would be a combined debt restructuring and asset revaluation exercise, which should leave the enterprise with a debt that it can service and which reflects the productive value of its assets.

In addition there are a number of specific and more detailed operational improvements which can be made with respect to the reliability of the network, improved domestic transmission capacity, and improved labour productivity.

Several of those measures are embodied in a Financial Restructuring Plan, prepared by EDM's previous consultant Coopers & Lybrand. The fundamental concept of that plan is the transformation of EDM into a joint stock company with increased authority for managing its affairs and with tariffs determined by a tariff structure that compensates the enterprise for the effects of currency devaluations.

6.6 Assessment of Financial Restructuring Process

The restructuring of EDM's capital base would primarily consist of the determination of the debts for which the new company would assume responsibility and, secondly, of an evaluation of the fixed assets. This process would yield the equity of the new company and also the need for the owner to provide additional capital. An important issue is how to agree on the debt situation to get rid of old debts in the balance sheet that are not to be reimbursed. The Restructuring Study suggested that part of the liabilities could be transformed into equity since the underlying agreements lacked provisions for repayments. It is worth keeping in mind, however, that these resources have been used for the power sector. Transferring government loans into Metical-denominated owners capital, does not change the fact that EDM has been unable to generate a return on the assets it has used. From a national and also from a donor's perspective the restructuring would be immaterial, as something of a cosmetic operation.

On the other hand, the Review Team appreciates the view that the level of return so far is, to a considerable extent, due to circumstances outside of EDM's control and also that the restructuring would establish a cleaner basis for EDM's future operation in a way that the obligations for the former government loans would henceforth be subordinated to EDM's regular debt servicing. Any dividend on owners capital would be at the owner's discretion and dependent on EDM's financial situation.

Tariff reform is another important aspect of the Financial Restructuring Plan. It is suggested that the average sales price should be gradually lifted to the equivalent of 9.5 UScents per kWh over the next few years and that tariffs should be indexed to the exchange rate Metical/USD.

The indexing would ensure that tariffs, when established, are maintained at or near the intended level in real prices and that debt service capacity is maintained, as most loans would be denominated in foreign currency.

The Review Team feels that the most important criterion for determining the level of tariffs should be the long run marginal cost of providing electric power to the consumer (generation, transmission and distribution). As the consumers decision to use electricity is in general a long term decision (by acquisition of equipment and installations), efficient pricing requires that the real long term marginal cost of supply is considered. The availability of Cahora Bassa power, at a price well below actual cost, is for a limited quantity, which could be quickly absorbed with the growth of the industrial production. The country would be ill advised to encourage electricity consumption based on this artificially low price, only to find consumers, particularly in relatively power intensive industries, unable later on to pay the true cost and thus unable to attract new capital for expansion.

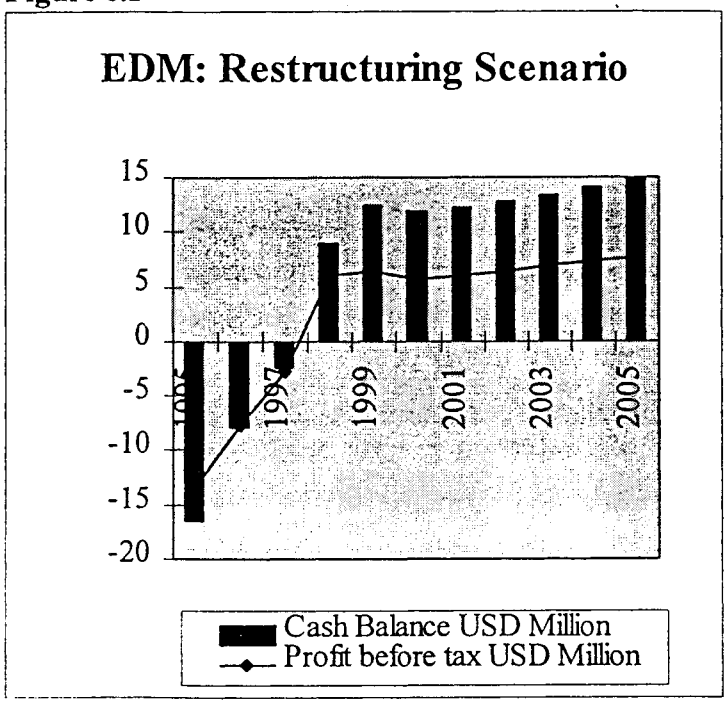
The current tariff level of about 7 UScents per kWh is clearly too low to yield an adequate return on investments in new capacity . Even the suggested target level of 9.5 UScents might be insufficient. On a total assessment however, the Review Team feels that a pricing as suggested and dictated by financial requirements, would be a reasonable solution at this stage.

The low price power supply from Cahora Bassa power also has a bearing on EDM's debt relationship to the Government. The right to take this power at a low price is really an asset given to EDM by the Government, for which EDM should pay a return, at least comparable to the one that could have been sold for to third party purchasers (Malawi, Swaziland). Even though the Financial Restructuring study shows that this is beyond EDM's financial capability in the foreseeable future, this could well change later on, when EDM is over the hump and the Cahora Bassa power can be seen to generate a considerable "producer's surplus". By maintaining former dept as owner's capital, the owners have the option of claiming dividends within EDM's financial capability, an option that would be formally lost if the debt were written off.

The financial projections suggest that the profitability of EDM would be low to modest, if the savings on the cost of power from the Cahora Bassa energy are taken into account. This should be a matter of concern for the government and the donors. If this is correct, it would suggest that Cabora Bassa would in effect subsidise a low yielding enterprise. It is recommended that EDM's future prospects are reviewed separately from the Cahora Bassa issue and that a corporate and capital structure is devised, which would result in a return on capital that is adequate for the purpose of asset replacement and commensurate with the market cost of investment for Mozambique.

It has been estimated by EDM that the present value of the savings in bulk power cost for the Cabora Bassa energy, as compared to that from Eskom over a 10 year period, would correspond to USD 114 million. Part of this value is reflected in the increased profitability that EDM is expected to achieve after implementation of the Recovery Plan. Figure 6.1 shows profits before tax and the accumulated cash balance according to the Financial Recovery Plan. The projections assume that the tariff would increase from currently around 7 UScents per kWh to 9.5 UScents per kWh, that the Cabora Bassa supplies would be fully utilised and that both losses and operating costs would be reduced.

Figure 6.1



The financial projections also show that from 1998 and onwards there would be no need for donor financed assistance. EDM in its new form, would maintain a positive cash income generation of between USD 10 to 15 million. Profits before tax but after depreciation, would range between USD 6 and 8 million and annual cash flow would increase from USD 32.4 million in 1998 to USD 44.1 million in year 2005. The discounted value of this income stream, using a discount rate of 8 per cent, would be USD 262 million. However, since the net present value of the Cabora Bassa savings alone have been estimated at USD 114 million, the assets of EDM would, according to the consultant's projections, only be able to generate an income stream with a net present value of the difference, i.e., USD 148 million which is modest compared with the current debt of EDM of over USD 630 million and considerably less than the USD 230 of long-term loans that the new EDM is expected, by the consultants, to carry in its accounts.

It is also recommended that the budget for the enterprise comprises all costs and investments, regardless of the source of financing. All donor supported recurrent expenditures should be included as costs and the financial support should be regarded as extra-ordinary income. This would allow for transparency and give both EDM and the donors a good overview of total operations. It would also constitute a good basis for discussion of the development of activities and assistance.

From 1998, with the access to Cabora Bassa power, financial support would not, in principle, be needed. The Government has to decide to what extent EDM is going to be the beneficiary of the low cost power. Reduction of losses and more efficient administration will also contribute to a situation where EDM is financially self sustainable.

6.7 Reduction of Losses

To summarise, it would appear that total losses could be in the order of 25 to 30 per cent and even higher in Maputo (see section 4.5). Of the total, about 5 per cent would be normal technical losses and 5 per cent is street light energy, which has hitherto not been billed. The remaining 15 to 20 per cent, with the exception of normal customer default losses of a few per cent, could be recovered with proper metering, control systems, etc. If energy used for street lights were also billed, which would be required if EDM would be commercialised, the total to be recovered is 25 per cent.

In 1993 sales revenue amounted to MT 165.6 billion corresponding to approximately USD 44 million for deliveries of 703 GWh. Recorded production (including purchases from South Africa) was 829 GWh or 118 per cent of sales. Of this some 13 per cent should be recoverable. This would correspond to around MT 20 billion. If, in addition, collection was improved so that the average collection period would be two months instead of six, EDM would improve its balance sheet by a total of MT 75 billion which at a nominal[11] cost of capital of 12 per cent would equal a revenue of MT 9 billion annually.

Principally, losses are defined either as technical losses (system losses) or administrative losses (billing and collection). The cost of technical losses refers to the cost of bulk power which is in the south, presently decided by the contract with Eskom. When the Cahora Bassa power is available, also in the south, in 1998, the costs will be reduced considerably. The administrative losses are referred to consumption and the costs are equivalent to the tariff level. Technical losses may be reduced either by investments or by better load management through a adequate tariff system. Reduction of administrative losses means improvement of routines and control functions, including also training of the manpower. Taking into consideration the size of the losses and the costs involved, the urgency of loss reduction is obviously related to the administrative losses. This means concentration on efforts in order to make sure that all consumption is being metered, read and billed, and that payments on the electricity bills are collected.

6.8 Demand Side Management and Energy Efficiency

Both NORAD and SIDA are involved in this area and there would appear to be merit in a closer cooperation or at least, information exchange between the two donors. NORAD is directly involved through its sub-sector agreement supporting "Power by Saving", which intended to promote energy-conservation and efficiency with special emphasis on key industries and the tertiary sub-sector (commercial and offices, street lighting, etc). The conclusion from the pilot project on improving the EDM customer service function to advise end-users on efficient utilization, seeing it basically as a institutional problem, seems appropriate. Energy efficiency is very important and EDM's institutional capability to manage and implement actions in this field needs urgent attention.

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[11] 12 per cent is considered indicative of the real alternative cost of capital for Mozambique at present.

SIDA's support to this area is mainly channelled through the Stockholm Environmental Institute, SEI, and the World Bank/ESMAP from special Methodology and Research funds.

Mozambique together with Tanzania, Zimbabwe and Zambia is partaking in an energy efficiency/rural electrification programme run by the Stockholm Environmental Institute. This project is at present most advanced in Tanzania with some interesting developments, e.g. positive experiences from the supply and installation of meters and load limiters and efficient lighting in communal settings as part of a demand side management programme.

The experiences from SIDA's support to ESMAP's electricity efficiency strategy programme in Tanzania might be of interest. A recent study to investigate how efficiently Tanesco's large consumers used electricity, showed that within 25 chosen companies, there was a saving potential of 10 MW (35 GWh/yr). The maximum demand of these 25 companies is in the order of 80 MW so the saving potential is around 13%.

6.9 Assessment of Manpower Development and Training

The manpower in EDM has been scaled down during the recent years as shown in table 3.6, but the labour productivity is still low, being on the level of other major utilities in the region struggling to improve. Measured by the ratio of consumers to employees, which was 48 in 1993 and expected to reach about 60 at the end of 1995 (2500 employees), there should still be potential for improvements in the area of 20-30%, while maintaining a labour-intensive profile in the operations. In comparison, it could be mentioned that a similar figure in Scandinavia would be upwards from 120.

The human resource situation has gradually improved, mainly as a consequence of the internal training organised by EDM with the support of Swedish and Norwegian donors (see table 3.3). The absolute reduction in employees, while the proportion of skilled personnel has increased, may be taken as a proof of this. However, the number of highly qualified staff is still insufficient and it makes the organisation vulnerable. Continuous future efforts to invest in the education and training of the employees are very important.

Referring to section 3.4.2, the number of expatriates constitutes 1.3 % of the total staff of EDM, if personnel on consultants' teams and personnel on direct contract with EDM is counted. This is very high and may be defensible only for a shorter period, while preparations of the "new EDM" are taking place. It is important that capacity and conditions on EDM's side (counterparts etc) are adjusted, so the benefits from technology transfer and training can be maximized.

The training activities of EDM is very closely linked to human resources development. Different programmes, organised in steps, give the individual a good overview of the opportunities and provides the management a platform to use in the development of the organisation. A database with information on background and education for each employee is still lacking. This database is under way, however, and will be complete for the electricians category, during 1995. This will then start to give the organisation better knowledge of skills and education needs and it will most probably lead to a more "demand-driven" education process, when knowledge can be decentralised based on the new planning tool.

The reports on the SIDA-supported training programmes are ambitious and comprehensive, but it would be helpful if each activity or output were stronger related to overall efficiency criteria of EDM. In general, the Review Team assumes that the main core of support to training activities should continue in the direction of specialising EDM personnel in disciplines and routines of particular importance for efficiency development in operation and maintenance.

Training activities in the NORAD-financed sector of managerial and institutional development needs special attention on development of personnel in the commercial sector and in activities related to increase the efficiency of this sector. Improvements need to come fast and seem to require a boost in planned training activities over a period.

6.10 Strengthening and Extension of the Physical System

As electrification is considered one of the basic factors for development, also expressed by the clear relationship between GDP and consumption of energy per capita, the Review Team agrees that this would constitute a major objective for EDM in the years to come. When the DC line from Cahora Bassa is recommissioned in 1998, and repairs on the transmission system after the war continue, EDM will have power and transmission capacity for many years to come to accommodate extension of the distribution system.

The issue of rural electrification was discussed during the Review Team's visit, and both general aspects and actual projects have been mentioned in this context. The projects specially mentioned was **Mbau, a small hydropower plant in Niassa, the construction of a line from Mocuba to Gurué, the construction of the Alto Malema hydropower plant , the construction of a 33 kV line from Xaí-Xaí to Inhambane,** and **the rural electrification programmes in general**.

For instance the choice between alternatives of Mbau small hydropower project, compared to connecting Lichinga to the main grid, shall in general follow the lines of least cost planning, where the economic merits of the projects expressed in net present value have to be given an decisive importance. The situation of war which prevailed in Mozambique up to 1992, is a different situation from today. Different criteria or premises for choice of projects prevail today, where least cost planning must be primary.

In becoming a commercial entity, EDM needs to follow commercial principles also in rural electrification. It seems accordingly correct for EDM in general to follow a policy of electrifying the major population centres and gradually extend the network into the surrounding rural districts. The first efforts need to be concentrated on recovering assets in existing networks which has been destroyed during the war, by rehabilitating and reconnecting them to the system, especially in the districts where people are moving out from the towns and resettling at their earlier homesteads.

Decisions on rural electrification incorporating for instance, broader considerations in connection with rural development, are referred to government policies and shall as such not be the direct concern of EDM as a commercial entity. The point is that subsidies for rural

electrification should either be i) external to EDM, or ii) refunded directly to EDM. EDM as the executing agency of such electrification projects, should anyway be compensated for the non-commercial component of the costs.

Major projects of regional nature like the transmission links **Cahora Bassa - Harare (Zimbabwe), Cahora Bassa - Lilongwe (Malawi), Maputo - Zombodze(Swaziland)** and the hydropower projects **Cahora Bassa II and Mepanda-Uncua**, are per definition, commercially based and should be treated as such also in the context of financing.

6.11 Operation and Maintenance

The war situation has affected operation and maintenance of the technical installations. To keep main installation in operation, allocation of financial and human resources has been needed for repair of sabotaged equipment and security reasons has made difficult the access to installations in the district.

Tables 2.8, 2.9 and 2.10 shows that forced outages, both in number and average length has dropped drastically since 1991-92, which indicate that EDM is returning to more normal activities of repair and maintenance tasks. It is expected that these figures continue to drop while EDM is implementing rehabilitation of provisional repairs or destroyed installations and returning to ordinary maintenance. However, mines still represent a limiting factor in the field.

During the years of war, EDM has continued to improve the quality of its staff. The limiting factors in executing the extraordinary maintenance work, left after years of war, are management and human resources capacity and not least, equipment and spare parts.

7 Assessment of Assistance by NORAD and SIDA

7.1 Direction of the programmes and programme impacts

The Review Team is in general agreement with the direction and content of the NORAD and SIDA programmes.

While the NORAD and SIDA programmes , in contrast to the more project-oriented assistance from other donors, have been provided on a long term basis and given EDM a relatively stable and predictable basis, they may even so have contributed towards continued aid dependence and relieved the organisation of the pressure of necessity to change. It is the Review Team's impression that the new situation with a prospect of autonomy has injected some business spirit and understanding of needs into management. The best service NORAD and SIDA can do to EDM is to direct the support, so as to ensure that this hopeful process does not loose momentum.

Apart from a consciousness of efficiency detected during the Team's visit in Maputo, a few global indicators of performance may substantiate this impression. The increasing **ratio of**

number of consumers to number of employees (table 3.6) is a clear indication that the training and institutional development has had an positive impact. The comprehensive reduction of **forced outages and the average length of the outages** (tables 2.8-2.10), may further indicate better efficiency in operation and maintenance, in spite of the fact that some of this may be attributed to after-war impacts. **Losses measured in energy and economic terms** is another important indicator. The doubling of the collection of electricity bills in Beira in economic terms , which is essentially more than can be accounted to load and tariff increases, is an undisputable improvement, while the Northern and Southern regions seem to be lagging behind. **Financial indicators like rate of return on fixed assets in operation** and **debt/equity ratio** are to the best, not qualifying indicators at the moment. **Number of expatriates in EDM**, either as employees of EDM or member of the consultants' team, are still at a very high level, representing 1.3 % of the EDM staff which is a considerable share of the highly qualified staff

7.2 NORAD Programme

7.2.1 The Current Programme

In the country programme negotiations in 1977, Norway was requested to support the power sector in Mozambique. During the period 1978 - 86, the cooperation between Norway and Mozambique resulted in a number of project agreements including hydropower studies, construction of the small hydropower plants in Lichinga and Cuamba, pole impregnation plant, supply of equipment and spare parts and institutional cooperation NVE-EDM. The financial support increased from NOK 25 million per year to about NOK 45 million per year, at the end of the period.

It was found expedient to enter into a four year sector agreement in 1987, due to the gradual increase in the Norwegian support to the sector. The agreement was later extended to comprise also the years 1991 and 1992. The total financial support during these six years amounted to about NOK 300 million. In addition to continued support to projects started under the first period (for instance Cuamba), financing was allocated to extensions (for instance the hydropower studies) and new projects as rehabilitation of the 275 kV line from Eskom, the 110 kV line Maputo - Corumana - Ressano Garcia and the NORAD/SIDA financed Corumana hydropower station.

The new four year sector agreement for 1993-96, resulted in a financial grant of NOK 192 million tentatively distributed with an annual budget of NOK 48 million. The agreement represented a major readjustment in projects and priorities. Hydropower studies, institutional cooperation NVE-EDM and major investment projects were not included. NOK 127.5 million were allocated for purchase of equipment and spare parts. The two other major allocations were made for a reframed institutional development project, including supply of computerised management systems and five advisers and for training concentrated to management training. It was already foreseen and agreed that SIDA should compensate in the areas of technical training where NORAD support now would cease. This is a reality since 1994, when the NORAD financed management training, through a contract between EDM and EDP-INTERNEL, started.

The overall objective of the last agreement was formulated as "to support and strengthen Mozambique's ability to provide a regular supply of electricity to its consumers, by giving financial support to a programme for institutional development and assistance to various project studies and activities within the sector", being in line with Mozambique's development objective of an economic and ecologically sustainable utilisation of the hydropower resources.

The programme gives the following indicators on attainment of objectives in the period:

1 Institutional development
- replacement of expatriates with competent local personnel
- a broader representation of competent middle management staff
- training managed by EDM's own resources and personnel

2. Equipment and spare parts
- maintaining a stable power supply in the urban and densely populated areas

3. Legal and Regulatory framework
- clarified distribution of roles between the Ministry of Industry and Energy and EDM

4. Planning
- in-house planning competence
- long-term investment plan

5. Consumer relations
- better informed and more satisfied consumers

The actual spending of funds during the period is shown in chapter 5.

7.2.2 The Components of the Programme

The Commodity Assistance Programme has enabled EDM to continue their own activities of realising smaller distribution projects, which is not suitable for turn-key agreements or engagement of contractors and has been, as such, a fundamental contribution to maintenance of an annual electrification level of 4000 - 5000 new consumers . The funds partly used for spare parts have also played an essential role in meeting the objective of a stable power supply in urban and densely populated areas.

In 1994 the commodity assistance post grew to NOK 66 million, which means the double of the initial tentative budget, due to the construction of the 33 kV line Nampula - Angoche. The Review Team is of the opinion that the commodity assistance on equipment and spare parts has such positive impact that it should continue until EDM can be reasonably expected to generate the necessary funds by itself. However, the Team wishes to emphasize the need to maintain a fixed level, possibly in the same range as the tentative budget for 1993 - 96, prioritizing accordingly, and to avoid investment projects or any other activities to be included. It is assumed that equipment and spare parts will be in huge demand for

rehabilitation and repair of distribution networks after the war, in order to resume supply to customers or improve quality of existing supply.

The Institutional Development Project is also strongly supported by the Review Team, providing EDM with the necessary resources to manage the transformation into a commercial and efficient entity. To meet the objectives, it is imperative that the resources made available can be used in an efficient way. This is only partly the case today as the accounting and financial control system and the customer information and billing system, both supposed to be essential tools, have not met the requirements. Both systems should without delay be replaced by off-the shelf systems, enabling implementation of appropriate and efficient routines.

The attainment of the objective of improved customer relationship will depend on efficient and reliable billing and collection. At present this may not be the case.

The restructuring process shall be carried forward with the necessary momentum to attain the goals. This may require more specific targets requiring closer follow-up also from both NORAD's and SIDA's side. The natural environment of competitive factors are lacking in Mozambique and only the strong internal drive in EDM can give the process the necessary momentum forward. In this connection it should be mentioned that the legal and regulatory framework needs to be approved to give EDM the formal platform. The ability of the Ministry and the not yet established National Electricity Council, to fill their roles and participate appropriately in the process, is of major importance in the restructuring process of the power sector.

Training is an imperative support function in the restructuring process, embracing capabilities which include management, corporate planning operation and use of information systems and routines.

In the continuance of a cooperation in the power sector, resources should be concentrated to providing the support to the above activities. The other project on the programme for 1993-96 is peripheral in this context.

7.2.3 Cuamba Hydropower Plant

The construction of the project continued through the heavy part of the war, interrupted in periods due to nearby acts of war and problems with supply of equipment etc. The 1 MW plant was inaugurated in 1988 and has since then provided a reliable supply of both water and electricity to the community. Due to the stabilizing effect of the project providing a reliable electricity supply, in a district seriously suffering from the war, the population of the area increased close to 70% - to 76,000 - during the period of war. Table 7.1 shows the generation and the billed consumption in MWh since commissioning of the station:

Table 7.1: Produced and billed consumption in Cuamba

Year	1989	1991	1993	1994
Produced (MWh)	1387	1890	2202	2027
Billed (MWh)	n/a	1230	1448	1485

The above figures show losses of the same size as for EDM in general, about 30 %.

It is stated in the Socio-economic Impact Study [42] that the construction of the small scale hydropower plant, Cuamba, has been a particular success, with high availability and reliable operation, supplying local industry, health institutions, commercial activities and households. In particular, the report emphasizes the effects the electricity supply had, not only to Cuamba, but to the whole southern part of the province during the war-time and the potential it creates for post-war development in the area.

The report also mention the uncertainty among local people as to the stability of earth around the dam, pointing at falling stones and small landslides. However, it has not been presented any specific assessments that indicate any real basis for this concern.

7.3 SIDA Programme

7.3.1. Introduction

The stated overall objective of the SIDA Programme, is to contribute to the development of an efficient and financially sound energy sector aiming at the promotion of the economic development of the country. As all projects and activities in the Programme refer to the electricity subsector, "sound energy sector" above is interpreted to actually mean "sound electricity sector".

There is no indicator for the development objective presented in SIDA's Programme, but the ratio of number of employees per consumer is regarded as a reasonable indicator of the direction of the general efficiency in the sector.

SIDA's specific objectives are:

- to assist Mozambique in improving the efficiency in the operation and maintenance of the transmission and distribution systems in the country;

- to assist Mozambique in the administrative and technical development of the organisation, EDM.

Again, no indicators for these objectives were presented in the sector agreement, but an indication of the efficiency in the operation and maintenance of the transmission and distribution is provided by the development of the number and lengths of outages in these networks. Section 2.2 reports positive developments in these areas i.e., the efficiency in the operation and maintenance has improved.

Indicators of a positive development of technical and administrative professionalism in EDM, would reflect a trend towards continuously larger proportions of EDM staff at higher qualification levels. This is illustrated by Table 3.4 i.e., confirming the increasing professionalism in EDM.

7.3.2 Administrative and Technical Development Projects

The SIDA support over several years of the technical development at EDM, has brought the level of development up to a generally satisfactory level, but the breadth is not enough. Due to the fragile organisation on the technical side, an abrupt end to the SIDA technical support would most likely result in a collapse of what has been achieved over the years.

Regarding **Technical Assistance on Transmission and Distribution** the Review Team recommends continued support to this project, although at a somewhat lower level than at present and with the aim to phase out the project over the next three years. In addition to short term visiting specialists, the following resident staff is envisaged:

- Chief adviser, the whole TA period.
- Protection adviser, 2 years
- Maintenance adviser, 2 years
- Distribution planning adviser, 2 years

An archive specialist for 1-2 years, possibly on short-term missions after an initial period of preparatory work to decide the organisation of the work, would be of considerable support to the distribution planning adviser. EDM would need to reserve the manpower necessary to do the work as soon as the archive system and the work programme is decided. The proposed activity is, so to say, covering the missing link between the distribution planning on one side and the customer information system, on the other side.

The Technical Assistance Project should concentrate on the core objectives for each activity and as early as possible, during the period, phase out extraneous activities such as operating aircraft, managing vehicle fleet and financing consumables and spare parts.

The Review Team recommends that the training assistance to the **Training Centre Activities** is continued initially on a similar level as under the present agreement, i.e. mainly in the form of support to the training management, but with preparations for a complete taking over of financing by EDM, by 1998.

The **Loss Reduction Project - Distribution** is very important and should be continued. SIDA is financing the contract between EDM and SwedPower (March 1994) for this subject. The following objectives are referred:

1) review of the distribution system flow structures to identify the losses,
2) identification of methods to reduce losses,
3) review of meters and metering procedures and
4) survey of routines for connecting new customers.

The project has been delayed due to staffing problems and lack of counterparts. Preparations and staffing were completed in early 1995 and the it has been running smoothly since then.

The project would gain on a stronger formulated strategy and targets including economic indicators, in order to concentrate efforts to the areas with highest return. The project should

primarily establish the magnitude of losses and their causes, and then identify and prioritize the most cost-effective measures of loss reduction. Among the issues that require improvement and would contribute to reduce the administrative losses, are control and registration routines of customer connections, meter registration and maintenance system to be a coordinated interface to the Customer Information and Billing System, meter-reading routines and management reporting in connection with these issues.

7.3.3. Evaluation of Investment Projects

7.3.3.1. Beira Substation

Beira substation supplies 13,500 consumers in Beira, with 600 new consumers connected last year. A maximum demand for Beira of 17.3 MW was registered in February 1995. The current annual growth is about 7%. The energy distributed from the Beira substation was 73 GWh in 1994 of which 62 GWh was invoiced.

Although the previous sabotage actions of the power lines to Beira have stopped, the hydropower supply to Beira is still somewhat erratic. EDM's statistics in Beira (78) show that on average in 1994, there were 7 monthly interruptions of 6 -144 minutes in the supply from the hydropower stations in Mavuzi and Chicamba.

The power cuts are mainly due to the poor condition of the Beira substation, eg poor selectivity resulting in total trip outs for local faults, but aggravated by the poor communication systems to the hydropower stations. Only HF radio communication exists (no night time communication possible) as the old PLC system is inoperable and the VHF systems around Beira and Chimoio cannot reach the hydropower stations.

SwedPower won the tendering for the consulting services for the Beira substation. The contract dated May, 1993 is for SEK 1,380,000. ABB Substation AB won the contract for the Renovation of Beira Substation. The total contract, signed on the 31 of May 1994, is for SEK 16,620,000:-. The time of completion is June 25th, 1995. The project was one month behind schedule during the Review Mission's visit to Beira.

The technical standard is generally satisfactory. ABB's contract covers a turn-key delivery of new indoor switchgear for 22 and 6.6 kV, ie the outdoor switchgear and transformers are not involved (except for the supply of 3 new SF6 110 kV circuit breakers). However, it would have been prudent to include repairing the tap-changers on the transformers, which EDM cannot do itself. In addition, the air conditioning requirements for the control room specifies the temperature to be brought down to 20°C from a tropical maximum of 45°C with a relative humidity of 100%, which results in an oversized air conditioning installation.

It can be argued that this type of project is best suited to a smaller contractor. Renovations of old installations with limited documentation of existing buildings and installations and where the specifications put all the onus on the contractor to establish the correct existing conditions and to design accordingly, are very difficult to tender on for an overseas contractor (Only major contractors were short-listed and only ABB tendered. The initial tender was high in comparison with the estimates).

The strategy developed by EDM/SwedPower is that trouble-shooting and simpler fault-finding in the distribution networks (including transformers) are dealt with at the regional level. More advanced fault-finding is done by the specialised groups in Maputo.

For Beira, the situation is quite advantageous as there is a good back-up in Chimoio. There is one specialist group in Beira and one group in Chimoio, each consisting of one control - and one maintenance specialist. In addition there are two telecommunications specialists in Chimoio.

Specific Portuguese and English maintenance manuals for each substation will be available as a result of SwedPower's work. In addition, more generalised operation manuals in Portuguese and English will be available. This system has already been found to work satisfactorily in Mozambique. Although the operation manuals are not followed in detail, they are being used.

7.3.3.2. Beira Gas Turbine

From 1981 the 110 kV transmission lines supplying Beira were sabotaged numerous times. During 1985 and 1986, Beira was without electricity five months each year. The frequent interruptions in the energy supply seriously affected the economic and social life in the city of Beira and disrupted vital functions like water and sewage systems.

In addition, the reliability of the power supply to Beira became increasingly important along with the continued implementation of a rehabilitation of the transport, communications and energy corridor between Beira and Zimbabwe, the "Beira Corridor", a huge SADCC programme comprising around 60 sub-projects.

Studies were therefore carried out during 1986 and 1987 on various solutions to arrange an emergency power supply to Beira. Alternative power plants studies included mooring an icebreaker in the port as well as different combinations of diesel generators and gas turbines.

In December 1987, Sweden and Mozambique signed an agreement on Emergency Power Supply to Beira Town. SEK 40.5 million to be charged to the Emergency Account and SEK 17.5 million to the SADCC account.

EDM and ABB STAL AB signed three contracts on 14 December 1987, with the following firm prices:

• MW gas turbines	SEK	53,100,900
• Resident Service Engineer during 2 years after Taking-over	SEK	2,450,000
• Inspection and maintenance services for a further 3 years	SEK	1,500,000

The gas turbine was commissioned on the 1st of January, 1989, a delay of about two months. The contract regarding provision of a resident Service Engineer expired on the 31st of December, 1990.

After a contractual service visit to Beira in April 1991, ABB STAL recommended that the chimney and sound outlet baffles should be repaired/replaced due to heavy corrosion damage. This recommendation was repeated after a subsequent contractual inspection by ABB STAL in January 1992.

SwedPower was appointed by SIDA and EDM to handle the matter already in 1991, but the matter has dragged on for quite some time. In spite of extended negotiations between all parties and an additional agreement with ABB for SEK 800,000, the defect has still not been rectified and on site there did not appear to be a complete agreement or understanding on how the situation would be resolved. This is 4 years after the defects were discovered! However, the main part of the repair material has arrived, ABB repair staff have been on site and more people were expected to arrive the week following the visit by the Review Mission. Without apportioning the blame, the handling of this matter does seem to lay itself open for criticism of various parties involved.

The gas turbine is an ABB STAL type GT35C, i.e. the latest design with a sophisticated computerized control system. EDM prefers this more modern design to the older version, type B, which had much of the control equipment consisting of relays.

A comprehensive training programme was included in the original contract with training both in Sweden and on site. However, some of the trained staff left the gas turbine in Beira shortly afterwards. A new training programme was subsequently implemented and now the staff seems to be adequately trained. On site, the Review Team was informed that the gas turbine is operated by 9 operators on a 24-hours roster and serviced by 7 repairmen. A service contract with ABB is in force and monthly maintenance reports are vetted by ABB. The EDM Staff seemed well acquainted with the operation and maintenance manuals and denied any language problems. Adjacent workshop and spares are adequate. However, the whole maintenance concept relies on some form of continued ABB Service assistance.

The improved reliability of electricity supply to Beira has increased the pressure on EDM to reduce the number and lengths of power cuts and the gas turbine is therefore nowadays more quickly called upon to cut in. The statistics of the operation and production of the gas turbine in Beira is shown in Table 2.9.

The cost of producing one kWh from the gas turbine is likely to be in the area of 20-25 US cents. With the present tariff system some 5 cents can be recouped. The large cost during power cuts, however, is not of financial but of socio-economic kind due to disturbances to industry, commerce and administration. In Sweden this cost has been estimated to about 30 SEK/kWh. In Mozambique the value is lower, say generally 0.5 - 1.0 USD/kWh, but the nature and importance of the Beira Corridor Transport System might have initially justified a higher figure for Beira. The economic cost of the average monthly cut off duration during 1994 of about 2 hours would correspond to about 2 MSEK/year assuming 0.60 UScents/kWh.

Although the residual value of a GT35 gas turbine from 1988 is considerably reduced after these 7 years, it could be resold or relocated to other locations for more frequent service. However, EDM strongly argues the need to keep the gas turbine in Beira. With peace in place, EDM now intends to concentrate on reinforcing the hydropower transmission lines to Beira,

which will require isolating the lines more frequently. The Review Mission sees no obvious other alternative and thus concurs with EDM in this respect.

Since the gas turbine was installed in Beira and the new 110 kV transmission line was constructed along the road, the number of sabotages decreased dramatically. The project has thus been very relevant to the needs.

The gas turbine has greatly contributed to providing reliable electricity supply to the city of Beira and the Beira Corridor activities, thus achieving the objectives and having a great positive impact.

7.3.3.3 SE6 Substation in Maputo

In January 1993, SwedPower was awarded a contract for SEK 970,000:- for consulting services for the project.

A contract was signed with ABB Substations AB on the 19th of November, 1993, for the turn-key project Finalisation of Substation SE6. The total contract amount is SEK 9,450,000.-. The date for completion is the 31st of May, 1995.

Although the project is labelled Finalization of SE6, it should rather be regarded as "Phase 2" of a three phase project. The previous "Phase 1", included the erection of the building and the installation of 33 kV switchgear inside the building.

The current "Phase 2", includes basically the installation of 11 kV "Safe Six" air insulated indoor switchgear and a transformer outside. This transformer has three windings (11 kV, 33 kV and 66 kV) and a future "Phase 3" will include 66 kV outdoor switchgear. The technical standard is deemed appropriate.

Because this project is a continuation of a previous one, it has been much simpler to implement than the Beira Substation. In the Beira Substation project, the excavation discovered quite often, unknown and hidden equipment which necessitated investigations and redesigns and/or site instructions. At SE6, the ground and the existing installation was well known and well documented.

Nevertheless, the project had to be stopped in June 1994, because a DNEP road construction project claimed some of the substation site. Although the City Council had originally allocated the plot to EDM for the substation, it became necessary to redesign the substation layout to accommodate the road. By October 1994, the project continued. Both the Contractor and the Consultant have indicated that they have suffered extra costs for extra work in relation to this change, but no cost figures have been presented. It is expected, however, that the contingency in the contractor's contract will cover his extra costs, as well as the only other variation presently envisaged (about SEK 17,000 for a cable box).

All civil works had basically been completed by the time of the visit of the Review Mission. The equipment had arrived and 6 containers with equipment were stored in EDM's store, but the transformer was still in the port. The contractor's site manager was due to arrive within

two weeks of the Review Mission's visit to start the electrical installations. No further delays were foreseen and the completion date is expected to be met.

However, there is a Court case pending over denied access to a building in the adjacent Zoo. The originally agreed entrance corridor, had to be deleted because of the redesign.

The general comments made above about the staff in relation to operation and maintenance, applies to SE6 as well.

7.4 Joint NORAD - SIDA financed Project : Corumana Hydropower Station

The Corumana Hydropower Project is integrated into the 45 m high Corumana Irrigation Dam in the Sabie River 140 km north-west of Maputo. The head is utilised in two Kaplan turbines capable of producing 36 GWh/year, on an average with a maximum peaking capacity of 11.9 MW, if no floodgates are erected. If the floodgates are erected, the energy output on long term can be raised to an average of 38 GWh/year, with a peaking capability of 14.5 MW. The civil construction making it possible to install the floodgates has not been completed.

The power station was commissioned and handed over to EDM in March 1991 and supplied Maputo via a 110 kV transmission line. A second line connect the station with the South African grid in Komatiport. Together, these two lines act as a reserve for the main (275 kV) Maputo-South Africa connection. The station is also supplying the surrounding area including the Sabie irrigation scheme.

The generation of power since the station came into commercial operation, is as follows:

Year	1991	1992	1993	1994	1995
Production (MWh)	1,706[12]	5,970	4,159[13]	-	-[14]

In September 1993, the Water Department (now Ministry of Water and Construction) introduced a new water regime including water fees. The Water Department advanced a demand towards EDM to pay the same fee, which was refused with reference to:

- the power station did not consume any water to the disadvantage of irrigation etc.
- EDM could buy the power cheaper from Eskom

This deadlock in negotiations until operation started again in March 1995, has resulted in a considerable national loss as EDM has been required to replace Corumana with purchase of power from Eskom. The loss of Corumana's 11.9 MW peak-lopping capacity constitutes the major cost in this connection. The financial loss during the 17 months of standstill may be as

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[12] 9 months operation in 1991 as commercial operation started in April.
[13] 9 months operation in 1993 until commercial operation was stopped in October due to lack of agreement between Water Department and EDM.
[14] Start of operation the 7th of March 1995

high as 2 million USD, the calculation based on Corumana's average production capacity, peak-lopping capacity of 11,9 MW and Eskom's regional tariffs in 1994.

In retrospect it can be concluded that possible problems to the effect of water management etc have been overseen during the planning.

Referring to the agreement signed the 3rd of March, 1995, which includes a fee corresponding to 50 % of the amount payable to Eskom for a similar quantity of power delivered to Maputo, the following comments are made:

i) it is understood that the fee has not been motivated by excess costs or losses on the hand of the Water Department due to the compromise between electric power production and irrigation, etc. Consequently, the fee appears to be an unmotivated cross-subsidisation in favour of the water sector. The special discount on consumption not motivated by quantity or voltage level, amplifies the impression of an unbalanced agreement.

ii) the agreement's set of rules regarding coordination of hydrological planning and water management is found appropriate.

With reference to i) above, the transfer of income endanger the financial basis for future operation, maintenance and renewal of the station. The agreement to this extent may even violate the understanding and the premises on which the financial decisions to construct the plant were based. The total grant of NOK 183.7 million made available, was divided between NORAD and SIDA as follows:

- NORAD: 83.9 MNOK (46 %)
- SIDA : 99.8 MNOK (54 %)

The field visit made to Corumana the 7th of March (the very first day of operation after the 17 months' stop of operation), showed a well designed and well-maintained station. However, two circumstances reduce the otherwise general positive impression:

- the main valve for generator 2 (butterfly valve) is still out of operation and has been out of operation for a time exceeding the standstill of the station. It may be that the efforts now being made to increase the counterweight solve the problem, but more probably the valve will have to be dismantled and repaired at a workshop abroad, eventually at the factory in Germany. In this case the station is out of operation for many months.

- it was informed that one of the main circuit-breakers has a defect release mechanism which makes it impossible to take it out for maintenance. The problem has existed since well within the guarantee period, according to the information received. The report from the guarantee inspection does not confirm this. The Review Team assume that switchgear personnel in EDM may help, but no technical investigation was made to confirm this.

It is relevant to point out that both these essential repairs are long overdue, especially since the closing of the station during the last 17 months has provided all the opportunities to get things in order.

D RECOMMENDATIONS

8 Programme Recommendations

In order to solve the issue of EDM's negative capital base the consultant, Coopers and Lybrand, has drawn up a Financial Recovery Plan under which EDM would be transformed from a state enterprise to a joint stock company with shares to be solely owned by the State. It is argued that this would put greater pressure on EDM to operate within its means. It would also require the company to address the issue of its negative capital and make it responsible for the debt in its books subsequently. As it is today, neither EDM nor the State, services the relatively large debt acquired in the past for the investments made by EDM in the power sector.

This change would also make it possible to open up the electricity sector to competition by eventually abolishing the monopoly. This could be one way in which to offset the risk, always inherent in a monopoly situation, that inefficiencies are compensated for by raised tariffs.

Alternatively, Mozambique could create an independent regulatory body with authority to control the electricity prices at different stages of the generating, transmission and distribution chain. However, it is important now in the ongoing restructuring process in EDM that the systems being developed, is based on the principle of transparency in order to make it easy for a regulatory body to execute its work. Given the dominance of Cahora Bassa as the source of power supply for Mozambique and since its power is almost free of charge, regulation will be called for even in case of an open market. This would imply introduction of firm policies as regards to financial performance as well as carefully monitoring performance targets. There are several different models for regulating power suppliers and the draft Law on Electricity, provides the National Electricity Council to act in the role of independent regulator for the electricity sector, based on policy instructions from the Minister.

In the absence of competition, it is recommended for future Norwegian and Swedish support to the electricity sector of Mozambique, to be oriented towards structural changes to ensure efficiency pressure on EDM. From 1998, with access to Cahora Bassa power, financial support should not be needed. Reduction of losses and more efficient administration would also contribute to a situation where EDM could be financially self-sustained.

Consequently, the NORAD and SIDA programmes, - supporting activities embraced by the projects designated Institutional Development, Training, Technical Assistance and Loss Reduction, -represent a well composed package, vital in the restructuring and efficiency programme. The result of these efforts is that EDM is now on the way to becoming a self-sustained, commercially oriented enterprise. Taking into account the present status of the ongoing processes, and the importance to maintain the present momentum and enthusiasm, the Review Team recommends support in the amounts and of the kind rendered now by NORAD and SIDA for another 2 to 4 years The support should be contingent upon unremitting follow-up from EDM's management of the programmes for institutional development which is now under way. The team consider it important that the progress of the

programmes and activities are focused on measurable results that should be reflected in the operation plan.

Timely and adequate decisions, ever so painful they might be, have to be taken and enforced in order to avoid halt in the processes. Of the more concrete milestones to be mentioned, the team considers important that the National Assembly approves the legal framework for the sector without delay, that functioning general ledger and customer information systems are implemented, and that the Commercial Department rapidly becomes an efficient operative department.

9 Specific Recommendations on Activities

It is recommended that the **loss reduction activities** incorporated in the Loss Reduction Project(SIDA) and the Institutional Development Project (NORAD) are extended and coordinated in time and activity to obtain best possible effect. Management-, administrative-, information - and control routines as well as training activities are relevant in this context. Objectives should be reformulated in financial terms instead of in terms of activity.

The decision to replace the General Ledger System by a off-the-shelf system should without delay be followed by a similar decision regarding the Customer Information and Billing System.

The **commodity assistance** from NORAD, which was initiated due to special circumstances - frequent destruction and damage to the distribution system - would be very helpful also in the continuation, provided that it is always restricted to the amount budgeted and not burdened with additional ever so justified items such as in 1994, with financing of the 33 kV line to Angoche. By maintaining the discipline that this is an available but limited resource, this item will fill the dual function of providing EDM with a much needed pool of material for work that EDM itself can undertake and facing EDM with a real case of prioritizing.

Regarding the project **Technical Assistance on Transmission and Distribution** the Review Team recommends continued support, but phasing it out over the next three years. Inputs in the form of short-term visiting specialists and resident advisers are envisaged to strengthen the capabilities in the fields of system protection, maintenance planning, management and distribution planning.

The project should concentrate on the core objectives for each activity and, as early as possible during the period, phase out extraneous activities such as operating aircraft, managing vehicle fleet and financing consumables and spare parts.

The Review Team recommends that the SIDA training assistance to the **Training Centre Activities** is continued initially on a similar level as under the present agreement, i.e. mainly in the form of support to the training management. The NORAD-funded training component is similarly recommended to be maintained to support the management training and the thrust to train personnel in the administrative and commercial operations and routines.

The Review Team recommends that other budget components like the personnel fund and the consultant fund (NORAD) not related to the above, should be carefully reassessed and eventually faded out. The rural electrification component (NORAD), should be limited to the above recommendation of supply of equipment and spare parts. Investments in the physical system like substations, lines etc. should be referred to other type of financing outside the programmes, providing that EDM can obtain commercial financing.

E APPENDICES

The following appendices are enclosed:

E1 List of Reference Documents

E2 Terms of Reference

E1 LIST OF REFERENCE DOCUMENTS

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APPENDIX E2

TERMS OF REFERENCE

REVIEW OF THE ELECTRICITY SECTOR IN MOZAMBIQUE AND THE SUPPORT TO THE SECTOR BY NORWAY AND SWEDEN

1. BACKGROUND

Norway and Sweden have supported the electricity sector in Mozambique since the early 80'ies. This has been a major area of assistance for both countries, which i.a. is indicated by cooperation through Sector Agreements allowing for programme support rather than support on a project to project basis. NORAD's present sector agreement for the period 1993-96 has a frame of NOK 192 million, with two addendums of NOK 22 and 23 millions, while SIDA's agreement is for the period 1.07.92-30.06.95 with a frame of SEK 90 million. In addition to this assistance under the bilateral programmes both countries have provided assistance through regional projects (SADC). At present assistance through concessions and credits for projects carried out by companies from the two countries (export support) is particularly relevant.

Recipient and cooperating partner for the Norwegian and Swedish assistance has been Electricidade de Mozambique (EDM), established in 1977 as a parastatal organization under the Department of Energy, with responsibility for generation, transmission and distribution of electricity throughout Mozambique[1].
NORAD's sector programme concentrates on institution building and competence development, including training, aiming at improving the administrative efficiency of the company. A major component is commodity assistance, and the programme also includes components such as rural electrification and consultancy support.

SIDA's sector programme is directed towards technical matters like training for operation and maintenance of transmission and distribution systems, establishment of new technical standards and procedures etc. Linked to this, a number of investments have been made. These include substations and a gas turbine station in Beira.

EDM is currently undergoing a transformation with the ultimate goal of

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1 In addition to EDM, Hidroelectrica de Cahora Bassa (HCB) undertakes generation and sale of electricity from the Cahora Bassa power station.

becoming a highly efficient and commercially viable organization. To this end the government has enacted a new electricity act and new statutes for the operation of EDM have been prepared for government approval. EDM has been financially restructured, in as much as the government, effective as of 31 December 1994, has relieved the company of all debts not associated with on-lending agreements. The capital portion of the debt has been transformed into equity capital and a gradual increase of the average tariff to 9.5 US cents per kWh by 1998 has been approved. On the foundation of all this, and the improvements achieved within the company, EDM will in the near future be created as a public enterprise, with its own board of directors and management autonomy to act within the framework of market economy.

The present review, in addition to being formalized in the sector agreement in the case of NORAD, is motivated on basis of the fundamentally new situation for EDM, which may lead to a redirection or change in engagements. SIDA is in addition considering a concentration of their overall support programme to Mozambique.

2. OBJECTIVES

A primary objective of the review is to provide an independent overview and assessment of the sector in terms of the present system's adequacy to supply the customers with electricity and the plans for future expansions, together with the legal and institutional aspects required for a well functioning and efficient operation.

Specific objectives for NORAD and SIDA will be to acquire the documentation and analysis required to consider, and subsequently make decisions, regarding their future support to the sector. This will be done in consultation with the government of Mozambique on basis of the sector review and specific analysis of projects/sub-projects included in their respective sector programmes.

3. SCOPE OF WORK

3.1 General

Within the scope of work as defined below the team of consultants (hereinafter called "the Consultant") will document and present the present situation, condition, or system as the case may be, carry out analyses and assessments of the existing situation and plans for the future, and present their recommendations. The existing situation, the assessments and the recommendations shall be clearly separated in the report.

EDM shall be the primary source of information for the study. An important document will be EDM's report to the donor's meeting in Maputo in September 1994. NORAD and SIDA will make available copies of their sector agreements and minutes from their semi-annual or annual consultations. NORAD and SIDA

will also be available to give factual information if required.

It is acknowledged that a full and detailed assessment in some of the areas specified below will not be possible within the framework of the assignment. In such cases a statement of qualification regarding the assessment shall be made. The Consultant will prioritize the work in order to meet the main objectives of the review as stated in Section 2 above.

3.2 Sector Study

3.2.1 The Electricity Sector in a National Perspective

The Consultant will present and comment on the organizational set-up of the sector from the political to the operational level. Furthermore, a presentation and comments will be made regarding the

- development objectives of the electricity sector in the National Reconstruction Plan,
- economic, social and environmental significance of electricity supply in a development perspective,
- the electricity act and other laws and regulations pertaining to the sector, and
- tariff system and principles in the setting of tariff levels.

3.2.2 Present Electricity Supply, Existing Situation at EDM

Present Electricity Supply

The Consultant will briefly present the existing physical system for generation, transmission and distribution within the country, including interconnections with other countries; and assess its adequacy in serving the customers with reliable power. Key information such as installed capacity, actual production, import and export of power, consumption, technical and non technical losses, percentage of population served etc; shall be presented and commented upon.

Existing Situation at EDM

The Consultant will present and assess EDM's present capability in coping with its various tasks, in particular in view of the new situation with operation intended to follow commercial principles. Specifically the Consultant will i.a. present and assess the

- financial restructuring process and the prospects of establishing the required assets for self-sustainable commercial operation,

- organizational structure,

- human resources situation in various areas and levels of the organization (competence/experience and number of personnel),

- functional efficiency of the administration, e.g. delegation of authority, and

- number and role of expatriate personnel within the organization.

The Consultant will present an overview of all outside assistance to EDM by listing the agencies with their projects/programmes and budget allocations.

3.3 Assessment of Strategies and Plans

The Consultant will present and assess EDM's overall strategies and plans in relation to its goals as stated above. The assessments will include a review of the existing and potential regional cooperation in electricity supply (power pool). On a more detailed level the Consultant will i.a. present and assess plans regarding

- strengthened physical improvements with respect to generation, transmission and distribution,

- organizational changes (if any), institutional development and manpower training,

- operation and maintenance of the system,

- energy efficiency, demand side management and reduction of losses,

- metering, billing and revenue collection,

- accountancy and auditing,

- technical and corporate planning, and

- management information system.

The Consultant will asses the need for outside assistance (financial, technical) in the implementation of important tasks and projects. The possibility of attracting outside investors to participate in the sector shall also be assessed.

3.4 Assessment of Assistance by NORAD and SIDA

The Consultant will review all formal documents relating to the present sector programmes, like project documents prepared by EDM, sector agreements, semi-annual/annual reports by EDM and minutes from semi-annual/annual consultations between the parties. The Consultant will further familiarize himself with the various projects/sub-projects through contacts with EDM. For projects within institutional development and training, meetings may be held with the concerned experts/consultants and on-going or completed physical projects may be visited. Such meetings and visits shall be conducted in company with EDM. For experts/consultants involved in institutional development and training, job descriptions and Terms of Reference's for their engagements shall be reviewed.

The Consultant will review each and every one of the Norad supported projects/subprojects included in the two sector programmes (including those that have been initiated during the duration of the agreements). The following will i.a. be assessed for each of them:

- need in relation to the overall needs and priorities in the sector,
- results expected (originally) in relation to resource allocation,
- manner of organizing and implementing the project, incl. contractual relationships, roles and responsibilities,
- actual costs vs original budget and actual time spent in relation to original time schedule, and
- performance/actual results in relation to planned targets - to be assessed i.a. on basis of indicators of achievement and milestones set out in project documents, job descriptions, Terms of Reference's etc.

In respect of SIDAs projects, special attention shall be made to certain celected project activities, as outlined in Annex 1 to this TOR.

On basis of the individual assessments the Consultant will make an overall assessment of the two sector programmes in terms of reaching the intended overall development objectives as set out in the sector agreements. He will also present a recommendation for each of the individual ongoing projects as to whether they should continue as planned, be modified or terminated.

The Consultant will present his recommendation with respect to a future sector support programme for the two countries. This will be done on basis of the sector study and the assessments of the sector programmes. Furthermore, the Consultant will take into account the expertise and experience gained by the various experts/companies involved from each of the countries. The need for assistance in various areas and the magnitude of the support programme will be of major importance. However, specific projects shall be identified and

prioritized to the extent this is possible.

4. TIME SCHEDULE, REPORTING

The Consultant will present his report in 10 copies each to NORAD, SIDA and EDM no later than 8 weeks following signature of contract.

Oslo: 23.02.95

Sign NORAD

Sign SIDA

ANNEX 1

SPECIFIC TERMS OF REFERENCE

I SIDA ENERGY SECTOR PROGRAMMES

Specifically for the Swedish support the following programmes shall be analyzed and evaluated:

1) Technical Assistance on Transmission & Distribution including Loss Reduction.
2) EDM Training Centre Activities.
3) Electrical investment project covering hydroelectric and gas-turbine generation, transmission and distribution substations.

II EVALUATION OF SOFT PROGRAMMES

The evaluation of institutional Development related to 1) and 2) above is not easily performed through quantitative measures and becomes more subjective. It is extremely important to create some indicators which enables the proper appraisal of SIDAs support in Technical and Training Assistance. As SIDAs cooperation has developed from project investments to competence and institutional reinforcement in recent years, it is important that the programmes of technical assistance be thoroughly investigated. The specific requirement and objectives can be obtained from the Agreements with addenda and annexes such as Terms of Reference and Project document as well as Progress Reports and Agreed Minutes related to the ENERGY SECTOR COOPERATION agreements starting in the middle of the 1980s and ending with the period 1992/93 to 1994/95.

III EVALUATION OF PROJECTS

Evaluate investment projects under (3) above being tangible and have easily defined parameters, outputs, delivery schedules, benefits, etc and have been monitored and evaluated in progress and appraisal reports by EDMs Consultants and SIDAs advisors and audits. It will suffice if such reports are audited to verify the scope and quantify the value of each project investment and relate it to the benefits that the project has added to the Energy sector and to the welfare of society.

Nevertheless some selected projects should be investigated thoroughly and analyzed at greater depth through discussions with target groups and visits to the installation sites. We select the following:

Se 6 Substation in Maputo

* Beira Gas Turbin and renovation of Substation
* Corumana Hydro jointly financed by SIDA and NORAD

For these projects the assessment should cover but not be limited to the following aspects:

* Status of ongoing projects with respect to progress, completion dates, technical standard, expenditure and other essential matters in comparison to original plans, specifications and budgets. Problem areas are to be highlighted and their effect on the investment analyzed and if possible quantified in time and money terms.

* Finalized projects shall be studied on the spot to determined:
  - capability of the staff to operate
  - independency to perform maintenance
  - capability in trouble shooting
  - use of operation and maintenance manuals
  - no of faults, outages and duration.

This analysis will help to assess the positive affects in the investments.

IV SOME SPECIFIC SIDA OBJECTIVES

The purpose of the evaluation is to arrive at a clear assessments of results in an objective manner to enable SIDA and others concerned to determine the added value and achievements of each programme. The evaluation can identify the following judgements:

* Relevance of the programme to needs and problems
* Achievement of project/programme objectives
* Causal relations for (non) achievement
* Cost effectiveness and efficient resource use
* Impact of the programme on the sector/society
* Sustainability, knowledge/experience values

V GUIDELINES

The answer to the above will help SIDA in understanding the mechanisms that come in play in development assistance and in reviewing strategies with the view of continuing as before, focusing on certain aspects or completely withdrawing from the programme.

The evaluation could be structured on the following lines:

* Technical assistance on Transmission
* Technical assistance on Distribution
* Capability to Operate & Maintain networks
* Capability in sub-goals related to routine maintenance, telecommunication, protection HV equipment, network

planning, etc as can be outlined from objectives and progress reports.

On the above programmes the level of knowledge, the self-sufficiency and degree of dependency and the capability to manage tasks whether routine or unplanned should be assessed in central office, district offices and individual substations. The depth of knowledge and competence as well as the breadth quantified as number of staff shall be determined.

VI SPECIAL EVALUATION LOSS REDUCTION PROGRAMME

A special study shall be carried out on the Loss Reduction programme as this has been monitored on Result Based Management Methodology developed by SIDA and used in certain projects. We request that the procedures as applied in the Progress Reports be analyzed with regard to:

* relevance of parameters for measurement
* degree of details and elaboration
* sufficiency/deficiency in choosing and finding objective vs subjective indicators
* do the many result parameters give a coherent overall and integral assessment of capability

If the sub-goals monitored and evaluated should be complemented by other subjective assessments or judgements, the Team should suggest and apply such tests of measurements e.g visual inspection of substations, capability to use manuals, interviews with staff, etc.

A good indicator would be to review records of planned and forced power outages and determine the readiness of the organisation and staff in tackling and remedying the situations and primarily to identify the frequency of occurrence of faults and the performance of routine preventive maintenance. These guidelines are given with the view that the Team may develop its own measurement criteria along similar lines.

It may be of interest to study the development of the Tariff, and the number of consumers throughout the years.

The training centre and training activities should be assessed in a similar manner to determine the achieved results as compared to initial goals. Numbers of employees trained and still in EDM employment in various places, their functions today, etc will have to be evaluated. The facility of the Training Centre proper as it has developed may need to be evaluated in a special way to determine its contributions and adequacy.

The finding shall be presented in a comprehensive report properly structured to cover technical, economical and other aspects for the various development support programmes and projects together with an executive summary summing up conclusions and recommendations.

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95/3 Swedish African Museum Programme (SAMP). Leo Kenny, Beata Kasale
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95/4 Evaluation of the Establishing of the Bank of Namibia 1990-1995. Jon A. Solheim, Peter Winai
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96/1 The Beira-Gothenburg Twinning Programme. Arne Heileman, Lennart Peck
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Department for Democracy and Social Development

96/2 Debt Management. (Kenya) Kari Nars
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96/3 Telecommunications - A Swedish Contribution to Development. Lars Rylander, Ulf Rundin et al
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96/4 Biotechnology Project: Applied Biocatalysis. Karl Schügerl
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96/5 Democratic Development and Human Rights in Ethiopia. Christian Åhlund
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96/13 Forest Sector Development Programme - Lithuania-Sweden. Mårten Bendz
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96/14 Twinning Progammes With Local Authorities in Poland, Estonia, Latvia and Lithuania.
Håkan Falk, Börje Wallberg
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96/15 Swedish Support to the Forestry Sector in Latvia. Kurt Boström
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96/19 Sida/SAREC Supported Collaborative Programme for Biomedical Research Training in Central America. Alberto Nieto
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96/20 The Swedish Fisheries Programme in Guinea Bissau, 1977-1995. Tom Alberts, Christer Alexanderson
Department for Natural Resources and the Environment

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