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STAFF APPRAISAL REPORT

SOMALIA

POWER REHABILITATION AND ENERGY PROJECT

September 29, 1987

Energy and Industry Operations Division
Africa Country Department II

CURRENCY EQUIVALENTS

Currency Unit = Somali Shilling (SoSh)
US$1.0 = SoSh 120
(as of January 1987)

WEIGHTS AND MEASURES

1 kilometer (km)	=	0.621 miles
1 square kilometer (km^2)	=	0.386 square miles
1 kilovolt (kV)	=	1,000 volts
1 megawatt (MW)	=	1,000 kilowatts
1 megavolt ampere (MVA)	=	1,000 kilovolt amperes
1 gigawatt hour (GWh)	=	1 million kilowatt hours
1 ton of oil equivalent (toe)	=	10,500,000 kilocalories

bbl	=	barrel	MJ	=	megajoule
cm	=	centimeter	Mm^3	=	million cubic meters
GW	=	gigawatt	m^3	=	cubic meter
ha	=	hectare	MWh	=	megawatt hour
ktoe	=	kilotonnes of oil equiv.	od	=	oven dry
kW, kWh	=	kilowatt, kilowatt hour	sv	=	solid volume
LPG	=	liquified petroleum gas	t	=	tonne
M	=	million	TCF	=	trillion cubic feet
mcwb	=	moisture content wet basis	tpa, tpy	=	tonnes per annum, per year
			twe	=	tonnes of wood equivalent

GLOSSARY OF ABBREVIATIONS

ADB	African Development Bank
DANIDA	Danish International Development Agency
ECU	European Currency Unit
EIB	European Investment Bank
ENEE	Somalia National Electricity Corporation
ENEL	Italian Electric Utility
EPD	Energy Planning Department
EPU	Energy Planning Unit
FINNIDA	Finnish International Development Agency
FUA	Fund Unit of Account
GOS	Government of Somalia
IRAQSOMA	National Refinery
ISKIASH	National Cooperative
MNP	Ministry of National Planning
MJVD	Ministry of Juba Valley Development
NPA	National Petroleum Agency
NRA	National Range Agency
NWP	National Woodstove Project
ODA	Overseas Development Administration
RIP	Reference Investment Program
USAID	United States Agency for International Development
UNDP	United Nations Development Program

GOVERNMENT OF SOMALIA FISCAL YEAR = CALENDAR YEAR

SOMALIA

POWER REHABILITATION AND ENERGY PROJECT

Credit and Project Summary

Borrower: Government of Somalia (GOS)

Amount: SDR 9.7 million (US$ 12.5 million equivalent)

Beneficiaries: The Somalia National Electric Corporation (ENEE), the Ministry of National Planning (MNP), the National Woodstove Project (NWP).

Terms: 40 years [1]

Project Objectives: The project's principal objective is to improve the efficiency and reliability of power supply and distribution and to meet some of the unserved demand in Mogadishu, Somalia's main economic area. To sustain physical rehabilitation improvements, it would also assist ENEE in strengthening its performance in key technical, financial, and managerial areas. The project would further help the GOS to develop its capabilities for sound energy planning and policy formulation, with particular attention being given to identifying least cost supply and distribution options for petroleum products. Finally the project would promote conservation of woodfuels through dissemination of improved cooking stoves for higher cooking efficiency.

Project Description: The proposed project would (i) rehabilitate, replace, and extend ENEE's generating, transmission, and distribution facilities in Mogadishu; (ii) provide comprehensive advisory services, operational support including line managers, and training to ENEE for three years in all key corporate areas; (iii) provide technical assistance and logistical back-up resources to the MNP to strengthen energy planning, carry out subsector investment analyses and least cost petroleum procurement and distribution study, and develop household energy supply and demand management policies; and (iv) provide technical assistance and logistical back-up resources to the NWP to promote cooking efficiency improvements.

Project Risks: The main risk would be delays in implementation and non-sustainability of improvements. This risk will be minimized by the project's operational and management support and systems improvement component and regular monitoring of ENEE's financial performance.

Map: IBRD 20526

1/ Onlending terms are 7.76% repayment period of 15 years after grace period of 5 years.

Project Cost:

	Foreign	Local	Total
	(US$ million)		
Generation			
Rehabilitation	11.73	0.47	12.00
Expansion	25.11	3.35	28.46
Transmission and Distribution			
Rehabilitation	9.55	0.95	10.50
Expansion	15.07	1.40	16.47
General Plant	4.12	0.26	4.38
Project Management, Technical Assistance and Training	5.82	1.22	7.04
Energy Sector Planning and Studies	0.70	0.10	0.80
Household Energy Demand Management	0.08	0.24	0.33
ENEE System Development Study	0.28	0.09	0.37
Project Preparation Facility	1.50	-	1.50
Base Costs	73.76	8.08	81.85
Physical Contingencies	7.23	0.81	8.03
Price Contingencies	3.69	0.46	4.15
Total Project Costs	84.67	9.35	94.02

Note: The project would be exempt from duties and taxes.

Financing Plan:

	Foreign	Local	Total
	(US$ million)		
Government	-	0.4	0.4
ENEE	-	6.9	6.9
African Development Bank	9.5	-	9.5
European Investment Bank	14.7	-	14.7
Italian Govt.	48.1	1.9	50.0
IDA	12.5	-	12.5
Total	84.8	9.2	94.0

Estimated Disbursements of IDA Credit

	FY88	FY89	FY90	FY91	FY92
	US$ million				
Annual	2.7*	3.7	3.4	2.0	0.7
Cumulative	2.7	6.4	9.8	11.8	12.5

*Includes refinancing of PPF advance

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POWER REHABILITATION AND ENERGY PROJECT

STAFF APPRAISAL REPORT

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This report is the result of an appraisal mission which visited Somalia from March 9-25, 1987. The mission was led by Juergen Franz (Senior Financial Analyst) and included John Besant-Jones (Senior Economist), Anthony Sparkes (Power Engineer) and Mike Bess (Energy Specialist, USAID).

LIST OF ANNEXES

MAP: IBRD 20526

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POWER REHABILITATION AND ENERGY PROJECT

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I. THE ENERGY SECTOR

Introduction

1.01 Somalia is a large but sparsely populated country of about 5.8 million people (excluding refugees). [1/] With an estimated annual per capita income of US$260, it is among the poorest countries in the world, and is classified by the United Nations as a least developed country. Endowed poorly with known natural resources and a fragile environment for agriculture, Somalia faces formidable constraints to economic development in the face of a 3 percent annual growth of population. Livestock production accounts for about 40 percent of GDP and 80 percent of exports, but cannot increase substantially since the capacity of the rangeland is almost fully utilized. Growth of crop production, which accounts for about 12 percent of GDP, will require investments in irrigation rehabilitation and development, as well as in other infrastructure, research and extension, and thus can only be realized over the long term. Development of the tiny industrial sector is constrained, among other things, by a scarcity of skilled labor and of personnel with technical and managerial expertise. Somalia's economic development is a challenging task even with the best policies. Since 1983 the Government, with the support of the donor community, has embarked on a program of policy reform to achieve the twin objectives of financial stabilization, with economic adjustment and growth through fostering greater market orientation. [2/]

Energy Consumption

1.02 Total energy consumption increased at 7% annually from 1.1 million toe in 1984 to 1.25 million toe in 1986 due to rising woodfuels consumption and an increasing population. Thus, the average annual per capita consumption is about 200 kgoe, which is low by world standards but is typical of sub-Saharan countries. However, consumption of petroleum products, which in Somalia are based on imported energy, declined by 12.5% annually from 142.1 toe in 1984 to 109.6 toe in 1986. This drop reflected a long-term declining trend, since in 1975 the consumption of petroleum products was 172.5 toe. Consumption of electricity has increased steadily, from 5.0 toe in 1975 to 13.9 toe in 1984 and 22.3 toe in 1986. Woodfuels accounted for 83% of total energy consumption in 1986 and were used mostly for household cooking. Residential uses accounted for 90% of total energy

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1/ The official figure used by the UNHCR for refugees in camps is 700,000.

2/ Somalia: Recent Economic Development and Medium-Term Prospects. World Bank, Report No. 6542-SO (February 10, 1987).

consumption in 1986, transport for 5%, industry for 3%, agriculture for 1% and Government and commerce for 1%. The Bank's Energy Assessment Report 3/ of December 1985 provides further background information and Annex 1.1 shows the national energy balance for 1986.

Sector Organizations

1.03 Several Government institutions have responsibilities in the energy sector. The Ministry of National Planning (MNP) collates information on public investment projects and has created an Energy Planning Department (EPD) for planning and policy coordination in the energy sector. The Ministry of Mineral and Water Resources is in charge of developing petroleum and other mineral resources as well as hydrological resources, and it has responsibility for petroleum and natural gas exploration. The Ministry of Commerce supervises the National Petroleum Agency (NPA) which is responsible for importing and storing petroleum products. The Ministry of Industry oversees IRAQSOMA, the operator of the petroleum refinery near Mogadishu. The Ministry of Public Works supervises the national power utility, Ente Nazionale Energia Elettrica (ENEE). The Ministry of Livestock, Forestry and Range, through its National Range Agency (NRA) is responsible for forestry development. The Ministry of Juba Valley Development (MJVD) is responsible for the preparation and execution of the Baardheere dam project, a multipurpose scheme for power generation, irrigation development and flood control. Proposals regarding energy pricing and investment which affect the overall economy have to be approved by the Economic Commission of the Presidency.

1.04 Coordination between the Government agencies involved in the energy sector on energy policy formulation, planning and investment programming was only started with the recent creation of an energy planning unit in MNP. This unit has since been upgraded into a department (EPD). During preparation of the proposed credit, the GOS indicated that EPD will assume a central role with responsibility for overall energy sector policy and planning. Under the proposed project, IDA would provide technical assistance to EPD to improve the standards of energy investment planning and to strengthen the capability for policy-making and coordination. The proposed component also includes a national household energy survey to rectify critical deficiencies in the state of knowledge on household energy supply and demand. Terms of reference for the T.A. and studies under this component were discussed with Government during project appraisal, and Government's agreement to them would be sought at credit negotiations. Agreement would also be sought on a joint review of the studies conclusions and required follow-up action by GOS and IDA.

Energy Resources

1.05 Hydropower. The hydropower resources of Somalia are concentrated in the upper Juba Valley near Baardhere town with potential average energy availability of about 500 GWh/year. The proposed Baardhere project, about 350 km from Mogadishu, is planned as a multipurpose irrigation, power and flood control scheme. Detailed design work is currently being undertaken

3/ Somalia: Issues and Options in the Energy Sector. World Bank/UNDP, Report No. 5796-SO (December 1985).

for a dam and powerhouse with a capacity of about 105 MW. The arrangements for financing the project have yet to be finalized, several important issues remain to be resolved, and the earliest physically feasible completion date for the project would be 1994. 4/

1.06 A few small sites for hydro development exist on the Juba river. At the existing Fanoole diversion dam, there is an installation of 4.8 MW which produces about 10 GWh per year. A small storage dam could be built at Saakow with an initial capacity of about 10 MW and an output of 80 to 90 GWh per year. Both the Fanoole and Saakow sites have minimal firm energy capacity which would be increased substantially with river regulation made possible by construction of the Baardheere dam. A number of potential mini-hydro sites have been identified on the middle and lower reaches of the Shebelli, Somalia's other river. In the UN report, "Evaluation of Small Hydropower Sites" (1983), existing regulation barrage sites at Balad, Jamame and Falkeeron were studied. Of these only a 1.5 MW hydro scheme at Balade barrage is likely to be economic.

1.07 Hydrocarbon and Mineral Energy. There are indications of petroleum and natural gas resources in the country, but exploration has not yet resulted in commercial discoveries. The geothermal and lignite resources thus far identified in northern Somalia appear to be too small and remote from energy consumption centers to be of economic significance.

1.08 Forests. Somalia's forests cover about 39 million hectares, 60% of land cover. The total standing volume of wood is estimated at about 800 million cubic meters and, with a natural growth rate of 1.5-2.0% per annum, the annual wood supply would be approximately 12-16 million cubic meters. However, much of the forest is inaccessible due to isolation from poorly developed transportation infrastructure. The total accessible wooded area is estimated at not more than ten million hectares with a yield of not more than 3.5 million cubic meters as compared to an estimated annual fuelwood consumption of approximately 6 million cubic meters. Consequently, local patterns of supply and demand are seriously unbalanced, and scavenging for fuelwood and charcoal production has denuded large areas surrounding towns, villages and refugee camps.

1.09 Other Biomass Resources. While there is considerable biomass utilization in Somali households (for cooking), only bagasse accounts for any commercial utilization of non-woody biomass resources. The Juba Sugar Company produces annually 80,000-100,000 tonnes of bagasse, which with 500-1,000 tonnes of fuel oil is used to generate about 10 GWh from the sugar plant turbines for use in the sugar plant. However, the efficiency of power production from bagasse is low and could be increased with the introduction of pre-drying, pelletizing and other measures, which would

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4/ The World Bank intends to appraise the Baardheere Project during the second quarter of 1988. A Baardhere T.A. Credit to assist with project preparation has been appraised and is scheduled to be presented to IDA's Board of Directors in December 1987. Detailed design work is in progress, and Government of Somalia plans to issue a request for bids for the major works in mid 88. The optimization of the project power facilities is being studied by consultants with a report due by September 1987. Major project issues include riparian rights with Ethiopia and financing plan.

create surpluses to produce power for other uses such as pumping for irrigation. The use of other plant and animal residues is limited due to the limited crop production and the difficulty of collecting residues for energy use.

1.10 Wind and Solar. In Somalia wind and solar energy have economic potential for meeting energy requirements in rural areas due to the high cost of supplying conventional energy to these areas. Water-pumping windmills have been used in Somalia since the 1930s, and solar applications have been used for about the past 20 years. The Government attaches importance to wind and solar energy, but the development of these renewable energy forms is impeded by inadequate information about the resource base, the absence of a coherent Government strategy and policies, and the lack of effective institutions and of clear institutional responsibility. There has been considerable external assistance for the installation and operation of wind and solar equipment, but many installations have broken down and are awaiting repair due to the lack of arrangements for maintenance and supply of spare parts.

Energy Supply

1.11 Electric Power. Electricity is supplied in Mogadishu and elsewhere in Somalia mainly from diesel generators, and in 1986 over 95% of electricity generated by ENEE, municipalities, rural centers and self producers was from imported fuel. About 4% was produced at the Fanoole hydroscheme from where energy is distributed to rice irrigation pumping schemes at Jilib which are supplied in the dry season by diesel-generated electricity. The remaining 1% was produced from privately owned bagasse-fired steam units on sugar estates. Final results for 1987 are unlikely to differ from the 1986 actuals by more than a percentage point.

1.12 Crude Oil and Petroleum Products. Somalia relies entirely on imports of crude oil and refined products to meet petroleum products demand. Crude oil supplies have been erratic since the refinery was commissioned in 1980, and have declined in volume since 1983. The decline was compensated by an increase in imports of refined products to 1985, but in 1986 total imports of crude oil and products were 28% lower by volume than in 1985, due primarily to the country's foreign exchange constraints. Crude oil was provided under commodity aid arrangements to a value of about US$38 million in 1985. Imported petroleum products cost the equivalent of about US$20 million in 1985. The combined foreign exchange costs of crude oil and products of US$58 million accounted for 16% of the value of national merchandise imports and 61% of the value of merchandise exports in 1985. The value of imported crude oil and petroleum products in 1986 amounted to about US$38 million. Details of petroleum supply and consumption since 1980 are given in Annex 1.2. Petroleum consumption in 1986 was the lowest since 1981.

1.13 Somalia pays premium prices when it purchases refined products and crude oil on the international market. In 1986, Somalia paid about US$320 per tonne of refined products, which was about 40% above prevailing average world market prices, primarily because it purchases small quantities that rarely exceed 5,000 tonnes per shipment on short notice due to its poor foreign exchange situation. Likewise, Somalia did not obtain the full benefit of the decline in world crude oil prices during 1986,

paying a premium of about 30% in its average cost of 3$135/tonne. The proposed project includes technical assistance for reducing petroleum procurement costs as part of the study on petroleum supply arrangements.

1.14 Household Fuels. Household energy comprises about 90% of final energy consumption in Somalia, and its share is expected to remain around this level at least until the end of this century. Fuelwood for household cooking dominates the household portion of national energy demand. Including charcoal, woodfuels serve 98% of national household demand in terms of calorific values, i.e. before allowing for differences in conversion efficiencies for the various energy-using appliances in use. As deforestation continues and the distance from forests to population centers increases, charcoal's lower transportation costs per unit of energy will make it an increasingly attractive alternative to fuelwood. Similarly, while remaining a small proportion of total household energy demand, domestic use of electricity is expected to expand as suppressed demand will be satisfied to a larger extent with the removal of capacity constraints, particularly in the next few years under the proposed project. Provided that the pricing policy for petroleum products continues to fully reflect economic costs, demand for kerosene is expected to increase at around the rate of growth of urban population in Somalia, which is projected at about 6% annually.

Petroleum Procurement, Distribution and Pricing

1.15 The institutional arrangements for petroleum supply and distribution are complex, with a proliferation of parties with overlapping responsibilities and authority in the sector. The main parties are the National Petroleum Agency (NPA), the IRAQSOMA refinery company, the National Cooperative (ISKIASH) and the Ministry of Finance. NPA, with Ministry of Finance approval, imports both crude oil and refined products into the country. By law, Berbera and Kismayo Ports are the only designated points of entry into the country for refined products; the IRAQSOMA refinery is the designated source for the Mogadishu market. However, in practice, Government allows NPA to import refined products directly into Mogadishu (which accounts for over three quarters of the country's demand) when refinery output is inadequate to meet demand in the area. All refined products (whether imported or produced by IRAQSOMA) are then transferred by NPA to ISKIASH for distribution and marketing. ISKIASH, with over 90 retail outlets, is the only legal supplier of petroleum products at wholesale and retail levels.

1.16 The state-owned refinery, run by IRAQSOMA, is a simple 10,000 bbl per day distillation plant. The refinery has been affected by serious managerial, operational and financial problems. Operating costs are high by the standards of the world refining industry. In addition, frequent interruptions in crude oil supplies adversely affect refinery operations. In the current international oil market conditions, there are strong doubts about the economic justification for keeping the refinery in operation to meet Somali demand for petroleum products. Although the refinery was designed to process Basrah light crude, since late 1984 the Somali Government has been forced to seek other types of crude oil on the international commercial market, often paying above-market premiums (on 90-day terms). Refinery yield patterns, approximately 50% heavy/residual

fuel and 50% lighter products, do not match the local demand for products. In the past, the NPA has had to re-export considerable quantities of residual fuel oil at prices below world levels because of lack of local demand. However, recent developments, namely the commissioning of ENEE's oil-fired steam turbine in 1985 and the start-up of industrial projects (the urea plant and the Berbera cement plant), have created a substantial local market for heavy fuel oil.

1.17 The margins for distribution and marketing applicable to NPA and ISKIASH remain very low and do not cover basic operating costs. Consequently, the financial positions of these two entities have deteriorated over the past five years. NPA reported an official net loss of US$200,000 in 1985. The lack of internally-generated funds has resulted in a cut-back in essential maintenance and investment in plant, equipment and other infrastructure. The country's entire petroleum physical plant is old. The average age of ISKIASH's petroleum product vehicle fleet is five years. The bulk of their physical plant is comprised of stock acquired from international companies during the 1970s. Very little rehabilitation and virtually no new investment in handling equipment and facilities has taken place in the past decade. This accounts for undetermined, but probably high, losses of refined products at virtually every stage of the distribution system. Rehabilitation of existing storage, transport and service equipment is urgently required. Loss-reducing investments such as floating roofs for gasoline storage tanks, improved off-loading facilities, and rehabilitation of the vehicle fleet are of immediate priority.

1.18 Retail prices of petroleum products are controlled by Government. Official prices are based on c.i.f. import costs plus fuel taxes, handling fees, transportation charges and distribution margins. A special levy on gasoline and diesel sales is earmarked for a stabilization fund designed to compensate for short-term import price fluctuations. Increases in the official retail price of gasoline since 1983 have kept pace with domestic inflation, and the official retail prices for kerosene and diesel have been increased by 56% and 35% respectively relative to domestic inflation. In early 1987, the retail price of gasoline (SoSh 27.8/liter) was about 33% greater than the import parity price at the average of the auction and free market exchange rates (SoSh 135/US$). The retail prices of diesel and kerosene (SoSh 20.2 and 21.5/liter respectively) were at import parity levels at the same exchange rate. The ex-refinery price of heavy fuel oil (SoSh 8/liter) was about equal to the export price at the official exchange rate of SoSh 90/US$. There is an active parallel market for petroleum products, particularly for kerosene and gasoline, when official supplies are well below demand, whose existence complicates the compilation of market data and the assessment of consumer response to pricing signals.

1.19 In summary, petroleum procurement and refining, marketing and pricing suffer from a variety of shortcomings in Somalia. These problems increase foreign exchange costs to the country, and result in high internal physical losses through deterioration of the country's petroleum storage and distribution infrastructure. Distortions in the patterns of consumption, including uneconomic interfuel substitution, are introduced through inappropriate retail prices, including the existence of parallel market prices. The proposed project would address these issues through a study of petroleum products procurement, distribution and marketing,

including a review of the future role of the refinery, preparation of a plan for petroleum distribution, and for expansion and rehabilitation of facilities, and development of a system for allocating products throughout the country in accordance with economic priorities, especially under supply shortages. Terms of reference for this study were discussed with Government during project appraisal, and Government's agreement to them is a condition of Credit negotiations. Agreement was reached on joint review of the study's conclusions by GOS and IDA to define appropriate follow-up actions.

Household Energy Supply and Utilization

1.20 Woodfuels Production, and Marketing. The production and marketing of woodfuels is controlled by legislation by a few large cooperatives. The largest of these organizations are the National Charcoal Cooperative (Cadceed), the National Fuelwood Cooperative (Golol), and the National Woodfuels Marketing Cooperative (Hilaac). Private production and sale of woodfuels is illegal, yet it occurs on an undetermined scale. Monopolistic control of distribution and sales has led to inefficient use of woodfuel resources. Most production of charcoal for the Mogadishu market, which absorbed about 85% of national production of 97,000 tonnes in 1986, is produced in the Bay Region in Southern Somalia and is transported up to 450 km by truck.

1.21 Woodfuel Prices. The Government sets price levels for woodfuels at virtually all points of production, distribution and sale, but it is unclear how effectively these prices are applied, particularly at the retail level. There is considerable evidence that the prices paid to charcoal producers are too low to encourage producers to invest in reforestation, carry out proper resource management and improve production efficiency. Actual charcoal prices paid by most consumers are about four times higher than officially set prices, 5/ and almost all the operating margin appears to accrue to the Marketing Cooperative (Hilaac) and its members, who reap the windfall gains as unofficial retail prices increase with rising demand. Some institutional consumers of charcoal have access to supplies at the official retail price, which is below the economic cost of supply and gives them little incentive to improve utilization efficiency. Fuelwood pricing policies are also inefficient, as the Marketing Cooperative realizes windfall gains from legal sales of fuelwood. Stumpage fees have remained unchanged since the late 1960s and are significantly below the long-run marginal cost of maintaining the country's forestry resource base. The proposed project would assist Government to improve its understanding of the situation and design appropriate policies by means of a detailed survey of the Mogadishu commercial woodfuels marketing and distribution systems. Terms of reference for this component were prepared during project appraisal, and Government's agreement to them will be sought during Credit negotiations. Agreement would also be sought on joint review of the survey's conclusions and suitable follow-up actions.

5/ In early 1987, the official retail price for charcoal in Mogadishu was equivalent to SoSh 3.7/kg (SoSh 370 per quintal of 100 kg), whereas the open market price was about SoSh 15/kg (SoSh 600/40 kg bag). The official price paid to charcoal producers at the point of entry to Mogadishu was SoSh 2.7/kg (SoSh 270/quintal).

1.22 Stove Production and Marketing. Most of Somalia's rural and nomadic population, representing over 80% of the national population, use the traditional three-stone hearth for cooking and heating. Traditional soapstone, ceramic and metal stoves are used by most of Somalia's urban population and by many rural dwellers and refugees. The traditional soapstone stove is the most widely used commercial stove, accounting for some 75% of all stoves sold in urban areas, but it converts energy extremely inefficiently. Virtually all soapstone stoves are produced by the Ceel Bur Soapstone Cooperative in the Central Region of Somalia. Over the past four years, a more fuel-efficient soapstone stove has been designed under the National Woodstove Program (NWP) based on traditional stove designs. Average costs for the improved stove have been reduced to 30% more than the cost of the traditional stoves. More than 15,000 improved soapstone stoves have been sold in the Mogadishu area since 1984, accounting for some 15% of the Mogadishu stove market. The efforts under the NWP need to be increased greatly to bring about a real impact on deforestation and to reduce substantially the costs of household energy. The National Range Agency (NRA) needs to expand the NWP to develop yet better stove designs, carry out consumer testing of new designs, strengthen its capability to disseminate stoves to new designs and mount public awareness campaigns on the use of improved stoves and kitchen management practices. The proposed project would support these objectives through the provision of technical assistance to NRA for such purposes. Terms of reference for this component were prepared during project appraisal, and Government's agreement has since been obtained.

Bank Participation in the Sector

1.23 To date the Bank Group has had two lending operations in the energy sector of Somalia, the Petroleum Exploration Promotion Project (Credit 1043-SO), and the Afgoy Gas Delineation Project (Credit 1464-SO). Under the former, petroleum legislation was prepared providing the framework for Government negotiations with the oil companies under the latter. GOS has been successful in attracting international oil companies to Somalia, who shot nearly 8,500 km of seismic lines and drilled nine exploration wells. However, no commercial quantities of oil were discovered. Several of the companies continue with active exploration programs and several of those have well commitments. The Bank has also provided technical assistance to the energy sector. An energy sector assessment was carried out in 1984/85 under the Joint UNDP/World Bank Energy Assessment Program, and a Power Planning Study was carried out in 1986 with funds from the Afgoy Credit. Furthermore, the Bank is assisting the Government in the preparation of the Baardhere Dam Project.

Rationale for IDA's Involvement in the Energy Sector

1.24 IDA's country assistance strategy is based on assisting the GOS to sustain the implementation of existing policy reforms and of new policy measures to achieve financial stabilization and economic adjustment. The proposed credit would enable IDA to mobilize and focus donor assistance on an urgently required and comprehensive program of rehabilitation, institutional strengthening policy reform, and commercial orientation in the power sector, thus supporting efforts to stimulate agricultural and industrial production. IDA's lending program emphasizes support for key infrastructure to help increase sources of self-sustained growth, especially in agricultural and industrial production and public enterprise reform. IDA's support to energy planning is intended to bring about satisfaction of energy demand at least economic cost.

II. THE POWER SUBSECTOR

Organization

2.01 ENEE has responsibility for electricity supply in Mogadishu and the main regional centers of Hargeisa, Berbera, Burao, Baidoa and Kismayo. In the other regional centers, public electricity supply is the responsibility of the municipality. MJVD has responsibility for the preparation of the Baardheere multi-purpose (power, irrigation, flood control) dam scheme, but there has been little coordination with ENEE although it is the only organization with significant electrical operating experience in Somalia and its system would be the main recipient of Baardheere-produced power. The proposed project would therefore include assistance to formulate ENEE's input into the Baardhere planning process. Also, agreement with Government will be sought during negotiations, that IDA will review any institutional arrangements proposed for Baardhere to ensure an efficient power subsector organization and compatibility of such arrangements with ENEE's operational and managerial capabilities.

Sector Facilities

2.02 Presently power is supplied to about 40 towns in Somalia from local thermal generating capacity. There is no interconnection of load centers. Data on available capacity and power output is generally lacking. Somalia's capital, Mogadishu, with a population of about 700,000 is supplied with electricity from local thermal generation capacity, namely the Gezira 15 MW oil-fired steam unit and from diesel engine generators at Gezira and Centrale. The oil-fired steam unit and diesel units in these stations burn heavy residual fuel oil which is delivered by road transport to the site from the Mogadishu refinery, but when distillates are not being produced, ENEE's supply of fuel oil is imported. The Gezira oil-fired steam unit financed by the Kuwait Fund and Arab Fund was commissioned in January 1985. It was the subject of a supplier's initial two-year operational and maintenance contract and in early 1987 the unit was fully overhauled, and recommissioned in April 1987. The chimney stack, sea water intake and treatment plant and some of the auxiliaries have a design capacity to accommodate a second similarly sized unit.

2.03 The adjacent Gezira diesel station has a nameplate capacity of 27.5 MW consisting of five similar 5.5 MW diesel generators, of which two were commissioned in 1978, two in 1979 and the fifth in 1984. The Centrale station contains four 1.2 MW diesel units which are all more than 25 years old, and four 2.7 MW units which were commissioned between 1968 and 1977. Lack of maintenance expertise and of funds for spares and replacement parts has reduced considerably the capacity of both diesel stations. In early 1987, with the steam station also out of commission for its overhaul, Mogadishu's available public generation capacity was reduced to about 9 MW from its nameplate capacity of 55.7 MW (para. 3.07), with devastating effects on electricity supply to Mogadishu.

2.04 In Mogadishu, transmission and distribution takes places at 33 kV, 15 kV, 3 kV and 380/220 V, but the only 33 kV facility which has been energized is one overhead line feeding the north of Mogadishu from Gezira. Although other 33 kV equipment, including feeders and switchgear,

has been installed, it is either operated at 15 kV with inevitably high losses, or is out of service because other components are needed to complete circuits at 33 kV. ENEE has been unable to continue with its transmission system upgrading program because of its own and Somalia's resource constraints.

2.05 Outside of Mogadishu some consumers in about 40 towns have public electricity supplied from small diesel generators. Most of these are poorly maintained and several have been shut down or are restricted to day-time supply because of lack of funds for spares, lubricating oil and fuel. Annex 2.1 includes details of ENEE's generating facilities in Mogadishu and in the regions.

Access to Service

2.06 Statistics on consumer connections to the public supply system are available only for Mogadishu, where about 30% of the population have access to the public power system, constituting about 40,000 households at the end of 1986. These consumers can be divided into two broad categories, those who are relatively wealthy and are characterized by the installation of air conditioners in their houses, and those in the relatively low and middle income categories who use electricity for lighting and household electrical appliances except air conditioners. ENEE estimates that there are about 5,000 households in Mogadishu with air conditioners, including mainly senior public officials, wealthy private sector businessmen and expatriates. The air-conditioning load is a significant proportion of the system peak load, which occurs in the early evening, contributing an estimated 6 MW out of a total unconstrained peak demand of about 30 MW excluding system power losses in early 1987.

Characteristics of Present Supply and Consumption

2.07 Consumption of electricity throughout Somalia is highly constrained due to lack of fuel for installed generators, lack of generating capacity and dilapidated distribution systems. The situation in Mogadishu has been less severe than in the other towns since it is the only place that has received a regular 24 hour power supply. Nevertheless, even in Mogadishu consumers have been accustomed to frequent and prolonged power cuts for some years. The situation improved when the 15 MW oil-fired steam unit was commissioned in Gezira in January 1985, but became critical in the first quarter of 1987 while that unit was out of service under maintenance. Suppression of demand from connected consumers also occurs on overloaded distribution feeder lines due to poor voltage profiles, and from ENEE's policy of restricting new connections to the system.

2.08 Over the period 1978 to 1986, the amount of energy generated by ENEE for the Mogadishu power system increased about three-fold, from 41.7 GWh to 131.1 GWh, at an average annual rate of 15.4%, while the system maximum demand met by ENEE increased at 11.6%/year from 11.5 MW to 27.6 MW over the same period (Annex 2.2). The consequential increase in system load factor, from around 40% in 1978/1979 to around 55% in 1985/1986, is indicative of lack of investment to expand generating capacity as quickly as growth in system maximum demand. The mission estimates the unconstrained system load factor to have been 43% in 1986 (Annex 2.3).

2.09 Total system losses, comprising technical losses and unbilled consumption, has increased from 17% in 1979/1980 to 32.6% in 1985 and 27.6% in 1986 of generated energy. ENEE estimates technical losses in the later years to have been about 17%, which is a high level and reflects the poor condition of the Mogadishu distribution networks. The balance of around 11% represents unbilled consumption which, although not a loss in economic terms, represents a substantial loss of revenue to ENEE. The assistance under the proposed project to ENEE for billing and collections would reduce this level, and the rehabilitation work on the transmission and distribution networks under the project would reduce system technical losses to about 12% of generated energy. Targets on reduction of unbilled consumption and technical losses were agreed upon with ENEE.

2.10 As a result of the unreliability of ENEE's power supply, many consumers, across all categories from industrial and commercial to households, have installed their own generating facilities. ENEE estimated that at the end of 1986 generators were installed in about 450 consumers' premises with a combined capacity of about 6 MW. The mission has analyzed the costs to these consumers of power from these facilities (Annex 2.3) as an indication of consumer willingness-to-pay for electricity and consumer preference for taking power from ENEE at the 1987 tariff of SoSh 14/kWh for all categories. At current diesel prices, the variable financial costs of electricity from the largest private generators installed on industrial premises was about 65% of ENEE's tariff, and the variable costs of electricity from small private generators was a little lower than ENEE's tariff. ENEE's pre-1987 tariffs were lower than prevailing variable costs. The total cost of power from new generators including capital costs, is much higher than ENEE's tariff, and thus there will be no financial incentive for consumers to purchase new generators once they perceive ENEE's supply as being reliable, which should result from the system improvements under the proposed project. Due to high import taxes on the generators, and a retail price of diesel fuel equal to the import parity price at a foreign exchange premium of 50% over the official exchange rate (para. 1.18), the financial costs of power are 50% to 100% greater than the economic costs. The mission has estimated the weighted average value of consumer willingness-to-pay for power, based on these cost estimates, to be SoSh 26/kWh (Annex 6.1), about 85% higher than ENEE's tariff. This average falls within a range of about SoSh 17/kWh for industrial users to around SoSh 35/kWh for small power consumers.

2.11 To assess the extent of demand suppression that occurred in Mogadishu during 1986, the mission estimated the unconstrained demand for power according to the methodology used for the demand forecast (Annex 2.3). Comparison with actual generated output by ENEE indicates that the unserved proportion of system energy demand at the generating stations reached about 15% of unconstrained energy demand (154.5 GWh) and about 32% of unconstrained maximum power demand (41 MW). Part of this shortfall was due to the very low system power factor, estimated to be about 0.75, which lowers the power sent out to the system from the generating units in operation. It is expected that the work to the transmission and distribution networks under the proposed project would increase the system power factor to about 0.9.

Power Demand Forecast 1987-1994

2.12 Kennedy and Donkin (UK), consulting engineers, developed a detailed demand forecast for the Mogadishu system up to the year 2000 as part of their planning work for power systems throughout Somalia, which was presented in their report "Somalia - Power Planning Study" of February 1987, financed under Credit 1464-SO for the Afgoy Gas Delineation Project. The methodology employed was to simulate demand for four major consumer categories--domestic, commercial, Government and industrial--and to aggregate these demands to derive total system demand. This approach explicitly relates power demand to economic parameters (such as population and sector gross domestic product), and relates power demand to power sector parameters (such as numbers of connected consumers and price and income elasticities of power demand). The approach also minimizes dependency on the incomplete and imprecise historic demand data which represents actual suppressed consumption rather than unconstrained demand.

2.13 The mission reconstructed its own forecast for connected demand on ENEE's Mogadishu system up to 1994, using the above methodology in the manner described in Annex 2.3. The number of new connections added to the system would average about 6,000 annually to take up the back-log and forecast increase in demand for them. The assistance under the project would enable ENEE to meet this demand. By 1994, the number of connections to the existing Mogadishu system would double to about 90,000 from the present level of about 43,000.

2.14 The power demands of low and middle income domestic consumers is taken to be sensitive to tariff level, and the mission's forecast incorporates price/demand elasticity of minus 0.3 applied to the mission's forecast tariffs (Chapter 5) expressed in constant price terms. The power demand of high income domestic consumers is taken to be insensitive to the tariff level under consideration. Following its analysis of consumer willingness-to-pay for power based on the costs from private generators (para. 2.10), the mission has explicitly allowed for the existence of these generators in Mogadishu in its demand forecast. The existing privately-owned diesel generators will be required as a back-up to ENEE's supply (para. 2.18) but their owners generally will prefer to take power from ENEE, especially if they have had to pay substantially higher prices for diesel fuel than official retail prices when fuel supplies are constrained (para. 1.12).

2.15 The mission forecasts total system demand for energy in Mogadishu to increase at an average annual rate of 8.0% between 1986 and 1994, from 154.5 GWh to 286.1 GWh (Annex 2.3). Likewise, the system maximum demand is forecast by the mission to increase at 6.5%/year from 40.9 MW to 67.8 MW. Growth in all four main consumer categories is substantial. These forecasts incorporate the forecast improvement in system technical losses resulting from the project (para. 2.09). These growth rates are only just over half the historic rates for 1978 to 1986 in actual system output (para. 2.08). The total forecast demand on the Mogadishu system includes the demands from four areas near to Mogadishu, namely Afgoi, Balad, Jowhar and Merca, which are significant agricultural and agroindustrial centers along the Shebelli river. Kennedy and Donkin showed that interconnection with Mogadishu would be the least-cost method of meeting power demand in

these areas where distribution schemes already exist, but generation by engines fueled by imported diesel oil is intermittent and inefficient. Under the power investment program for the Mogadishu area agreed between ENEE and the mission during project appraisal (para. 4.01),these areas would be connected to the Mogadishu system between early 1990 and early 1992. These additions increase the forecast demands in 1994 to 344.3 GWh and 74.5 MW.

Power System Development Strategy

2.16 Planning the development of generating capacity in the Mogadishu power system over the relatively short period of eight years (1987 to 1994) has to be carried out in the context of a long-term least-cost development program. The key issue for power development in southern Somalia for the long term is when power from the Baardhere Multipurpose Hydroproject (para. 1.05) will be available to the Mogadishu and Juba Valley systems. Government of Somalia plans to commission the project at the earliest feasible date which is during 1994. Kennedy and Donkin, in their "Power Planning Study", concluded that the least-cost program would be to commission Baardhere in 1994 with complementary new thermal generating capacity beforehand. This conclusion holds even if the entire joint costs of the Baardhere dam and reservoir development were to be charged against the Baardhere power component in the evaluation of the least-cost power development program. The robustness of this conclusion was confirmed in the evaluation of the Baardhere Project carried out by the Bank during appraisal of the T.A. Credit for the Project (para. 1.05).

2.17 The generation development program for Mogadishu up to 1994 agreed between ENEE and the mission is based on Baardhere power being available from 1995 and is similar to Kennedy and Donkin's program. The program for new complementary thermal capacity is to commission a second 15 MW oil-fired steam unit in 1989 and a 10 MW diesel generator in mid-1989, both under the proposed project, a 12 MW gas turbine in early 1991 and a second unit in late 1992. These gas turbines would be the most appropriate form of quick-start spinning reserve to cover interruptions in the 350 km link between Baardhere and Mogadishu. The rehabilitation of the existing diesel units under the proposed project is scheduled to be completed by the second quarter of 1990. This program is the quickest feasible development program for new capacity up to 1992. No new thermal capacity is included in 1993 or 1994 due to the prospective availability of Baardhere power in 1995. If the Baardhere project were to be delayed substantially, Kennedy and Donkin determined that the least-cost strategy would be based on coal-fired steam units with gas turbines. The first coal-fired unit would be required in service by 1991, and a decision to proceed would have to be taken in 1988 which is when the prospects for commissioning Baardhere during 1994 are expected to be reasonably clear.

2.18 The mission's projections for the balance between demand and supply for power in the Mogadishu area to 1994 are shown in Annex 2.4. These projections show that a continuation of major energy shortages to mid 1989 is unavoidable, declining from 34% of the requirement for generated energy in 1987 to 22% in 1988 and 12% in the first quarter of 1989. Thereafter, system generating capacity exceeds the energy requirement. The projections also show that major power shortages at the evening peak

demands will occur regularly until late 1992, which will inconvenience mostly domestic consumers. However, regular power shortages at the time of the secondary midday peak demand, which is economically more important than the evening peak since it originates mainly from industrial and commercial consumers, should not last beyond early 1991. These projections are subject to the qualification that they do not incorporate any allowances for reserve generation capacity to cover major unplanned outages of generating units. The existing installed private generating capacity will provide substantial back-up capacity.

2.19 Recommendations on the expansion of the transmission and distribution systems were contained in the Power Planning Study (para. 2.12) and in the consultant's (Westinghouse, UK) report "Rehabilitation of Mogadishu Power System Report," financed from the PPF advanced by IDA (para. 4.07). The Power Planning Study investigated the economics of expanding the transmission system in Mogadishu at several standard voltages, and in accordance with the study recommendations, expansion will continue at 33 kV. The proposed system has been designed by computer simulation of network loadings in accordance with Westinghouse's recommendations on the most economical location of substations and routing of feeders based on future system loads.

Electricity Tariffs

2.20 Electricity tariffs vary considerably throughout Somalia. In 1986, when ENEE's tariff rates in Mogadishu were SoSh 8/kWh for single phase supply and SoSh 6.50/kWh for three phase supply, tariffs in non-ENEE supply areas varied between SoSh 3.5/kWh in Jilib (supplied from Fanoole hydrostation) to SoSh 9/kWh in Kismayo (supplied from small diesel generators). In early 1987, ENEE revised its tariff for the Mogadishu system to a single rate of SoSh 14/kWh for all consumers, ostensibly to ease the burden of billing. However, this simplification eliminated any discrimination between charges to consumers to reflect variations in costs in meeting their demand. Such variations arise from differences in supply voltage and in consumer load factors based on their contributions to system peak demand. Consequently, ENEE's tariff for Mogadishu does not reflect correctly the structure of economic costs, and gives misleading price signals to consumers which exacerbates an already critical situation.

2.21 Estimates of the marginal economic costs of meeting the demands of different consumer groups in Mogadishu were developed by Kennedy and Donkin in the report "Somalia, Power Planning Study." Based on the least-cost power development program for the Mogadishu system, including commissioning the Baardheere project during 1994, the marginal costs 6/ up to 1990 are as follows: domestic consumers, about US cents 18/kWh (SoSh 24.3/kWh); small commercial consumers, about US cents 13/kWh (SoSh 17.5/kWh); three phase supply to large commercial and municipal consumers, about US cents 8.5/kWh (SoSh 11.5/kWh); and large industrial consumers, about US cents 8/kWh (SoSh 10.8/kWh). The weighted average cost in 1987 price terms based on these estimates of marginal costs and the mission's demand forecast is about SoSh 16/kWh, which is 14% higher than ENEE's 1987 tariff but is only about 60% of the cost of power that

6/ Costs are converted into local currency terms at SoSh 135/US$.

consumers are paying from privately installed generators (average SoSh 26/kWh; para. 2.10). These estimates also show the wide range in marginal costs between consumer categories, and the general pattern of distortion from economic costs in ENEE's tariff is overcharging of large consumers and undercharging of small consumers. Development of a new tariff structure is ne of the priorities of the assistance for strengthening billing and collections under the proposed project (para. 3.08).

2.22 Aid Inflow. To date there has been no Bank group participation in the power subsector, although a power planning study was financed under the Afgoy Gas Delineation Credit and there is an ongoing dialogue on the preparation of the Baardheere Project. The only major recent aid-inflow into the sector was a loan from the Arab and Kuwait Funds for construction of two 15 MW steam units at Gezira near Mogadishu. Disbursements, however, were suspended after construction of the first unit because of debt service arrears by Somalia. A bilateral Italian program of about US$50 million equivalent, compatible with the proposed rehabilitation project, was signed in April 1986, but disbursements will only start during the second half of 1987. The proposed project is thus the first concerted donor effort for the power sector. Bilateral donors have assisted with equipment and technical assistance for small diesel stations in Baidoa and Kismayo (FINNIDA), Berbera (ODA), and Merca (DANIDA). UNDP is financing an ongoing windmill electricity generation project at Gezira.

III. THE IMPLEMENTING AGENCIES

3.01 The implementing agencies would be ENEE for the power components, the Energy Planning Department of the Ministry of National Planning for the energy sector planning components, and the National Woodstoves Project of the National Range Agency for the improved stoves component.

ENEE

3.02 ENEE is an entirely state-owned corporation created under Law No. 34 on April 7, 1973 to own and operate all public electricity facilities in Mogadishu and to plan power subsector development throughout the country. Its mandate was broadened in 1981 to include the eventual ownership and operation of all regional electricity operations. ENEE is empowered to undertake all relevant activities for the development, production, and distribution of power, including the taking of participations. Many systems, procedures and functions common to utilities and enterprises elsewhere either do not exist at ENEE, exist only in rudimentary form, or are not properly applied. The project would introduce/strengthen key corporate functions with a view to (i) establish a measure of commercialization and business orientation at ENEE; and (ii) build up its corporate capacity to take on further system expansion, such as Baardheere and others. For this, technical assistance, operational supports with line responsibilities, counterpart and other training would be provided as detailed in the paragraphs below and para. 4.08. Also, corporate performance targets and corresponding indicators have been set out (para. 3.14 and Annex 3.1) to provide a tangible, measurable framework for action by ENEE's management.

3.03 Organization and Management. ENEE has a twelve-member Board of Directors, which is appointed by the Government and consists of seven ENEE department heads and five ENEE employees. The Board functions at the level of an internal senior management committee and meets frequently to review management issues and operating problems. A Director General, also appointed by the Government, serves as Chairman of the Board and is responsible for day-to-day management. Electricity tariff increases are proposed by the Director General and the supervising Minister of Public Works but require the approval of the Supreme Revolutionary Council. The company at present does not have a supervisory board and thus there is a lack of proper oversight as well as healthy non-company outside influence. Under the project, ENEE's organizational structure, the creation of a standard Board function, and the interface between Government, management and Board, would be reviewed and established/modified as appropriate.

3.04 Planning. Although ENEE has qualified project and planning staff, they have been unable to devote the required attention to prepare appropriately detailed load forecasts, system expansion plans, and investment programs and to maintain linkages with the Baardheere preparation, because they have had to divert their full-time attention to the day-to-day demands of ENEE's consumers, attempting to ensure that the poorly maintained equipment is available to meet the needs of the system. ENEE's planning capabilities would be strengthened by the proposed project through the provision of assistance for maintenance supervision, thus freeing up planning resources, and specifically with the provision of in-house and overseas training, technical assistance and computer hardware and planning software.

3.05 Engineering Design and Construction. ENEE has about a dozen engineers and technicians on its staff but to date its design and construction activities have been limited to expansions of the 33 kV transmission lines, and 15 kV and 380 V distribution and consumer services. ENEE, using its stocks of materials, has recently begun to replace the inefficient and dangerous 40 year old 3 kV/380 V system in the commercial center of Mogadishu with modern 15 kV overhead lines and 15 kV/380 V substations. At the 33 kV voltage level, ENEE is using the services of consultants to design and procure new switchgear and substation extensions.

3.06 Operations, Maintenance and Status of Plant. ENEE's facilities are poorly maintained because of the lack of funds for replacement spares and consumables, the resulting unfamiliarity of ENEE's staff with modern preventive maintenance techniques, and a general shortage of skilled personnel. ENEE for several years has attempted to meet consumer demands by operating all available generating plant, and maintaining items only at break-down or when maintenance has been inevitable. As a result, unit availability has been low, producing the current emergency situation whereby in March 1987, at the time of the appraisal mission, each area of the capital was receiving power for only a few hours each day causing disruption to industrial output and a reluctance in the commercial sector to expand without dependable supplies.

3.07 Most of ENEE's generating equipment is run-down, with units and auxiliary plant standing abandoned because they have been cannibalized to

provide otherwise unobtainable spare parts for the operable plant. Although the steam power station has recently been the subject of a supplier's two-year warrantee overhaul and is therefore in good condition, both the Centrale and Gezira diesel stations' equipment are dilapidated. Under the IDA PPF, emergency repair work on three Gezira alternators was carried out in early 1987 to improve supplies in Mogadishu, but a lack of spares and consumables continues to cause frequent and lengthy outages of auxiliaries and prive movers. Working conditions in the Gezira diesel station are hot and dirty, and have been worsened by a conflagration in 1984 which destroyed the station's lighting scheme. The capital's distribution system is mostly 40 years old, outdated and dangerous to consumers and to ENEE's staff. It is the source of large inefficiencies because of undersized conductors and improperly located transformers. The system has a very low power factor and no correction equipment exists. To operate and maintain the power stations and distribution system ENEE uses poorly maintained vehicles which are run-down, insufficient in numbers, and between seven and more than 15 years old. Two-way radios are not installed and ENEE's communications are by an unreliable telephone system or through a power-line carrier which needs spares and maintenance.

3.08 Data Processing. ENEE relies on old, inefficient data processing equipment to perform customer billing and financial accounting. Frequent breakdowns with the equipment and its limited capacity to handle large amounts of data have resulted in significant delays in preparation of electricity bills (thus contributing to arrears, para. 3.09) and closing of financial accounts. In addition, much of the data processing requires manual operation, which has led to major errors in the accuracy of ENEE's financial data. The proposed project would replace the existing data processing facilities with a new integrated computer hardware and software system which will allow for more accurate, timely, and detailed billing and accounting functions.

3.09 Billing and Collection. As a result of inadequate billing equipment, inefficient billing practices, and lack of staff, the billing cycle from meter reading to bill delivery takes between 75 and 90 days and ENEE's 44,000 customers receive bills on a quarterly basis. Despite the fact that 20% of ENEE's customers account for more than 80% of total sales revenue, ENEE does not prioritize billing and attempt to provide regular monthly bills for their largest consumers. While almost all of the customers have meters, ENEE's meter readers are overworked and inadequately motivated due to low wages and, consequently, often base their customer consumption figures not on actual readings but on rough estimates; these estimates tend to fall significantly below actual consumption, which has contributed to ENEE's high level of losses, estimated at 24% in 1986. Customers either pay directly to the meter readers who distribute the bills or at one of ENEE's five local offices. The company's customer record system is poor and ENEE is often unable to reconcile the billing records of the meter readers with those of the local offices. ENEE has no fixed policy on customer arrears, although it will occasionally disconnect private consumers owing large balances. Consequently, accounts receivable were 440, 440, and 393 days of sales in 1984, 1985, and 1986 respectively. In the past, electricity deliveries to the public sector were not governed by contract and thus there were no formal remedies to fall back upon if contract performance by either side was unsatisfactory. A contract for the

public sector, acceptable to IDA, has recently become effective. Government agencies and municipalities, which account for 75% of total sales, owe the equivalent of 14 months of sales; private consumers, which account for 25% of total sales, owe the equivalent of 9 months of sales. The proposed project would develop new billing and collection systems; settlement of 50% of government arrears is a condition of negotiations and settlement of the other 50% a condition of credit effectiveness. Similarly, private arrears will be reduced to 180 days by negotiations.

3.10 Accounting and Audit. ENEE maintains its books in accordance with Somali accounting codes and regulations and is audited by the Magistrate of Accounts, the independent government auditing unit. As a result of inadequate accounting equipment, inadequately trained staff, and improper accounting procedures, ENEE's accounting system is weak and its books do not provide a completely reliable or accurate picture of the company's financial position. The Magistrate of Accounts does not perform regular or thorough audits of the company's books and the latest audit report, covering 1984, did not identify any of the irregularities present in ENEE's accounts. The project would address these deficiencies by developing a new accounting system, including both hardware, software and new procedures, and strengthening internal auditing capabilities. In addition, ENEE has appointed an independent auditor and presented audited 1986 accounts prior to negotiations (exemption from the statutory requirement to use the Magistrate of Accounts is being pursued through the country dialogue with Somalia). The project will further require (i) establishment of an asset registry and revaluation of fixed assets by December 31, 1988, and (ii) preparation of consolidated financial statements within six months of fiscal year end, beginning with 1987 accounts.

3.11 Insurance and Taxes. ENEE does not have satisfactory insurance coverage of its plant and equipment. Presentation of an insurance audit was a condition of negotiations and contracting of insurance acceptable to IDA is a condition of effectiveness. ENEE is subject to stamp taxes, custom tariffs and import duties, except on capital goods imported under donor-funded projects, but is exempt from corporate income tax. From its customers, ENEE collects a small service tax of SoSh 0.10 per kilowatt hour consumed for the municipal government and a small stamp tax of 2% for the Treasury. Total taxes represent about 3% of revenues which is rather low for a utility.

3.12 Personnel and Personnel Management. Following a Government imposed staff reduction of 15% in 1985, ENEE as of end-1986 had approximately 880 employees, of which about 25 or 3% were top and middle management, 82 or 9% were lower level managers and middle level staff, and the remaining 773 or 88% were lower level staff. While ENEE's overall staffing level of one employee per 50 customers is a satisfactory ratio by regional standards, there is a shortage of managers, engineers and skilled technicians and an excess of unskilled labor. Most of the company's engineers are graduates from the local university system and have little specialization in electrical or mechanical engineering; only the top managers have been trained abroad. The project therefore provides for

specialist short-term training, and an increase in the number of managers, engineers and skilled technicians. Despite recent increases, salaries continue to fall significantly short of those offered by the private sector, which has contributed to the company's difficulties in attracting, retaining, and motivating qualified staff. Therefore a new salary structure, which was prepared by ENEE and establishes competitiveness vis-à-vis other Somalia employers, will be implemented as of January 1, 1988.

3.13 Training. ENEE does not provide regular on-the-job or classroom training, maintain training facilities, or produce training manuals. With the exception of a short-term program conducted during the commissioning of the Gezira steam plant in 1985, ENEE staff have received no formal operational training in generation, transmission and distribution, or finance and administration in years. Two recent consultant studies of the company's manpower situation have highlighted the critical shortage of trained staff, particularly among generation plant operators, substation operators, electrical technicians and line workers, and have concluded that the development of a comprehensive training program has one of the highest priorities. The project will strengthen ENEE's training functions through the development of a training facility administered by the Training Manager who as a member of the management team is to be financed under the Credit. The TOR (Annex 4.3, Attachment 1, para. 7.c) for the management team require that a detailed training program is produced within six months of the team's arrival in Somalia. Funds equivalent to US$1 million have been included in the proposed Credit for such a training program for technician and accountants, and for managerial and technical training in Somalia and overseas.

3.14 Management Information System (MIS) and Performance Indicators. ENEE has no MIS to help managers identify problem areas early and take corrective action. Such a system would be developed and implemented under the proposed planning assistance to ENEE. An initial set of corporate performance indicators, both technical and financial, to be used while the MIS is defined and implemented, is shown in Annex 3.1.

Energy Planning Department (EPD)

3.15 An Energy Planning Unit was created in the Ministry of National Planning in 1984 and upgraded into a department in 1986. It is responsible for coordinating planning and policy formulation at the sectoral level, including: (i) proposing intra-sectoral priorities and preparing sectoral investment plans; (ii) ensuring the consistency of energy policies with macro-economic objectives; (iii) coordinating and monitoring sectoral activities; and (iv) collecting energy data and preparing energy balances and projections. The EPD staff in 1984-86 consisted of a USAID funded resident advisor responsible for day-to-day management, a local counterpart from the Ministry of National Planning Staff, and four recent graduates in engineering and economics from the Somali National University. With the resident advisor's departure in 1986, the local counterpart was promoted to Department Director. EPD has operated with only moderate success during its first two years. The Energy Assessment Report and USAID evaluation reports have indicated that while the EPD successfully introduced the concept of

national energy planning to Government, it has not played any significant role in coordinating policy, developing a sectoral investment budget, or monitoring energy sector issues and performance. Its weak performance arises from several factors, including lack of clarity in its objectives, insufficient funds for training and technical assistance, limited Government familiarity with and interest in macro-energy planning, and limited institutional support for the resident advisor. Recognizing the need to strengthen the energy planning capabilities of EPD, Government has requested additional technical assistance from the Bank and USAID. USAID has agreed to provide about US$50,000 of technical assistance to support 1987 operations and the proposed IDA component would cover technical assistance, training, and equipment requirements for 1988-90. During appraisal, agreement was reached with Government on EPD's revised objectives and revised organizational structure, Government's financing and staffing contributions, a detailed implementation schedule, and performance criteria.

National Woodstoves Project (NWP)

3.16 The National Woodstoves Project was created in 1983 in the National Range Agency of the Ministry of Livestock, Forestry and Range, with the objective of promoting natural resource conservation through the development and dissemination of improved cooking stoves throughout Somalia. NWP was funded by USAID and managed by a U.S. non-profit organization in 1983-85, but is now funded entirely by Government and managed by local staff. A project director is responsible for daily management and the staff of twelve includes stove design, stove production, marketing and extension specialists. NWP has successfully developed a new fuel-efficient soapstone stove incorporating traditional cooking practices and stove designs, which has received strong consumer acceptance in the Mogadishu area. An estimated 15,000 stoves have been sold in 1984-1986, accounting for about 15% of the Mogadishu market and resulting in estimated savannah land savings of about 200 ha p.a. The proposed project would provide technical assistance and training to support an expansion of NWP operations, including the dissemination of the improved soapstone stove technology from Mogadishu to other urban centers and the development of improved metal and ceramic stoves. During appraisal, agreement was reached with Government on its financing and staffing contributions, a detailed implementation schedule, and performance criteria.

IV. INVESTMENT PROGRAM AND PROJECT

Least Cost Power Reference Investment Program (RIP) for Generation, Transmission and Distribution

4.01 The least cost Reference Investment Program (RIP) was developed for the years 1987-1994 during the project appraisal process, following IDA, EIB and ENEE discussions on the demand and load forecasts produced in the Power Planning Study (para. 2.16). Details of the RIP are described in Annex 4.1.

4.02 During the project cycle (1987-1990), the RIP consists of the project, and major investments will include managerial support and

technical assistance, and the rehabilitation and expansion of the generating facilities and distribution systems. The RIP provides for an early increase in generation capacity through the commissioning in 1989 of a 10 MW diesel generator followed (under the Italian component) by a heavy fuel oil-fired 15 MW steam turbine unit, which will be installed at Gezira adjacent to the present 15 MW steam facility which was commissioned in 1985. The new unit will use the existing stack, water intake and treatment plant and several other common facilities, which were designed and built in anticipation of the construction of a second thermal unit. These sources of generation will be linked to the load centers by project components consisting of improved transmission facilities. The building of 15 kV distribution lines and substation, new 380/220 V networks, and the provision of services and meters for 20,000 existing and new consumers will be included under the Italian component. Later the RIP includes additional power generation facilities in the form of two gas turbines, expansion of the 33 kV system in Mogadishu and expansion of the transmission system to the towns of Merca and Jowhar and corresponding distribution reticulation and consumer services. ENEE and IDA will review the RIP annually to ensure that it remains least cost, and modify it as appropriate. ENEE and the Government agreed during negotiations to seek IDA's approval for changes to the program in excess of US$1 million equivalent or 1% of gross revalued fixed assets, whichever is smaller.

System Studies

4.03 It is expected that in late 1988 ENEE will need to make a decision regarding further expansion of its generating capacity (para. 2.17), and funds are proposed under the credit to finance a study by consultants which will address the generation and transmission needs of ENEE in the 1990s, taking into account the progress of the Baardhere scheme, and advising on the need for gas turbines or coal fired steam units.

The Project

4.04 Project Objectives. The project's primary focus is to improve the efficiency and reliability of power supply and distribution and to meet some of the unserved demand in Mogadishu, Somalia's main economic area. The project will:

(a) improve the reliability of electric availability in the Mogadishu area through carefully planned and competently executed programs of generation, transmission and distribution rehabilitation and expansion;

(b) rebuild ENEE's financial performance to restore and maintain viability through a well defined set of reform measures and performance parameters; and

(c) strengthen ENEE's managerial, operational and planning capabilities to sustain physical improvements through assistance, training, and systems improvements.

Additional objectives are to (i) prepare ENEE for taking on the additional tasks and responsibilities that the Baardhere Project would generate;

(ii) strengthen national energy planning and policy formulation capability; (iii) identify least cost supply and distribution options for petroleum products; and (iv) promote conservation of woodfuels through dissemination of improved cooking stoves and development of efficient charcoal production and marketing.

4.05 Project Preparation. Under a PPF advance, consultants prepared the power rehabilitation program underlying the proposed financing by African Development Bank (ADB), European Investment Bank (EIB) and IDA. Under a Supplemental Advance to the PPF, consultants are preparing technical specifications and bidding documents, and will assist ENEE in bid evaluation, contract negotiations, and contract conclusions. The Italian component was prepared by ENEL, the Italian utility, on behalf of the Italian Government. Bank staff have discussed the program's content in detail with Italian technical staff and have confirmed that the program is adequately prepared and in line with the investment priorities stipulated in the RIP. The energy planning and cooking efficiency components were prepared jointly by mission staff and EPD/NWP. TOR for (i) the operational assistance contract; (ii) the petroleum and products procurement, distribution, and marketing study; and (iii) energy planning advisor have been agreed with Government/ENEE in outline during appraisal. Finalization of the TOR for (ii) is a condition of negotiations. TOR for the other energy planning studies, i.e. household energy survey, and commercial fuelwood and charcoal survey, have been agreed upon with EPD during appraisal. Preceding the rehabilitation project, emergency works including several of the Gezira and Centrale diesels and engineering supervision are being carried out under IDA (PPF), ODA, and Italian financing to help alleviate the most severe impact of Mogadishu's electricity supply crisis until the rehabilitation project commences in full, which is expected to be in February 1988.

Project Description

4.06 The project components are outlined in paras. 4.07-4.09 below and described in detail in Annex 4.2.

4.07 Power Components

(a) Generation Rehabilitation. (i) at Gezira diesel power station, maintenance and rehabilitation by contractors of units and station auxiliaries, rewinding of spare stator, provision of new engine for unit No. 2; provision of fire detection and prevention scheme and new high intensity lighting scheme, provision of three years diesel generator and auxiliaries spares; (ii) under the Italian components at Centrale diesel power station, rehabilitation of unit auxiliaries and fuel treatment plant, repair/rewind of three alternator stators, provision of fire detection and prevention equipment, provision of diesel generator and auxiliary spares;

(b) Generation Expansion. (i) at the proposed 33 kV North substation, the installation of about 10 MW of heavy residual fuel oil-burning diesel generation; (ii) under the Italian component, at Gezira site the installation of a 15 MW heavy fuel-oil fired steam unit;

(c) Transmission and Distribution Rehabilitation and Expansion. (i) procurement of materials, for installation by ENEE, for the construction of 33 kV overhead and underground feeders in Mogadishu and 33 kV transmission lines to the towns of Afgoi and Balad; (ii) turn-key contract for provision and installation of new 33 kV switching and 33/15 kV substations and extensions to existing 33 kV switchyards; (iii) under the Italian component, rehabilitation of existing 15 kV network, and replacement with new 15 kV reticulation of 3 kV network, together with 20,000 new and 5,000 replacement consumer services; and

(d) General Plant. (i) provision of about 20 vehicles of various types, spares for existing vehicles, automotive repair tools and plant for vehicle maintenance workshop; (ii) provision of radio communications system; (iii) computers, accounting and billing machinery, and equipment; and under the Italian component, (iv) vehicles for use of distribution staff; and (v) expansion of existing pole factory.

4.08 Institutional Components (described in detail in the Terms of Reference contained in Annex 4.3):

(a) Consultancy services (i) for project management to assist ENEE in the procurement, engineering design, construction supervision and commissioning of the various project components; and (ii) provide for three years, seven staff to occupy the five line positions of Assistant Directors of Projects, Finance, Generation Operations, Generation Rehabilitation and Maintenance, and Transmission and Distribution, and the two posts of Training Manager and Planning Adviser; these staff will each have Somali counterparts to be trained as replacements; and

(b) Technical assistance to recruit 11 engineers and technicians who would be financed under the credit and employed by ENEE for three years in various positions to help improve ENEE's operations and procedures in generation, transmission and distribution, construction, operation and maintenance.

4.09 Energy Components

(a) Energy Planning Support. One full-time resident energy advisor for a period of three years with administrative and logistical back-up resources would be provided to strengthen energy planning and administration of EPD. Twenty-one staff-months of short-term technical assistance and consulting services would be provided to support petroleum procurement, refining, marketing and pricing studies, the development of household supply and demand management strategies, and subsector investment analyses. Twenty to thirty staff-months of overseas short-term training would be provided as well as in-country training in various fields of energy planning.

(b) Cooking Efficiency Improvements. Three staff-months of technical assistance and logistical back-up resources would be provided to improve soapstone marketing and distribution, to advance improved metal

stove technology, and to further promotion, dissemination, and extension of improved ceramic stoves.

Project Cost

4.10 The total cost of the proposed project, including physical and price contingencies, is estimated to be about US$94.0 million equivalent, of which US$84.8 million (90%) would be the foreign exchange cost (a project cost summary is presented in Table 4.1 and detailed in Annex 4.5). The project will be exempt from taxes and duties. Physical contingencies have been included at the level of 10% for all items. Price contingencies assume local inflation of 34% p.a. for 1987, 20% for 1988, 15% for 1989 and 12.5% thereafter. International inflation at the rate of 3% p.a. for 1987, 1% for 1988, 1989 and 1990 and 3.5% per annum thereafter has been adopted.

Project Implementation

4.11 Implementation of the Power Components. Consultants, financed under the IDA PPF, have been retained to carry out the work of project procurement, and ENEE submitted most of the bidding documents for approval to IDA and the respective financing agencies in August 1987. The bidding documents are scheduled to be issued in October 1987 and ENEE plans to place contracts with the successful bidders as soon as the credit and EIB and ADB financing become effective.

4.12 The three major power components to be procured under the project are the new 33 kV substations and substation extensions, the diesel generating plant, and the second steam unit. These components will be supplied, erected and commissioned through turn-key contracts respectively financed by ADB, EIB and Italian funds. The diesel plant is scheduled to be commissioned mid-1989 and the 33 kV substations are planned for commissioning in 1989 and 1990. The steam plant is scheduled for commissioning in late 1989. The construction work to extend the 33 kV transmission lines and the rehabilitation of transmission and distribution networks using materials purchased under the project will be carried out by ENEE staff under the supervision and guidance of the engineers and technicians included in the institutional component (para. 4.13). At Cezira power station, diesel engine major overhauls, long-outstanding because of lack of spare parts, and the erection in 1989 of the replacement diesel engine will be carried out by ENEE staff, supervised by the engine manufacturer. With the additional staff to be recruited under the institutional component, ENEE will have sufficient skilled staff to carry out this work. Contractors financed under the Italian components are scheduled to begin in mid 1987 the construction of a 15 kV distribution network which will replace the dangerous and high loss 3 kV network in the commercial center of Mogadishu. The line design, routing, material procurement and construction supervision will be carried out by ENEL, with ENEE's staff actively involved and working alongside the contractor's erection staff and the consultant's planners and supervisors. ENEE have yet to acquire the land for the North substation, and acquisition will be a condition of effectiveness. An implementation schedule for the project is shown in Annex 4.4.

Table 4.1: PROJECT COST SUMMARY
(US$ thousands equivalent)

	Foreign Cost	Local Cost [a]	Total Cost
Generation:			
Gezira rehabilitation [b]	3,574	261	3,835
Gezira spares	4,076	-	4,076
Gezira fire protection and H.I. lighting	1,227	175	1,402
Centrale rehabilitation	1,157	38	1,195
Centrale spares	1,500	-	1,500
Generation Expansion:			
10 MW diesel plant	7,807	1,649	9,456
15 MW steam plant	17,302	1,700 [c]	19,002
33 kV substations	3,937	350	4,287
33 kV transmission	1,613	100	1,713
15 kV and 380 V mains and services			
Reinstatement	10,419	1,041	11,460
Expansion	8,652	861	9,513
Distribution dept. vehicles and pole plant expansion & workshops	4,118	262	4,380
Communications/Computers	270	50	320
Project management, technical assistance, management and financial management support and training	5,553	1,165	6,718
Energy sector planning and studies	700	100	800
Household energy demand management	88	240	328
ENEE system development study (1989)	260	87	347
Refinancing of Project Preparation Facility	1,500	-	1,500
Total Base Cost	73,753	8,079	81,832
Physical Contingencies (10%)	7,225	808	8,033
Price Contingencies	3,692	462	4,153
Total Project Cost [d]	84,670	9,349	94,019

[a] Corresponding to an early 1987 auction exchange rate of SoSh 120 = US$1.00.
[b] Excludes expenditures incurred for emergency rehabilitation under IDA PPF I and II.
[c] Local cost of steam plant erection financed from Italian Aid funds.
[d] The project will be exempt from duties and taxes.

4.13 Implementation of the Institutional Components. In early September 1987 ENEE issued the letter of invitation (Annex 4.3) to a shortlist of consultancy firms, inviting proposals of project management, operational assistance, training and recruitment services. The closing date for receipt of proposals is November 16, 1987. Signature of a contract acceptable to IDA is a condition of effectiveness.

4.14 Implementation of Energy Components. The energy components would be executed by EPD and NWP. EPD would have overall responsibility for all energy planning activities and energy sector studies, and final responsibility for implementation, coordination and supervision of this work would rest with the Director of EPD and the resident advisor. NWP would continue to be responsible for the development and dissemination of improved stoves, and final responsibility for implementation, coordination and supervision of this work would rest with the NWP Director. EPD would be the local counterpart for IDA and cofinancing agencies, consultants, and contractors involved in the implementation of the energy components and would handle all correspondence, progress reports, requests for disbursements and procurement activities. To execute the energy components, NWP and EPD would be assisted by experienced consultants who would work under TOR satisfactory to IDA. Finally, accounting for the energy components will be carried out by EPD with annual audits to be performed by external auditors satisfactory to IDA. During negotiations, agreement was reached that IDA should receive accounts audited by independent auditors within six months after the end of each fiscal year.

Consulting Services

4.15 The execution of the project would require consulting services for the implementation of the institutional component (para. 4.13) and to assist ENEE in the analysis of the consumer billing needs and accountancy hardware and software design, procurement and implementation; and the inspection, construction supervison, startup, testing, commissioning and acceptance and certification of the various project packages and subcomponents. ENEE has agreed to procure and retain consultancy services for project supervision in accordance with IDA guidelines, and has requested proposals for such services in the letter inviting proposals for the institutional components (para. 4.13 and Annex 4.3). The total man-months required for the services is estimated at about 640. The gross man-month rate including travel, direct expenses, local transport, housing and per diems has been estimated at about US$11,500.

Procurement

4.16 The institutional component, which embraces managerial assistance and the engineering and consultancy services, would account for about 55% of the IDA funding of the project. ENEE is currently processing this component (para. 4.13) and has agreed to procure and to retain the services in accordance with IDA guidelines.

4.17 The diesel generator spares to be purchased with some of the IDA funds are of a proprietary nature and can be supplied only by the original manufacturer. ENEE would procure these parts from the supplier, by direct contracting at a total cost of about US$0.8 million (about 6% of the

Table 4.2: PROCUREMENT ARRANGEMENTS a/
(US$ million)

	Procurement Method					
	ICB	DC b/	CS c/	Other d/	Cofinanciers	Total
Diesel plant				1.9	9.0	10.9
Steam plant					22.0	22.0
Proprietary spares for diesel units and auxiliaries		0.8 (0.8)		0.1	7.4	8.3 (0.8)
Non-proprietary spares for diesel units	0.5 (0.5)					0.5 (0.5)
Rehabilitation of power station auxiliaries	1.8 (1.8)			0.2	1.3	3.3 (1.8)
Gezira fire prevention and lighting schemes				0.2	1.4	1.6
33 kV transmission and substations				0.5	6.4	6.9
15 kV distribution and 380 V mains				2.2	22.0	24.2
General plant				0.3	4.7	5.0
Project management, technical assistance and training			6.7 (6.7)	1.4		8.1 (6.7)
System study			0.3 (0.3)	0.1		0.4 (0.3)
Technical assistance (energy/household)			0.9 (0.9)	0.4		1.3 (0.9)
Project preparation facility			1.5 (1.5)			1.5 (1.5)
Total	2.3 (2.3)	0.8 (0.8)	9.4 (9.4)	7.3	74.2	94.0 (12.5)

a/ Figures in parentheses are the respective amounts financed by the IDA Credit.
b/ DC - direct contracting of proprietary spares that can be purchased only from manufacturers of original equipment.
c/ CS - consultancy services procured and retained in accordance with IDA guidelines.
d/ Local costs, mostly labor, borne by implementing agency.

proposed credit). The contract for power station unit and auxiliary plant replacement and overhaul (US$1.8 million) would be procured through the process of international competitive bidding (ICB). ENEE would also apply ICB to the procurement of non-proprietary spares and consumables for Gezira power station, estimated to cost about US$0.5 million. A summary of the procurement methods is presented in Table 4.2. Procurement of items for the project financed by EIB, ADB, and Italy will be purchased in accordance with their normal practices.

Financing Plan

4.18 The total foreign exchange cost of the project is US$84.7 million, of which IDA would finance US$12.5 million equivalent, and cofinanciers would finance US$72.2 million. Cofinanciers (all parallel) are the European Investment Bank (EIB), US$14.7 million (ECU 13 million), African Development Bank (ADB), US$9.5 million (FUA 8 million), and the Italian Government about US$47.8 million (Lira 62 billion). Local project costs total US$9.3 million equivalent of which ENEE would finance US$6.9 million equivalent, GOS US$0.4 million equivalent and Italy US$2.2 million equivalent. Local currency requirements for the power subsector components would be provided by ENEE from operational surplus cash generated as a result of the 80% tariff increase in early 1987 and subsequent tariff increases, and for the EPD and NWF in part by USAID and by the Government for the remainder. Table 4.3 summarizes the financing plan for which further detail is provided in Annex 4.6.

Table 4.3: SUMMARY OF PROJECT FINANCING PLAN
(US$ million)

Item	ENEE	GOS	IDA	ADB	EIB	Italy	Total
Power Sector Components	6.9	-	10.1	9.5	14.7	50.0	92.2
Energy Sector Components	-	0.4	0.9	-	-	-	1.3
PPF	-	-	1.5	-	-	-	1.5
Total	6.9	0.4	12.5	9.5	14.7	50.0	94.0

4.19 During negotiations agreement was reached that (i) Government would onlend to ENEE US$10.3 million of the proceeds of the proposed credit at 7.76% and 15 years repayment after a five-year grace period with ENEE carrying the foreign exchange risk; and (ii) Government would make available to ENEE US$1.3 million of the proceeds of the proposed credit against payment of matching amounts in local currency; conversion of the foreign currencies in SoSh would be carried out at the highest legal rate, which presently would be the median auction rate; if the auction were to be discontinued another rate acceptable to IDA would be agreed upon. The arrangement for the US$1.3 million which would be duplicated for US$3.4 million from EIB, reflects the fact that the US$4.7 million are for spare parts, which should be funded from operational cash flow rather than through loans. Signature of a subsidiary loan agreement and foreign currency purchase agreement between Government and ENEE acceptable to IDA would be a condition of effectiveness. ADB funds are being lent to

Government at 0.75% service fee, and with terms of 50 years including 10 years of grace. Onlending to ENEE would be at the current ADB rate (7.64%) interest and 15 years repayment after five years of grace. EIB funds would be lent to Government for (i) 10 years including 9 years of grace and 1% interest for the US$2 million earmarked for spare parts and (ii) 25 years, including five years of grace and at an interest rate of 2% for the rest. The latter would be onlent to ENEE on similar terms but with an interest rate of 8-10%. Effectiveness of the ADB/EIB loans would be conditions of effectiveness for the IDA credit. Italian financing will be provided as grant to Somalia and passed on to ENEE as equity.

4.20 ADB, EIB and IDA have confirmed with the Italian Government the content, schedule, and disbursement pattern of its funding, because implementation of the Italian component needs to be in-step and parallel to those components funded by ADB, EIB, and IDA to ensure balanced and economically viable rehabilitation results. A colenders meeting took place in June 1987 during which cofinancing arrangements and coordination were finalized and recorded in minutes.

Disbursement

4.21 The proposed credit would be disbursed against: (a) 100% of the foreign expenditure of directly imported equipment and materials quoted on a CIF basis; (b) 100% of ex-factory cost of any locally manufactured items; (c) 100% of the foreign expenditures for consulting services including the employment of the technical staff eventually employed by ENEE referred to in Annex 4.3, Attachment 3; and (d) 100% of the cost of training under the project of ENEE, EPD and NWP staff. Annex 4.7 gives the proposed credit disbursement schedule which conforms with the standard profile for IDA credits for power projects in the Eastern and Southern Region of Africa. All bidding documents and contracts for the supply of services and goods which are to be financed by the Association would be subject to the Association's prior review.

Monitoring and Reporting

4.22 Satisfactory procedures would be agreed for monitoring the progress of project execution, including the energy and cooking efficiency components. Progress reports on project execution and project financial reports would be made on a quarterly basis. A project completion report would be furnished to IDA by ENEE, MNP, and NWP within six months after the closing date of the credit.

Special Accounts

4.23 In order to expedite project execution and give the implementing agencies rapid access to funds under the credit, the Government would open two Special Accounts at a commercial bank. Account A for the ENEE would have an initial deposit of US$800,000; Account B for EPD would have an initial amount of US$100,000. The combined total of the special accounts corresponds to about 7% of credit proceeds. Payments from the Special Accounts shall be made exclusively for eligible expenditures. The Special Accounts would be replenished by IDA as needed, in accordance with

established procedures. The channelling of funds for spare parts will be via a foreign currency purchase agreement between GOS and ENEE (para. 4.19). Agreement was reached with Government during negotiations that the special accounts will be audited by independent auditors and sent to IDA not later than six months after the end of each year.

Environmental Aspects

4.24 Transmission and distribution components of the project would be designed and erected in accordance with current technological practices and will cause minimal disturbance to the environment. The replacement distribution and consumer services components would be an aesthetic improvement on the present arrangements and would provide a safer environment for the public and ENEE's staff. The rehabilitation and corrective maintenance at Gezira and Centrale diesel power stations would improve the visual appearance of the buildings and reduce air pollution currently caused by inefficiently burnt fuel oil. Safety improvements and fire protection would be achieved as well. The addition of a second oil burning steam unit using the existing adequately designed stack would have little additional environmental impact. The diesel generator would be situated in an area designated for industrial development, and it would be designed with acceptably low noise emissions.

Project Risks

4.25 The major risk associated with this project is the sustainability of physical and institutional improvements once the rehabilitation works have been completed. While ENEE will be strengthened at the end of the project, a complete institutional turn-around after only three years cannot be expected. The proposed project is therefore a first step only and subsequent efforts will be required to ensure that the institutional improvements become permanent.

V. FINANCIAL ANALYSIS

Introduction

5.01 ENEE is responsible for all public electricity operations in Somalia. In addition, it operates a small cement pole factory and imports and sells low volumes of light bulbs, light fixtures, and sockets. ENEE's historic financial statements only reflect Mogadishu activities and do not yet consolidate the six regional operations, which will be included from 1987 only. While the financial statements do consolidate the pole factory and electrical materials activities, no separate accounts are kept. The proposed project would address these deficiencies through restructuring of ENEE's financial accounting systems and development of consolidated financial statements.

Financial Position and Past Operating Results

5.02 ENEE's financial performance for the past several years has been poor, characterized by low operational efficiency, low profitability, and severe illiquidity. ENEE's operating results for 1984, 1985, and 1986 are summarized in Table 5.1.

Table 5.1: ENEE - SUMMARY OF INCOME STATEMENTS, MOGADISHU SYSTEM 1986-86

	1984	1985	1986
Units Sold (MWh)	87,653	94,866	104,852
Average Revenue (SoSh/KWh)	2.76	3.64	6.03
	------ SoSh million ------		
Operating Revenue	281	471	879
Operating Expenses			
Fuel	161	336	467
Labor	15	29	38
Other	34	30	59
Depreciation	44	226	240
Subtotal	254	621	804
Operating Income	26	(150)	75
Less:			
Interest & Other fin. charges	28	46	107
Net Income (Loss)	(2)	(196)	(32)
Return on Non-Revalued Assets (%)	13	(7)	2
Debt Service Coverage (times)	2.4	0.6	2.2
Contribution to Investment (%)	5	0	(56)

ENEE's cash generation from operations during the past three years has been insufficient to cover financial charges, annual net income has been negative and debt service has not been met from internally generated sources. Also, ENEE has not been able to contribute to new capital investments over the past two years, as indicated by investment contribution levels of 0% in 1985 and -56% in 1986. ENEE has therefore had to rely increasingly on short-term borrowing, delayed payment of bills, and deferred maintenance. ENEE has severely cut back on almost all maintenance work on plant and equipment, which has led to the current state of widespread equipment failure and system breakdown; ENEE staff estimate that less than one third of all required maintenance is being annually performed. Had ENEE carried out its regular maintenance during the past three years, its financial performance would have been significantly worse. Return on assets is presently not a meaningful performance indicator as the asset base has not been properly revalued in line with increasing replacement costs (ENEE attempted to revalue assets in 1985 but the exercise was incomplete and did not conform to standard accounting practice). However, even with significantly undervalued assets, ENEE has generated poor rates of return, which were negative in 1985 and only 2% in 1986. The asset revaluation proposed under the project (para. 3.09) would address these issues and agreement was reached with ENEE during negotiations that development of a proper asset registry and asset revaluation would be completed for IDA review by December 31, 1988.

5.03 Several factors have contributed to ENEE's weak operating results. First, fuel costs, which account for about 80% of all cash operating expenses, have doubled between 1984 and 1986, due to both the continuing depreciation of the SoSh and Government's petroleum pricing policies which allow the National Petroleum Agency to accrue the profit of lower petroleum product border prices without passing on any of the benefit to consumers. Second, steep rises in domestic inflation have resulted in increases in all other operating areas. Third, ENEE has run extremely large system losses, estimated at 24% in 1986, arising from both a high level of unmetered/unbilled consumption and an inefficient and poorly maintained transmission and distribution network. Finally, these adverse cost factors have not been offset by adequate revenues, because of the depressed and unmet demand outlined earlier (para. 2.11) and inadequate tariff levels.

5.04 As shown in Table 5.2, tariffs have not kept pace with inflation between 1984 and 1986, eroding electricity rates in real terms and subsequently ENEE's financial and operating performance. However, in February 1987, Government authorized an average increase of about 80%, raising tariffs to about 11 US¢/kWh which is close to the estimated long run marginal cost of electricity (para. 2.21). As part of the tariff action, ENEE's simple two-tier tariff structure was temporarily replaced by a single rate for all customers. A new rate structure would be designed and implemented under the proposed project (para. 3.08).

Table 5.2: COMPARATIVE PRICE AND TARIFF INDICES, 1981-86

	1981	1982	1983	1984	1985	1986	1987
Local Inflation (%)	0	23	36	92	38	37	34 a/
Consumer Price Index	100	123	168	323	446	611	819
Tariff Increase (%)	0	44	42	0	32	66	80
Index	100	144	204	204	269	447	805

a/ Estimated

5.05 ENEE's financial position for 1984-86 is summarized in Table 5.3. During 1984-86 ENEE faced increasingly severe liquidity and solvency problems, as evidenced by accumulating debt arrears and the short term borrowing. The two principal changes in its financial structure have been the partial revaluation of fixed assets and the booking of the new 15 MW Gezira steam plant in 1985, which significantly increased the fixed asset account, and the corresponding increase in long-term debt, reflecting the Kuwaiti Fund and Arab Fund financing of the steam unit. (Although ENEE signed the loans in 1982 and drew down the bulk of funds in 1982-84, it did not follow standard accounting principles and only showed the corresponding asset and liability on its balance sheet when the steam unit was

Table 5.3: ENEE - SUMMARY OF BALANCE SHEET, MOGADISHU SYSTEM, 1984-86
(SoSh million)

	1984	1985	1986
Assets			
Current Assets			
Cash	2	3	23
Accounts Receivable	292	417	681
Inventory	32	22	166
Other	14	54	25
Subtotal	339	496	895
Net Fixed Assets	300	3,728	3,604
Work In Progress	6	8	2
Total Assets	645	4,232	4,501
Liabilities and Equity			
Current Liabilities			
Accounts Payable	224	296	331
Overdraft	0	58	135
Current Portion Long-Term Debt	43	75	244
Debt Service Arrears	18	87	249
Other	4	5	10
Subtotal	289	521	949
Long-Term Debt	282	3,833	3,664
Other LT - Liabilities	9	10	11
Equity and Retained Earnings	65	(132)	(123)
Total Liabilities and Equity	645	4,232	4,501
Current Ratio	1.18	0.95	0.97
Debt: Debt and Equity (%)	81	104	104
Accounts Receivable (days)	379	324	324
Accounts Payable (days)	418	295	231

commissioned in 1985.) The company's main financial weaknesses are the following:

(a) Accounts receivable continue to run very high, as end 1986 arrears represent more than 9 months of sales. However, some improvements were made since 1984 when receivables represented more than 12 months of sales;

(b) Accounts payable, which consist largely of unpaid old fuel bills to the National Petroleum Agency (NPA), are also high, equivalent to about 7 months of non-payroll cash operating expenses. ENEE's position has improved since 1984, when overdue bills represented almost 14 months of non-payroll cash operating expenses, because of recent legislation requiring all state enterprise transactions with NPA to be on a cash-only basis;

(c) ENEE has accumulated large debt service arrears, defaulting on all interest and principal payments since 1984 on its 18.7 million dinar borrowings from the Kuwait Fund and Arab Fund, which were on-lent by Government with no additional interest. ENEE carries the foreign exchange risk on these loans and the continuing SoSh devaluation has exacerbated ENEE's debt-service problems;

(d) ENEE has been under-capitalized and highly leveraged, with a debt-to-equity ratio of 81/19 in 1984. The large 1985 loss turned corporate equity into a deficit and without the equity contribution from Government in 1986 to finance some outstanding investment costs for the Jesira steam unit, the equity deficit would have increased further; and

(e) To compensate for operating cash shortfalls, the company has had to rely on local overdraft facilities that carry an interest rate of 20%. These short-term borrowings have been used primarily to finance petroleum purchases, maintenance materials, and capital investment costs (ENEE used some of these funds in 1985 and 1986 to buy foreign exchange under the Italian commodity aid import program to finance transmission and distribution materials, which account for the increase in inventory levels in 1986).

Financial Restructuring of ENEE

5.06 Given the company's outdated and inefficient financial operating systems, the restructuring program essentially replaces, step by step, the existing billing, collection, accounting, plant and inventory control, and planning systems with new procedures, hardware, and software. The successful integration of the new system requires a comprehensive technical assistance and management strengthening program (para. 4.08). The restructuring program also sets out financial performance parameters which are designed to sustain ENEE's medium and long term financial viability. Conditionality has been attached to key actions initiating the reform process. The program components and associated conditionalities are presented in Table 5.4.

Table 5.4: FINANC RESTRUCTURING OF ENEE

Measures	Status of Implementation
A. System Improvements	
1. Appointment of external auditor and audited 1986 accounts	Implemented
2. Annual consolidated audited financial statements	6 months after end of fiscal year, beginning FY87
3. Adequate insurance coverage	Insurance audit received prior to negotiations, contracting of adequate insurance effectiveness (para. 3.11)

4. Contract with public sector customers	Draft contract was presented prior to negotiations, and contract became effective prior to Board presentation (para. 3.09)
5. New billing and collection procedures, and equipment	By June 30, 1988
6. New financial accounting system and accounting equipment	By September 30, 1988
7. Inventory control system	By December 31, 1988
8. New plant accounting system, asset registry and revaluation	By March 31, 1989
9. Financial budgeting and planning system, financial MIS	By June 30,1989
B. Financial Performance Parameters	
10. Rate of return on revalued net fixed assets	8% from 1990
11. Contribution to investment	1%, 10%, 15%, 20%, and 30% in 1988, 1989, 1990, 1991 and 1992 and thereafter, respectively
12. Performance Review	ENEE and Government will annually review with IDA whether ENEE will meet the performance requirements for that year and take appropriate measures, including adjustment of tariffs.
13. Receivables and payables	Implemented prior to negotiations: Settlement of 50% of public sector arrears including debt arrears; reduction of private sector arrears to 180 days of sales By credit effectiveness: Settlement of remaining public sector arrears Thereafter: not more than 120 days in 1988 and 90 days from 1989 of sales revenue and non-payroll cash operating expenditures respectively
14. Investment program	Annual review with IDA from 1988; changes in RIP of more than 1% of gross fixed assets or US$1 million equivalent, whichever is smaller, to be approved by IDA

15. Debt Service Coverage	No new debt without IDA's agreeent if debt service coverage ratio, including the new debt and based on reasonable financial projections, is less than 1.5 during any year of the projection period
16. Restoration of short-term operating viability	80% tariff increase was implemented in February 1987

5.07 ENEE's projected financial statements for 1987-1994 together with notes and assumptions used in these statements are presented in Annexes 5.1 through 5.4. Selected indicators through 1992 are shown in Table 5.5. As already indicated in Table 5.4, the 80% tariff increase of February 1987 has restored ENEE's short term financial viability. Even when taking into account ENEE's limited current ability to deliver electricity, bill for it and collect revenues, the incremental cash flow should cover operating expenditures and debt service in 1987, including the settlement of debt arrears and repayment of short term loans. The increase which was considerably larger than the 30-50% indicated by immediate cash flow needs, should provide satisfactory revenue flows through 1989 particularly with by then improved billing and collection systems. The expected period of relative financial comfort should help ENEE's overall rehabilitation effort. After 1989, annual tariff increases between 5% and 35% are projected to be necessary for meeting financial requirements and for maintaining financial performance. Contribution to investment, debt service coverage, and current ratio would all meet the stipulated performance criteria. Returns on assets remain erratic, but specific returns can be meaningfully targetted and tariffs set accordingly only once the asset base has been properly registered and revalued in early 1989 (Table 5.4-A8). ENEE's capital structure will be strengthened and its debt/debt and equity ratio will normalize as a result of equity contributions from Government in amounts equal to the grant funds received in connection with the Italian component (para. 4.19).

Table 5.5: ENEE FINANCIAL PROJECTIONS - SELECTED INDICATORS
(SoSh millions, current terms)

Indicator	1986	1987	1988	1989	1990	1991	1992
Electricity Sales	632	1273	1681	2285	3993	4804	5619
Internal Contribution to Investment	(62)	412	396	331	1059	1419	950
Investment Program	111	650	2782	6230	6573	4190	2397
Contribution to Investment (%)	(55)	63	14	5	16	34	40
Debt Service Coverage (times)	1.6	1.6	1.8	1.6	2.4	2.3	1.6
Current Ratio	0.9	1.7	2.8	2.3	1.7	1.1	1.1
Debt/Debt and Equity Ratio (%)	103	109	94	81	68	62	58
Projected Avg. Tariff Increases (%)	66	80	0	0	35	5	5
Tariffs (US¢/kWh)	5.5	10.1	8.2	7.1	8.5	8.1	7.8
Domestic Inflation	40	34	20	15	12.5	12.5	12.5
Rate of Return (%)	2.1	13.0	5.7	2.5	6.1	4.0	2.5

Financial Covenants

5.08 ENEE's actual financial performance will be monitored during project implementation and an annual review will be undertaken jointly by ENEE, GOS, and IDA to ensure the company maintains a sound financial position. Agreement on the review process and associated criteria was reached with ENEE and GOS during negotiations and is reflected in several financial covenants. First, ENEE should (i) from 1990 on earn a return on net fixed revalued assets of not less than 8%; and (ii) generate funds from internal sources of not less than 1%, 10%, 15%, 20% and 30% of its investment program in 1988, 1989, 1990, 1991 and 1992 and thereafter respectively. Second, ENEE should not incur debt without IDA's agreement unless reasonable financial projections indicate that the debt service coverage including the new debt to be incurred will not be less than 1.5 in any given year of the projection period. Third, ENEE will reduce accounts receivable and payable to 120 days by 1988 and to 90 days from 1989 on, of electricity sales and non-payroll cash expenditures respectively. Fourth, ENEE will seek IDA's approval for any changes in the RIP greater than US$1 million equivalent or 1% of gross fixed assets, whichever is the smaller. Fifth, ENEE and Government will annually review with IDA whether ENEE will meet the performance requirements for that year and the next year and take appropriate measures including adjustment of tariffs.

VI. PROJECT JUSTIFICATION

The Need for the Project

6.01 The project constitutes the majority of ENEE's development program for the Mogadishu system to 1994, accounting for about 85% of the total investment. 8/ The program, and thus the project is required to eliminate the present lack of generation, transmission and distribution capacity to meet existing and forecast growth in demand to 1994 in the Mogadishu system. The project is also required to reduce the costs of meeting demand by displacing costly private generation facilities and by improving system operating efficiency and supply reliability. The availability of generation capacity has to be increased to make up for a 32% deficit relative to system peak demand in 1986, and to meet an increase of about 80% in system peak demand, including interconnected load centers, by 1994. The Mogadishu system transmission capacity also needs to be increased by a similar overall rate. These increases in capacity would bring about substantial economic benefit through removing a bottleneck to industrial and commercial activity in Mogadishu and agriculture in surrounding areas. The system distribution capacity needs to be increased to meet increases in the demands from existing consumers and to take on the demands from new consumers, especially in the residential category, which will approximately double the total number of connected consumers by 1994.

8/ The costs of the PPF and the long-term planning work included in the project, accounting for about 4% of total project costs, are excluded from the economic evaluation of the Mogadishu power development program to 1994.

Approach to Evaluation

6.02 The Mogadishu power development program to 1994 with commissioning of the Baardhere project in 1995 has been shown to be the least-cost development program for the power system in Southern Somalia (para. 2.16). The economic return to the Mogadishu power development program to 1994 is derived from the incremental costs and benefits from the program. The increments are relative to the mission's assessment of the situation that would prevail if no rehabilitation or development of the Mogadishu system were to take place, i.e. (i) none of the existing diesel units would be operable after the first quarter of 1990; and (ii) the existing oil-fired steam unit would be the only source of power in Mogadishu. Thus, the incremental costs are the differences in total system costs, comprising capital, O&M and fuel costs, between the development program case and the no rehabilitation and development case. The costs of technical assistance for project management and training are also included in the "with program" case since this assistance is considered to be essential for achieving the projected improvement in system performance. Similarly, the incremental benefits are the differences in the value of total served power demand between the two cases. The served demand in the "with program" case is based on the mission's power demand forecast (Annex 2.3).

Economic Costs and Benefits

6.03 Power system economic costs are valued in 1987 price terms, and are based on international prices CIF Mogadishu and associated internal costs. Somali taxes and duties are excluded from the costs. Operating costs which are independent of system development are not included since they are common to all development options. Similarly, the capital and O&M costs, and the benefits as well, associated with hydropower from Baardheere are not included in the comparison. This approach avoids the need for arbitrary allocation of the joint costs of this multipurpose project between irrigation, flood control and power development programs with further allocation between the power programs for Mogadishu and the Juba Valley. The comparison captures the savings in costs arising from improvements in system operating efficiency brought about under the development program. The main sources of savings are (a) reduction in system technical losses from improved balance in the loading of transformer capacity, improved voltage profiles on distribution feeders and installation of reactive power compensation equipment in the transmission system; and (b) reduction in the specific fuel consumption rates of the existing diesel units. System economic costs associated with the two evaluation cases are summarized in Annex 6.1.

6.04 System benefits are derived from the increase in served energy demand that would be achieved under the development program. Since Baardhere costs are omitted from the comparison, for consistency the demand for Baardhere power from 1995 is also omitted. The comparison focusses on the utilization of thermal generation capacity as well as transmission and distribution capacity in Mogadishu that is rehabilitated or added by 1994. The served demands in the two evaluation cases are summarized in Annex 6.1. The incremental served demand is valued at the average consumer willingness-to-pay for power from ENEE's system which is estimated by the

mission to be SoSh 26/kWh (19.2 US¢/kWh at an exchange rate of SoSh 135/US$) in 1987 price terms. This estimate is derived from the weighted average cost to consumers of meeting their demands for power from the types of private power sources currently in use in Mogadishu (Annex 6.1).

Economic Rate of Return

6.05 The economic rate of return to the net incremental benefits of the Mogadishu power development program to 1994 is 25%, as detailed in Annex 6.1. This estimate is conservative since it does not include the benefits after 1994 from the Baardhere power handled by the transmission and distribution components in the program. Any delay in commissioning the Baardhere Project would increase the economic rate of return to the program through greater utilization of the thermal generating capacity that is rehabilitated and added up to 1994 for the period from 1995 until commissioning of Baardhere.

VII. AGREEMENTS REACHED AND RECOMMENDATIONS

Agreements Reached

7.01 The following agreements were reached with ENEE and Government:

(a) GOS will onlend to ENEE US$10.3 million equivalent at 7.76% with a maturity of 20 years, including five years of grace, with the foreign exchange risk to be borne by ENEE. ENEE is to receive US$1.3 million of the credit proceeds against payment of matching amounts in local currency and conversion of the foreign currencies into SoSh taking place at the highest legal exchange rate, i.e., for the time being the median auction exchange rate based on a three month average; or otherwise by a rate acceptable to IDA (para. 4.19).

(b) ENEE will continue to employ qualified auditors and will send consolidated audited accounts to IDA within six months after the end of the fiscal year (para 3.09).

(c) GOS shall send to IDA not later than six months after the end of each year audited accounts for the energy components (para. 4.14) and the special accounts (para. 4.23).

(d) ENEE will not incur any debt without IDA's agreement unless reasonable financial projections indicate that the debt service coverage including the new debt to be incurred will not be less than 1.5 in any given year of the projection period (Table 5.4 and para. 5.08).

(e) ENEE will reduce accounts receivable and payable to 120 days by 1988 and to 90 days from 1989 on, of electricity sales and non-payroll cash expenditures respectively (Table 5.4 and para. 5.08).

(f) Power subsector expansion for the Mogadishu system and ENEE as a whole will be in accordance with the Reference Investment Program (RIP); the RIP will be reviewed annually and revised if required; ENEE will seek IDA's approval for any changes in the RIP greater then US$ 1 million equivalent, or 1% of gross fixed assets, whichever is the smaller (Table 5.4 and para. 5.08).

(g) ENEE should (i) from 1990 on earn a return on net fixed revalued assets of not less than 8%; (ii) generate funds from internal sources of not less than 1%, 10%, 15%, 20%, and 30% of its investment program in 1988, 1989, 1990, 1991 and 1992 and thereafter, respectively. ENEE and Government will annually review with IDA whether ENEE will meet the performance requirements for that year and the next year and take appropriate measures, including adjustment of tariffs (Table 5.4 and para. 5.08).

(h) ENEE, MNP, and NWP will furnish to IDA a project completion report within six months after the closing date of the project (para. 4.22).

(i) Institutional arrangements proposed for Baardhere will be presented to IDA for review (para. 2.01).

(j) The results of the household energy survey (para. 1.04), the petroleum procurement and distribution study (para. 1.19) and the commercial woodfuels marketing study will be jointly reviewed by GOS and IDA to define appropriate follow-up actions.

Conditions of Effectiveness

7.02 The following are conditions of effectiveness:

(k) Settlement of remaining 50% of public sector arrears owed by and to ENEE (Table 5.4 and para. 3.08).

(l) ENEE has contracted insurance coverage acceptable to IDA (para. 3.11).

(m) Signature of project management/operational assistance contract for ENEE (para. 4.13).

(n) Confirmation by the Somali Government of physical content, timing, disbursement schedule, and implementation arrangements of its bilateral project component with Italy (para. 4.20).

(o) Effectiveness of EIB and ADB credits (para. 4.19).

(p) Signature of subsidiary loan agreement and foreign currency purchase agreements between Government and ENEE and acceptable to IDA regarding the onlending of the IDA credit proceeds (para. 4.19).

(q) ENEE will have (i) acquired the land and rights related thereto for the accomodation of the north substation and power plant and (ii) secured a right-of-way for the route of extra high voltage lines into the substation from a north-westerly direction (para. 4.12).

Recommendation

7.03 With the above conditions and agreements, the project is suitable for an IDA credit of SDR 9.7 million equivalent to US$12.5 million to be lent to Somalia for a term of 40 years including a period of 10 years grace.

SOMALIA
POWER REHABILITATION AND ENERGY PROJECT

NATIONAL ENERGY BALANCE FOR 1986
(thousand tonnes of oil equivalent)

	Primary Energy						Petroleum Products							Proportions	
	Fuelwood	Agricultural Residues	Crude Oil	Hydro-Elec.	Charcoal	Electricity	Gasoline	Jet-Fuel Kerosene	LPG	Diesel	Fuel Oil	Total	Line Totals	Total	Excluding Woodfuels
														(%)	(%)
Gross Supply															
Production	1,270	37.4	-	2.5	-	-	-	-	-	-	-	-	1,309.9	87.7	17.8
Imports	-	-	126.1	-	-	-	14.1	9.6	-	38.8	-	62.5	188.6	12.6	84.4
Primary Exports	-	-	-	-	-	-	-	-	-	-	(4.9)	(4.9)	(4.9)	(0.3)	(2.2)
Stock Changes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gross Supply Available	1,270	37.4	126.1	2.5	-	-	14.1	9.6	-	38.8	(4.9)	57.6	1,493.6	100.0	100.0
Conversion															
Petroleum Refinery	-	-	(117.1)	-	-	-	9.1	13.5	0.4	37.1	57.0	117.1	0	-	-
Charcoal Production	(65.9)	-	-	-	65.9	-	-	-	-	-	-	-	0	-	-
Electricity Generation	-	(37.4)	-	(2.5)	-	105.0	-	-	-	(20.8)	(44.3)	(65.1)	0	-	-
Conversion Losses	(154.1)	-	(9.0)	-	-	(79.5)	-	-	-	-	-	0	(242.6)	(16.2)	(39.6)
Transmission & Distribution Power Losses	-	-	-	-	-	(3.2)	-	-	-	-	-	0	(3.2)	(0.2)	(1.4)
Net Supply Available	1,050	0	0	0	65.9	22.3	23.2	23.1	0.4	55.1	7.8	109.6	1,247.8	83.6	59.0
(Net Domestic Consumption)														100.0	100.0
Consumption by Sector															
Transport	-	-	-	-	-	-	23.2	-	-	44.1	-	67.3	67.3	5.4	51.0
Industry	7.4	-	-	-	3.4	8.6	-	-	-	2.8	7.8	10.6	30.0	2.4	14.6
Agriculture	-	-	-	-	-	-	-	-	-	8.2	-	8.2	8.2	0.7	6.2
Commercial & Government	2.1	-	-	-	1.9	7.9	-	4.6	-	-	-	4.6	16.5	1.3	9.5
Residential	1,040.5	n.a.	-	-	60.6	5.8	-	18.5	0.4	-	-	18.9	1,125.8	90.2	18.7

Source: Mission based on data from ENEE, IRAQSOMA, NPA and EPD.

SOMALIA

POWER REHABILITATION AND ENERGY PROJECT

BASIC DATA AND ASSUMPTIONS FOR THE 1986 NATIONAL ENERGY BALANCE

Fuelwood Supply Average annual consumption = 0.6 m3/capita; population of Somalia in 1986 = 6.2 million including 0.7 million refugees. Total annual consumption 0.75 x 0.6 x 6.2 = 2.8 million tonnes of air-dried wood of 15% average moisture content, calorific content 16.0 GJ/t and solid density of 0.75 t/m3. Equivalent energy supplied in 1986 = 2.8 x 16.0 = 44.8 million GJ, equivalent to 1,050 thousand toe at 42.7 GJ/toe. Fuelwood used for charcoal production is an additional supply of energy.

Agricultural Residues Supply There are data only for bagasse production at Juba Sugar Factory - about 110,000 tonnes in 1986 which was used to generate about 10 GWh of electricity. Other sugar plants were not in operation during 1986. Calorific content of air-dried bagasse with 30% moisture content = 14.7 GJ/t, 0.34 t/toe. Energy supply was equivalent to 110,000x0.34 = 37.4 thousand toe.

Crude Oil Supply IRAQSOMA processed 126,100 t in 1986, with estimated refinery losses by weight of about 5%.

Petroleum Products Supply Product yield pattern on weight basis from refinery crude oil in 1986 was LPG - 0.3%; Gasoline - 7.4%; Kerosene/Jet Fuel - 11%; Diesel - 31.2%; Heavy Fuel Oil - 50.1%. Balance of consumption made up from direct imports of products. Ratio tonnes product/toe by calorific value: LPG - 0.94; Gasoline - 0.97; Kerosene/Jet Fuel - 0.98; Diesel - 1.02; Heavy Fuel Oil - 1.06.

Charcoal Production in 1986 was about 97,000 tonnes with a calorific content of about 29 GJ/t, equivalent to 97 x 29/42.7 = 65.9 thousand toe. The average conversion efficiency was about 30% on an energy content basis, and thus about 220 thousand toe of fuelwood was used during 1986 to produce charcoal.

Electricity Production in Mogadishu for 1986 was 131.1 GWh generated from an HFO-burning steam unit and HFO-burning diesel sets at an average specific fuel consumption of about 0.37 liters/kWh. Total consumption of heavy fuel oil (HFO) at 1,045 liters/t was about 47,000 tonnes. The remaining HFO was supplied to the Berbera cement plant (about 8,300 tonnes) with a small amount (about 700 tonnes) to the Gezira urea plant. About 10 GWh of hydroelectricity was produced at Fanode in the Juba Valley, for which the energy equivalence is based on 4,000 kWh/toe. About 10 GWh was generated from bagasse at the Juba Sugar factory. Production from diesel sets burning diesel fuel is estimated to have been about 30 GWh in isolated load centers and 30 GWh in industrial plants at an average specific fuel consumption of about 0.45 liters/kWh, and total consumption at 1,200 liters/t was about 18,750 tonnes. About 5 GWh is estimated to have been generated from small diesel sets, together with a relatively small amount from gasoline sets, at 0.60 liters/kWh consuming 2,500 tonnes of diesel

oil. A thermal efficiency rate of 34% is generally used to derive generated electrical energy (sent out from station) and generation conversion losses, except for a rate of 6.7% for bagasse-generated power. Transmission and distribution losses were estimated from a weighted average of 17% of sent out energy excluding private producers (161 GWh).

Sectoral Consumption Estimated proportions for each fuel:

- fuelwood: industry 0.7%; commerce 0.2%; residential-remainder.
- charcoal: industry 5.2%; commerce 2.8%; residential-remainder.

(Source: "Somalia - Issues and Options in the Energy Sector").

- electricity: - Mogadishu consumption (131 GWh) - mission's simulated energy demand for 1986 for demand forecast:
  - industry 18%; Comm./Gov. 49%; residential 33%
  - Private generators in industry: (50 GWh) - industry 100%
  - Isolated Load Centers (30 GWh) - mission's estimate of one third total for each of the three sectors.
  - Small generators (5 GWh): 50% each in commerce and residential.
  - weighted averages for national electricity consumption by sector:
    industry 38.7%; comm./gov. 35.5%; domestic 25.8%.
- kerosene: commerce 20%; residential 80%.

ANNEX 1.2

SOMALIA

POWER REHABILITATION AND ENERGY PROJECT

National Petroleum Supply and Consumption 1980-1986 [a]/
(thousand tonnes)

	1980	1981	1982	1983	1984	1985	1986
Imports							
Crude Oil	265.7	-	179.5	212.6	123.6	158.5	126.8
Petroleum Products	-	185.7	96.6	88.1	101.8	103.2	62.0
Refining							
Crude Oil Processed	264.8	-	179.5	212.9	136.4	158.5	126.8
Product Output							
LPG	0.3	-	0.4	0.2	0.1	0.1	0.4
Gasoline	46.6	-	23.9	29.0	23.4	9.5	9.2
Kerosene/Jet Fuel	19.2	-	18.9	14.7	13.5	18.3	13.7
Diesel Oil	80.7	-	56.9	84.0	53.6	46.5	39.1
Heavy Fuel Oil	110.0	-	74.7	82.4	44.2	82.2	62.9
Own Consumption & Losses	8.0	-	4.7	2.6	1.6	1.9	1.5
Re-Exports	108.0	-	75.7	82.4	31.4	45.9	5.2
Gasoline	6.7	-	3.0	2.0	3.0	-	-
Heavy Fuel Oil	101.3	-	72.7	80.4	28.4	45.9	5.2
Bunker Sales	17.2	15.0	10.0	10.0	10.0	-	-
Jet Fuel	8.5	8.0	8.0	8.0	8.0		
Heavy Fuel Oil	8.7	7.0	2.0	2.0	2.0		
Inland Consumption	212.5	176.3	182.8	206.3	208.2	213.9	182.1
LPG	0.3	-	0.4	0.2	0.1	-	0.4
Gasoline	58.6	40.8	43.4	47.8	45.4	36.5	22.9
Kerosene/Jet Fuel	24.8	15.2	22.8	25.2	29.5	35.2	23.2
Diesel Oil	126.8	120.3	114.2	131.1	117.4	105.8	77.9
Heavy Fuel Oil	2.0	-	2.0	2.0	15.8	36.4	57.7

a/ Differences between total supply and sales reflect stock changes.

Source: NPA; Iraqsoma; Iskiash.

SOMALIA

POWER REHABILITATION AND ENERGY PROJECT

ENEE's Installed Generating Capacity

Location	Make and Type	Fuel	No of Units and Nameplate Rating (kW)	Commissioning Dates	Available Capacity (kW) a/	Speed (rpm)	Generator Voltage	Remarks
Mogadishu								
Gezira diesel station	Mirlees V 16 M	HFO	5 x 5,732	78, 78, 78, 79, 80	2 x 4,000	500	15,000	
Gezira steam station	BBC turbine Lentjeb Boiler	HFO	1 x 16,500	85	Zero	1,500	6,300	Recommissioned in April 1987 following manufacturer's 2-year warranty overhaul
Centrale diesel station	Deutz/Pelizzari 6-in-line	Diesel	4 x 960	59, 59, 63, 64	2 x 500	273	380	Two sets cannibalized and retired.
Centrale diesel station	Deutz VI2	HFO	4 x 2,160	68, 74, 75, 77	1 x 1,000	375	380	Although converted in 1983 to burn HFO, currently running on automotive diesel fuel because of failed auxiliaries.
Northern Region								
Hargeira diesel station	Ruston	Diesel	1 x 1,000	84	Zero	500	380	When fuel is available, power station generates only from 1730-0530 each night.
	Deutz	Diesel	1 x 400	NA	200	750	380	
	Deutz	Diesel	1 x 800	72	400	750	380	
Berbera diesel station	Ruston	Diesel	1 x 1,000	84		500	380	When fuel is available, power station generates from 1800-0200 each night.
	Ruston	Diesel	1 x 900	82	1,050	500	380	
	English Electricity	Diesel	2 x 450	63		500	380	
Burao diesel station	Ruston	Diesel	2 x 1,000			500	380	When fuel is available, power station generates from 1800-0100 each night.
	Deutz	Diesel	1 x 450	81		750	380	
	Deutz	Diesel	1 x 80	77		750	380	
	MAN	Diesel	1 x 150	81	90	500	380	
Southern Region								
Baidoa diesel station	Finnish	Diesel	2 x 700	88	NA	750	400)	Shown here are details of plant to be commissioned in 1988, financed from Finnish aid funds.
Kismayo diesel station	Finnish	Diesel	2 x 1,000	88	NA	750	400)	

a/ As at March 31, 1987.

27-May-87

ANNEX 2.2

SOMALIA

POWER REHABILITATION AND ENERGY PROJECT

MOGADISHU SYSTEM POWER GENERATION AND CONSUMPTION 1978-1986

CY	1978	1979	1980	1981	1982	1983	1984	1985	1986	Average Growth
Energy Supply & Consumption (MWh)										(%/y)
Energy Generated	41730	44200	58900	72670	75719	91203	113253	123440	131065	15.4%
System Losses & Unbilled Consumption	7935	7514	10013	13810	13629	20627	24463	40277	36200	
Billed Consumption	33795	36686	48887	58860	62090	70576	88790	83163	94865	13.8%
Billings by Consumer Category										
Private a/	13502	13429	20859	19390	20875	32569	33222	25598	31861	
Municipal	2132	2780	1961	2710	2471	1992	2186	938	4163	
Government b/	13122	17900	21101	32700	31654	29184	46066	44513	49633	
Embassies c/	5039	2577	4966	4060	7090	6831	7316	12114	9208	
System Maximum Demand (MW)	11.5	13.5	14.5	16.5	17.2	20.2	24.2	25.5	27.6	11.6%
System Load Factor	41.4%	37.4%	46.4%	50.3%	50.3%	51.5%	53.4%	55.3%	54.2%	
Energy Losses etc./Energy Generated	19.0%	17.0%	17.0%	19.0%	18.0%	22.6%	21.6%	32.6%	27.6%	
Numbers of Consumer Connections										
Private	17388	19176	22293	24901	27593	32378	37453	38434	39981	
Municipal	91	102	105	105	105	105	110	115	177	
Government	1418	1677	1692	1721	1813	1895	1837	1988	2140	
Embassies	364	417	475	505	518	613	473	413	452	
	19261	21372	24565	27232	30029	34991	39873	40950	42750	10.5%

a/ Includes consumption by Somali private households,small commerce,small industry and about 1500 expatriate households.
b/ Includes consumption by large public sector industry and infrastructure,and about 2000 households of senior public officials.
c/ Includes consumption by about 500 households of embassy staff.

Source: ENEE

SOMALIA

POWER REHABILITATION AND ENERGY PROJECT

MOGADISHU SYSTEM POWER DEMAND FORECAST 1987-1994

Approach and Methodology

1. Following the approach of Kennedy & Donkin (UK) in their report "Somalia - Power Planning Study" of February 1987, the mission has constructed estimates of energy and peak power demands on the Mogadishu system (at the points of consumption), starting with the calendar year 1987 as the base year and projecting demand up to 1994. These estimates are for demand that is connected to ENEE's system and is unconstrained by system supply capacity. The mission's forecasts are given in the tables at the end of this Annex. The estimates are simulated according to consumer categories that reflect important differences in energy consumption characteristics, namely domestic (households), commerce, Government and industry. Total system energy demand is the sum of these category demands. This approach permits the power demand forecast to be related to forecasts for economic parameters such as population and sector gross domestic product (GDP), and to power sector parameters such as numbers of connected consumers and price and income elasticities of power demand. Separate forecasts are derived for the city of Mogadishu and the four towns whose power systems are scheduled to be connected to the Mogadishu system by 1992, namely Afgoi, Balad, Jowhar and Merca. The interconnections of these towns with Mogadishu by 1992 was shown by Kennedy and Donkin in their report to be the least-cost method of meeting demand.

2. ENEE's billing data and operating records are inadequate for demand forecasting purposes since they reflect the highly constrained supply conditions that are described in Chapter 2 of this report, and the data are not suitably organized. To indicate the extent of demand suppression in 1986, the simulated demand for that year was estimated according to the adopted approach and compared with actual outputs by ENEE as follows.

	Actual System Output	Estimated Unconstrained System Demand	Unserved Proportion of System Demand
Generated Energy (GWh)	131.1	154.5	15%
System Maximum Demand (MW)	27.6	41	32%
System Load Factor	54%	43%	

(data relate to sent-out from power station and thus, include system losses).

3. Domestic Energy Demand: Forecasts of domestic, or household, energy demand are based on the following projections: (i) the number of households which is derived from the total population of Mogadishu and an average household size of 5.8 people. The population in 1984 was estimated from the national census to be 700,000 and its projected natural annual

growth rate is 3.0%. With projected immigration of 21,000 people annually, the annual growth rate is 6% in 1986 declining to 5% in 1993; (ii) high income households which are all connected to ENEE's system and are characterized by ownership of air conditioners. They are estimated to number about 5,000 (2,000 households for senior public officials, 500 for embassy staff, 1,500 for other expatriates, 1,000 for private Somali households) with an an average specific consumption of 5,000 kWh/year in 1986; (iii) low and middle income households for which the connection rate to ENEE's system is projected to increase from 20% in 1986 to 32.5% of the total number of households in this group in 1994, with an average specific consumption of 600 kWh/year in 1986. The projected connection rates in each category are applied to category populations which increase at the overall urban population growth rate.

4. Projected rates of specific consumption for the two income groups are related to the following factors: (i) the income elasticity of demand, under which the rate of growth of specific power consumption is 1.7 times the projected growth in national per capita income which is 1.07% annually based on the projected GDP growth of 4.1% given in the World Bank's report "Somalia - Recent Economic Developments and Medium Term Prospects (February 10, 1987)" and population growth of 3.0% per annum; and (ii) the price elasticity of demand for the low and middle income households under which specific consumption changes at minus 0.3 times the rate of change in tariff level. The power demand of high income consumers is taken to be insensitive to the tariff level since many of these consumers have their electricity bills subsidized (senior civil servants, expatriates) and the others are wealthy. The net effects of these factors is to increase specific consumption between 1987 and 1994 by 8% for low and middle income households and 12.5% for high income households.

5. Connections to the Power System: ENEE's capacity to add new connections to the power system will constrain the growth in connected demand during the period of the demand forecast. This constraint is taken into account explicitly by limiting the projected growth in connections in the low and middle income domestic category so that the total annual new connections on the system do not exceed ENEE's projected capacity to extend the sub-transmission and distribution networks and to connect new consumers to these networks. Up to 1992, the assistance to be provided directly for this work under the Power Rehabilitation Project will constitute a major part of this capacity, and thereafter it is expected that ENEE's capacity will be sufficiently strengthened under the project to achieve a connection rate averaging 6,000 annually.

6. Commercial Energy Demand: Forecasts of commercial energy demand are derived for two sub-categories, viz small commerce such as shops and restaurants and large commerce comprising banks, offices, hotels, embassies (but embassy housing is included in the domestic high income category) and transport centers (port, airport). The forecast power demand for the small commerce category is based on the following projections: (i) total number of establishments, which is linked to the number of households at the rate of 150 establishments per 1,000 households in the central area of the city and 60 per 1,000 in the outer areas; (ii) the proportion of this total that is connected to ENEE's system, which is projected to increase from 55% in

1986 to 71% in 1994; and (iii) the specific consumption of power which is projected to increase from 2,000 kWh/year in 1986 at the projected growth in national per capita income (para. 4 of this Annex). The forecast power demand for the large commerce category is based on assessments of growth prospects of individual large consumers and groups of consumers. Housing for embassy staff that is included by ENEE in the Embassy category for billings is transferred to the high-income domestic sub-category in the mission's forecast.

7. Government Energy Demand: Forecasts of government energy demand are derived for three categories, namely (i) large establishments such as prisons, hospitals, university, schools and military areas by each sub-group; (ii) municipal buildings, which are linked to the city population at the rate of 20 establishments per 1,000 households, and whose specific annual consumption averages 2,000 kWh/year; and (iii) street lighting, for which demand is projected to increase at the same rate as the city population. Housing for senior officials that is included by ENEE in the Government category for billings is transferred to the high-income domestic sub-category in the mission's forecast.

8. Industrial Energy Demand: Forecasts of industrial energy demand are derived for two sub-categories: (i) large industries, mainly in the public sector, whose future demands are assessed by individual plant; and (ii) small industries, mainly artisanal, which are linked to the city population at the rate of 30 establishments per 1,000 households, and whose specific annual consumption averages 5,000 kWh. No new large industrial plants are included in the forecast in view of the highly uncertain prospects for the viability of new developments for the next few years. The growth in industrial demand is expected to come from increases in capacity utilization of existing plants from the present low levels of around 25%.

9. System Maximum Power Demand: The peak daily power demand on the Mogadishu system occurs in the early evening (between 6 p.m. and 7 p.m.), and a secondary daily peak in demand occurs around midday. The forecast unconstrained system peak power demand is estimated from sum of the forecast power demands for the main consumer categories that coincide at the time of the system peak demand. A coincidence factor (equal to or less than unity) is applied to the forecast maximum demand of a category to reflect that it may not coincide with the timing of the system maximum demand. The forecast maximum power demand of a consumer category is derived from the forecast energy demand and the estimated load factor for that category.

10. In estimating the coincident category power demands with the system power demand, the following values were used for load factors and category coincidence factors:

		Load Factor (%)	Coincidence Factor: Evening Peak (%)	Coincidence Factor: Midday Peak (%)
Domestic:	low and middle income	25	100	10
	high income	50	100	25
Commerce:	large commerce	42*	25	100
	embassies	50	100	100
	small commerce	65	100	100
Government:	large Government	45	75	100
	municipal	45	25	100
	street lighting	50	100	0
Industry:	large industry	37*	25	100
	small industry	55	35	100

* average for 1986 to 1994.

11. The program adopted for the interconnections of the power systems in the four outlying towns with the Mogadishu power system is as follows:

Afgoi - January 1990; Balad - January 1990;
Jowhar - January 1992; Merca and Shalamabad - January 1991.

12. Consumers Willingness to Pay for Power from ENEE is an issue for forecasting demand on ENEE's system following the increase in tariffs implemented in early 1987 to SoSh 14/kWh (US¢10.4/kWh at the average of the auction and free market exchange rates, SoSh 135/US$ in March 1987), especially in view of the substantial amount of privately-owned generators already installed on consumers premises. ENEE concluded from a survey in end 1986 that there were between 400 and 500 privately-owned generators in Mogadishu, ranging in size from 0.5 kW to 800 kW with combined rated capacity of 5 to 6 MW.

13. The demand forecast for low-income domestic consumers already takes into account the effect of tariff levels through the estimated price/demand elasticity of minus 0.3. Rather than fuel switching, this effect is considered to reflect constraints on overall energy consumption as well as use of power from low household incomes. By way of comparison, the estimated cost of lighting using kerosene lamps is equivalent to SoSh 17.2/kWh, as detailed below, which is about 23% higher than ENEE's power tariff.

Cost of kerosene fuel	SoSh 21/liter
Ratio of Calorific values of /liter kerosene to /kWh electricity	3.4
Ratio of conversion efficiencies of kerosene and electrical appliances	0.4
Equivalent cost of utilizable energy from kerosene	ShSh 15.4/kWh
Capital cost of a kerosene lamp	SoSh 400
Capital annuity factor @ 16% interest and 3 year life	0.445
Equivalent capital cost over 100 kWh/year/lamp	SoSh 1.8/kWh
Total cost of using kerosene for lighting (equivalent)	SoSh 17.2/kWh

14. The effect of tariffs on other consumers demands is considered to be through switching to privately-owned generators. The economic costs to Somalia and the financial costs to consumers of power from privately owned generators currently installed in Mogadishu are detailed in the attached table in this Annex in early 1987 prices for the range of generator sizes in operation. These costs are based on meeting the consumers' total power requirements from the private generators and thus, represent the lowest average costs of power from these sources. As back-up sources to ENEE's supply, private generators would be used less than in the evaluation cases, and the average cost of power from them would be higher. This feature is particularly marked for the small generators for which annualized capital costs are a substantial proportion of total annual costs. Foreign costs are converted into Somali currency terms at the equivalent rate of SoSh 135/US$. Economic costs of capital equipment are based on typical international costs cif Mogadishu and exclude import duties. The financial costs include Somali duties and taxes on such equipment, equivalent to a cumulative tax of 65%, and the average retail mark-up by Mogadishu suppliers of 65% on the after tax cost. Economic costs of fuel are based on import parity prices, whereas the financial costs are the official retail prices and thus, represent the lowest prices that consumers pay when fuel is in short supply. Capital annuity factors are calculated from estimated working lives assuming that the generators are properly maintained, the estimated opportunity cost of capital in Somalia for deriving economic costs, and the interest rate charged on loans for equipment purchase in Somalia for deriving financial costs.

15. The analysis of power costs from private generators shows that such power typically costs the consumers about SoSh 22/kWh from large and medium-sized diesel generators, about SoSh 36/kWh from small diesel generators and about SoSh 85/kWh from small gasoline generators, based on typical power consumption patterns. The analysis of the corresponding economic costs shows that the financial costs of power from the large and medium-sized diesel generators are about 50% greater than the economic costs, and from small generators the financial costs are about 100% greater than the economic costs.

16. Up to end 1986 ENEE's tariffs were low enough for ENEE's power to be cheaper to consumers than the costs of power from their own generators, and so these consumers used their generators as a back-up power source. However, at ENEE's tariff introduced in early 1987 (SoSh 14/kWh), and the current petroleum product prices, the variable financial costs of power about (SoSh 9/kWh) from own generating facilities used in industrial plants are about 65% of ENEE's tariff, and the variable costs from the small generators are also a little less than ENEE's tariff. The total cost of power from new generators including capital costs, is much higher than ENEE's tariff for all types of privately-installed generator. The above cost analysis gives an indication of the limit of consumers willingness to pay for power from ENEE. With a tariff of SoSh 14/kWh, ENEE is likely to meet some resistance from large industrial consumers who have already installed their own generating facilities. Consumers with small diesel generators already installed will not have a strong preference since their variable costs are also about SoSh 14/kWh. There will be no financial incentive for consumers to purchase new generators.

17. The following approach is adopted to allow for existing and additional privately-owned generators for forecasting power demand on ENEE's system. Up to 1994, ENEE is unlikely to have sufficient generating capacity to meet the forecast evening peak demands on its system, and will have little capacity in reserve for the midday peak demand (Annex 2.4). Hence, the existing privately-owned diesel generators will be required as back-up to ENEE's supply. It is anticipated that Government will increase the price of diesel fuel to restore its relationship with power tariffs which existed up to end 1986, and that the situation prevailing in early 1987 will not remain in force throughout the forecast period.

18. According to the mission's projections, ENEE's generation capacity is likely to remain inadequate to meet the total demand for energy at least until early 1989 (Annex 2.4). Once power consumers perceive that the reliability of ENEE's supply will improve due to the Power Rehabilitation Project, there will be little incentive for them to purchase new generators themselves, especially in the small commercial and domestic categories. The urea plant and the oil refinery at Gezira, the SOMALTEX factory at Balad and the sugar mill at Jowhar co-generate with process steam their own power from steam turbines. It is therefore assumed that substantial amounts of power will continue to be produced at these plants, but there will be greater use of ENEE's power once it is available to minimize total production costs.

19. System Losses. Forecast demand at point of station output to the transmission system (sent out power) is based on forecast consumer demand and system technical losses excluding losses within power stations. In the present condition of the system, energy losses are estimated to be about 20% down to low voltage supply, and 5% at 15 kV supply to large consumers. The weighted average loss is 16.7% of sent out energy. Power losses are estimated to be nearly double the energy losses as a proportion of sent out power, viz. presently about 30%. Under the improvements to the transmission and distribution systems from the Power Rehabilitation Project, system energy losses are expected to be reduced steadily to 15% for low voltage supply by 1991, and 11.6% overall. It is assumed that losses will remain at these levels until 1994. Further reduction after 1991 would require a second major effort on the scale of the present project.

20. Summary of Demand Forecasts. The forecast growth rates in demand from 1987 to 1994 are shown below. Although substantial, even with the addition of the four outlying towns, the forecast rates are well below the historic rate of growth of supply for 1978 to 1986 which indicates a constrained growth in demand for that period.

	Growth Rate	
	Historic 1978-1986	Forecast 1987-1994
	(%/year)	
Mogadishu System		
System Energy Demand	15.4	8.0
System Maximum Power Demand	11.6	6.5
Mogadishu + Interconnected Systems		
System Energy Demand	-	10.5
System Maximum Power Demand	-	7.8

The underlying growth in power demand is expected to be significant in all sectors, averaging 9.0%/year in the domestic category, 5.6%/year in the commercial and Government categories, and 15.1% in the industrial category as industrial output picks up from the presently extremely depressed levels.

21. There is a significant difference for purposes of economic justification between the sectoral composition of the evening and midday peak demands. About 50% of the evening peak demand is in the domestic sector, of which probably at least half is from air-conditioners, whereas about 30% is in the commercial and industrial sectors. Conversely, about 60% of the midday peak demand is in the commercial and industrial sectors, whereas only about 10% is in the domestic sector. In both cases, the balance of the peak demand is in the Government sector (about 20% and 30% respectively). Since power losses are a higher proportion of demand for low voltage supply (domestic consumers) than for medium voltage supply (large industrial and commercial consumers), this difference is more pronounced in terms of peak demand at the generating stations than the comparison quoted above for coincident demands at the points of consumption.

SOMALIA - POWER REHABILITATION AND ENERGY PROJECT

COSTS OF ELECTRICITY FROM PRIVATELY-INSTALLED GENERATORS IN MOGADISHU

	Type and Typical User				
Technical Parameters	Large (industrial)	Medium (industrial large commercial)	Medium Small (commercial and municipal offices)	Small (restaurants & high income households)	Very Small (kiosks)
Generator Rated Capacity (kVA)	1,000	312	12.5	3.0	1.3
Engine Speed (rpm)	500	1,500	3,000	3,000	3,000
Typical Power Factor	0.8	0.8	0.8	0.8	0.8
Max. Power Output (kW)	800	250	10	2.4	1.0
Fuel Consumed	diesel	diesel	diesel	diesel	gasoline
Annual Usage (hours)	3,000	3,000	3,000	3,000	2,000
Average Capacity Factor	0.75	0.75	0.75	0.75	0.75
Annual Load Factor	25%	25%	25%	25%	17%
Average Energy Production (MWh)	1,752	548	22.0	5.0	1.5
Operating life (hours)	60,000	20,000	15,000	13,500	6,000
Working Life (years)	20	7	5	4.5	3
Specific Fuel Consumption (liters/kWh)	0.37	0.40	0.45	0.50	0.55
Economic Costs					
Capital Cost (SoSh thousand)	74,000	16,875	608	135	95
Capital Annuity Factor @ 8%	0.102	0.192	0.251	0.273	0.388
Annual Capital Cost (SoSh thousand)	7,548	3,240	152.6	36.9	36.9
Fixed O & M Cost (SoSh thousand)	740	169	6.1	1.3	1.0
Economic Cost of Fuel (SoSh/liter)	20.0	20.0	20.0	20.0	21.0
Variable O & M Cost (SoSh thousand)	1.35	1.35	1.35	1.35	1.35
Average Variable Cost (SoSh/kWh)	8.75	9.35	10.35	11.35	12.90
Annual Variable Cost (SoSh thousand)	15,330	5,124	227.7	56.8	19.4
Total Annual Cost (SoSh thousand)	23,618	8,533	386.4	95.0	57.3
Average Cost (SoSh/kWh)	13.5	15.6	17.6	19.0	38.2
(US¢/kWh equivalent)	10.0	11.5	13.0	14.1	28.3
Financial Costs					
Capital Cost (SoSh thousand)	122,000	27,850	1,640	370	230
Capital Annuity Factor @ 16%	0.169	0.248	0.305	0.328	0.445
Annual Capital Cost (SoSh thousand)	20,618	6,907	500.2	121.4	102.4
Fixed O & M Cost (SoSh thousand)	1,220	279	16.4	3.7	2.3
Fuel Price (SoSh/liter)	20.0	20.0	20.0	20.0	27.5
Variable O & M Cost (SoSh/kWh)	1.35	1.35	1.35	1.35	1.35
Average Variable Cost (SoSh/kWh)	8.75	9.35	10.35	11.35	16.48
Annual Variable Cost (SoSh thousand)	15,330	5,124	227.7	56.8	24.7
Total Annual Cost (SoSh thousand)	37,168	12,310	744.3	181.9	129.4
Average Cost (SoSh/kWh)	21.2	22.5	33.8	36.4	86.3
(US¢/kWh equivalent)	15.7	16.6	25.1	27.0	63.9

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SOMALIA-POWER REHABILITATION AND ENERGY PROJECT

MOGADISHU SYSTEM POWER DEMAND FORECAST 1987-1994

Mogadishu Forecast Connected Energy Demand by Consumer Category (MWh/y)

Consumer Category	CY	1986	1987	1988	1989	1990	1991	1992	1993	1994	Average Growth (%/y)
Domestic		41136	43050	50038	53437	59392	67133	72404	76714	81952	9.0%
Commerce		28531	30094	31755	33519	35381	37355	39448	41653	43999	5.6%
Government		35279	36062	36863	39855	42867	45906	48966	53739	54682	5.6%
Industry		23400	28808	36534	46404	58019	65950	67894	69839	71845	15.1%
Total Mogadishu Connected Demand		128347	138014	155190	173216	195660	216344	228713	241944	252478	8.8%
System Technical Losses		26151	27600	28697	28063	27816	28417	30189	31895	33645	
Total Requirement for Sent-out Energy		154498	165614	183887	201279	223476	244761	258902	273839	286124	8.0%
Annual Growth in Demand for Energy			7.2%	11.0%	9.5%	11.0%	9.5%	5.8%	5.8%	4.5%	
System Technical Losses:		16.9%	16.7%	15.6%	13.9%	12.4%	11.6%	11.7%	11.6%	11.8%	

Forecast Energy Demand from Isolated Load Centers on the Mogadishu System (MWh/y)

Consumer Category	CY	1986	1987	1988	1989	1990	1991	1992	1993	1994
Domestic		0	0	0	0	1314	2971	4538	5497	6609
Commerce		0	0	0	0	1049	1934	2645	2989	3375
Government		0	0	0	0	1708	2211	2596	2683	2775
Industry		0	0	0	0	14040	20130	34157	37450	39732
Total Demand of Connected Load Centers		0	0	0	0	18111	27246	43936	48619	52491
System Technical Losses		0	0	0	0	2707	3893	5062	5434	5654
Total Requirement for Sent-out Energy from the Mogadishu System		0	0	0	0	20818	31138	48998	54053	58145
System Technical Losses:		0.0%	0.0%	0.0%	0.0%	13.0%	12.5%	10.3%	10.1%	9.7%

Interconnection Dates: Afgoi- Jan-90 Balad- Jan-90 Jowhar- Jan-92 Merca & Shalamabad Jan-91

Forecast Connected Energy Demand for Mogadishu and Connected Load Centers (MWh/y)

Consumer Category	CY	1986	1987	1988	1989	1990	1991	1992	1993	1994	
Domestic		41136	43050	50038	53437	60706	70104	76942	82211	88561	10.1%
Commerce		28531	30094	31755	33519	36430	39289	42093	44642	47374	6.5%
Government		35279	36062	36863	39855	44575	48117	51562	56422	57457	6.3%
Industry		23400	28808	36534	46404	72059	86080	102051	107289	111577	21.6%
Total Combined Demand		128347	138014	155190	173216	213771	243590	272649	290564	304969	11.4%
System Technical Losses		26151	27600	28697	28063	30523	32309	35252	37329	39300	
Total Requirement for Sent-out Energy		154498	165614	183887	201279	244294	275899	307900	327893	344269	10.5%
Growth in Combined Demand on Mogadishu System			7.2%	11.0%	9.5%	21.4%	12.9%	11.6%	6.5%	5.0%	
System Technical Losses:		16.9%	16.7%	15.6%	13.9%	12.5%	11.7%	11.4%	11.4%	11.4%	

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MOGADISHU SYSTEM POWER DEMAND FORECAST 1987-1994

Mogadishu Forecast Connected Power Demand (MW)

Coincident Consumer Category Power Demand CY	1986	1987	1988	1989	1990	1991	1992	1993	1994	Average Growth (%/y)
Evening Peak Demand										
Domestic	13.1	13.4	16.1	17.2	19.4	22.4	24.3	25.7	27.4	
Commerce	4.2	4.4	4.7	4.9	5.2	5.5	5.8	6.1	6.5	
Government	6.1	6.2	6.3	6.9	7.4	7.9	8.5	9.3	9.5	
Industry	5.1	5.7	6.8	7.9	9.0	9.1	9.3	9.4	9.5	
Coincident Max.Demand of Consumers	28.5	29.8	34.0	36.9	41.1	45.0	47.8	50.5	52.9	
Power Losses at Peak System Demand	12.4	12.7	13.6	12.9	12.6	12.6	13.5	14.2	14.9	
Maximum Demand to be sent out	40.9	42.4	47.5	49.9	53.7	57.7	61.3	64.7	67.8	6.5%
Av.Rate System Power Losses(%MWs.o.)	30.3%	29.8%	28.6%	25.9%	23.5%	21.9%	22.0%	22.0%	22.0%	
System Load Factor	43.1%	44.5%	44.2%	46.1%	47.5%	48.5%	48.2%	48.3%	48.2%	
Midday Peak Demand										
Domestic	2.2	2.3	2.6	2.8	3.1	3.5	3.7	4.0	4.2	
Commerce	6.5	6.8	7.1	7.4	7.7	8.1	8.4	8.8	9.2	
Government	8.4	8.6	8.8	9.5	10.2	11.0	11.7	12.9	13.1	
Industry	9.1	9.8	11.1	12.5	13.9	14.2	14.6	14.9	15.4	
Coincident Max.Demand of Consumers	26.2	27.5	29.6	32.2	35.0	36.8	38.5	40.6	42.0	
Power Losses at Peak System Demand	10.6	11.0	10.6	10.2	9.5	8.9	9.2	9.7	10.0	
Maximum Demand to be sent out	36.8	38.5	40.2	42.4	44.5	45.6	47.7	50.4	51.9	
Av.Rate System Power Losses(%MWs.o.)	28.9%	28.5%	26.4%	24.0%	21.4%	19.5%	19.4%	19.3%	19.2%	

Forecast Non-coincident Power Peak Demand from Isolated Load Centers on the Mogadishu System (MW)

CY	1986	1987	1988	1989	1990	1991	1992	1993	1994
Afgoi	0.0	0.0	0.0	0.0	3.5	3.7	4.0	4.2	4.5
Balad	0.0	0.0	0.0	0.0	2.9	3.4	3.9	4.4	4.7
Jowhar	0.0	0.0	0.0	0.0	0.0	0.0	3.7	3.8	4.0
Merca & Shalaanabad	0.0	0.0	0.0	0.0	0.0	2.4	2.8	3.1	3.4
Combined Maximum Demand to be sent out	0.0	0.0	0.0	0.0	6.4	9.5	14.3	15.5	16.6

Interconnection Dates: Afgoi- Jan-90 Balad- Jan-90 Jowhar- Jan-92 Merca & Shalaanabad Jan-91

Forecast Maximum Power Demand to be sent out for Mogadishu and Connected Load Centers(MW)

Isolated Load Centers Coincidence Factor *	CY	1986	1987	1988	1989	1990	1991	1992	1993	1994	
Evening Peak Demand	40%	40.9	42.4	47.5	49.9	56.3	61.5	67.0	70.9	74.5	7.8%
Midday Peak Demand	87%	36.8	38.5	40.2	42.4	50.1	54.0	60.2	63.9	66.5	7.7%
System Load Factor		43.1%	44.5%	44.2%	46.1%	49.6%	51.2%	52.4%	52.8%	52.8%	

* Weighted average by 1992 category demands and the Mogadishu category coincidence and load factors

Total Connections on the Mogadishu System								
-in Mogadishu	42750	45373	51640	58541	65955	73060	79750	84972	90442
-in connected load centers	0	0	0	0	2200	4808	7089	8218	9453
-total connections	42750	45373	51640	58541	68155	77868	86839	93191	99895

SOMALIA

POWER REHABILITATION AND ENERGY PROJECT

Mogadishu System Generation Development Program 1987-1994

Framework for System Development

1. Planning the development of the Mogadishu power system over the relatively short period of eight years to 1994 has to be carried out in the context of a long-term least-cost development program. The key issue for power development in southern Somalia for the long-term is when power from the Baardheere multipurpose hydroproject will be available to the Mogadishu system. The earliest feasible date for commissioning the Baardheere power facilities is during 1994.

2. Kennedy and Donkin (UK) in their report "Somalia- Power Planning Study" of February 1987, investigated the economic costs of meeting the forecast demand for power in the Mogadishu area up to the year 2005 under three different programs for developing generation capacity:

- Commission Baardhere in 1994 with complementary new thermal capacity installed before and after Baardheere;
- Commission Baardhere in 1999 with complementary new thermal capacity installed before and after Baardheere; and
- an all thermal capacity program.

From their economic evaluation, Kennedy and Donkin (K&D) concluded that the least-cost program would be to commission Baardheere in 1994 with the following new complementary thermal generating capacity: a second 15 MW oil-fired steam unit commissioned in 1988; a 15 MW diesel-burning gas turbine in 1989; a second 15 MW gas turbine in 1990; a third 15 MW gas turbine in 1993. K&D also recommended that new diesel capacity be installed in 1991 on the assumption that all the existing diesel units at the Centrale Station would be retired by 1992.

3. The generation development program for Mogadishu up to 1994 agreed between ENEE and the mission is based on the above program and the rehabilitation program for the existing diesel generators in Mogadishu under the project. The program allows for some adjustment to allow for slippage in the earliest likely feasible commissioning dates. It will not be possible to avoid shortfalls in installed capacity relative to energy demand up to 1989 and peak power demand up to 1991. The dates for commissioning the second steam unit is slipped to early 1990. The programmed commissioning dates for a new diesel generator is mid-1989, and for the gas turbines early 1991 and late 1992. Under the operating conditions in Mogadishu, gas turbines will have substantial derating, and it is assumed that machines with a 15 MW name-plate rating will achieve a maximum output of about 12 MW. These gas turbines would be the main spinning reserve capacity in the Mogadishu system in the decade following commissioning of Baardheere in 1994.

4. If the Baardhere project were to be delayed substantially, K&D determined that the least-cost strategy for development of generation capacity would be based on 20 MW coal-fired steam units for base load operation, and 15 MW and 30 MW diesel-burning gas turbines for peak load operation and system reserve capacity. With a 5-year delay to 1999 for Baardheere commissioning, the least-cost development program up to 1998 according to K&D would comprise the second 15 MW oil-fired steam unit in 1988, 15 MW gas turbines in 1990, 1991 and 1995, 20 MW coal-fired steam units in 1993 and 1997, and a 30 MW gas turbine in 1998. In the all-thermal development program, the investments up to 1998 are the same as in the case of Baardheere commissioning in 1999.

5. Commissioning of the second 15 MW oil-fired steam unit is included in all the development programs because of the reduction in capital costs through investment already undertaken in common facilities for the existing first unit at Gezira. The role of gas turbines is also common to the development programs. The critical difference for thermal capacity is the date of commencing a program of coal-fired steam units (1991 if Baardhere is delayed, 2004 if Baardhere is commissioned in 1994). With the respective lead times, a decision on the first coal-fired unit can be delayed until 1988 by when the prospects for commissioning Baardheere in 1994 are expected to be reasonably clear.

Power Demand/Supply Balance to 1994

6. The mission's projections for the balance between demand and supply for power in the Mogadishu area to 1994 are shown on the accompanying tables to this Annex. The main assumptions for these projections are as follows:

- unconstrained connected demand on the Mogadishu system will increase according to the mission's forecast given in Annex 2.3; and

- the commissioning program for new generating capacity is as outlined in paragraph 3 above.

As a result of the rehabilitation and replacement program for the generation, transmission and distribution systems under the Power Rehabilitation Project, it is assumed that:

- the availability of the existing generating units, for which the timing of rehabilitation and subsequent planned maintenance is important, will improve according to the rates given in the mission's projections;

- there is an improvement in the derating factor at the generator output terminals due to an increase in the system power factor from the present level of 0.7 to 0.9 by the start of 1990; and

- energy technical losses in the tranmission and distribution systems will decline from the estimated present level of 16.7% of energy sent out to the system from the generation stations to 11.7% by the start of 1991.

7. Under the above assumptions, the mission's projections show that the amount of energy that the actual system generating capacity can send out will be about 34% short of the requirement for generated energy in 1987, 22% short in 1988, and 12% in the first quarter of 1989. Thereafter, system energy generation capacity exceeds the energy requirement. However, there will be small amounts of unserved energy demand associated with the shortfalls in system power capacity to meet peak demands. By comparison, the energy deficit in 1986 was about 15% of the requirement, and the deterioration in 1987 reflects the prolonged outage of generating units for major maintenance and rehabilitation. In 1994 the gas turbines are being required to generate at 18% average annual load factor, which is a high level for this relatively expensive source of energy. With the assumption that in 1995 the Mogadishu system will be supplied from Baardhere hydropower, this level of usage of gas turbines is only temporary.

Energy Demand and Supply to the Mogadishu System 1986 - 1994
(GWh)

	1986	1987	1988	1989	1990	1991	1992	1993	1994
Demand for Generated Energy	154.5	165.6	183.9	201.3	244.3	275.9	307.9	327.9	344.3
Energy Sent Out	131.1	109.2	142.3	189.8	241.5	273.9	305.4	327.6	342.7
Served Energy Demand	109.2	90.9	120.1	163.2	211.3	242.1	270.0	289.3	302.5
Ratio of Demand to Sent Out Energy	0.85	0.66	0.77	0.94	0.99	0.99	0.99	1.00	1.00

In 1986, the demand for generated energy refers to the mission's estimate of unconstrained demand (Annex 2.3), the energy sent out is ENEE's recorded data (Annex 2.2), and the served energy demand assumes that the rate of system technical losses was the same as estimated for 1987, ie 16.7% of sent-out energy. Since ENEE's billings in 1986 amounted to 94.9 GWh (Annex 2.2), this assumption implies unbilled consumption, which is included in served demand, of about 14.3 GWh in 1986, equal to about 11% of energy sent-out to the system.

8. With the program for rehabilitating existing generation capacity and adding new capacity, ENEE will be able to avoid regular severe power cuts at periods of evening peak demand from late 1992 onwards. This situation follows completion of rehabilitating existing units and installing the second oil-fired steam unit and a new diesel generator and two gas turbines, and allows for a planned maintenance program for the generating units. There is no reserve capacity available to cover substantial unplanned outage of generating capacity up to 1994. From 1987 to early 1991, substantial regular power cuts at the secondary midday peak demands will be unavoidable due to lack of available generating capacity, as shown below and in the tables in this Annex.

Power Demand and Supply to the Mogadishu System 1986 - 1994
(MW)

	1986	1987	1988	1989	1990	1991	1992	1993	1994
Evening System Peak Demand	40.9	42.4	47.5	49.9	56.3	61.5	67.0	70.9	74.5
Midday System Peak Demand	36.8	38.5	40.2	42.4	50.1	54.0	60.2	63.9	66.5
Minimum Sent Out Power Capability	27.6	10.5	19.6	26.6	43.2	45.9	56.7	69.3	69.3
Minimum Ratio of Capability to Peak Demand:									
- Evening	0.67	0.25	0.41	0.53	0.77	0.75	0.85	0.98	0.93
- Midday	0.75	0.27	0.49	0.63	0.86	0.85	0.94	1.08	1.04

The estimates of unconstrained peak demands were taken from the mission's demand forecast (Annex 2.3).

SOMALIA-POWER REHABILITATION AND ENERGY PROJECT

MOGADISHU SYSTEM POWER AND ENERGY BALANCES WITH DEVELOPMENT PROGRAM 1987-1990

Quarterly Demand as % Annual Demand					Jan-Mar 23.5%	Apr-Jun 25.3%	Jul-Sep 25.2%	Oct-Dec 26.0%								
CY		1987				1988				1989				1990		
Requirement for Generated Energy(MWh)		165614				183887				201279				244294		
Maximum Demand to be met in evening(MW)		42.4				47.5				49.9				56.3		
Maximum Demand to be met at midday(MW)		38.5				40.2				42.4				50.1		
Quarterly Load Duration Curve		Jan-Mar	Apr.-Jun	Jul.-Sep	Oct.-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
Requirement for Generated Energy(MWh)		36234	41900	41734	45057	43214	46523	46339	47808	47302	50923	50721	52330	57410	61806	61561	63513
Quarterly Max.Demand (MW)		42.4	42.4	42.4	42.4	47.5	47.5	47.5	47.5	49.9	49.9	49.9	49.9	56.3	56.3	56.3	56.3
Quarterly Load Factor		39%	45%	45%	46%	42%	45%	45%	46%	43%	47%	46%	48%	47%	50%	50%	52%
Peak Load MW @ XMax.Dem	70%	29.7	29.7	29.7	29.7	33.3	33.3	33.3	33.3	34.9	34.9	34.9	34.9	39.4	39.4	39.4	39.4
Peak MWh @ Max.% Duration	10%	1393	1393	1393	1393	1560	1560	1560	1560	1639	1639	1639	1639	1849	1849	1849	1849
Base Load Max.Demand(MW)		0	4	4	5	1	4	4	5	3	6	6	7	7	11	11	13
Base Load Energy Demand(MWh)		0	8793	8461	11108	2400	9017	8649	11587	6328	13572	13168	16385	15224	24015	23525	27429
Intermediate Load Energy Demand(MWh)		34841	31714	31660	30557	39254	35946	36130	34661	39334	35712	35914	34306	40337	35941	36186	34234
System Generating Capacity	Rating																
Availability of Units (%):	(MWso)																
Steam Units(Gesira Station)																	
Unit 01	15.0	0%	60%	80%	80%	80%	25%	80%	80%	80%	25%	80%	80%	80%	25%	80%	80%
Unit 02	15.0	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	40%	80%	80%	80%
Diesel Units																	
Gesira Unit 01	5.0	60%	60%	60%	60%	0%	60%	60%	60%	0%	60%	60%	60%	50%	70%	70%	70%
Gesira Unit 02	5.0	0%	0%	0%	0%	0%	0%	0%	0%	40%	60%	60%	40%	70%	70%	70%	20%
Gesira Unit 03	5.0	0%	0%	0%	0%	40%	60%	40%	60%	60%	60%	60%	0%	70%	50%	70%	70%
Gesira Unit 04	5.0	60%	60%	60%	0%	60%	60%	60%	40%	60%	60%	60%	60%	20%	70%	70%	70%
Gesira Unit 05	5.0	60%	60%	40%	60%	60%	60%	0%	60%	60%	60%	40%	60%	70%	70%	20%	70%
Centrale Unit 05	2.0	30%	30%	0%	50%	50%	50%	30%	50%	50%	50%	50%	0%	50%	50%	50%	50%
Centrale Unit 06	2.0	0%	0%	0%	0%	50%	50%	50%	30%	50%	50%	50%	50%	0%	50%	50%	50%
Centrale Unit 07	2.0	0%	0%	0%	0%	50%	50%	50%	30%	50%	30%	50%	0%	50%	50%	50%	50%
Centrale Unit 08	2.0	0%	0%	0%	50%	50%	50%	30%	50%	50%	0%	50%	50%	50%	50%	30%	50%
New Diesel Unit & Gas Turbines																	
Unit 01	10.0	0%	0%	0%	0%	0%	0%	0%	0%	0%	90%	90%	90%	90%	90%	45%	90%
Unit 02	12.0	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Unit 03	12.0	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Power Supply/Demand																	
Probable Minimum Available Capacity at Peak (MW)																	
Steam Units		0	15	15	15	15	0	15	15	15	0	15	15	15	15	30	30
Diesel Units		15	15	10	14	18	28	14	19	23	43	40	31	33	40	26	40
Gas Turbines		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		15	30	25	29	33	28	29	34	38	43	55	46	48	55	56	70
Derating Factor for Generators due to system power factor		0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.9	0.9	0.9	0.9
Sent Out Capability at Peak(MWso)		10.5	21.0	17.5	20.3	23.1	19.6	20.3	23.8	26.6	30.1	44.0	36.8	43.2	49.5	50.4	63.0
Quarterly Max.Evening Demand (MW)		42.4	42.4	42.4	42.4	47.5	47.5	47.5	47.5	49.9	49.9	49.9	49.9	56.3	56.3	56.3	56.3
Surplus/Deficit Power (MW)		-31.9	-21.4	-24.9	-22.1	-24.4	-27.9	-27.2	-23.7	-23.3	-19.8	-5.9	-13.1	-13.1	-6.8	-5.9	6.7
Deficit as % of Max.Demand		75%	50%	59%	52%	51%	59%	57%	50%	47%	40%	12%	26%	23%	12%	10%	0%
Deficit on Installed Capacity (MW)		46	31	36	32	35	40	39	34	33	28	7	16	15	8	7	0

MOGADISHU SYSTEM POWER AND ENERGY BALANCES WITH DEVELOPMENT PROGRAM 1987-1990 (continued)

Power Supply/Demand (cont.) CY	1987				1988				1989				1990			
Quarterly Max.Midday Demand (MW)	38.5	38.5	38.5	38.5	40.2	40.2	40.2	40.2	42.4	42.4	42.4	42.4	50.1	50.1	50.1	50.1
Surplus/Deficit Power (MW)	-28.0	-17.5	-21.0	-18.2	-17.1	-20.6	-19.9	-16.4	-15.8	-12.3	1.6	-5.6	-6.9	-0.6	0.3	12.9
Deficit as % of Max.Demand	73%	45%	55%	47%	43%	51%	50%	41%	37%	29%	0%	13%	14%	1%	0%	0%
Deficit on Installed Capacity (MW)	40	25	30	26	24	29	28	23	23	18	0	7	8	1	0	0
Energy Supply/Demand																
Derating Factor for Generators due to system power factor	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.9	0.9	0.9	0.9
System Energy Capability (MWh)																
Steam Units	0	18396	18396	18396	18396	5749	18396	18396	18396	5749	21024	21024	35478	31043	47304	47304
Diesel Units	14717	14717	12264	12264	18396	24528	17170	21769	22995	27594	31536	22776	33507	40406	36661	37449
New Diesel Unit	0	0	0	0	0	0	0	0	0	16556	18922	18922	21287	21287	10643	21287
Total Energy Generation Capability	14717	33113	30660	30660	36792	30277	35566	40165	41391	49899	71482	62722	90272	92736	94608	106040
Unserved Energy Demand due to																
Power Deficit(MWh)	17808	6187	9723	6971	6941	10853	10037	6778	5598	3497	646	1434	1434	745	646	0
Power Limit to Served Energy(MWh)	18426	35713	32011	36087	36274	35670	36302	41030	41704	47426	50075	50895	55976	61061	60915	63513
Surplus/Deficit Energy (MWh)	-21517	-8787	-11074	-12397	-6941	-16246	-10773	-7644	-5911	-3497	-646	-1434	-1434	-745	-646	0
Deficit as % of Requirement	59%	21%	27%	29%	16%	35%	23%	16%	12%	7%	1%	3%	2%	1%	1%	0%
Estimated Energy Sent Out (MWh)	14717	33113	30660	30660	36274	30277	35566	40165	41391	47426	50075	50895	55976	61061	60915	63513
System Energy Losses	16.7%	16.7%	16.7%	16.7%	15.6%	15.6%	15.6%	15.6%	14.0%	14.0%	14.0%	14.0%	12.5%	12.5%	12.5%	12.5%
Served Energy Demand(MWh) -quarterly	12259	27583	25540	25540	30615	25554	30017	33899	35596	40786	43065	43770	48979	53428	53300	55574
-annually	90922				120085				163217				211281			
Actual Energy Generated (MWh)																
Steam Units	0	18396	18396	18396	18396	5749	18396	18396	18396	5749	21024	21024	33113	26313	42574	42574
Diesel Units	14717	14717	12264	12264	17878	24528	17170	21769	22995	41677	29051	29871	22863	34748	18341	20939
Gas Turbines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Generated quarterly	14717	33113	30660	30660	36274	30277	35566	40165	41391	47426	50075	50895	55976	61061	60915	63513
annually	109150				142281				189788				241464			
Estimated Fuel Consumption																
Specific Consumption of Fuel(liters/kWh)		Steam Units		0.335	Gas Turbines		0.350									
-Diesel Units	0.393	0.393	0.393	0.393	0.352	0.352	0.352	0.352	0.311	0.311	0.311	0.311	0.270	0.270	0.270	0.270
Quarterly Fuel Consumption(thou.liters	5784	11946	10982	10982	12456	10560	12206	13825	13314	15437	16078	16610	17266	18197	19214	19916
Incremental Economic Cost of Development Program(1987 prices)																
With Development Program (US$thousand):																
Capital Costs-Generation	-	-	920	631	0	2123	2123	1062	8752	4376	2188	6564	1097	3292	3292	3292
-Transmission & Distrib.	-	-	550	561	0	1622	4867	1622	2567	1712	3423	856	2053	2053	1369	1369
O&M Costs inc.Spares & Consumables																
-Generation	114	100	100	100	400	500	200	175	700	500	500	447	400	500	400	350
-Transmission & Distribution	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Fuel Oil Costs @USc/liter & 9.4	544	1123	1032	1032	1171	993	1147	1300	1252	1712	1511	1693	1623	1711	1806	1872
Diesel Oil Costs @USc/liter 14.7																
Total Economic Costs(US$thousand)	662	1227	2606	2328	1575	5242	8341	4162	13275	8304	7627	9564	5178	7560	6871	6887
Without Development Program:																
Total Economic Costs(US$thousand)	662	1227	1136	1080	1253	1021	1420	1420	1412	829	1102	978	853	342	683	683
Incremental Economic Cost(US$thousand)	0	0	1470	1249	322	4221	6922	2743	11864	7475	6524	8586	4324	7218	6188	6204
Incremental Served Demand with Development Program (MWh)																
With Development Program	12259	27583	25540	25540	30615	25554	30017	33899	35596	40786	43065	43770	48979	53428	53300	55574
Without Development Program	12259	27583	25540	24263	26174	21390	28777	30001	27811	17048	24774	21964	19155	6066	15324	15324
Incremental Served Demand	0	0	0	1277	4441	4164	1240	3898	7786	23739	18291	21806	29824	47363	37977	40250

SOMALIA-POWER REHABILITATION AND ENERGY PROJECT

MOGADISHU SYSTEM POWER AND ENERGY BALANCES WITH DEVELOPMENT PROGRAM 1991-1994

CY		1991				1992				1993				1994			
Requirement for Generated Energy(MWh)		275899				307900				327893				344269			
Maximum Demand to be met in evening(MW)		61.5				67.0				70.9				74.5			
Maximum Demand to be met at midday(MW)		54.0				60.2				63.9				66.5			
Quarterly Load Duration Curve		Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
Requirement for Generated Energy(MWh)		64837	69802	69525	71730	72358	77898	77589	80049	77056	82956	82627	85247	80904	87099	86754	89504
Quarterly Max.Demand (MW)		61.5	61.5	61.5	61.5	67	67	67	67	70.9	70.9	70.9	70.9	74.5	74.5	74.5	74.5
Quarterly Load Factor		48%	52%	52%	53%	49%	53%	53%	55%	50%	53%	53%	55%	50%	53%	53%	55%
Peak Load MW @ %Max.Dem	70%	43.1	43.1	43.1	43.1	46.9	46.9	46.9	46.9	49.6	49.6	49.6	49.6	52.2	52.2	52.2	52.2
Peak MWh @ Max.% Duration	10%	2020	2020	2020	2020	2201	2201	2201	2201	2329	2329	2329	2329	2447	2447	2447	2447
Base Load Max.Demand(MW)		10	14	14	16	12	17	17	19	13	18	18	21	14	19	19	22
Base Load Energy Demand(MWh)		20879	30807	30255	34663	26190	37270	36653	41573	28687	40487	39830	45069	30015	42404	41714	47216
Intermediate Load Energy Demand(MWh)		41938	36974	37250	35046	43967	38427	38735	36275	46040	40140	40468	37848	48441	42247	42592	39841
System Generating Capacity	Rating																
Availability of Units (%):	(MWso)																
Steam Units(Gesira Station)																	
Unit 01	15.0	80%	25%	80%	80%	80%	25%	80%	80%	80%	25%	80%	80%	80%	25%	80%	80%
Unit 02	15.0	25%	80%	80%	80%	25%	80%	80%	80%	25%	80%	80%	80%	25%	80%	80%	80%
Diesel Units																	
Gesira Unit 01	5.0	70%	20%	70%	70%	70%	70%	50%	70%	70%	70%	70%	20%	70%	70%	70%	70%
Gesira Unit 02	5.0	70%	70%	70%	70%	50%	70%	70%	70%	70%	20%	70%	70%	70%	20%	70%	70%
Gesira Unit 03	5.0	70%	70%	20%	70%	70%	70%	70%	50%	70%	70%	70%	70%	20%	70%	70%	70%
Gesira Unit 04	5.0	50%	70%	70%	70%	70%	20%	70%	70%	70%	70%	50%	70%	70%	70%	20%	70%
Gesira Unit 05	5.0	70%	70%	70%	50%	70%	70%	70%	70%	20%	70%	70%	70%	70%	70%	70%	20%
Centrale Unit 05	2.0	30%	50%	50%	50%	50%	0%	50%	50%	50%	50%	30%	50%	50%	50%	50%	0%
Centrale Unit 06	2.0	50%	30%	50%	50%	50%	50%	0%	50%	50%	50%	50%	30%	50%	50%	50%	50%
Centrale Unit 07	2.0	30%	50%	50%	50%	50%	0%	50%	50%	50%	50%	30%	50%	50%	50%	50%	0%
Centrale Unit 08	2.0	50%	50%	50%	0%	50%	50%	50%	50%	30%	50%	50%	50%	50%	0%	50%	50%
New Gas Turbine(peak & reserve duty)																	
Unit 01	12.0	90%	90%	45%	90%	90%	90%	45%	90%	90%	90%	45%	90%	90%	90%	45%	90%
Unit 02	12.0	50%	90%	90%	90%	90%	90%	90%	45%	90%	90%	90%	45%	90%	90%	90%	45%
Unit 03	12.0	0%	0%	0%	0%	0%	0%	0%	45%	90%	90%	90%	45%	90%	90%	90%	45%
Power Supply/Demand																	
Probable Minimum Available Capacity at Peak (MW)																	
Steam Units		15	15	30	30	15	15	30	30	15	15	30	30	15	15	30	30
Diesel Units		24	26	28	26	28	24	26	28	26	28	24	26	28	26	28	24
Gas Turbines		12	24	12	24	24	24	12	24	36	36	24	24	36	36	24	24
		51	65	70	80	67	63	68	82	77	79	78	80	79	77	82	78
Derating Factor for Generators due to system power factor		0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Sent Out Capability at Peak(MWso)		45.9	58.5	63.0	72.0	60.3	56.7	61.2	73.8	69.3	71.1	70.2	72.0	71.1	69.3	73.8	70.2
Quarterly Max.Evening Demand (MW)		61.5	61.5	61.5	61.5	67.0	67.0	67.0	67.0	70.9	70.9	70.9	70.9	74.5	74.5	74.5	74.5
Surplus/Deficit Power (MW)		-15.6	-3.0	1.5	10.5	-6.7	-10.3	-5.8	6.8	-1.6	0.2	-0.7	1.1	-3.4	-5.2	-0.7	-4.3
Deficit as % of Max.Demand		25%	5%	0%	0%	10%	15%	9%	0%	2%	0%	1%	0%	5%	7%	1%	6%
Deficit on Installed Capacity (MW)		17	3	0	0	7	11	6	0	2	0	1	0	4	6	1	5

MOGADISHU SYSTEM POWER AND ENERGY BALANCES WITH DEVELOPMENT PROGRAM 1991-1994 (continued)

Power Supply/Demand (cont.) CY	1991				1992				1993				1994				
Quarterly Max.Midday Demand (MW)	54.0	54.0	54.0	54.0	60.2	60.2	60.2	60.2	63.9	63.9	63.9	63.9	66.5	66.5	66.5	66.5	
Surplus/Deficit Power (MW)	-8.1	4.5	9.0	18.0	0.1	-3.5	1.0	13.6	5.4	7.2	6.3	8.1	4.6	2.8	7.3	3.7	
Deficit as % of Max.Demand	15%	0%	0%	0%	0%	6%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Deficit on Installed Capacity (MW)	9	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	
Energy Supply/Demand																	
Derating Factor for Generators due to:																	
system power factor	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	
System Energy Capability (MWh)																	
Steam Units	31043	31043	47304	47304	31043	31043	47304	47304	31043	31043	47304	47304	31043	31043	47304	47304	
Diesel Units	38829	36661	37449	38435	40406	33507	38435	40406	36661	37449	38929	36661	37449	35478	37449	33507	
Gas Turbines	33113	42574	31930	42574	42574	42574	31930	42574	63860	63860	53217	42574	63860	63860	53217	42574	
Total Energy Generation Capability	102985	110277	116683	128312	114022	107124	117669	130283	131564	132353	139350	126538	132353	130382	137970	123385	
Unserved Energy Demand due to																	
Power Deficit(MWh)	1708	329	0	0	734	1128	635	0	175	0	77	0	372	569	77	471	
Power Limit to Served Energy(MWh)	63129	69473	69525	71730	71624	76770	76954	80049	76881	82956	82550	85247	80532	86529	86677	89034	
Surplus/Deficit Energy (MWh)	-1708	-329	0	0	-734	-1128	-635	0	-175	0	-77	0	-372	-569	-77	-471	
Deficit as % of Requirement	3%	0%	0%	0%	1%	1%	1%	0%	0%	0%	0%	0%	0%	1%	0%	1%	
Estimated Energy Sent Out (MWh)	63129	69473	69525	71730	71624	76770	76954	80049	76881	82956	82550	85247	80532	86529	86677	89034	
System Energy Losses	11.6%	11.6%	11.6%	11.6%	11.7%	11.7%	11.7%	11.7%	11.7%	11.7%	11.7%	11.7%	11.8%	11.8%	11.8%	11.8%	
Served Energy Demand(MWh) -quarterly	55806	61414	61460	63409	63244	67788	67950	70683	67886	73250	72892	75273	71029	76319	76449	78528	
-annually	242089				269665				289301				302325				
Actual Energy Generated (MWh)																	
Steam Units	29565	26313	42574	42574	29565	26313	42574	42574	29565	26313	42574	42574	29565	26313	42574	42574	
Diesel Units	33564	36661	26951	29156	40406	33507	34380	37476	36661	37449	38829	36661	37449	35478	37449	33507	
Gas Turbines	0	6500	0	0	1653	16950	0	0	10655	19194	1148	6013	13518	24738	6654	12953	
Total Energy Generated quarterly	63129	69473	69525	71730	71624	76770	76954	80049	76881	82956	82550	85247	80532	86529	86677	89034	
annually	273857				305397				327634				342772				
Estimated Fuel Consumption																	
Specific Consumption of Fuel(liters/kW Gas Turbines		0.350			Steam Units		0.335										
-Diesel Units	0.270	0.270	0.270	0.270	0.280	0.280	0.280	0.280	0.290	0.290	0.290	0.290	0.300	0.300	0.300	0.300	
Quarterly Fuel Consumption(thou.liters	18967	20988	21539	22134	21796	24129	23889	24755	24265	26393	25924	26998	25870	28117	27826	28848	Total Costs
Incremental Economic Cost of Development Program(1987 prices)																	(US$thou.in 1987 prices)
With Development Program (US$thousand):																	
Capital Costs-Generation	5339	1780	890	890	365	365	243	243	382	55	55	55	0	0	0	0	50374
-Transmission & Distrib.	1381	1381	1381	1381	1237	1237	1237	1237	1131	1131	1131	1131	1049	1049	1049	1049	43814
O&M Costs inc.Spares & Consumables																	
-Generation	600	400	570	600	600	800	900	700	700	900	900	750	800	900	900	900	17406
-Transmission & Distribution	30	30	40	40	40	40	40	40	45	45	45	45	45	45	45	45	724
Fuel Oil Costs @US¢/liter 9.4	1783	2093	2025	2081	2080	2583	2246	2327	2479	2837	2458	2649	2683	3102	2739	2952	60636
Diesel Oil Costs @US¢/liter 14.7	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	------
Total Economic Costs(US$thousand)	9132	5684	4905	4991	4321	5024	4665	4547	4737	4968	4589	4630	4577	5096	4733	4946	172954
Without Development Program:																	------
Total Economic Costs(US$thousand)	683	285	683	683	683	285	683	683	683	285	683	683	683	285	683	683	
Incremental Economic Cost(US$thousand	8449	5399	4222	4308	3638	4739	3982	3864	4053	4683	3905	3947	3894	4811	4050	4263	
Incremental Served Demand with Development Program (MWh)																	
With Development Program	55806	61414	61460	63409	63244	67788	67950	70683	67886	73250	72892	75273	71029	76319	76449	78528	
Without Development Program	15324	4789	15324	15324	15324	4789	15324	15324	15324	4789	15324	15324	15324	4789	15324	15324	
Incremental Served Demand	40482	56625	46136	48085	47920	62999	52626	55360	52562	68461	57568	59949	55705	71530	61125	63204	

ANNEX 3.1

SOMALIA
POWER REHABILITATION AND ENERGY PROJECT
ENEE - CORPORATE PERFORMANCE INDICATORS

Description	Actual 1985	Actual 1986	Proposed Targets 1988	1989	1990	1991	1992
Technical							
Installed Capacity (MW)	39.2	55.7	55.7	63.8 a/	80.3 b/	92.3 c/	92.3
Installed Dependable Capacity (MW) d/	33.5 e/	20.0 f/	28	36	46	49	61
Peak Demand (MW)	26	28	33	35	39	43	47
Capacity Surplus (MW)	7.5	Neg	Neg	1	7	6	14
Available Generation (MWhSO)	23	131	142	225	383	456	468
Total Requirement for sent-out energy (MWhSO)	40	154	184	201	244	276	308
Deficit/Surplus in energy sent out	D	D	D	S	S	S	S
Energy Generated (MWh)	123	131	142	190	241	273	305
Non-technical Losses (MWh)	18	16	14	18	10	8	6
Technical Losses (MWh)	22	20	22	27	30	31	34
Total Losses (% of generation)	33	28	25	24	17	14	13
Sales (MWh)	83	95	110	145	201	234	265
Diesels (Gezira) (kWh/liter)	3.6	3.6	3.2	3.6	3.7	3.7	3.7
Steam (Gezira) (kWh/liter)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Institutional							
New Salary Structure			X				
Organizational Review/Adjustment			X	X			
New Board in place					X		
No. of Consumers	39,873	44,000	51,000	57,000	63,000	69,000	75,000
Sales/Consumer per year (kWh)	2,081	2,159	2,157	2,544	3,190	3,3900	3,530
No. of Employees	1,010	880	995	1,036	1,086	1,113	1,154
No. of Consumers per Employee	39	50	51	55	58	62	65
Financial							
Independent Audit in place			X				
Adequate Insurance Coverage			X				
Consolidated Financial Statements			X				
New Billing and Collection System				X			
New Accounting System				X			
Inventory Control System				X			
Asset Registry and Revaluation				X			
Financial MIS				X			
Rate of Return	(7)	2	NA	NA	8	8	8
Internal Contribution to Investment (%)	0	(56)	0	10	20	30	30
Debt Service Coverage	0.6	2.2	1.5	1.5	1.5	1.5	1.5
Accounts Receivable	324	324	120	90	90	90	90
Accounts Payable	295	231	120	90	90	90	90

a/ Diesel unit commissioned, Centrale Deutz/Pelizzari diesels retired.
b/ Steam unit commissioned
c/ Gas turbine commissioned
d/ Proposed targets after 1989 assume that manufacturer's overhaul schedule recommendations are being complied with.
e/ November 1985 - Power Planning Study.

SOMALIA

POWER REHABILITATION AND ENERGY PROJECT

ENEE Reference Investment Program (RIP) for Mogadishu System a/
(US$ 000)

	1987			1988			1989			1990			1991			1992			1993			1994		
	Local	Forex	Total	Local	Forex	Total	Local	Forex	Total	Local	Forex	Total	Local	Forex	Total	Local	Forex	Total	Local	Forex	Total	Local	Forex	Total
1. Generation																								
Gezira Rehab	110	0	110	77	1,770	1,847	81	1,018	1,099	76	689	765	27	166	193	0	0	0	0	0	0	0	0	0
Gezira Spares	0	0	0	0	1,033	1,033	0	1,033	1,033	0	1,033	1,033	0	455	455	0	440	440	0	0	0			0
Gezira fire protection and lighting schemes	0	0	0	80	900	980	40	320	360	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Centrale Rehab	100	1,200	1,300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Centrale Spares	0	0	0	0	1,500	1,500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15 MW Steam Unit	0	0	0	0	0	0	340	8,354	8,694	1,020	8,270	9,290	340	1,750	2,090	0	0	0	0	0	0	0	0	0
10 MW Diesel Generato	0	0	0	0	0	0	302	6,659	6,961	1,354	254	1,608	0	737	737	0	0	0	0	0	0	0	0	0
12 MW Gas Turbine	0	0	0	0	0	0	0	0	0	49	4,483	4,532	218	171	389	0	496	496	0	0	0	0	0	0
12 MW Gas Turbine	0	0	0	0	0	0	0	0	0	0	0	0	49	4,483	4,532	218	171	389	0	496	496	0	0	0
Sub-Total	210	1,200	1,410	157	5,203	5,360	763	17,384	18,147	2,499	14,729	17,228	634	7,762	8,396	218	1,107	1,325	0	496	496	0	0	0
2. 33kV Substations	0	0	0	25	1,390	1,415	150	1,900	2,050	120	890	1,010	55	450	505	55	800	855	55	800	855	55	800	855
33kV Transmission	0	0	0	10	400	410	40	300	340	40	150	190	40	490	530	40	350	390	40	350	390	40	350	390
Sub-Total	0	0	0	35	1,790	1,825	190	2,200	2,390	160	1,040	1,200	95	940	1,035	95	1,150	1,245	95	1,150	1,245	95	1,150	1,245
3. Distribution(15kV+10)																								
Reinstatement	14	1,450	1,464	70	2,087	2,157	280	2,087	2,367	280	2,087	2,367	397	1,948	2,345	70	1,400	1,470	70	1,400	1,470	50	1,000	1,050
Expansion	0	0	0	140	2,087	2,227	560	2,087	2,647	560	2,087	2,647	793	2,087	2,880	560	2,365	2,925	200	2,000	2,200	200	2,200	2,400
Sub-Total	14	1,450	1,464	210	4,174	4,384	840	4,174	5,014	840	4,174	5,014	1,190	4,035	5,225	630	3,765	4,395	270	3,400	3,670	250	3,200	3,450
4. General Plant																								
Vehicles	0	0	0	0	858	858	0	200	200	0	72	72	0	50	50	30	100	130	20	40	60	20	70	90
Workshop/Main Facilit	0	0	0	0	0	0	70	200	270	40	110	150	10	30	40	10	30	40	40	250	290	30	100	130
Distr.Dept/Veh/Polefa	0	0	0	40	945	985	10	118	128	0	0	0	10	20	30	10	0	10	10	0	10	20	30	50
Commnic/Computers	0	0	0	20	200	220	30	70	100	0	0	0	0	0	0	40	100	140	10	20	30	20	30	50
Sub-Total	0	0	0	60	2,003	2,063	110	588	698	40	182	222	20	100	120	90	230	320	80	310	390	90	230	320
5. Project Management, Technical Assistance, and Training	0	0	0	352	1,632	1,984	345	1,617	1,962	369	1,912	2,281	53	472	525	60	710	770	110	1,000	1,110	120	1,000	1,120
Sub-Total	0	0	0	352	1,632	1,984	345	1,617	1,962	369	1,912	2,281	53	472	525	60	710	770	110	1,000	1,110	120	1,000	1,120
6. Studies																								
PPF I	0	750	750	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PPF II	0	750	750	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
System Dev.Study	0	0	0	0	0	0	55	280	335	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Feasibility Studies	0	0	0	0	0	0	0	0	0	60	420	480	0	0	0	0	0	0	0	0	0	0	0	0
Sub-Total	0	1,500	1,500	0	0	0	55	280	335	60	420	480	0	0	0	0	0	0	0	0	0	0	0	0
Total Base Cost	224	4,150	4,374	804	14,902	15,206	2,263	25,943	28,206	3,928	22,307	26,235	1,952	12,819	14,771	1,053	6,612	7,665	515	6,806	6,521	515	5,230	5,745
Physical Contingency	22	265	287	80	1,440	1,521	226	2,594	2,821	393	2,231	2,624	195	1,282	1,477	105	661	767	52	601	652	52	523	575
Price Contingency	4	44	47	31	559	590	114	1,303	1,416	292	1,377	1,619	172	1,126	1,298	136	856	992	89	1,036	1,126	112	1,135	1,247
Total Inv. US$ '000	250	4,459	4,709	916	16,401	17,317	2,603	29,840	32,443	4,563	25,914	30,478	2,319	15,227	17,546	1,295	8,129	9,424	655	7,642	8,298	678	6,888	7,566
Total Inv. SSh million	35	616	650	156	2,801	2,958	516	5,918	6,435	1,019	5,785	6,803	569	3,738	4,307	345	2,169	2,514	198	2,216	2,406	214	2,171	2,385

a/ Excludes all expenditures for Baardheere hydro and associated transmission

SOMALIA

POWER REHABILITATION AND ENERGY PROJECT

Project Description

The project will consist of the following components:

1. The Consulting Services for project management, operational assistance, training, and recruitment as described in detail in Annex 4.3.

2. At Gezira power station, using IDA, ADF and EIB funds, procurement, delivery and supervision by manufacturer of installation of new 5,966 brake kW capacity Mirlees Blackstone KV16M engine for diesel unit No. 2; rewind of spare 15 kV, 7,200 kVA stator; rehabilitation of auxiliaries for five units and station auxiliaries (including refurbishing of switchboards, replacement and recalibration of instrumentation and repair and/or replacement of fuel treatment equipment); provision of fire detection and prevention equipment and new high intensity lighting scheme, and provision of three years spares and consumable materials.

3. At Centrale-Hamar power station, using Italian funding and engineered and supervised by ENEL, the rehabilitation of four 2,250 kW diesel unit prime movers, repair or rewind of alternators (2,700 kVA) for diesels 6, 7 and 8; rehabilitation of station auxiliaries (including overhaul of heavy fuel oil separators, replacement of fuel oil heaters and remedial work on transformer banks an switchgear), provision of fire detection and prevention equipment.

4. Provision of a 10 MW (site rating) heavy residual fuel oil burning diesel generator and associated step-up transformer, two road tankers and tank farm of 1x500 and 2x1,000 tonne capacity to be installed at and in timely coordination with the new North 33 kV substation.

5. Using Italian aid funding and engineered and supervised by ENEL, the provision of a second 15 MW oil-fired boiler and steam turbo generator at the Gezira complex using the existing stack, water intake and treatment plant and other common facilities.

6. 33 kV Transmission and Associated Substations.

(i) procurement of materials for the construction by ENEE of 7 km of 33 kV overhead line to replace sections of line encroached on by new buildings constructed dangerously close to existing conductors and structures;

(ii) procurement of 9 km of 33 kV underground cables and accessories and materials for the construction by ENEE of 9 km of underground feeders and 70 km of 33 kV overhead line to interconnect the Gezira, Centrale, North, West, and East substations, and Afgoi and Balad towns;

(iii) extensions of 33 kV switchgear assemblies at Gezira and West substations;

(iv) new 33 kV substations at Centrale, North, and East sites;

(v) installation of seven 10 MVA 33 kV/15 kV transformers; and

(vi) installation of surge arrestors at existing and new 33 kV substations.

7. 15 kV and 380/220 V Distribution. Using Italian aid funds and engineered and supervised by ENEL, provision of materials, plant, vehicles and contractors for:

(i) installation at 15 kV of airbreak switches and drop-out fuse gear, transformers and materials for about 165 15 kV/380/220 pole and ground mounted substations;

(ii) the construction of (a) about 30 km of 15 kV overhead distribution lines; (b) 26 km of 380/220V 4-wire mains; and (c) 2, 3 and 4 wire subsidiary 380/220 V submains and concentric consumer service wire, meters and fuse cut-outs to improve supplies to about 5,000 existing consumers; and (d) mains, submains and consumer materials to connect about 20,000 new customers;

(iii) an expansion of the existing pole factory to enable ENEE to produce pre-stressed 8 and 11 meter poles at the rate of at least 60 units per week;

(iv) an emergency rehabilitation component to begin in 1987 to replace existing 3 kV amd 380/220 V overhead lines in Zone 1 (Wadajar) and Zone 13 (Caboul Casils) of Mogadishu;

(v) installation of about 5 MVAr of power factor correction equipment and provision of transmission and distribution spares; and

(vi) an expansion of the transmission and distribution workshops.

8. Communications. Provision of a 2-channel radio communication system with sets installed in each vehicle, substation and power station.

9. General Plant.

(i) provision of spares for existing fleet;

(ii) provision of vehicles including two 7-ton trucks with integral 5-ton cranes, six 4-wheel drive open-back 2-ton utilities one "bucket" truck, one trench excavator and pole-hole drill, and 10 half-ton open-back 4-wheel drive utility vans, and two 10-seater buses; and

(iii) workshop tools and equipment.

10. Energy Sector Planning. Provision of the services of a long term (three years) energy planning advisor to the Energy Planning Department (EPD) in the Ministry of National Planning; short term technical assistance in the fields of petroleum procurement marketing and distribution, household energy, woodfuels supply and distribution; external and in-country short term training, equipment and materials.

11. Household Energy Demand Management. Provision to the National Woodstoves Project (NWP) National Range Agency of three manmonths of short term technical assistance, external and in-country training and equipment and materials to support NWP's activities in the design, testing, development and dissemination of improved energy efficient woodstoves.

SOMALIA

POWER REHABILITATION AND ENERGY PROJECT

Terms of Reference for Consulting Services for Project Management/ Operational Assistance/Training and Recruitment Tasks

Objectives

1. The objectives of these services will be:

(a) to assist Ente Nazionale Energia Elettrica (ENEE) in the procurement, engineering and design, inspection, construction supervision, and start-up testing and commissioning and acceptance of the various project packages and subcomponents listed in the Description of the Project (Annex 4.2); and

(b) to assist ENEE in its recovery plan by making improvements in the utility's management, financial and engineering functions - in the short term with the provision of staff support, and in the longer term with system and managerial improvements and reorganization, staff development and training.

2. In the managerial area, operational assistance will need to review the duties and responsibilities of the ENEE management and staff, and recommend and where agreed implement during the project period, reorganization, management systems and procedures, delegation and clarification of authority, and training schemes.

3. The objective of the operational assistance in the finance area is to formulate and implement a set of institutional, operational and investment measures to strengthen the reliability and efficiency of ENEE's financial management, particularly in the areas of customer billing, collections and record keeping; plant accounting; inventory management and control; financial accounting and financial statement preparation; and financial planning and forecasting. In addition, the company's data processing requirements should be reviewed, including the introduction of appropriate hardware and software systems which it is intended also be financed under the Project. Given ENEE's limited experience with modern financial management systems, the assistance should be focussed on developing financial reforms that can be integrated easily and expeditiously into the existing operations.

4. The objective of the recovery plan in the technical and engineering area will be the improvement of ENEE's generation and transmission, operation and maintenance procedures, keeping in mind the utility's main objective - the provision to consumers of supplies of safely, efficiently and reliably produced electricity.

Scope of Work

5. The following is an outline of the task to be performed by the consultant together with, in Section A - Project Management and Section B -

The Recovery Plan, a suggested approach to the task, but the invited consultants are not limited to these suggestions, although each offer will be evaluated by ENEE bearing these parameters in mind. Section C - Reports, outlines the regular reports the consultant will provide.

A. PROJECT MANAGEMENT

6. It is expected that by the time that the subject consultancy services contract comes into effect, ENEE will have already largely completed the bidding process and signed procurement contracts for the provision of many of the project's packages and subcomponents.

7. To assist ENEE in the management of the project, the consultant will provide home-office and on-site staff in sufficient strength to perform the following tasks:

(a) Carry out factory inspection of equipment and materials;

(b) Perform construction and commissioning management for the turn-key packages;

(c) Provide technical assistance to ENEE in supervision of the transmission, distribution and services construction;

(d) Provide procurement assistance and installation supervision for equipment that ENEE, upon advice from the consultant, installs during the project period. This will include the hard and software for the accounting and billing system; and

(e) Certify invoices for payment, and generally assist ENEE in its relations with the donors EIB, ADB and IDA, and ensure the appropriate technical integration of all aspects of the project including those components financed by the Italian aid funds.

B. THE RECOVERY PLAN

8. To assist ENEE in its recovery plan, the consultant would provide resident consultant staff, who will hold in-line, responsible posts of authority in ENEE for three years. A list of these posts and the description of each is included as Attachment 1 to this Annex.

9. On behalf of ENEE, the consultant would recruit staff to be contracted by ENEE at the commencement of the project (see Attachment 2 to this Annex). The international search for suitable candidates will have been carried out by the consultant with the objective of maximizing the effect of the funds available. Offers of employment would be based on a 2-year contract with a subsequent possible 1-year renewal. (For each first renewal after the initial 2-year period - indicating performance satisfactory for both ENEE and the employee - the consultant would receive a bonus equivalent to two months of the employee's first year base salary.)

10. Home office and consultant resident staff will be expected to carry out the following tasks during the project period.

11. Organizational Structure. Review organizational structure of ENEE (including statutes, role and composition/authority of its Board as well as the linkages among Government, ENEE, management and Board), evaluate and, where agreed, implement restructuring option.

12. Generation and Transmission Operations. Review existing systems and procedures and status of plant, and recommend and after agreement implement changes to ensure that in the short and long term supplies of electricity in Mogadishu are reliable. Such changes in operational procedures would need to embrace merit order use of generating plant, load shedding and scheduling of electricity supplies to priority users, strict outage of plant and equipment for maintenance purposes, proper manning of centers of operational control including control rooms and where necessary switch-houses and switching yards. Codes of practices and safety regulations used elsewhere would need to be reviewed and revised for use in the Somali environment, and following endorsement by the ENEE Board and Government, enforced for the safety of the public, the staff and the plant. Review record keeping of operational statistics, and installations (including cable route drawings and consumer service connections) and where improvements are needed implement changes.

13. Generation and Transmission Maintenance. Review existing practices of diesel generation and furnace, boiler and steam plant maintenance and implement improvements where necessary. Implement safe methods of isolation of equipment and safe and efficient methods of working; recommend and where possible implement improvements in working conditions; recommend and assist in the procurement of spares, consumables and tools and plant items to improve maintenance techniques and results; improve where necessary record keeping of maintenance performed; implement routine preventative maintenance programs for ENEE's power stations, substations, transformers, overhead lines and consumer services and meters; improve the efficiency of diesel generators by routine maintenance including accurate repairs and adjustments to fuel injectors; implement plans to ensure that instrumentation is properly repaired and adjusted to show plant status including exhaust temperatures on diesel equipment and quality of furnace exhausts; ensure that auxiliary plant is properly maintained so that most economic fuels can be used in diesel prime movers; ensure that sufficient spares are always in stock to enable routine and emergency maintenance to be performed with reasonable timeliness.

14. Customer Billing and Collection. Review existing billing procedures; recommend new procedures and new hardware/software requirements to improve reliability of billing data and expedite billing process; implement new system including necessary training. Review existing collection practices; recommend new procedures designed to expedite collection time and reduce level of arrears for both private and public sector customers; implement new procedures, including necessary training. Review level of illegal connections; recommend and implement new procedures to ensure complete billing of all customers.

15. Plant Accounting. Survey ENEE assets and inventories, both in Mogadishu and the regions; make necessary write-downs and write-offs to existing asset register; derive monetary value of assets for financial statements. Review existing plant accounting practices; recommend new procedures and hardware/software requirements to develop computerized asset register for financial statement preparation and capital investment planning; and implement new system, including necessary training. Review appropriate revaluation method for fixed assets in financial statements; revalue fixed assets according to new method beginning with the 1987 financial statements and train staff in new system.

16. Procurement and Inventory Control. Review existing commercial procurement procedures; recommend and implement new procedures to simplify and accelerate ENEE and Ministry of Finance purchase approval process. Review existing inventory control and accounting procedures; recommend and implement new procedures to ensure more accurate accounting and valuation for maintenance planning and financial statement preparation.

17. Financial Accounting and Financial Statements. Review existing procedures and account classifications used in financial accounting system and financial statement preparation; recommend new procedures, classifications, and hardware/software requirements to provide more thorough and timely financial statements; implement new system, including necessary training.

18. Review existing treatment of operations outside Mogadishu in financial statements; develop new procedures to prepare consolidated accounts; consolidate accounts for 1987 financial statements and train staff in new system.

19. Review existing treatment of subsidiary operations such as pole factory and electrical equipment sales in financial statements; develop new procedures to better monitor financial performance of individual subsidiary operations; implement new procedures.

20. Review existing depreciation practices used in financial statements; develop a more complete depreciation accounting system based on appropriate units of plant life with and reasonable net salvage value of equipment, implement new system, including necessary training.

21. Prepare audited and consolidated financial statements.

22. Auditing. Review existing internal auditing procedures; recommend and implement new practices to strengthen internal auditing and financial control functions.

23. Financial Planning. Review existing systems and procedures for forecasting capital requirements, investment plans, and cash flow; recommend new hardware/software required to strengthen financial projection and analysis capabilities; implement new system, including necessary training.

24. Review financial management information needs and reporting requirements; develop financial MIS; outline performance indicators to monitor financial performance; implement MIS, including necessary training.

25. Analyze annual financial requirements including tariff adjustments to meet stipulated performance parameters.

26. The following schedule is envisaged for the implementation of the recovery plan in the areas of fiscal control:

- Commissioning of the new billing system by December 1988, with monthly billing of all customers thereafter;
- Commissioning of new financial accounting system by September 30, 1988;
- Commissioning of new inventory control system by December 31, 1988;
- Revaluation and computerization of asset base by March 31, 1989;
- Preparation of audited and consolidated financial statements within six months after the end of the fiscal year;
- Preparation of multi-annual financial forecasts for ENEE, including annual update;
- Preparation of tariff and other financial proposals necessary to meet financial performance criteria agreed with ENEE's lenders;
- Commissioning of financial MIS by June 30, 1989;

27. Manpower and Training. Conduct manpower needs assessment for implementation of engineering operations and maintenance and financial management reforms; identify new positions and write job descriptions; assist in local hiring.

28. Review training and qualifications of existing managerial, financial management and accounting and engineering staff; determine training requirements necessary for implementation of the reforms; develop and organize training course; develop training materials as necessary to support training program.

29. Review and evaluate existing technical, engineering, managerial and financial training programs available in Somalia, the region, and overseas, which would be appropriate for ENEE training and arrange for selected ENEE staff to participate in the chosen program.

30. Equipment Procurement. Assist ENEE in evaluating, selecting, procuring and setting to work the most appropriate hardware/software option for the various accounting, billing, collection, planning and MIS functions of the utility, and assist ENEE in the procurement of other incidental material needs of the recovery plan.

31. Assist ENEE in securing necessary technical service and support contracts from hardware and software equipment suppliers.

32. Planning. Review and update in a timely fashion ENEE's generation, transmission and distribution development plans to the mid 1990s including the integration into ENEE's Mogadishu system of the proposed 100 MW Baardheere hydroelectric project and its associated 500 km of 220 kV transmission lines and substations, and the towns of Afgoi, Balad, Jowhar and Merca.

33. Review and revise where agreed ENEE's corporate procedures, its statutory instruments, and advise the Director General and Government on the need for and the format and objectives of a Statutory Board of Governors.

34. Counterparts. Evaluate the various staff of ENEE and possible local recruits, propose the most suitable to act as counterparts to the consultant's and expert staff, evaluate their progress during training and over the project period, and support them with advice during the transitional final year of the contract when the counterparts take up their designated positions.

C. REPORTS

35. During the course of the services the consultant shall submit to ENEE quarterly reports within 15 days of the end of the quarter giving a statement of the work performed and its results, and a detailed account of project progress including a statement and supporting tables illustrating the project expenditures to date and cost of the project to completion; a reconciliation of both progress and expenditure of the services and a schedule of the work to be performed during the remainder of the period of the services; the consultant's findings and advice for improvements, his latest conclusions and recommendations; the personnel employed during the quarter; equipment, used, installed or required.

SOMALIA

POWER REHABILITATION AND ENERGY PROJECT

Staff in Consultant's Employ and Their Terms of Reference

Head Office and On-site Support Staff

1. Expertise and number to be assessed by proposing consultant.

Project Management

2. One resident staff consultant will assist ENEE's Project Director and occupy the in-line post of Assistant Director (Projects) and be responsible for the following aspects of the project:

(a) coordination between ENEE, the consultants' head office, and the contractors employed by ENEE under the project;

(b) on-site engineering supervision and progressing of ENEE's contractors employed under the project for rehabilitating the generation plant equipment and the installation of the 33 kV switchgear and substations, and new generating plant;

(c) organization of ENEE's project stores;

(d) review of contractors' delivery and erection invoices for payment;

(e) production of disbursement applications to the various donors EIB, ADB and IDA; and

(f) production, in liaison with the consultants' head office, of quarterly project reports, to ENEE and the various financing organizations, together with project accounts.

Operational Support

3. Four resident consultant staff would assume line positions and corresponding responsibilities in the technical and financial departments, working as assistant directors for (i) generation operations; (ii) rehabilitation and maintenance; (iii) transmission and distribution; and (iv) finance. In addition to their day-to-day responsibilities, the consultant staff will recommend and, in coordination with ENEE's top management, implement organizational improvements in their areas of work and for ENEE as a whole. They will also assist the training manager in identifying the details of training priorities, programs and candidates. One resident consultant staff will act as training manager responsible to ENEE's director general.

4. The Assistant Director (Generation Operations) would be responsible to ENEE's Technical Director for the safe and efficient day-to-day operation of the Gezira diesel and steam power station and the Centrale diesel power station and their operational shift staff. He would liaise with the Assistant Director (Generation Rehabilitation and Maintenance) for availability of plant for routine and other maintenance either funded under the Project or otherwise. He would establish merit order priority operation of generators taking into account comparative efficiencies, age, maintenance costs and capacities, and establish safe methods of operation. He would be responsible through the finance department for fuel stocks replenishment and their security, and his duties would be those normally encompassed by the post entitled Power Stations Manager. Under his direction a statistic section would be established to handle records of plant efficiencies, outputs, histories, etc.

5. The Assistant Director (Generation Rehabilitation and Maintenance) would be responsible to the Technical Director for scheduling, organizing, and supervising ENEE's staff in that rehabilitation and routine maintenance which is to be performed by ENEE's staff at the Gezira and Centrale power stations.

6. The Assistant Director (Transmission and Distribution) would be responsible to ENEE's Technical Director for the planning and construction of expansions to the 33 and 15 kV networks. He would also be responsible for the rehabilitation and expansion by ENEE's staff of the 15 kV and 380/220 V networks. He would, where appropriate, reorganize and be responsible for ENEE's existing transmission and distribution staff directing them in safe working and isolating procedures via a set of safety instructions to be designed by him for approval and ratification by ENEE's Board. His aims would be the safety of the public and ENEE's staff and the efficient operation of the networks. His departmental responsibilities would also encompass the consumer services and metering section and the pole manufacturing plant.

7. The Training Manager will be responsible to the Director General for the organization of ENEE's training needs both in Somalia and overseas. He will identify the detailed training needs of the Somalian staff (and the identified counterparts to the Assistant Directors) based on ENEE's operational requirements and the advice of the Directors and Assistant Directors. As necessary the Training Manager would be expected to be able to draw support from the consultants' head office. His duties will encompass:

(a) establishing a training program for technicians and accountants;

(b) organize overseas training in industry and academia when such training is not available in-house nor in Somalia; and

(c) produce within six months of his arrival in Somalia a fully comprehensive training plan budget with contingencies for the project time-span, including estimates of ENEE staff travel and subsistence allowances where these are necessary during training

abroad. This training plan and budget will be a refining of the plan and provisional budget sum for training contained in the consultant's proposal. The five consultant staff will remain in their positions for a period of three years. During the first year, they will, in coordination with ENEE's top management, propose counterpart staff who will be trained on the job or elsewhere under the training provisional sum and who will be expected to take on their responsibilities at the beginning of the second 6-month period of the third year; at this stage, the five consultant staff will for their final six months act as advisors.

Planning Advisor

8. One resident consultant staff engineering economist would occupy the post of Planning Advisor for three years and would advise ENEE's Director General on questions of corporate structure, including Board functions, staffing, and power system planning including advice on issues relating to protection of the environment. His advice would reflect the impending construction and commissioning of the 100 MW Baardheere hydroelectric project and the associated cost recovery, with which Somalia's electricity industry will be faced.

OUTLINE DESCRIPTION OF POSITIONS FOR WHICH CONSULTANT IS TO RECRUIT ON BEHALF OF ENEE

Staff will be recruited by the consultant for ENEE's direct employment. They would be expected to participate in training and the imparting of their skills to ENEE's staff.

1. The Controller of Stores will be responsible to the Assistant Director (Finance) for the replenishment, disbursement and safekeeping of ENEE's materials. He will establish an efficient procedure for the recording and reordering of stocks at the request of the various operational departments. He will initially carry out an inventory and evaluation, and write-off and dispose where necessary and with the approval of the Director General, ENEE's current stocks. He will carry out an annual stock-taking exercise. He will establish with the various departments minimum and maximum stock levels to ensure the reliable and efficient operation of ENEE's generation and transmission departments.

2. The Instrumentation and Communications Engineer will be responsible to the Assistant Director (Transmission and Distribution) for a small department of ENEE's technicians for the calibration, repair and installation of power station and transmission instrumentation. He will also be responsible for the installation and maintenace of fixed and mobile radio and carrier communication equipment and for the establishment and operation of a meter test facility.

3. Two Diesel Mechanics will be responsible to the Assistant Director (Generation Rehabilitation and Maintenance) for the supervision and active participation in the maintenance and rehabilitation of the diesel prime movers and mechanical auxiliaries at Gezira power station. One will have a certificate in fuel injector calibration and maintenance.

4. Four Operators will be responsible to the Assistant Director (Generation Operations) for shift control of ENEE's staff in the safe, efficient operation of Gezira oil-fired steam power station.

5. The Switchgear Technician will be responsible to the Assistant Director (Transmission and Distribution) for the acceptance by ENEE of the 33 kV switchgear erected by contractors. He will be responsible for its maintenance and that of the 15 kV and 33 kV switchgear on the system and within the confines of the power stations.

6. The Power Station Electrician will be responsible to the Assistant Director (Generation Rehabilitation and Maintenance) for the routine and emergency maintenance of electrical plant within the Gezira power station.

7. The Regional Electrification Engineer will be responsible to the Assistant Director (Generation Operations) for the coordination of the generation and distribution of electricity in the provincial towns associated with ENEE.

Recruitment

8. The international search for suitable candidates should be carried out with a view to minimizing employment costs to ENEE while meeting the stipulated qualification requirements. On behalf of ENEE, and following contract negotiations, the consultant will hire the personnel referred to in 1 to 7 above. Contract offers should be based on a 2-year contract with a subsequent possible 1-year renewal. For each renewal after the initial two years - indicating performance satisfaction for both ENEE and the employee - the consultants will receive a bonus equivalent to two months of that employee's base salary.

ANNEX 4.4

SOMALIA

POWER REHABILITATION AND ENERGY PROJECT

Project Implementation Schedule

Component	CY 87	CY 88	CY 89	CY 90	CY 91	CY 92
Project Management and Technical Assistance						
Issue of LOI	x					
Evaluation	x					
Contract Award	x					
Staff in Place		xxxxxxxxxxxxxxxxxxxx				
Advisory Period				xxxxx		
Commissioning of:						
New billing system		xxxx				
Financial MIS			xxxx			
Accounting system		xxxx				
Inventory control			xxx			
Asset revaluation			xxxx			
System Study		xxxx				
Generation						
Gezira Rehabilitation						
Enquiry issued	x					
Contract award	x					
Implementation		xxxxxxxxxxxxxxxxxx				
Unit 2 commissioned			x			
Diesel generator						
Enquiry issued	x					
Contract award	x					
Works manufacture		xxxxxx				
Installed on-site		xxxxxxx				
Steam Plant						
Contract award		x				
Works manufacture		xxxxxxxxxx				
Installation on-site			xxxxxxxxxxx			
Gezira Spares Manufacturing and Delivery		xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx				
Centrale rehabilitation	xxxxxx					
Transmission and Distribution						
15 kV Emergency Program	xxxxxx					
15 kV Rehabilitation		xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx				
33 kV Substations						
Enquiry issued	x					
Contract award	x					
West sub. commissioned		x				
North sub. commissioned		x				
Central sub. commissioned						
East sub. commissioned			x			
Services and Meters		xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx				

ANNEX 4.5

SOMALIA
POWER REHABILITATION AND ENERGY PROJECT
PROJECT COST TABLE

	Local Cost	Foreign Cost	Total Cost	Local Cost	Foreign Cost	Total Cost
	----------US$,000----------			----------SShM----------		
Gezira Rehabilitation	261	3,574	3,835	31	429	460
Gezira Spares	0	4,076	4,076	0	489	489
Gezira fire protection and high intensity lighting	175	1,227	1,402	21	147	168
Centrale rehabilitation	38	1,157	1,195	5	139	143
Centrale spares	0	1,500	1,500	0	180	180
15 MW Steam Unit	1,700	17,302	19,002	204	2,076	2,280
10 MW Diesel Unit	1,649	7,807	9,456	198	937	1,135
33kV Substations and Power Line Carrier	350	3,937	4,287	42	472	514
33kV Transmission Expansion	100	1,613	1,713	12	194	206
15kV/380V Reinstatement	1,041	10,419	11,460	125	1,250	1,375
15kV/380V Expansion	861	8,652	9,513	103	1,038	1,142
Vehicles, spares, workshop and tools (ADB)	110	1,487	1,597	13	178	192
Electrical workshops, pole factory and vehicles (Italy)	152	2,631	2,783	18	316	334
Computer and billing equipment	50	270	320	6	32	38
Technical Assistance, Project Management and Training	1,165	5,553	6,718	140	666	806
Study: Energy	100	700	800	12	84	96
Study: Household	240	88	328	29	11	39
Study: ENEE Development	87	260	347	10	31	42
PPF Refinancing	0	1,500	1,500	0	180	180
Total base cost	8,079	73,753	81,832	969	8,850	9,820
Physical Contingencies	808	7,225	8,033	97	885	982
Price Contingencies	462	3,692	4,153	1,074	8,085	9,159
Total Contingencies	1,270	10,917	12,187	1,171	8,970	10,141
Total Project Cost	9,349	84,670	94,019	2,140	17,820	19,961

ANNEX 4.6

SOMALIA

POWER REHABILITATION AND ENERGY PROJECT

Financing Plan
(US$ million)

Item	ADB	EIB	IDA	Italy Govt.	ENEE	Somali Govt.	Total
Gezira Power Station							
Replacement prime mover for Unit No. 2		2.3			0.1		2.4
Rehabilitation			1.8		0.2		2.0
Fire prevention and lighting schemes	1.4				0.2		1.6
Diesel and auxiliary spares		3.4 a/	1.3 a/				4.7
15 MW steam plant and training				22.0 b/			22.0 b/
Centrale Power Station							
Rehabilitation, diesel spares and training				3.0			3.0
10 MW diesel plant		9.0			1.9		10.9
33 kV switchgear/transformer + 33 kV interconnector materials	6.4				0.5		6.9
15 kV + 380 mains rehabilitation and expansion programs and training				22.0	2.2		24 2
General plant (vehicles, pole plant, workshop)	1.7			3.0	0.3		5.0
PPF I and II			1.5				1.5
Project management, operations assistance/training, billing equipment			6.7		1.4		8.1
System studies			0.3		0.1		0.4
Energy Planning and Household Management			0.9			0.4	1.3
Total	9.5	14.7	12.5	50.0	6.9 c/	0.4	94.0

a/ No lending to ENEE; only foreign exchange allocation against matching funds in local currency by ENEE.
b/ Includes financing of local costs of steam plant erection.
c/ Actual financing by ENEE is US$11.4 million which includes US$4.6 million for operating spares.

ANNEX 4.7

SOMALIA

POWER REHABILITATION AND ENERGY PROJECT

Estimated Schedule of Disbursements a/
(US$ million)

Assumptions		
	Loan Signing:	November 1987
	Effective Date:	January 1988
	Closing Date	June 30, 1992

IDA Fiscal Year and Semester	Disbursement Semester	Disbursement Cumulative	Percent Disbursement % of Total Credit
1988			
June 30, 1988	2.7 b/	2.7	22%
1989			
Dec. 31, 1988	1.9	4.6	37%
June 30, 1989	1.8	6.4	51%
1990			
Dec. 31, 1989	1.7	8.1	64%
June 30, 190	1.7	9.8	78%
1991			
Dec. 31, 1990	1.4	11.2	89%
June 30, 1991	0.6	11.8	95%
1992			
Dec. 31, 1991	0.5	12.3	98%
June 30, 1992	0.2	12.5	100%

a/ The disbursement schedule conforms with the standard profile for IDA credits for power projects in the Eastern and Southern Africa Region.

b/ Includes refinancing of Project Preparation Facility advanced by IDA in IDA FY87.

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ANNEX 5.1

SOMALIA
POWER REHABILITATION AND ENERGY PROJECT
ENEE (MOGADISHU SYSTEM)

INCOME STATEMENT FOR THE YEARS ENDING DECEMBER 31, 1984-1994
(So. Sh. Million - Current Terms)

	ACTUAL			FORECAST							
	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Operating Revenue											
Electricity Sales	242	345	632	1,273	1,681	2,285	3,993	4,804	5,619	6,932	8,693
Connection Charges	36	117	224	269	309	348	391	440	495	557	557
Other	3	8	23	28	32	36	40	45	51	57	57
TOTAL	281	471	879	1,569	2,022	2,669	4,425	5,290	6,165	7,547	9,308
Operating Expenses											
Fuel	161	336	467	459	743	984	1,370	1,771	2,337	3,032	3,812
Maintenance Materials	22	8	23	75	130	220	295	398	502	577	669
Personnel	15	29	38	52	129	149	167	188	212	238	268
Administration	6	10	12	16	30	34	38	43	48	54	61
Depreciation	44	226	240	374	572	960	1,458	1,894	2,286	2,639	3,075
Other	6	13	23	31	55	64	72	81	91	102	115
TOTAL	254	621	804	1,008	1,659	2,410	3,401	4,374	5,475	6,643	7,999
Net Operating Income	27	(151)	75	562	363	258	1,024	916	690	904	1,308
Non-Operating Expenses											
Interest-LTD	24	40	88	106	193	370	549	688	787	894	1,026
Other Fin. Charges	4	6	19	0	0	0	0	0	0	0	0
TOTAL	28	46	107	106	193	370	549	688	787	894	1,026
Net Income	(1)	(197)	(31)	456	170	(111)	475	228	(97)	10	282

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SOMALIA
POWER REHABILITATION AND ENERGY PROJECT
ENEE (MOGADISHU SYSTEM)

ANNEX 5.2

BALANCE SHEET FOR THE YEARS ENDING DECEMBER 31, 1984-1994
(So. Sh. Million - Current Terms)

	ACTUAL			FORECAST							
ASSETS	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Current Assets											
Operating Cash/Bank	2	3	23	26	45	60	80	102	131	165	202
Surplus Cash	0	0	0	375	1,130	988	264	135	73	260	705
Accts. Receivable	292	417	681	418	415	563	985	1,185	1,386	1,709	2,144
Inventory	32	22	166	102	167	237	327	428	557	698	858
Other	13	53	25	23	23	23	23	23	23	23	23
Total Cur. Assets	339	496	894	944	1,779	1,872	1,679	1,872	2,169	2,855	3,933
Fixed Assets											
Gross	450	4,104	4,220	5,966	9,557	16,334	24,944	32,858	39,990	47,505	55,903
Less:Accum Dep.	150	376	616	944	1,791	3,047	4,876	7,293	10,404	14,317	19,182
Net	300	3,728	3,604	5,022	7,766	13,287	20,068	25,565	29,586	33,188	36,721
Work in Progress	6	8	3	112	519	1,406	1,462	1,039	542	499	487
Deferred Assets											
Gross	0	0	0	231	231	308	432	432	432	432	432
Less:Accum Dep.	0	0	0	46	92	154	240	327	413	439	439
Net	0	0	0	185	139	154	192	105	19	(7)	(7)
TOTAL ASSETS	645	4,232	4,502	6,263	10,203	16,718	23,400	28,582	32,315	36,535	41,134
LIABILITIES AND EQUITY											
Liabilities											
Current Liabilities											
Accts Payable	224	296	311	191	236	321	438	565	734	929	1,148
Overdraft	0	58	135	0	0	0	0	0	0	0	0
Other	4	5	10	10	10	10	10	10	10	10	10
Curr. Portion LTD	43	75	244	330	384	481	529	1,079	1,173	1,659	1,782
Debt Arrears	18	87	249	0	0	0	0	0	0	0	0
Total Cur Liab	288	520	948	532	630	812	977	1,654	1,917	2,598	2,940
Long-Term Debt (Net)	282	3,833	3,664	6,222	9,027	12,803	15,324	16,689	17,767	19,186	20,757
Other Long-Term Liab.	9	10	11	12	13	14	15	16	17	18	19 Pension Fund
Total Liabilities	579	4,363	4,624	6,765	9,670	13,629	16,317	18,359	19,701	21,802	23,716
Equity											
Paid-In Capital	31	31	71	499	1,831	4,806	8,132	9,752	10,446	10,446	10,446
Retained Earnings	35	(163)	(194)	262	432	321	796	1,023	926	936	1,218
Reval. Surplus	0	0	0	(1,264)	(1,731)	(2,039)	(1,845)	(553)	1,242	3,351	5,754
Total Equity	66	(132)	(123)	(503)	533	3,089	7,083	10,222	12,614	14,733	17,418
TOTAL LIAB & EQUITY	645	4,231	4,501	6,262	10,202	16,718	23,400	28,581	32,315	36,534	41,133

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SOMALIA
POWER REHABILITATION AND ENERGY PROJECT
ENEE (MOGADISHU SYSTEM)

ANNEX 5.3

SOURCES AND USES OF FUNDS FOR THE YEARS ENDING DECEMBER 31, 1984-1994
(So. Sh. Million - Current Terms)

	ACTUAL			FORECAST							
	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Operating Income	27	(151)	75	562	363	258	1,024	916	690	904	1,308
Depreciation	44	226	240	374	572	960	1,458	1,894	2,286	2,639	3,075
Cash from Oper.	70	75	315	936	935	1,218	2,482	2,809	2,975	3,543	4,383
Deductions											
Interest	13	6	19	248	193	370	549	688	787	894	1,026
Principal	1	0	0	485	330	384	481	529	1,079	1,173	1,659
Increase in W/C	44	82	358	(210)	16	133	393	172	160	269	374
Other	0	0	0	0	0	0	0	0	0	0	0
Total Deductions	58	88	377	523	539	887	1,423	1,390	2,026	2,336	3,060
Contrib. to Invest.	12	(12)	(62)	412	396	331	1,059	1,419	950	1,207	1,323
Investment Program	233	2,428	111	650	2,782	6,230	6,573	4,190	2,397	2,406	2,385
Financing Gap	220	2,441	173	238	2,386	5,898	5,514	2,771	1,448	1,200	1,062
Financed By:											
Long-Term Debt	207	2,383	75	188	1,842	2,797	1,484	1,043	720	1,421	1,545
Overdraft	0	58	77	0	0	0	0	0	0	0	0
Equity Contrib.	0	0	40	428	1,332	2,975	3,326	1,620	694	0	0
Total Financing	207	2,440	193	616	3,160	5,772	4,810	2,663	1,414	1,421	1,545
Cash Beginning of Year	16	3	2	22	401	1,175	1,048	344	237	204	425
Ann.Cash Surplus(Deficit)	(13)	(0)	20	378	774	(127)	(704)	(107)	(33)	221	483
Cash End of Year	3	2	22	401	1,175	1,048	344	237	204	425	908

SOMALIA

POWER REHABILITATION AND ENERGY PROJECT

ASSUMPTIONS USED IN FINANCIAL ANALYSIS

1. Inflation and Exchange Rates. The following rates were used:

	1987	1988	1989	1990	1991	1992	1993	1994
Domestic Inflation (%)	34.0	20.0	15.0	12.5	12.5	12.5	12.5	12.5
Intl. Inflation (%)	3.0	1.0	1.0	1.0	3.5	3.5	3.5	3.5
Devaluation of So. Sh. (%)	30.1	18.8	13.9	11.4	8.7	8.7	8.7	8.7

2. Sales and Revenues. Electricity sales for the period 1987-1992 are calculated on the basis of the demand forecast agreed with ENEE (Annex 2.3) and assume the following average tariff increases, to become effective on January 1 of each year:

	1988	1989	1990	1991	1992	1993	1994
Average Tariff Increase (%)	0	0	35	5	5	15	20

Connection charges and other revenues are based on historical trends, annually adjusted for domestic inflation.

3. Operating Costs. Maintenance requirements are based on standard industry levels for ENEE's generating equipment and transmission and distribution system. Fuel requirements are based on ENEE's consumption records for diesels and steam units, as well as industry standards. While staff size has been kept at the existing level, the increase in personnel costs in 1988 accounts for the implementation of the new compensation package under the project (para. 3.12). A 50% real increase in administration costs and other costs is assumed in 1988 to account for the new administrative, supervisory, insurance and reporting requirements of the project. Domestic inflation is annually applied to all expenditures, except fuel costs which are inflated in line with the devaluation of the So. Sh. and real term price movements based on the Bank's latest commodity projections.

4. Assets and Depreciation. Fixed assets are revalued in line with domestic inflation and depreciation is charged at an average rate of 5.5% of revalued gross fixed assets, which is consistent with past experience. The following retirement schedule for the existing diesel generating equipment is assumed, based on year-end dispersals: Centrale 1-4 in 1987, Centrale 6 and 7 in 1989, Centrale 5 and 8 and Gesira 3 and 4 in 1991, and Gesira 1, 2, and 5 in 1992. The average gestation period for new investments in transmission, distribution, and generation is assumed at 1.25 years; accordingly, 75% of these new investments go directly into the fixed asset base and 25% into work-in-progress, from where they exit into the asset base one year later. Studies are entered under deferred assets, and are depreciated over 5 years.

5. Inventory. Inventory is projected to consist of two months of annual petroleum requirements and four months of annual maintenance requirements.

6. Cash, Accounts Receivable, Accountants Payable. Operating cash requirements have been estimated at 15 days of cash operating expenses. Annual cash positions above this level are deemed to be surplus funds and are counted against necessary tariff increases. Accounts receivable, after the financial restructuring required by credit effectiveness, are assumed to represent 90 days of annual electricity sales. Accounts payable are similarly reduced to 90 days equivalent of non-payroll cash operating expenditures.

7. Debt Service. ENEE's existing debt service obligations under the Kuwaiti Fund and Arab Development Fund loans are continued in line with original loan terms. The existing debt service arrears and overdraft are assumed to be settled in 1987 with the cash generated by the 80% tariff increase in February 1987. The onlending interest rate for the IDA credit, ADB and EIB are those indicated in para. 4.19.

8. Investment Program. Projected investment levels are identical with the agreed reference program presented in Annex 5.1, except for the Gezira spares which represent maintenance costs and are integrated in the income statement.

SOMALIA

POWER REHABILITATION AND ENERGY PROJECT

ECONOMIC RETURN TO THE MOGADISHU POWER DEVELOPMENT PROGRAM

Approach to Evaluation

1. The economic return to the Mogadishu Power Development Program to 1994 is derived from the incremental costs and benefits from the Program. The increments are relative to the mission's assessment of the situation that would prevail if no rehabilitation or development of the Mogadishu system were to take place. Thus the incremental costs are the differences in total system costs, comprising capital, O & M and fuel costs, between the development program case and the no rehabilitation and development case. The costs of technical assistance for project management and training are also included in the with program case since this assistance is considered to be essential to achieving the projected improvement in system performance. Similarly, the incremental benefits are the differences in total served power demand between the development program case and the no rehabilitation and development case. Served demand in the with program case is based on the mission's power demand forecast (Annex 2.3).

System Supply Capability

2. The generation development program for the Mogadishu system includes the availability of Baardheere power from 1995 to meet demand in both Mogadishu and the Juba Valley. The average annual energy available from Baardheere of 530 GWh is about 20% greater than the combined forecast energy demands in 1995 of about 443 GWh. However, the installed capacity of 105 MW is insufficient to allow the greatest use of Baardheere energy to meet demands in both systems, so that in 1995 about 425 GWh of Baardheere energy could be accepted by the systems, and 18 GWh has to be supplied from the thermal generating capacity installed beforehand.

3. The proposed Baardheere installed generating capacity restricts the rate of increase of utilization of the Baardheere energy potential to a much lower rate than the increase in demand, so that even by the year 2002 the full energy potential cannot be utilized under the least-cost method of meeting both the Mogadishu and Juba Valley demands. Consequently, the energy required from thermal units, particularly the Mogadishu oil-fired steam units, increases rapidly from almost zero in 1995 to about 242 GWh in 2002. The projections are not taken beyond the year 2002 for purposes of evaluating the Mogadishu Power Rehabilitation Project since the rehabilitated diesel units will be reaching the end of their working lives by then. Also, additional generating capacity will required in 2003 to meet the forecast increase in power demand, and it would not be possible to disaggregate the benefits from this new capacity from the rest of the system. A projection of Mogadishu system energy supply from the generation sources for 1987 to 2002 is given in this Annex, for which the mission modified the detailed simulation work done by Kennedy & Donkin. The transmission and distribution rehabilitation and development program will have to be continued beyond 1994 to meet the forecast demand to 2002. The required annual rate of investment is taken to be the same as projected for 1994.

4. For purposes of the economic evaluation, the mission has projected the power supply situation in the no rehabilitation and development case. In their current condition, it is possible that none of the existing diesel units would be operable after the first quarter of 1990. This would leave the existing oil-fired steam unit as the only source of power in Mogadishu, and it is assumed that ENEE would carry out adequate maintenance annually to keep this unit in service. Assuming that system technical losses and specific fuel consumption rates do not deteriorate from the present levels, which is probably optimistic, the mission estimated that served energy demand in Mogadishu would decline from 89.6 GWh in 1987 and 106.3 GWh in 1988 to 91.6 GWh in 1989, 55.9 GWh in 1990 and 50.8 GWh from 1991. Thus, the approximate proportion of total demand for energy that would be served in this case declines from 70% in 1987 and 80% in 1988 to 60% in 1989, 30% in 1990, 25% in 1991 and 20% in 1994.

5. In the comparator case of no rehabilitation and development in the Mogadishu system, the capacity of the existing transmission and distribution networks will severely constrain the amount of power that can be delivered to consumers. The interconnection between the Gezira power station and the main substations at 21st October Rd. and Centrale are the principal constraints, although the existing 15 kV and 3 kV distribution are also major constraints. Westinghouse Electric S.A. estimate that the maximum system demand of 27.6 MW served in 1986 is about the largest load that can be transmitted in the system in its present condition. The same conclusion would apply if the source of generated power were to be Baardheere with an entry point to the system other than at Gezira power station. This limitation becomes the overriding constraint on the Mogadishu system for supplying energy once Baardheere power becomes available.

Economic Costs and Benefits

6. Power system economic costs are valued in economic terms at 1987 price terms, and are based on international prices cif Mogadishu and associated internal costs. Somali taxes and duties are excluded from the costs. Operating costs which are independent of system development are not included in this cost comparison since they are common to all development options. Similarly, the capital and O & M costs associated with hydropower from Baardheere are not included in the comparison to avoid the need for arbitrary assumptions on the allocation of joint costs between power, irrigation and flood control objectives and an allocation of power costs between the Mogadishu and Juba Valley power systems. The comparison captures the savings in costs arising from improvements in system operating efficiency brought about under the development program. The main sources of savings are (a) reduction in system technical losses by improving the balance of transformer loading and the voltage profiles on distribution feeders, and by installing reactive power compensation equipment in the transmission system; and (b) reduction in the specific fuel consumption rates of the existing diesel units. The system economic costs associated with the development program case are detailed in the tables to Annex 2.4, and the costs for the two evaluation cases are compared in the table to this Annex.

7. System benefits are derived from the increase in served energy demand that would be achieved under the development program, as detailed in the tables to Annex 2.4. Since Baardheere costs are omitted from the comparison, for consistency the demand served from Baardheere power from 1995 is also omitted. Thus the comparison focusses on the utilization up to the year 2002 of the thermal generation capacity as well as transmission and distribution capacity in Mogadishu that is rehabilitated or added by 1994. This approach credits the investment in the Mogadishu transmission and distribution systems after 1995 only with the limited proportion of demand supplied from thermal capacity, whereas this portion of the investment program is also essential for deriving the benefits from the supply of Baardheere power to Mogadishu. This underestimation of benefits to the 1987-1994 Mogadishu power development program is unavoidable with the exclusion of Baardheere power costs and benefits from the evaluation. The served demands in the two evaluation cases are summarized in the table to this Annex.

8. The incremental served demand is valued at an estimate of average consumers willingness to pay for power from ENEE's system in 1987 price terms, which is derived from the weighted average cost to consumers of meeting their demands for power from private power sources at costs analyzed in Annex 2.3. These costs are based on past evidence that consumers are prepared to incur them. The weighted average cost of consumers willingness to pay for the forecast demand for power is estimated to be SoSh 26/kWh on the following basis.

Consumer Category	Willingness to pay for ENEE power (SoSh/kWh)	Proportion of Total 1991 Demand in Category (%)
Low/Medium Income Households	17.2	14.1
High Income Households	36.4	15.0
Small Commercial establishments	33.8	8.6
Large Commercial establishments	22.5	7.8
Government-large establishments	21.2	15.0
Government- municipal	33.8	3.8
Industry-large plants	21.2	26.8
Industry-small workshops	36.4	8.9
Weighted average	26.0	100.0

The equivalent value at SoSh 135/US$ is US cents 19.2/kWh.

9. The economic rate of return to the net incremental benefits of the Mogadishu power development program to 1994 is computed to be 25.3%, as detailed in the table to this Annex. This estimate does not include any costs and benefits associated with the supply of power from the Baardheere project, and thus it excludes some of the benefits after 1994 from the development of the transmission and distribution systems in Mogadishu. This rate therefore, is a conservative estimate of the economic return to the Mogadishu power development program up to the commissioning of the Baardheere project at the beginning of 1995. Any delay in the commissioning date for the Baardheere project would require extended use of the thermal generating facilities, and would thus increase the economic rate of return to the Mogadishu power development program.

SOMALIA-POWER REHABILITATION AND ENERGY PROJECT

ESTIMATED ECONOMIC RETURN TO THE DEVELOPMENT PROGRAM FOR 1987-1994

With Development Program Case

Mogadishu System Energy Demand and Supply 1987-2002

CY	Mogadishu Required Energy	Juba Valley Demand	Supply to Mogadishu: Hydro (B'heere)	Oil-fired Steam	Diesel Units	Gas Turbines	Mogadishu Served Demand: Total	Thermal
	(GWh)						(GWh)	
1987	166			55	54	0	91	91
1988	184			61	81	0	120	120
1989	201			66	123	0	163	163
1990	244			145	97	0	211	211
1991	276			141	126	6	242	242
1992	308			141	146	19	270	270
1993	328			141	150	37	289	289
1994	344			141	144	58	302	302
1995	368	75	350	16	1	1	325	16
1996	394	95	350	40	3	1	348	39
1997	422	115	344	71	6	1	372	69
1998	451	131	342	99	9	1	398	96
1999	483	141	340	129	13	1	426	126
2000	517	156	334	141	40	2	456	161
2001	553	172	326	141	83	3	488	200
2002	592	187	317	141	128	6	522	242

Economic Costs

CY	Capital +O&M	Fuel	Technic. Assistan.	Total
	(US$thousands)			
1987	3092	3731	0	6823
1988	14710	4610	2123	21443
1989	32602	6168	2099	40869
1990	19484	7012	2446	28942
1991	16730	7982	569	25281
1992	9323	9235	847	19405
1993	8500	10423	1221	20144
1994	7877	11475	506	19858
1995	7877	595	0	8472
1996	7877	1400	0	9277
1997	7877	2448	0	10325
1998	7877	3431	0	11308
1999	7877	4476	0	12353
2000	7877	5660	0	13537
2001	7877	6929	0	14806
2002	7877	8343	0	16220

Demand Valued @US¢/kWh: 19.2

Incremental Benefits and Costs (with program less without program cases)

CY	Benefit of Incremental Served Demand from Thermal	Increment Economic Cost	Net Economic Benefit
	(US$thousand)		
1987	245	6823	-6578
1988	2639	16973	-14335
1989	13751	37004	-23253
1990	29839	26434	3405
1991	36735	22946	13789
1992	42030	17070	24960
1993	45800	17809	27991
1994	48300	17524	30777
1995	3110	8056	-4946
1996	7477	8861	-1384
1997	13166	9909	3256
1998	18504	10892	7611
1999	24192	11937	12255
2000	30932	13121	17810
2001	38412	14390	24020
2002	46488	15804	30684

Economic Rate of Return 25.3%

Without Development Program Case

Mogadishu System Energy Demand and Supply 1987-2002

CY	Mogadishu Energy Supplied	Supply to Mogadishu: Hydro (B'heere)	Oil-fired Steam	Diesel Units	Gas Turbines	Mogadishu Served Demand: Total	Thermal
	(GWh)		(GWh)			(GWh)	
1987	108		55	52	0	90	90
1988	128		61	74	0	106	106
1989	110		61	52	0	92	92
1990	67		61	6	0	56	56
1991	61		61	0	0	51	51
1992	61		61	0	0	51	51
1993	61		61	0	0	51	51
1994	61		61	0	0	51	51
1995	242	242	0	0	0	201	0
1996	242	242	0	0	0	201	0
1997	242	242	0	0	0	201	0
1998	242	242	0	0	0	201	0
1999	242	242	0	0	0	201	0
2000	242	242	0	0	0	201	0
2001	242	242	0	0	0	201	0
2002	242	242	0	0	0	201	0

Economic Costs

CY	Capital +O&M	Fuel	Technic. Assistan.	Total
	(US$thousands)			
1987	476	3994	0	4470
1988	476	3389	0	3865
1989	416	2092	0	2508
1990	416	1919	0	2335
1991	416	1919	0	2335
1992	416	1919	0	2335
1993	416	1919	0	2335
1994	416	1919	0	2335
1995	416	0	0	416
1996	416	0	0	416
1997	416	0	0	416
1998	416	0	0	416
1999	416	0	0	416
2000	416	0	0	416
2001	416	0	0	416
2002	416	0	0	416

Notes

1/Mogadishu energy requirement projected from 1995 onwards at an annual growth rate of 7.0% and includes system technical losses.
2/Juba Valley demand is based on Kennedy & Donkin's forecast.
3/Baardheere supply becomes available to Mogadishu and the Juba Valley by the start of 1995.
4/The amount of Baardheere energy utilized in Mogadishu is limited to less than the available energy (530GWh/year) minus the amount supplied to the Juba Valley by the amount of generating capacity installed at Baardheere.
5/Baardheere capital and O&M costs are not included in the economic cost streams.

ANNEX 7.1

SOMALIA

POWER REHABILITATION AND ENERGY PROJECT

Documents Entered into Project File

1. Kennedy and Donkin. Somalia - Power Planning Study. Final report - February 1987.

2. Westinghouse Electric SA. Rehabilitation of Mogadishu Power System. Final report and recommendations - March 1987.

3. Societe Generale pour l'Industrie. Project Data Review. Feasibility study and project preparation for the extension of the power supply system in Mogadishu - December 1983.

4. Bechtel National Inc. System Rehabilitation Assessment and Management Audit of ENEE. Summary report - May 1986.

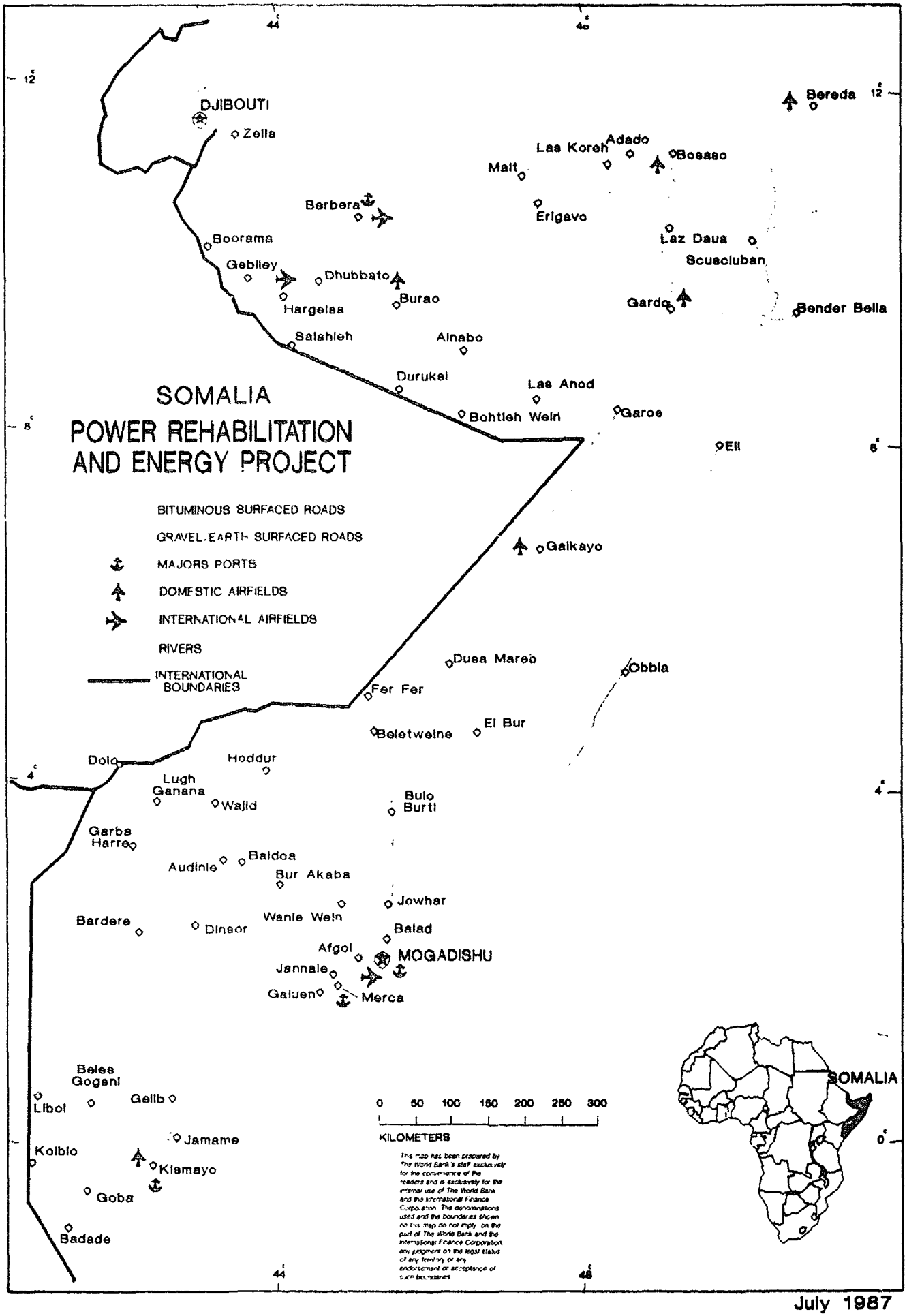
5. Energy Development International. Energy Strategies for Somalia. Summary report of the National Energy Assessment - October 1982.

World Bank Documents

6. Report No. 6542-SO. Somalia - Recent Economic Developments and Medium Term Prospects - February 1987.

7. Report No. 5796-SO. Somalia - Issues and Options in the Energy Sector - December 1987.

MAP SECTION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POWER REHABILITATION AND ENERGY PROJECT
BITUMINOUS SURFACED ROADS
GRAVEL, EARTH SURFACED ROADS
MAJORS PORTS
DOMESTIC AIRFIELDS
INTERNATIONAL AIRFIELDS
RIVERS
INTERNATIONAL BOUNDARIES
DJIBOUTI
Zeila
Berbera
Boorama
Gebiley
Dhubbato
Hargeisa
Burao
Salahleh
Alnabo
Durukel
Bohtleh Wein
Las Anod
Garoe
Ell
Bereda
Las Koreh
Adado
Bosaso
Malt
Erigavo
Laz Daua
Scuecluban
Gardo
Bender Bella
Galkayo
Duaa Mareb
Obbia
Fer Fer
Beletweine
El Bur
Dolo
Hoddur
Lugh Ganana
Wajid
Bulo Burti
Garba Harre
Audinle
Baidoa
Bur Akaba
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Dinaor
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Balad
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KILOMETERS
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SOMALIA

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