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ENERGY IN WEST AND CENTRAL AFRICA: ISSUES, PROBLEMS, AND DONOR ACTIVITIES

Final Report

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PREFACE

This report is a revised version of an earlier report (No. 88-12), with the same title, dated June 1988. Revisions were made to the earlier report in response to comments received from the Regional Economic and Development Services Office for West and Central Africa (REDSO/WCA), for whom the report was prepared. The major change in the report is that it has been expanded to cover five additional countries: Central African Republic, Congo, Equatorial Guinea, Gabon, and Sao Tome and Principe. Information about these countries has been incorporated into the body of the report and all of the exhibits, and summaries of their energy situations have been prepared and included in Annex B. In addition, since completion of the earlier report, more detailed information about Liberia was obtained. Therefore, Annex B of this report includes a more complete summary of Liberia's energy situation. Finally, minor changes were made to the report introduction (page 1, para. 2) concerning REDSO/WCA's responsibilities and request for S&T/EY assistance.

CONTENTS

ENERGY IN WEST AND CENTRAL AFRICA: ISSUES, PROBLEMS, AND DONOR ACTIVITIES

I. INTRODUCTION

West and Central Africa has the lowest energy consumption per capita of any region in the world and faces a number of serious constraints to ensuring adequate, affordable, and reliable energy supplies to fuel the region's economic growth and development. These constraints include fuelwood shortages which are already affecting 130 million people in 34 African countries (including Southern and Eastern Africa), a crippling dependence on imported fuels, inadequate, unreliable, and inefficient electricity supplies, and a shortage of skilled manpower to plan and implement least-cost energy policies and programs.

The U.S. Agency for International Development's (A.I.D.) Regional Economic and Development Services Office for West and Central Africa (REDSO/WCA) is responsible for the provision of specialized program advice and assistance to A.I.D. missions and offices in 24 countries of West and Central Africa (Exhibit 1). In the exercise of his responsibility, REDSO/WCA's Energy Officer has requested that A.I.D.'s Office of Energy (S&T/EY) provide background information on the energy situation in these countries and the activities of bilateral and multilateral donors in the region. This information will be used to help identify appropriate and effective energy activities for A.I.D. and to ensure that A.I.D's energy assistance in the region complements other donors' activities.

To assist in this effort, RCG/Hagler, Bailly, the prime contractor for S&T/EY's Energy Conservation Services Program, has prepared this summary of the energy situation in the region and the energy activities of other donors.

Data Sources

In preparing this report, RCG/Hagler, Bailly reviewed the available literature and data on energy in Africa and contacted bilateral and multilateral donors to obtain information on their energy assistance programs. Most of the bilateral donors contacted did not have information on their energy programs in their Washington, D.C. offices. Letters have been sent to these donors' (e.g., France, Germany, Japan, United Kingdom) home offices requesting information on their energy programs. This information will be forwarded to S&T/EY when it is received.

The literature reviewed included:

EXHIBIT 1: REGIONAL ECONOMIC AND DEVELOPMENT SUPPORT OFFICE - WEST AND CENTRAL AFRICAN COUNTRIES

Benin
Burkina Faso
Cameroon
Cape Verde
Central African Republic
Chad
Congo
Cote d'Ivoire
Equatorial Guinea
Gabon
The Gambia
Ghana
Guinea (Conakry)
Guinea-Bissau
Liberia
Mali
Mauritania
Niger
Nigeria
Sao Tome and Principe
Senegal
Sierra Leone
Togo
Zaire

- The Joint UNDP/World Bank Energy Sector Management Assistance Programme's (ESMAP) country energy assessments and activity and project reports
- World Bank and African Development Bank project appraisal reports
- Annual reports and project summaries of bilateral (e.g., Canada, Denmark) and multilateral (United Nations Development Program, EEC) donor agencies
- United Nations Energy Statistics Yearbook
- Studies on energy in Africa by the International Development Research Center (Ottawa) and the World Bank
- A.I.D. Congressional Presentations

A complete list of sources is presented in the bibliography in Annex A.

In general, published information on energy in West and Central Africa is sparse and of uneven quality, and there are very few regional studies. The most complete sources of country energy information are the ESMAP energy assessments. However, some assessments (e.g., Gambia, Nigeria, Senegal) are up to five years old and therefore somewhat dated. In addition, ESMAP has not conducted assessments for Cameroon, Central African Republic, Chad, Equatorial Guinea, or Mali, countries on which there is also very little energy information from other sources. A.I.D.'s Energy Initiatives for Africa program produced a series of short, unpublished briefing papers on the energy situation in each country. However, most of these papers were prepared in 1983 and are also somewhat dated.

Organization of the Report

This report is divided into four sections, including this introduction, and two appendices. Section 2 presents an overview of the energy situation in the region and summarizes the key energy issues and problems that emerged from the literature review. Section 3 discusses the energy assistance programs of major bilateral and multilateral donors. Section 4 makes some very preliminary and general recommendations for targeting A.I.D.'s energy activities in West and Central Africa. Annex A contains a bibliography of sources consulted to prepare this report. Annex B presents a brief summary of the energy situation in individual countries for which information was available. These country summaries are generally based upon the ESMAP energy assessments.

II. THE ENERGY SITUATION IN WEST AND CENTRAL AFRICA

This section describes the general energy situation in the 24 West and Central African countries and summarizes the region's major energy issues and problems. Overviews of the energy situation in specific countries are presented in Annex B.

Energy Resources

West and Central Africa has substantial energy resources, including hydro, oil, gas, coal, uranium, biomass, solar and wind. However, these resources are distributed very unevenly, and a number of countries, such as Burkina Faso, the Gambia, Guinea-Bissau, Mali, and Mauritania, have a very limited resource base to meet their energy needs.

Hydro is the most widely distributed energy resource, with large hydroelectric potential found in a number of countries, including Benin, Congo, Cote d'Ivoire, Ghana, Guinea, Senegal, Sierra Leone, Togo, Zaire. Zaire has 32 percent of Africa's total exploitable hydro resources. However, much of the region's hydro potential has not been developed. For example, in Cote d'Ivoire only 20 percent of the hydroelectric potential has been harnessed. The countries with the largest oil reserves are Nigeria, Cameroon, Gabon, Congo, and Cote d'Ivoire. Smaller fields exist in Benin, Ghana, Guinea-Bissau, Niger, Senegal, and Zaire. There are natural gas reserves in all of the oil-producing countries. Proven reserves are around 1,000 billion m^3 in Nigeria, and 100, 85, and 12 billion cubic meters, respectively, in Cameroon, Cote d'Ivoire, and Gabon. Much smaller fields are reported in Ghana and Senegal. There are some small coal deposits in Nigeria and Niger, but most of Africa's coal resources are located in eastern and southern Africa. Niger has large reserves of uranium, which are being developed for export. Some uranium has been found in Nigeria and Mali.

Biomass resources -- particularly wood and agricultural residues -- are the most important energy source for most the region. However, as discussed below, West and Central Africa's forests are being depleted at an alarming rate and deforestation has become one of the region's most serious problems. Still, a large share of the region's energy potential from biomass, primarily agricultural residues, remains untapped. For example, 500,000 toe of biomass residues are generated annually by agroindustry and sawmills in Cote d'Ivoire, of which only one-half has been tapped for energy use.

Given the region's geographic and climatic conditions, there appears to be significant potential for harnessing solar energy. In Burkina Faso, there has been some testing of solar water heaters and photovoltaic (PV) pumping for village and livestock water supply. Mali has a larger program, with over 100 PV pumping stations, lighting, refrigeration and communication systems, over 200 urban passive water heaters, and some solar dryers.

Energy Production

The region's oil producers are Benin, Cameroon, Congo, Cote d'Ivoire, Gabon, Nigeria, and Zaire. Only Cameroon, Gabon, and Nigeria are considered major oil producers. Of the primary fuels other than wood, all of the hydro, most of the gas, and some of the oil and coal are used to generate electricity (see Exhibit 2). Hydro accounts for most of the capacity in Cameroon, Congo, Cote d'Ivoire, Ghana, and Zaire, and a significant share in Central African Republic, Gabon, Liberia, Mali, and Nigeria. The remaining capacity is oil-fired except in Niger (coal) and Nigeria (coal and natural gas). Industrial autoproduction is important in Ghana, Ivory Coast, Liberia, and Sierra Leone. Estimates of annual fuelwood production per capita (including wood used to make charcoal) range from 0.1 to 1.5 m^3 for 11 of the 24 West and Central African countries (Burkina, Cameroon, Cote d'Ivoire, Ghana, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, and Sierra Leone). Wood production data are generally less reliable than data for other fuels.

Energy Consumption

Energy consumption in most countries in the region is dominated by an almost complete reliance on imported petroleum fuels for meeting the energy needs of the modern sector (with the exception of Cameroon, Congo, Gabon, Nigeria, and Zaire) and on fuelwood for meeting household needs. Exhibit 3 presents the composition of total energy requirements in each country.

The principal energy requirement in most countries is for household cooking, which depends almost completely on fuelwood, charcoal, and other biomass resources. In Burkina Faso, household cooking accounts for 90 percent of primary energy consumption. In Guinea, households account for 73 percent of energy consumption. Households account for 90 percent of energy consumption in Guinea-Bissau and 86 percent of final energy demand in Sierra Leone.

The most striking feature of energy consumption in Africa is the use of non-commercial energy, primarily fuelwood, but also agricultural residues. Non-commercial energy accounts for about 80 percent of total energy consumption in Sub-Saharan Africa. It is used to meet the energy requirements of both households and small-scale industries in rural areas since other forms are either unavailable or too expensive. Firewood provides 90 to 98 percent of the energy needs of rural people. Forest resources currently satisfy 86 percent of the gross energy requirements in Benin. In Burkina Faso, over 91 percent of primary energy requirements are met by domestic biomass energy, of which fuelwood accounts for 84 percent and crop residues account for 7 percent. Fuelwood accounts for 81 percent of total energy consumption in the Central African Republic. In Ghana, wood meets 73 percent of primary energy demand. Fuelwood accounts for 89 percent of total energy supply in Guinea-Bissau and 87 percent in

Exhibit 2

1985 NET INSTALLED CAPACITY OF ELECTRIC GENERATING PLANTS
IN WEST AND CENTRAL AFRICA
(in MW)

Country	Total	Thermal	Hydro
Benin	15	15	--
Burkina Faso	40	40	--
Cameroon	570	73	497
Cape Verde	4	4	--
Central African Rep.	30	10	20
Chad	38	38	--
Congo	149	29	120
Cote d'Ivoire	1163	278	885
Equatorial Guinea	7	6	1
Gabon	200	75	125
Gambia	11	11	--
Ghana	1060	108	952
Guinea (Conakry)	175	125	50
Guinea-Bissau	7	7	--
Liberia	325	244	81
Mali	56	36	20
Mauritania	55	55	--
Niger	65	65	--
Nigeria	4025	2125	1900
Sao Tome & Principe	6	4	2
Senegal	180	180	--
Sierra Leone	106	102	4
Togo	36	32	4
Zaire	2166	55	2111

-- = not applicable

Source: United Nations Energy Statistics Yearbook 1985

Exhibit 3

1985 ENERGY CONSUMPTION IN WEST AND CENTRAL AFRICAN COUNTRIES

Country	1985 Total Energy Requirements ('000 TJ)					
	Solids	Liquids	Gas	Primary elec.	Tradition-al Fuels	TOTAL
Benin	--	4	--	--	41	45
Burkina Faso	0	6	--	0	63	69
Cameroon	0	122	--	27	80	229
Cape Verde	0	1	--	0	--	1
Central African Rep.	--	3	--	0	29	32
Chad	0	3	--	0	30	33
Congo	--	4	0	3	16	23
Cote d'Ivoire	--	55	--	17	81	153
Equatorial Guinea	--	1	--	0	4	5
Gabon	--	30	8	3	12	53
Gambia	--	2	--	0	7	9
Ghana	0	26	--	36	71	133
Guinea (Conakry)	--	12	--	0	30	42
Guinea-Bissau	--	1	--	0	4	5
Liberia	--	21	--	3	37	61
Mali	--	6	--	0	45	51
Mauritania	0	8	--	0	0	8
Niger	2	8	--	1	36	47
Nigeria	2	404	220	26	857	1509
Sao Tome & Principe	N/A	N/A	N/A	N/A	N/A	N/A
Senegal	--	31	--	0	40	71
Sierra Leone	0	8	--	0	75	83
Togo	0	3	--	1	6	10
Zaire	9	32	--	53	275	369

NOTES

Solid fuels: hard coal, lignite, peat, coke, oil shale
Liquid fuels: crude petroleum, natural gas liquids, petroleum products
Gases: natural gas, gasworks gas, coke-oven gas, blast furnace gas
Primary electricity: geothermal, hydro, nuclear, wind
Traditional fuels: fuelwood, bagasse, charcoal, animal, vegetal, and other wastes

0 = less than 0.5 of the unit specified (i.e., less than 500 TJ) or nil
-- = not applicable
N/A = Data not available

Source: United Nations Energy Statistics Yearbook 1985

Niger. Biomass energy sources account for 86 percent of total energy consumption in Zaire.

The transport sector is often the major consumer of petroleum products. For example, transport accounts for 50 percent of petroleum product consumption in Guinea-Bissau, 59 percent In Cote d'Ivoire, 74 percent in Mali, 74 percent in Nigeria, 53 percent in Sao Tome and Principe, and 59 percent in Sierra Leone.

Industry accounts for a major share of commercial energy consumption in the region. For example, industry accounts for 31 percent of total commercial energy consumption in Cote d'Ivoire, 39 percent in Gabon, 79 percent in Togo, and 55 percent in Zaire. However, this is dominated by industry's consumption of electricity, which approaches and sometimes exceeds 50 percent of total electricity consumption (Cote d'Ivoire: 30 percent, Gabon: 55 percent, Liberia: 73 percent, Niger: 48 percent, Zaire: 86 percent).

There is a very low level of electrification in West and Central Africa, which is a major constraint upon industrialization. For example, in 1985 only about 3 percent of Zaire's population has access to electricity. In Ghana, less than 10 percent of the population has access to electricity supplies. Per capita electricity consumption in Sub-Saharan Africa overall is 35 to 75 times lower than in industrialized countries.

Key Energy Issues and Problems

Most countries in West and Central Africa face the dual problems of inefficient and unreliable energy supplies and inefficient end-use of both commercial and traditional energy. A key problem is the lack of investment capital, particularly foreign exchange, to finance energy supply and development. In addition to financial and economic problems, technical (e.g., lack of skills) and environmental factors (e.g., limited resource base) are major constraints on the energy sector.

The key energy issues and problems that emerged from the literature review and that generally apply to West and Central African countries are:

- Lack of adequate and reliable data for energy planning
- High dependence on imported oil (with the exception of Nigeria, Cameroon, Congo, Gabon, and Zaire)
- Deforestation and fuelwood shortages
- Power system inefficiency and unreliability
- Poor petroleum sector procurement, marketing, and distribution systems

- Lack of skilled manpower and adequate institutional frameworks to plan and implement energy policies and programs
- Inefficiency of energy end-use: fuelwood and charcoal in the household sectors and petroleum products and electricity in the industry, buildings, and transport sectors
- Inefficient pricing policies (although a number of countries have taken steps to rationalize their energy pricing systems since the energy assessments were conducted)

These issues are discussed in more detail below

Lack of Data

The analytical basis for making energy decisions in West and Central Africa is insufficient. Energy consumption statistics are generally not reliable or complete enough for analysis, forecasting, and planning. There is a serious lack of energy consumption data disaggregated by sector and subsector (e.g., households, transport, industry), and very sparse data on non-commercial energy consumption. Some countries still do not have comprehensive energy resource surveys (e.g., Mali). There is not enough information on fuelwood problems. Surveys are required to understand wood and charcoal consumption patterns, as well as the determinants of substitution between these and other fuels. A more careful evaluation of fuelwood policies is also required, concentrating on the lessons learned from supply and demand side programs.

Dependence on Petroleum Imports

Although a few countries are net oil exporters (i.e., Cameroon, Congo, Gabon, Nigeria, Zaire), most are very dependent on imported petroleum (Exhibit 4) and face serious problems in obtaining foreign exchange to finance their energy imports (due to depressed prices for major export commodities and debt servicing). In many cases, petroleum imports supply all of a country's non-woodfuel energy needs (e.g., Burkina Faso, the Gambia, Guinea Bissau, Mauritania, Niger). With a limited resource base, these countries' have few options for reducing their dependence on imported petroleum. The net balance of energy trade is negative for almost all countries, with the possible exceptions of Cameroon, Congo, Gabon, Nigeria, and Zaire.

Deforestation and Fuelwood Shortages

Wood and charcoal are the most important rural cooking fuels in all countries, and the depletion of wood resources has become a serious problem. Most fuelwood is consumed with an efficiency of only 5 to 10 percent, resulting in forest depletion of

Exhibit 4

DEPENDENCE ON ENERGY IMPORTS

Country	Net Energy Imports As % of Merch. Exports (1985) 1/	
Benin	N/A	
Burkina Faso	60	3/
Cameroon	1	2/
Cape Verde	N/A	
Central African Republic	1	2/
Chad	N/A	
Congo	1	2/
Cote d'Ivoire	10	3/
Equatorial Guinea	N/A	
Gabon	N/A	
Gambia	27.4	3/
Ghana	9	2/
Guinea	N/A	
Guinea-Bissau	N/A	
Liberia	16	2/
Mali	55	2/
Mauritania	8.6	3/
Niger	3	2/
Nigeria	N/A	
Sao Tome & Principe	N/A	
Senegal	17	2/
Sierra Leone	26	3/
Togo	10.4	3/
Zaire	12	2/

N/A = Not applicable or not available

1/ Source: World Development Report 1987
2/ Indicates figure for year other than 1985
3/ Source: International Monetary Fund. International Financial Statistics. January 1988. For Burkina, data is for 1984. Figures represent petroleum imports as a percentage of total exports for 1985.

about 4 million hectares per year. Fuelwood shortages already affect 180 million people in 34 African countries.

According to the World Bank almost all of West and Central Africa faces fuelwood shortages:

> Very serious fuelwood shortages: Burkina Faso, Chad, Cote d'Ivoire, Mali, Mauritania, Niger, Senegal
>
> Serious fuelwood shortages: Benin, Cameroon, Cape Verde, Congo, Equatorial Guinea, Gabon, Gambia, Ghana, Guinea Bissau, Liberia, Nigeria, Sao Tome and Principe, Sierra Leone, Togo, Zaire[1]

The only countries not facing serious fuelwood shortages are Central African Republic and Guinea.

There is an urgent need to increase fuelwood production and improve utilization of cook stoves. However, across countries there is a lack of institutions and manpower to adequately manage the countries' forest resources. Few countries have management plans for the rational exploitation of forest resources.

Power System Inefficiency and Unreliability

Serious technical inefficiencies and unreliability of power supplies are widespread in West and Central Africa and the quality of electricity service has declined in recent years. Problems include operations and maintenance problems, poor management, financially troubled public utilities, lack of spare parts, transmission and distribution losses, lack of skilled manpower, and in many cases, tariffs that have not been adequately adjusted to reflect economic costs. In Nigeria, for example, frequent power outages have resulted from a lack of spare parts, inadequate operational supervision, and poor maintenance. In Liberia, there are problems of a low power factor and a distribution system which suffers from overloaded transformers and poor connections. Electricity losses in Cape Verde are about 38 percent. In Guinea Bissau, over half of the installed generating capacity is out of service and about 40 percent of the electricity produced is lost (and stolen) in the distribution network. Electricity losses in Liberia are 35 percent of generation, of which 20 percent is due to unbilled customers and 15 percent is due to technical losses. In 1986, less than half of Sierra Leone's installed generating capacity was in service and between one-third and one-half of the electricity generated was being lost in technical and non-technical losses; consumers were experiencing frequent and prolonged supply interruptions. In Ghana, diesel stations and distribution line systems are in poor working order due to a lack of spare parts

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[1] World Bank. Deforestation, Fuelwood Consumption, and Forest Conservation in Africa: An Action Program for FY86-88. January 27, 1986.

resulting from foreign exchange shortages. Isolated stations are old and unreliable and uneconomic to keep in service. In Senegal, there has been a serious deterioration in the power supply system. The largest power plant needs to be rehabilitated and the other main generating facility is inefficient and obsolete and should be replaced. The Dakar region distribution system is poorly maintained, resulting in poor quality of service and high losses (16 percent). The Gambia Utilities Corporation's distribution lines and transformers are overloaded and the country's power facilities need to be expanded and rehabilitated. In Zaire, nearly all power plants, especially isolated thermal and hydro facilities, need rehabilitation.

There is an urgent need for programs in power plant rehabilitation, transmission and distribution loss reduction, and technical, economic, and managerial training.

Poor Petroleum Sector Supply, Marketing and Distribution Systems

There is a great need to improve the procurement, marketing, and distribution of petroleum products. Despite the decline in international petroleum prices since the early 1980s, petroleum imports have remained a burden on most African economies. Supply systems are often inadequate, adding to the costs of petroleum. In Burkina Faso, for example, petroleum supply is high cost because of high ex-refinery prices and long and inefficient transportation links. Another problem is that with no cracking capacity (other than Nigeria), refineries are severely limited in their ability to meet the demand for middle distillates, which has generally grown much faster than the demand for heavier fuel oil. Restructuring of refining capacity has been suggested both because of problems in the output-demand mismatch and because of chronic underutilization.

Lack of Skilled Manpower and Institutional Frameworks

Across all countries, there is a serious lack of personnel in the energy sector with adequate technical, financial, economic, managerial, and energy planning skills. In some cases (e.g., Zaire), manpower problems are the main constraint to efficient energy planning and management. Lack of technical expertise in the power sector in many countries has resulted in the high losses and unreliable electricity supply. For example, functional illiteracy is pervasive in the Gambia Utilities Corporation and Niger's utility lacks managerial, technical, and financial personnel. Senegal's energy institutions lack qualified personnel, especially in economics and finance and in specialized areas such as wood and household fuels.

Many countries (e.g., Benin, Sierra Leone, Togo) lack a central government organization responsible for formulating and coordinating energy policies. There is a general lack of consistent energy planning and development for petroleum, power, and forestry in all countries.

Inefficiency of Energy End-Use

Inefficient energy end-use in the household, transport, buildings, and industry sectors was identified as a problem in all 24 countries. Firewood is the main energy source and is consumed with very low levels of efficiency (5 to 10 percent). Conversion losses in charcoal kilns range from 60 to 90 percent. There is a great potential to increase the efficiency of fuelwood and charcoal utilization. In addition, much of the agroindustrial residues are wasted, offering a large underutilized potential for energy use. In Ghana, for example, substantial amounts of residues from the wood processing industry are currently wasted. These residues could be used to generate steam at the mills and to produce charcoal and sawdust briquettes for urban commercial and domestic consumption.

In the industry and buildings sectors, outmoded and poorly maintained equipment and suboptimal techniques in energy use result in large energy losses. According to the World Bank, energy efficiency in the industrial sector in Ghana is low and could be increased by at least 15 percent through housekeeping measures. However, policy, institutional, economic, and financial constraints limit the effectiveness of any government program to rationalize energy use in Ghanaian industry. In Niger, the consumption of electricity in buildings has increased rapidly in recent years and is inefficient due to dilapidated equipment and poor operating practices. The World Bank estimates that 40 percent of electricity consumption for air conditioning could be saved through more efficient equipment and practices.

Inefficient Pricing Policies

In many countries electricity tariffs and prices for petroleum products and fuelwood do not reflect real economic costs. This problem is especially serious for countries facing serious fuelwood shortages, where fuelwood prices are low and households have no incentive to use wood efficiently. A number of countries have been rationalizing tariffs and petroleum product prices as part of structural adjustment programs.

III. DONOR-SUPPORTED ENERGY ACTIVITIES IN WEST AND CENTRAL AFRICA

The donors that are the most active in the energy sector in West and Central Africa are the World Bank, the African Development Bank, the United Nations, and the European Economic Community. Bilateral donors such as the Canadian International Development Agency (CIDA) and the Danish International Development Agency (DANIDA) offer direct energy sector assistance and also participate in ESMAP. Other bilateral donors, including the French, British, German, and Japanese, support energy projects in West and Central Africa, but detailed information was not available at the time this report was prepared. Exhibit 5 summarizes the major donors' past, present, and prospective energy activities in the region. This list is not exhaustive and is based solely upon what was readily available from published sources.

World Bank

The World Bank is the largest donor to the energy sector in West and Central Africa. The World Bank supports energy activities through two mechanisms: 1) IBRD and IDA loans and 2) Joint UNDP/World Bank ESMAP program energy assessments, energy-related preinvestment activities, and technical, institutional and policy assistance.

Between 1978 and 1982, the World Bank lent an annual average of $26.9 million for oil, gas, and coal projects in West Africa (excludes Zaire) and $58.6 million for power projects. The lending program for 1983 through 1987 is summarized below:

SECTOR	1983	1984	1985	1986	1987
Oil, gas, coal	36.0	51.0	2.6	---	15.0
Power	24.0	30.0	15.5	48.0	6.3
Total	60.0	81.0	18.1	48.0	21.3

Source: World Bank Annual Report 1987.

The ESMAP program was started jointly by the World Bank and the United Nations Development Programme in 1983, as a companion to the Energy Assessment Program which was established in 1980. ESMAP is supporting financially and technically by donor countries and bilateral and multilateral organizations. ESMAP is currently carrying out activities in more than 50 countries, including all West and Central African countries except for Cameroon, Chad, and Equatorial Guinea.

EXHIBIT 5: SUMMARY OF DONOR-SUPPORTED ENERGY PROJECTS IN WEST AND CENTRAL AFRICA

Country	USAID Projects 1/			UNDP/WB ESMAP 10/			WORLD BANK		
	Years	Mill$		Years	Mill$	Projects	Years	IBRD/IDA 11/ Mill$	Projects
REGIONAL/CENTRALLY FUNDED	1982-89	7.3	Energy Initiatives for Africa (EIA) (698-0424)	1987		Regional Seminar on Reducing electric power system losses			
	1987-	14.0	Natural Resources Management Support (698-0467)	1988-	0.6	Optimizing Petroleum Supplies in Sub-Saharan Africa			
				1987-	0.2	Ecole Superieure Interafricaine de l'Electricite (ESIE) In-Depth Training Study			
			Forest Resources Management (936-5519) - TA & training	prospect	0.1	Guidelines for Utility Management & Billing			
Benin				1985		Energy Assessment	1982-86	5.0	TA to Petroleum Sector Project
							1985-87	18.0	Seme Oil Field Phase II Development Project
							1985-90	2.6	Forestry Project, including planting & strengthening of Forestry & Water Department
							1985-89	15.0	Nangbeto Hydroelectric Project
Burkina Faso	1981-86	4.66	Forestry Education & Development (686-0235)	1986		Energy Assessment			
	1985-	1.00	Southwest Region Reforestation (686-0934)	1986		Technical Assistance Program	1980	14.5	Rural Afforestation
	1987		EIA: Economics Training Program for Forestry/Natural Resource Managers	prospect	0.1	Petroleum Supply Management Study 2/			
				1988-	0.7	Urban Household Energy Strategy 3/			
Cameroon							1983-88	7.0	Forestry Project, includes plantations, institution-building
Cape Verde				1984		Energy Assessment			
				1988-	0.3	Household Energy Strategy Study	1988-	8.0	Water sector project which includes formulation of energy master plan, rehab of infrastructure, and tariff studies 12/
							1988-	4.0	Infrastructure Rehab project which includes improving efficiency of energy sector by financing spare parts & other materials & TA 13/
Central African Republic				prospect	0.3	Energy Assessment 24/			
				prospect	0.4	Household Energy Strategy Study	prospect	8.0	Power: Construction of regulatory/ storage dam on M'BALI river, strengthening of power utility in tech & financial operations 19/
							prospect	15.0	Forestry/Environment: Aerial photography, forest inventory, forest management plan, forestry protection, institutional development and technical assistance 2/
Chad				prospect	0.5	Household Energy Strategy Study	prospect	30.0	Petroleum-to support implementation of least cost product supply system & provide TA to strengthen government management of sector14/
							prospect	5.0	Petroleum exploration

EXHIBIT 5: SUMMARY OF DONOR-SUPPORTED ENERGY PROJECTS IN WEST AND CENTRAL AFRICA

Country	USAID			UNDP/WB ESMAP 10/			WORLD BANK IBRD/IDA 11/		
	Years	Mill$	Projects 1/	Years	Mill$	Projects	Years	Mill$	Projects
Congo				1988		Energy Assessment	1980-86	5.0	Petroleum Sector Technical Assistance
				prospect	0.3	Power Development Plan, incl. data collection, demand on load forecast, optimization, recommendations for investment decisions 7/	1987-89	4.0	Second Technical Assistance Project, includes formulation of more effective petroleum development strategy
				prospect	0.3	Power efficiency			
Cote d'Ivoire	1986-88	0.3	EIA: National Energy Conseration Planning	1985		Energy Assessment	prospect	100.0	Energy Sector Adjustment Operation 15/
	1987		EIA: Natural Resources Economics Workshop	1987		Improved Biomass Utilization --Pilot Projects using Agroindustrial Residues	1981-87	33.0	First Power Project, includes equipment, planning studies, overhaul of generators
	1987		EIA: Charcoal production project design	prospect	0.8	Power Efficiency TA 5/	1985-90	31.3	Second Forestry Project, includes plantations, strengthen institutions
				prospect	0.1	Power Systems Efficiency Study 6/			
Equatorial Guinea							1983-88	2.4	Petroleum Sector Technical Assistance
							1984-90	6.0	Technical Assistance Project, includes forestry specialist
Gabon				1988		Energy Assessment			
				prospect	0.8	Natural Gas Development			
Gambia	1979-86	1.58	Gambia Forestry (635-0205)	1983		Energy Assessment	1987-	7.0	Water Supply/Electricity- includes Banjul electricity system rehab, TA & training
				1985		Petroleum Supply Management Assistance	1988-93	7.0	Water Supply & Electricity Project includes improvement of distrib. system, generation capacity expansion, rehabilitation, TA to strengthen utility, training
				1985		Solar PV Applications	1981		Energy Credit, includes financing transformers, cable & spare parts to begin rehabilitation of T&D
				1985		Solar Water Heating Retrofit	1982-88	1.5	Energy Project to develop strategy for accelerated hydrocarbon exploration, & strengthen power & forestry sectors
Ghana				1986		Energy Assessment	1983-	26.0	Forest industries rehabilitation
				1988-	0.2	Improved Charcoal Production	1983-87	11.0	Energy Project, includes petroleum exploration, TA to petroleum corp. & Nat'l Energy Board, energy info center, studies on petroleum pricing, renewables, minihydro, natural gas
				1988-	0.3	Improved Charcoal Stoves			
				1988	0.1	Industrial Energy Rationalization 8/			
				prospect	0.9	Industrial Energy TA 2/			
							1984-87	6.9	Refinery Rehabilitation & TA
							1986-91	28.0	Power System Rehabilitation
							1987-92	6.3	Northern Grid Extension
							prospect	45.0	ECG Fifth Power Project

EXHIBIT 5: SUMMARY OF DONOR-SUPPORTED ENERGY PROJECTS IN WEST AND CENTRAL AFRICA

Country	USAID			UNDP/WB ESMAP 10/			WORLD BANK		
	Years	Mill$	Projects 1/	Years	Mill$	Projects	Years	IBRD/IDA 11/ Mill$	Projects
Guinea	1983-86	0.65	Appropriate Technology (cookstoves) (675-0208)	1986		Energy Assessment	1984-87	8.0	Petroleum Exploration Promotion, also includes TA to improve reliability of electricity service
	?-1986		Community Forestry	prospect	0.5	Household Energy Strategy4/	1986-90	8.0	Second Power Engineering & TA, includes repairs to Banea dam & assessment of sites for hydro-electric development
							prospect	35.0	Power II: exploit hydro resources & reduce oil import bill; provide power utility infrastructure for industrial & commercial activity; transmission facilities; increase reliability; extend access to service 19/
Guinea-Bissau				1984		Energy Assessment	1981-86	6.7	Petroleum Exploration Project
				1985		Recommended TA Projects	1983-87	12.8	Second Petroleum Explor. Project, includes institutional support & training & pricing study
				prospect	0.1	TA to Power Sector 2/			
				prospect	0.2	Charcoal Production/Utiliz.			
Liberia	1984-86	0.3	EIA: Energy Planning Advisor	1984		Energy Assessment	1978-87	6.0	Forestry Project
				1985		Recommended TA Projects	1981-87	5.0	Petroleum Exploration Promotion
				1988	0.2	Power Efficiency 8/	1986-90	2.6	Second Petroleum Sector TA Project
Mali	1978-83	4.5	Renewable Energy (688-0217)	prospect	0.3	Energy Assessment	prospect	40.0	Power II- Policy & institutional reforms, & financial restructuring to improve performance of energy sector. Includes construction of transmission line, reinforcement & extension of distribution system rehab of hydro plants & diesel units, TA, training, spare parts, studies 16/
	1985-88	0.66	Vita Woodstoves (688-0237)	prospect	0.5	Household Energy Strategy			
	1983-	1.66	Village Reforestation (688-0937)				1983-88	24.0	Power/Water Project, includes development of master plan, investments, institutional development, manpower assessment
	1986-	15.50	Forestry Sector Development (688-0235)				1984-89	7.6	Biomass Alcohol & Energy Efficiency
	1987		EIA: Economics Training Program for Forestry/Natural Resource Managers				1986-91	6.3	Second Forestry Project, includes TA, institutional development, wood plantations, pilot rural forestry schemes
Mauritania				1985		Energy Assessment	1982-87	3.0	Petroleum Exploration Promotion
				1988-	0.3	Household Energy Strategy Study	prospect	5.0	Energy Technical Assistance, incl. petroleum exploration potential, implementation of household fuel strategy, power expansion plan

EXHIBIT 5: SUMMARY OF DONOR-SUPPORTED ENERGY PROJECTS IN WEST AND CENTRAL AFRICA

Country	USAID			UNDP/WB ESMAP 10/			WORLD BANK		
	Years	Mill$	Projects 1/	Years	Mill$	Projects	Years	IBRD/IDA 11/ Mill$	Projects
Niger	1980-	4.44	Forestry & Land Use Planning (683-0230)	1984		Energy Assessment	1988-94	31.5	Energy Project:firewood conservation, substitution of energy sources, renewables development, electric power conservation, least cost power supply, increase capability to administer petrol. explor.
	1989-	6.00	Natural Resources Management (683-0262)	1986		Status Report			
				prospect	0.1	Energy Efficiency in Bldgs2/			
	1987		EIA: ECOWAS Energy Audit Training in Utilities	prospect	0.3	Household Energy Strategy6/			
				1988	0.5	Improved Urban Cookstoves9/			
							1985-88	7.5	Power Engineering & TA Project helping define least-cost power development program, training, institutional study
							1982-88	10.1	Second Forestry Project
Nigeria				prospect	0.7	Energy Strategy Assistance	1980-87	100.0	Lagos Power Distribution Project
				1983		Energy Assessment	1982-87	100.0	Sixth Power Project, includes transmission lines, substations, transformers,spare parts,rehabilitation,master plan study
							1986-89	25.0	Gas Technical Assistance Project
							1987-95	71.0	Forestry II Project, to strengthen Forestry Department & project states through TA & training, afforestation, plantation management, new plantations
							prospect	350.0	Power VII- Program to commercialize power authority. Includes T&D system improvements; rehab of generation and transmission facilities, TA, training 26/
							prospect	17.0	Refinery Rehabilitation 25/
Sao Tome & Principe				1985		Energy Assessment			
Senegal	1986-	10.00	Reforestation & Soil Conservation (685-0283)	1983		Energy Assessment	1987-91	20.0	Energy Sector Rehabilitation, including extension & rehabilitation of T&D networks, TA to implement Electricity Authority's rehabilitation program, training, managerial & financial rehabilitation, industrial energy conservation program, petroleum pricing studies
	1979-86	3.43	Fuelwood Production (685-0219)	1985		Industrial Energy Conservation Study			
				1984		Status Report			
	1987		EIA: Economics Training Program for Forestry/Natural Resource Managers	1988	3.0	Industrial Energy Conservation 9/			
				1988	0.3	Urban Household Energy Strategy 9/			
							1983-88	9.5	Petroleum Exploration Project
							?		Power Engineering & TA Project to develop energy plan & reorganize the sector
							1982-87	9.3	Forestry Project, includes plantations, farm forestry, training
Sierra Leone	1987		EIA: ECOWAS Energy Audit Training in Utilities	1987		Energy Assessment	1982-87	5.0	Power Sector Engineering & TA
			EIA: Private Charcoal Production TA	prospect	0.2	Power System Efficiency 7/			
				prospect	0.4	Household Energy Strategy			

EXHIBIT 5: SUMMARY OF DONOR-SUPPORTED ENERGY PROJECTS IN WEST AND CENTRAL AFRICA

Country	USAID		UNDP/WB ESMAP 10/			WORLD BANK		
	Years	Mill$ Projects 1/	Years	Mill$	Projects	Years	IBRD/IDA 11/ Mill$	Projects
Togo			1985		Energy Assessment	1982-85	2.0	Power Engineering & TA, helped Togo & Benin complete preparations for Nangbeto Hydroelectric Project improving power sector planning, institution building, accounting
			1987		Power Efficiency Improvement	1985-89	15.0	Nangbeto Hydroelectric
			1986		Wood Recovery in Nangbeto Lake	prospect	15.0	Power Rehabilitation: Rehab & extension of distribution system; spares & equipment, TA & training 19/
Zaire	1987	EIA: Charcoal production project design (for World Bank)	1986		Energy Assessment	prospect	40.0	Power III- Scope to be defined 19/
			prospect	0.2	Kinshasa Power Distribution Program Review 4/	prospect	67.0	Energy I- High priority items of power utility's investment program 16/
			prospect	0.2	Power subsector institutions	1987-90	41.9	Second Power Project, includes rehabilitation, T&D rehab, maintenance, strengthen utility
			prospect	0.2	Isolated power systems	1983-87	19.0	Shaba Power System Rehabilitation Rehabilitation of electric generating stations & T&D system of Shaba region, strengthen capabilities of utility, financial assistance to Ministry of Energy to launch National Energy Commission
			prospect	0.2	Electricity marketing	1983-	45.0	Ruzizi II Hydroelectric Project (with Rwanda & Burundi), includes dam, power station, transmission line, tariff study
			prospect	0.3	Kinshasa Power System Efficiency	1984-88	3.5	Petroleum Sector Technical Assist.

EXHIBIT 5: SUMMARY OF DONOR-SUPPORTED ENERGY PROJECTS IN WEST AND CENTRAL AFRICA

Country	AFRICAN DEVELOPMENT BANK 20/ Years	Mill$	Projects	Years	Mill$ TOTAL	UNDP 21/ Projects	EUROPEAN COMMUNITY Years	Projects
REGIONAL/CENTRALLY FUNDED				1982-86	1.00	Regional Solar Energy Center	1981-90	Mali,Mauritania,Senegal:2 dams one for hydroelectricity (co-(financed w/bilateral donors)
				1986	0.04	Developing program for strengthening natural resources management capabilities in Africa		
Benin	1988-90	8.8	Electric Energy Generation & Transmission Dispatching:w/ Togo. Construction of main substation for network	1985-88	8.12	Nangbeto hydroelectric TA & training		
				1981-86	0.98	Forestry resources development		
	1982-	10.6	Water & Electricity Supply in 9 District Main Towns					
	1982-	14.2	Firewood Plantation					
	1983-	19.6	Nangbeto Hydroelectric dam					
Burkina Faso	prospect	34.9	Construction of hydroelectric dam and power station (still under study)	1978-86	1.00	Forestry resources development		
Cameroon				1986	0.14	UNDP/FAO Review & Planning Mission for Forestry Sector	1983	Hydropower Station-loan from European Investment Bank ECU 25 million
Cape Verde				1986-88	1.34	Preparatory assistance for development of hydro resources	1985-	Wind energy application demonsntrations
Central African Republic	prospect	8.2	Extension of Bangui electric network, incls construction of substations, transformer stations, tools & electrical equipment 22/					
	prospect	36.9	Construction of M'BALI hydroelectric dam 23/					
	1988-	14.1	Bangui power rehabilitation					
Chad	prospect	1.2	Study of electricity market, tariffs, and forecasts for future generating stations Terms of reference to be prepared in 1988.	1983-86	0.24	TA to petroleum sector		
				1985-90	6.07	Preparatory assistance for development & exploitation of rural hydro resources		
				1985-87	0.89	Support/strengthen forestry activities		

EXHIBIT 5: SUMMARY OF DONOR-SUPPORTED ENERGY PROJECTS IN WEST AND CENTRAL AFRICA

Country	AFRICAN DEVELOPMENT BANK 20/ Years	Mill$	Projects	Years	Mill$ TOTAL	UNDP 21/ Projects	EUROPEAN COMMUNITY Years	Projects
Congo				1981-87	2.3	Forestry development		
Cote d'Ivoire	prospect	29.9	Reforestation project (project evaluated & presented to Board in 1987)				1982	Electricity Monitoring Station ECU 11 million
	prospect	48.0	Energy sector loan					
Equatorial Guinea	1988-	21.2	Construction of 10 micro electric generating stations 23/	1979-86	1.5	Emergency Assistance in Electricity Sector		
				1985-87	0.1	Support to Ministry of Industry (Energy)		
Gabon	1988-	44.8	Electrification btwn Libreville and Port Gentil					
	prospect	16.6	Power interconnection					
Gambia	prospect		Strengthening water & electricity services, including line loss reduction through reinforcement & rehab of distribution system, TA to achieve financial viability Detailed design under preparation					
Ghana	1987-	38.1	Electricity network reinforcement & extension	1984-87	0.39	TA to National Energy Board		Petroleum refinery rehabilitation
				1984-87	0.44	TA to National Petroleum Corporation	1977	Hydroelectric dam-European Development Fund ECU 9 million

EXHIBIT 5: SUMMARY OF DONOR-SUPPORTED ENERGY PROJECTS IN WEST AND CENTRAL AFRICA

Country	AFRICAN DEVELOPMENT BANK 20/ Years	Mill$	Projects	UNDP 21/ Years	Mill$ TOTAL	Projects	EUROPEAN COMMUNITY
Guinea	prospect	8.2	Electricity (planned for 1989)	1983-87	3.46	Reforestation, Protection & management of 4 sites	
Guinea-Bissau	1988-	7.1	Rehabilitation & extension of thermal power station & distribution networks	1979-86	1.06	Electricity development & creation of national electricity & water organization	Financing of power sector master plan
	1979-	8.2	Electrification of 7 rural centers	1986-88	0.08	Assistance to public utility	
	1978-84	4.3	Renovation & extension of Bissau thermal station				
Liberia							
Mali	prospect	11.8	Energy Sector Rehabilitation (planned for 1989)				1977-81 Selingue dam (co-financed) Eur. Dvl. Fund: ECU 12 million
	1977-81	5.9	Selingue hydroelectric dam				1982-84 Solar Energy Research Center
	1986-88	1.1	Power Transmission Study				
	1984-88	13.3	Regional Solar Energy Center				
Mauritania							
Niger	prospect	22.2	Hydroelectric dam for agriculture, fish, navigation, & electricity production (under study)				1981 Thermal Power Station - European Development Bank loan ECU 10 million

EXHIBIT 5: SUMMARY OF DONOR-SUPPORTED ENERGY PROJECTS IN WEST AND CENTRAL AFRICA

Country	AFRICAN DEVELOPMENT BANK 20/ Years	Mill$	Projects	Years	Mill$ TOTAL	UNDP 21/ Projects	EUROPEAN COMMUNITY
Nigeria	prospect	166.3	NEPA Power System Improvement (planned for 1988)	1979-86	3.20	Development of forest management capability	1980 Lagos Electricity Grid ECU 25 million
Sao Tome & Principe							
Senegal	1987-		Rehabilitation of Electricity Sector: generation, T&D, TA & training, industrial energy conservation	1982-86	0.64	Forestry training in the Central/East region	
				1983-86	0.72	Forest inventory in Casamance & East Senegal & setting up forest classification	
	1976-80		St. Louis Power Project, increased generation capacity				
	1987-		Rural & urban electrification 4 rural & 2 urban areas				
Sierra Leone				1984-87	0.69	Alleviation of fuelwood supply shortage in western area	
Togo	1986-	17.3	Forestry Development	1985-89	0.40	Nangbeto hydroelectric	
	1983-	19.6	Nangbeto Hydroelectric dam	1984-86	0.17	Petroleum exploration assistance	
				1984-86	0.66	Reforestation in the North & forest management	

EXHIBIT 5: SUMMARY OF DONOR-SUPPORTED ENERGY PROJECTS IN WEST AND CENTRAL AFRICA

Country	AFRICAN DEVELOPMENT BANK 20/ Years	Mill$	Projects	Years	Mill$ TOTAL	UNDP 21/ Projects	EUROPEAN COMMUNITY Years	Projects
Zaire	prospect	51.2	Rehabilitation of hydro generating stations. Project evaluation in 1989.	1985-86	0.03	Training of National Electricity Authority teachers	1983	Two hydroelectric stations Eur.Dvl.Fund ECU 17 million
	prospect	63.0	Electricity II (planned for 1988)					
	prospect	68.8	Electricity IV (planned for 1990)					
	1988		Petroleum Sector Support: support petroleum imports & reinforce distribution facilities					
	1983-88	18.9	Rural electrification of Bas-Zaire					
	1983-88	27.8	Electrification of Kinshasa					
	1986-	41.3	Katende Hydro power station & rehabilitation of Kinshasa power network					

EXHIBIT 5: SUMMARY OF DONOR-SUPPORTED ENERGY PROJECTS IN WEST AND CENTRAL AFRICA

Country		OTHER BILATERAL DONORS
REGIONAL/CENTRALLY FUNDED		
Benin		DANIDA: Hydroelectric power generation
Burkina Faso	1985/86	CIDA: Agriculture project included 1,500 improved cookstov
		GTZ (Germany): Renewables
	1986	DANIDA: Additions to power capacity
Cameroon	1985/86	CIDA: Forestry project
Cape Verde	1986-	DANIDA: Pilot wind energy project
Central African Republic		
Chad		
Congo		

EXHIBIT 5: SUMMARY OF DONOR-SUPPORTED ENERGY PROJECTS IN WEST AND CENTRAL AFRICA

Country		OTHER BILATERAL DONORS
Cote d'Ivoire	1985/86	CIDA: Rural electrification
Equatorial Guinea		
Gabon		
Gambia	1986	ODA(UK): Fuel-efficient stoves DANIDA: Additions to power capacity GTZ: Institutional strengthening of power utility
	1984	ODA(UK): Power rehabilitation in provinces
Ghana		
Guinea		

EXHIBIT 5: SUMMARY OF DONOR-SUPPORTED ENERGY PROJECTS IN WEST AND CENTRAL AFRICA

Country		OTHER BILATERAL DONORS
Guinea-Bissau		
Liberia		
Mali		GTZ (Germany): Renewables
Mauritania		
Niger	1985/86	CIDA: Agriculture project included supply of 64,000 seedlings for reforestation GTZ (Germany): Renewables
Nigeria		

EXHIBIT 5: SUMMARY OF DONOR-SUPPORTED ENERGY PROJECTS IN WEST AND CENTRAL AFRICA

Country		OTHER BILATERAL DONORS
Sao Tome & Principe		
Senegal	1985/86	CIDA: Forestry project DANIDA: Additions to power capacity DANIDA: Briquetting of agricultural waste & use of peat DANIDA: Promotion of energy-saving cookstoves
Sierra Leone	1988	GTZ & ODA: Power generation spare parts
	1986	DANIDA: Additions to power cap
Togo	1985/86	CIDA: Multi-donor Nangbeto hydroelectric development
	1986-	DANIDA: Additions to power cap
Zaire	1985/86	CIDA: $4.1m forestry project

EXHIBIT 5: SUMMARY OF DONOR-SUPPORTED ENERGY PROJECTS IN WEST AND CENTRAL AFRICA

NOTES:
1/ Source: AID Congressional Presentations
2/ Detailed identification of activity
3/ Mission has explored issues and initiated task
4/ Prospective activity
5/ Government request received
6/ Discussions with government
7/ Activity Initiation Brief (AIB) prepared
8/ Final report distributed to country and donors
9/ Reports being drafted
10/ Sources: Information and Status Reports, December 20, 1987 and April 1988 Annual Report, June 1988
11/ Sources: Monthly Operational Summary of World Bank and IDA Proposed Projects as of November 30, 1987, Status of IBRD/IDA Projects in Execution, October 30, 1987, March 31, 1988. Project amounts include IBRD or IDA credit or loan only, not total project cost
12/ Approved by Executive Directors Novemer 24, 1987.
13/ Negotiations scheduled for March 1988
14/ Appraisal mission scheduled for March 1988
15/ Appraisal mission scheduled for 1st quarter 1988
16/ Negotiations scheduled for September/October 1988
17/ Negotiations completed
18/ African Development Bank appraisal mission under way. Negotiations planned for 3rd quarter 1988
19/ Project preparation under way
20/ Quarterly Operational Summary, September 30, 1987, 1988-90 Indicative Lending Programme, Project Appraisal Reports. Project amounts include ADF, ADB, and NTF credits & loans only, not total project cost.
21/ UNDP Compendium of Approved Projects. Most recent report 30 September 1986. Total project cost includes government & 3rd party contributions
22/ Preparatory studies completed
23/ Appraisal of project planned
24/ Government request received
25/ Appraisal completed
26/ Emergency rehabilitation program has been prepared & negotiations tentatively scheduled for August/September 1988

Over the years, the largest share of the World Bank's lending has been for projects in the power sector. The World Bank's energy assistance to West and Central Africa has included:

- Country energy assessments
- Power system expansion, efficiency, rehabilitation, and distribution system extension projects (including technical assistance and training)
- Petroleum sector supply, distribution, and management projects
- Forestry projects, including forest conservation and reforestation, training, and technical assistance. Forestry components are often included in agricultural projects
- Household energy strategies and development and distribution of more efficient cookstoves

African Development Bank

Most of the African Development Bank's energy projects have been in the power sector, particularly rural electrification, power plant rehabilitation, line loss reduction, and distribution system rehabilitation projects. The Bank has also sponsored some petroleum and forestry sector projects. A major new emphasis in the African Development Bank's 1988-90 program will be environmental management, including forestry. All new projects will be subject to environmental assessments.

United Nations Development Program

In addition to participation in ESMAP, UNDP sponsors energy projects in West and Central Africa in the power sector (primarily technical assistance and training), forestry sector, and the petroleum sector (primarily training, technical assistance, institutional development).

United Nations Industrial Development Organization

UNIDO's energy-related technical assistance to Africa has been steadily increasing. Between 1980 and 1986, UNIDO executed 110 regional and national projects for a total of $11 million. At the regional level, assistance provided included studies of industrial energy management, training courses and regional cooperation in the exchange of information and research and development findings. A regional seminar was held on strengthening capabilities in the field of energy management and planning in industry. It identified the need for integrated national energy-industry planning. Country

projects are oriented towards ensuring the supply of energy to industry as well as the establishment of industries to serve the energy sector. Assistance is also provided to help solve the energy problems of rural and small-scale industries. Projects to increase the efficiency of utilization of indigenous resources and the local manufacture of energy equipment have been initiated in Mali and Niger. UNIDO's future programs will focus on:

1. Measures for improved utilization of indigenous energy resources, including new and renewable sources of energy
2. Possible diversification of energy supplies
3. Institutional measures for harmonizing national and regional grids
4. Programs for improved energy management and energy conservation in industrial subsectors and processes, and investment programs.

European Economic Community

The EEC is the sixth largest energy sector donor and energy is the EEC's largest sectoral program. The EEC provides assistance through the European Development Bank and the European Development Fund. Between 1981 and 1985, the European Development Fund provided energy assistance of $207 million ECU. The EEC's energy assistance is heavily weighted toward projects in the power sector. In 1983, 73 percent of energy assistance was for hydropower, 3 percent for thermal power, 10 percent for electricity distribution, 10 percent for renewables, and 4 percent for "other." In 1984, 26 percent of energy assistance was for hydro, 12 percent for power, 31 percent for electricity demand, 11 percent for renewables, and 20 percent for "other." In 1985, electricity demand received 36 percent of total energy assistance, renewables 26 percent, and "other" 38 percent. Ethiopia has been the largest recipient of energy assistance, followed by Kenya and Rwanda. Most energy assistance has been for capital projects (80%), while 7 percent has been for studies and assessments, and 2 percent for technical assistance. Between 1976 and 1985, 80 percent of energy assistance went to power (of which half was for hydro), 11 percent to renewables, and 7 percent was unclassified. The EEC tends to concentrate its energy assistance on energy supply in urban areas, particularly electricity generation. A large number of hydroelectric power generating stations have been built, often cofinanced with other institutions such as the African Development Bank and the World Bank. There has been little emphasis on meeting rural energy needs.

IV. PRELIMINARY RECOMMENDATIONS FOR A.I.D. ENERGY ACTIVITIES

West and Central Africa's energy problems are jeopardizing the countries' economic growth and development and political stability. Given the nature, scope, and implications of the region's energy problems and the shortage of investment capital and skilled manpower, there is an urgent need for continued donor assistance in the energy sector. In light of the region's economic problems and the limited resource base of many countries (which restricts their energy supply options), increasing the efficiency of current energy supply and utilization should be the top priority of donor energy strategies. Energy sector rehabilitation to increase the efficiency and reliability of energy supplies and promote efficient energy use is the least-cost solution and offers the greatest short-term relief.

Based upon the general findings of the literature search, the recommendations of the ESMAP energy assessments, and the focus of other donors' past, present, and prospective energy activities, the areas where A.I.D. energy assistance is most urgently needed would appear to be:

- Data collection and analysis: particularly data on energy consumption by households, industry, buildings, and transport
- Technical assistance and training to improve energy planning and management capabilities in all energy subsectors
- Forestry management and reforestation programs, including data gathering efforts (e.g., fuelwood consumption surveys, forest inventories)
- Development and dissemination of improved cookstoves
- Power plant rehabilitation and improvements in transmission and distribution systems (identified by World Bank and African Development Bank as key technical assistance priorities for Burkina, Congo, Cote d'Ivoire, Gambia, Ghana, Guinea-Bissau, Liberia, Mali, Mauritania, Nigeria, Sao Tome and Principe, Senegal, Togo, Zaire)
- Household energy surveys and strategies (identified by World Bank as key technical assistance need for Cape Verde, Senegal, Burkina, Guinea, Zaire, Mali, Mauritania, Niger, Nigeria)
- Petroleum supply management (developing least cost petroleum product supply system identified by World Bank as key technical assistance need for Burkina Faso, Cape Verde, Chad, Gambia, Zaire, Togo, Ghana, Guinea, Mauritania)

- Promotion of private sector involvement in decentralized energy production (e.g., World Bank has recommended that Burkina Faso encourage private generation of electricity for public supply, that Congo investigate ways to involve the private sector in electricity generation, and that Liberia study power exchange possibilities between the mining enclave and utility; Liberian government has requested a study of privatization of the power subsector)

- Energy audits and technical assistance for large energy users to identify and implement energy conservation and fuel substitution opportunities (e.g., World Bank has recommended audits of buildings, transport, industry, and petroleum refining sectors in Nigeria, driver training and industrial audits in Mauritania, driver training in Niger, industrial audits in Benin and Ghana, buildings energy conservation programs in Niger and Burkina). There has been little work by major donors in energy conservation except for ESMAP work in Senegal.

- Studies on using agroindustrial residues for meeting energy needs (e.g., recommended by World Bank in Benin, Burkina, Togo, Senegal)

- Promotion of regional cooperation, especially concerning hydro development (e.g., Cote d'Ivoire, Ghana, Togo, Benin). Also introduction of new technologies and petroleum procurement.

A.I.D. cannot provide energy assistance to all 24 REDSO/WCA countries. Rather it should focus its limited resources on those countries that have the greatest need for energy assistance and that are priority targets for A.I.D. assistance. Exhibit 6 indicates the size of A.I.D.'s actual FY1988 and proposed FY 1989 Development Assistance and Economic Support Funds programs in West and Central Africa, and may be helpful in identifying target countries for A.I.D.'s future energy assistance.

Exhibit 6: A.I.D. ASSISTANCE TO WEST AND CENTRAL AFRICA

COUNTRY	FY88 ESTIMATED OBLIGATIONS (US$ '000)			FY89 REQUEST (US$ '000)		
	DA	ESF	TOTAL	DA	ESF	TOTAL
Benin	0	0	0	0	0	0
Burkina Faso	2,500	0	2,500	2,500	0	2,500
Cameroon	20,000	0	20,000	18,000	0	18,000
Cape Verde	2,500	0	2,500	2,500	0	2,500
Central African Rep.	2,000	0	2,000	2,000	0	2,000
Chad	6,040	10,000	16,040	6,000	10,000	16,000
Congo	500	0	500	500	0	500
Cote d'Ivoire	500	0	500	500	0	500
Equatorial Guinea	850	0	850	1,000	0	1,000
Gabon	0	0	0	0	0	0
Gambia	3,500	0	3,500	3,500	0	3,500
Ghana	5,000	0	5,000	8,000	0	8,000
Guinea	10,000	0	10,000	12,000	0	12,000
Guinea-Bissau	2,000	0	2,000	2,000	0	2,000
Liberia	10,000	11,000	21,000	10,000	7,000	17,000
Mali	13,000	0	13,000	12,000	0	12,000
Mauritania	3,000	0	3,000	3,000	0	3,000
Niger	20,924	0	20,924	18,000	0	18,000
Nigeria	11,430	0	11,430	11,500	0	11,500
Sao Tome & Principe	300	0	300	300	0	300
Senegal	22,654	10,000	32,654	22,000	10,000	32,000
Sierra Leone	500	0	500	500	0	500
Togo	3,750	0	3,750	3,750	0	3,750
Zaire	33,000	0	33,000	33,000	0	33,000

Source: USAID Congressional Presentation FY89, Main Volume.

DA - Development Assistance
ESF - Economic Support Funds

ANNEX A: SELECTED BIBLIOGRAPHY

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ANNEX B: SUMMARY OF COUNTRY ENERGY ASSESSMENTS

This annex presents brief summaries of the energy situation, key energy issues and problems, and recommendations for priority energy sector activities for countries for which information was readily available. These summaries are based primarily on the UNDP/World Bank Energy Sector Management Assistance Program (ESMAP) Country Energy Assessments, but also draw upon information available in African Development and World Bank project appraisal reports. Several of the ESMAP assessments were completed in 1983 and 1984. For these countries (e.g., Nigeria, the Gambia) the information presented may be somewhat dated. In addition, for some countries (e.g., Cameroon, Central African Republic, Chad, Equatorial Guinea, Mali), ESMAP energy assessments have not been carried out and other sources of energy information were not available.

BENIN

Overview

Benin has a diversified resource base which, in principle, can meet the country's projected energy needs. Gross energy consumption is projected to increase from 840,000 toe in 1982 to 1,600,000 toe in 1998. Fuelwood and agricultural residues are the most important energy resources in Benin. Forest resources currently satisfy 56 percent of gross energy requirements. Although the overall supply-demand balance is positive, fuelwood shortages have developed in the densely populated southern areas and the more arid northern zones.

Benin has offshore hydrocarbon resources and oil production began in 1982. Crude oil is currently exported. Petroleum products meet 13 percent of internal energy needs and are being imported at competitive prices. Hydropower resources are large in comparison with present demand (2 percent of gross energy input), can be developed economically only in the context of an interconnected West African power system. All electricity and petroleum product supplies are imported. Benin's coastal electric power system was interconnected with Togo and Ghana in the early 1970s. Hydropower imports from Ghana supplied almost 90 percent of Benin's internal electric power requirements until the drought forced Ghana to curtail electricity supplies by 50 percent in late 1983. Benin has since been forced to use higher cost thermal generation facilities. The level of electrification is low, with 20 percent of the urban population having access to electricity and electricity accounting for less than 2 percent of final consumption

Major Energy Issues and Problems

The highest priority issue in the energy sector is to ensure an adequate long term supply of fuelwood at competitive prices. To achieve this it is necessary to formulate a management plan for the rational exploitation of existing forest resources and to evaluate the energy potential of agricultural residues. The development of Benin's energy resources is constrained by market size and the availability of financial and technical production factors.

Specific energy issues and problems include:

- Main constraint to effective management of forest resources is the weakness of government institutions
- No energy planning capability or institutional framework to provide coordination and guidance to subsectors

- Lack of data on energy use in small and medium sized industry, transport, households
- Market prices for fuelwood and charcoal do not reflect economic costs. Retail prices for petroleum products are set above economic costs. Average electricity tariffs are adequate to meet long-run marginal cost (LRMC). However, a tariff study has suggested that changes be made in the tariff structure.
- Inefficiency of fuelwood and charcoal stoves in household sector

Recommendations and Priorities

- Open forest areas in central Benin for exploitation and introduce efficient charcoal conversion equipment
- Promote rural reforestation through expansion of technical assistance services
- Assist rural sector in integrated agro-silvicultural project development
- Technical assistance programs with an intensive training component to improve energy management capacity
- Establish incentives for private sector involvement in decentralized energy production and to encourage efficient energy use
- Pursue cooperation with neighboring countries in the development of energy resources, the introduction of new technologies, and the procurement of imported requirements
- Evaluate non-associated natural gas potential
- Evaluate opportunities for converting agricultural residues into energy, including steam generation or cogeneration. To promote conversion of residues into electric power in isolated areas, consideration should be given to signing sales agreements (with tariff equal to LRMC) with enterprises to produce electric power from biomass
- Complete distribution networks in centers already served, improve service reliability and reduce physical and financial losses
- Extend the electricity services to new areas on the basis of evidence that electricity is the least cost option for meeting specific energy requirements

- Conduct energy audits in selected enterprises which are undergoing rehabilitation and hold seminars on energy conservation opportunities in individual sectors
- Conduct feasibility study for using agro-industrial residues available at Bohican for steam or cogeneration
- Evaluate energy use in residential, commercial, and institutional buildings
- Conduct detailed transport study as a basis for planning long-term expansion of transport infrastructure

BURKINA FASO

Overview

Burkina Faso has a very limited resource base to meet its energy needs. Over 91 percent of primary energy requirements are met by domestic biomass energy, of which fuelwood accounted for 84 percent and crop residues accounted for 7 percent. The remaining 8.4 percent of primary energy requirements are met by imported petroleum products, of which about 30 percent are used in the country's thermal-only power generation system.

Burkina's principal energy requirement is for household cooking, which accounted for 90 percent of primary energy consumption in 1983. In industry, bagasse and other agroindustrial residues are the main energy sources for both process heat and electricity generation. Petroleum products meet almost the entire energy requirement of the modern economy. Supplies are high-cost because of high ex-refinery prices and long and inefficient transport links. There are no net subsidies on petroleum products. In the long term there is scope for developing hydro sites for both irrigation and electricity generation, possibly in conjunction with interconnection with the larger electricity systems in the region.

Domestic biomass (fuelwood and agricultural residues) cannot continue to satisfy the requirements of household cooking. There is some potential to use agroindustrial residues to reduce industrial consumption of oil, as for example more efficient use of bagasse in the sugar industry.

Major Energy Issues and Problems

The most serious energy-related problem facing Burkina is that the agricultural resource base is threatened by erosion and loss of soil fertility due to use of fuelwood, crop residue and dung as household fuels. Overcutting of wood resources for agricultural clearing, livestock grazing, and fuelwood consumption is leading to rapid depletion of sparse forest cover. If measures are not taken, the national fuelwood deficit will rise to around 1.5 million m^3 by 1995.

Other major energy issues and problems include:

- Imported petroleum products are placing an increasing burden on the balance of payments
- Lack of technical and managerial personnel
- Weak institutions

- Lack of investment resources
- Lack of foreign exchange resources

Recommendations and Priorities

With a very limited resource base, more efficient use of fuelwood, agroindustrial residues and imported petroleum products will remain the key elements of Burkina's energy strategy for the foreseeable future. The most important part of the Government's energy strategy will be to take measures to relieve the pressure of household energy on the agricultural sector by improving fuelwood supply. Priority measures recommended by the World Bank include:

- Improved management of village forests, improved exploitation of bush fallows, establishment of permanent logging sites in wood-surplus areas, and development of mini-nurseries
- Reinforcement of woodstove dissemination program. There should also be an evaluation of the scope for marketing a kerosene stove which is both more efficient and adapted to local cooking requirements.
- Investigation of ways to improve regulation of current urban fuelwood supply chain (licenses and price controls)
- Improvement of public sector energy planning through institutional development, including creation of a small energy planning unit and training of staff in the power, petroleum, and forestry, and household energy sectors
- Design and implementation of a household energy project
- Review of arrangements for importing, transporting, and storing petroleum products
- Evaluation of options for major interconnections with the larger grids in the region and the role and timing of additional thermal capacity
- Design and implementation of procedures for selecting energy-efficient air conditioning systems for buildings
- Restoration of fuel oil plant to normal availability
- Encouragement of private generation of electricity for public supply (including defining utility's marginal costs as a basis for establishing tariffs at which utility would purchase private-generating electricity)

- Elimination of pricing distortions and simplification of price structures (LPG, petroleum products, low voltage electricity tariffs).

The priority technical assistance program identified by ESMAP was for an Urban Household Energy Strategy Study. Funding has been provided for this study. Petroleum import management and power plant rehabilitation studies were also identified as priorities.

CAMEROON

No country information available.

CAPE VERDE

Overview

The energy situation of Cape Verde is characterized by a complete reliance on imported petroleum fuels for meeting the needs of transport, industry, and one-third of households, and a gradual destruction of the naturally sparse plant cover which provides fuel for two-thirds of the households.

There is a severe shortage of firewood and an absence of affordable substitutes.

The government sets energy prices to reflect their full economic cost.

Given the dependence on fuel imports and the fuelwood shortage, the government's energy sector objectives are to minimize the economic cost of energy and increase the reliability of its supply.

Major Energy Issues and Problems

- Firewood shortage
- Inefficient electricity generation, transmission, and distribution. Current losses are at about 38 percent.

Recommendations and Priorities

The World Bank assessment concluded that the top priority for the sector is to increase the efficiency of energy supply and utilization, and to continue developing the country's single major energy resource, firewood. Specific recommendations and priorities include:

- Formulation and implementation of a forest management program that includes afforestation investments, a program to introduce efficient wood stoves, and a training program for forest service staff
- Establishment of a forestry data recording and collection system
- Consolidation of the Directorate General of Energy to formulate energy development strategies, coordinate sector-wide planning, and prepare energy sector investment programs
- Creation of an energy information center to collect, process and publish energy sector data and run a public information program

- Design of a power system loss reduction program
- Increase electricity supply and reduce electricity costs by improving the efficiency of power generation and reducing the losses between generation and sales to 12 to 15 percent. (Utility is preparing the replacement and rehabilitation of its major distribution systems)
- Projects to demonstrate and develop wind energy for power generation, water desalination, and water pumping
- Implementation of a Management Information System to provide utility with a solid basis for setting tariffs and technical and financial performance targets, and for monitoring achievement

CENTRAL AFRICAN REPUBLIC

Energy consumption in the Central African Republic is dominated by fuelwood, which accounts for 81 percent of total energy consumption. The country's energy sector is constrained by the high costs of petroleum and electricity supplies, which is partially the result of the country's land-locked position, and aggravated by weak institutions at both the policymaking and operational levels. There is no coherent energy strategy.

The Government has requested that ESMAP carry out an energy assessment. Preparatory work on the assessment is underway.

CHAD

No country information available.

CONGO

Overview

Congo has substantial petroleum, hydroelectric and forestry resources. Its petroleum reserves, estimated conservatively at between 1,065 million and 2,050 million barrels, are the mainstay of the country's economy. The economy is dominated by oil, which accounts for 40 percent of GDP, 90 percent of exports, and two-thirds of budgetary receipts. However, with the oil price collapse in 1985, projected oil revenues for 1986 and 1987 fell to one-third and one-fifth, respectively, of 1985 levels.

Per capita energy consumption of 290 kilograms of oil equivalent in 1985 is low compared to other countries at similar income levels. Wood fuels and other biomass account for 46 percent of net domestic consumption, petroleum products account for 45 percent, and electricity and crude oil account for the remaining 9 percent. Households and transport are the major energy consuming sectors, accounting for 50 percent and 23 percent, respectively, of final demand. Households account for 97 percent of wood fuel consumption and more than 85 percent of household demand is satisfied by woodfuels. The other major energy consuming sectors are the petroleum industry and other industry, which contribute 15 percent and 10 percent, respectively, to final demand.

An important characteristic of Congo is the high degree of urbanization, with nearly 55 percent of the total population living in urban areas.

Major Energy Issues and Problems

- Declining oil export revenues due to oil price decline
- Economy's heavy dependence on oil export revenues
- Inefficient energy prices
- Weak national power utility
- Unreliable and inefficient electricity supply
- Deforestation around Brazzaville

Recommendations and Priorities

World Bank mission recommendations for action include:

In the power sector:

- Completion and commissioning of the Loudima-Brazzaville transmission link and a central control center
- Completion of rehabilitation and conversion to 20 kV of the Brazzaville and Pointe Noire distribution networks
- Design of network operating strategy for new Brazzaville-Pointe Noire interconnected system
- Definition of least cost arrangement for ensuring adequate security of supply for Pointe Noire electricity consumers
- Detailed design and rehabilitation program for Djoue and Moukoukoulou hydro stations
- Mobilization of financial resources from consumers (through tariff increases) and private investors (through direct participation in electricity supply) - increase role for private electricity supply
- Investigation of ways to promote private generation of power by entrepreneurs or consumer cooperatives
- Strengthening and restructuring of utility, including technical assistance and training
- Development of medium term strategy for rural electrification

In the petroleum sector:

- Review of petroleum development strategy, including possible improvements to fiscal framework
- Exploration promotion of onshore acreage and 1987 offshore relinquishments
- Feasibility studies of rapid development of low cost, onshore oil fields and recycling of offshore Litchendjili gas-condensate field
- Development of new ex-refinery pricing and/or procurement arrangements
- Technical assistance and training to Ministry of Mines and Energy staff to strengthen petroleum subsector management capabilities

In the household energy and woodfuels sectors:

- Preparation of program to promote private production and marketing of high efficiency woodstoves for household cooking

- Program of demand management centered on utilization of improved stoves and energy substitution
- Economic and financial evaluation of charcoal production from existing plantations

Several of these recommendations have been accepted and are being implemented by the government.

COTE D'IVOIRE

Overview

Cote d'Ivoire has a large and diversified energy resource base that includes petroleum, recently discovered natural gas, hydropower, forest reserves, and biomass residues. However, exploitation and use of these resources is constrained by tight financial conditions and limited coordination of subsector planning and policy. Current crude oil production averages 20,500 barrels per day. Natural gas has only recently been discovered and has not yet been developed. Only 20 percent of the hydro potential is currently harnessed and although approximately 500,000 toe of biomass residues are generated annually by agroindustries and sawmills, only half of it is tapped for energy use. Abundant forests have traditionally been the major indigenous energy resource, but due to rapid deforestation, the availability of this resource has been declining and is in short supply in some areas.

Current energy consumption is based on hydroelectricity (17 percent), petroleum products (34 percent), and biomass resources (48 percent). Hydro plants produce most of the country's commercial power. The transportation sector is the major consumer of petroleum products (53 percent). Electricity generation's share of petroleum consumption increased sharply (to 34 percent) as a result of the drought. Petroleum consumption by industry is relatively small (12 percent). Fuelwood accounts for at least 85 percent of household energy consumption.

There has been little done officially to promote energy conservation and to improve end-use efficiencies.

Major Energy Issues and Problems

- Deforestation rate is higher than the rate of annual forest productivity. Current and planned rates of reforestation are not sufficient to meet future fuel needs; shortages are already evident in urban areas
- Short-term power shortages and poor reservoir management
- Need for new power generation facilities (in the early 1990s)
- Large financial losses of the refinery
- Weak and poorly coordinated institutional infrastructure in the energy sector

Recommendations and Priorities

- Stimulation of further exploration of hydrocarbon resources and continue technical training program
- Development of natural gas reserves
- Rehabilitation of the SIR refinery in Abidjan
- Revision of plans for expansion of power generation capacity
- Development of programs to increase the supply and efficient utilization of traditional fuels (fuelwood, charcoal, biomass residues), including revised national forest inventory and fuelwood consumption surveys, formulation of an integrated fuelwood/forestry policies, establishment of fast-growing industrial plantations, establishment of improved forestry extension program, formulation of a program to promote and disseminate improved wood and charcoal stoves
- Study of the technical, financial, and economic feasibility of using unexploited biomass residues to generate surplus power in palm oil extraction plants and to displace diesel-based power and process steam generation in the coffee industry
- Revision of electricity pricing. Because of rehabilitation of refinery, major changes in petroleum pricing system premature at this time
- Development of conservation programs. Specific recommendations include high efficiency air conditioners, program to evaluate and improve energy efficiency of industrial processes and public lighting, study of the scope and requirements for fuel conservation and substitution in the transportation sector.

A recent UNDP/World Bank study (1988) identified several areas in the electric utility where technical assistance is urgently needed. The government and the utility have requested ESMAP assistance in contacting bilateral donors. The areas where assistance is needed include rehabilitation work at the steam power plant, improvements in commercial operations, and some technical improvements to the distribution system.

EQUATORIAL GUINEA

Equatorial Guinea is well-endowed with natural resources. Oil exploration has been underway since the mid-1960s and has recently accelerated with assistance from Spain, the United Nations, and the International Development Association.

There is a severe shortage of skilled personnel at all levels and the country's physical infrastructure, including the electricity system, is in urgent need of rehabilitation. Electricity supply is unreliable and power cuts are frequent. Petroleum product and electricity prices do not reflect their economic costs. However, in the last few years some steps have been taken to adjust energy prices.

No ESMAP energy assessment has been carried out and very little other energy information is available.

GABON

ESMAP completed an energy assessment for Gabon in January 1988, but the report has not yet been released. The assessment focuses in particular on Gabon's options following the oil price decline. As a result, emphasis has been placed on the conventional energy subsectors (petroleum and electricity). Discussions were held with the government in December 1987, at which time several potential follow up activities were reviewed, including a gas utilization study and diagnostic evaluation of refining and petroleum product pricing.

Gabon has the highest per capita income (US$3,080 in 1986) in Sub-Saharan Africa. However, the country is in the midst of a major economic and financial crisis, resulting from the collapse in oil prices and the excessive public spending and short-term borrowing during the period of high oil prices. The collapse of oil prices in 1986 reduced GDP by about 6 percent and led to a further decline of about 13 percent in 1987.

Gabon's economy is heavily dependent on oil. Oil accounts for 69 percent of the country's export earnings, down from more than 80 percent up until 1985. With recent oil discoveries more than doubling the country's known oil reserves, oil will continue to play a major role in the economy for the foreseeable future.

Gabon has a rich resource base, which includes ample arable land, adequate rainfall, large unexploited forestry resources, signficant mineral deposits (uranium, manganese, and iron ore), and oil. Of a total area of 24 million hectares (ha) of tropical high forest, 4 million ha have been exploited and another 12.5 million ha are suitable for commercial exploitation. However, the Ministry of Water Resources and Forestry does not have the staff to carry out its functions adequately or to build up a satisfactorily comprehensive picture of national forest resources needed for sound long-term management.

THE GAMBIA

Overview

The Gambia relies completely on imported petroleum to meet its commercial energy needs, including the generation of electricity which is entirely diesel-based. The government faces difficulties in servicing the petroleum import bill because of depressed export prices for the country's major export commodity - groundnuts. The Gambia's options for reducing dependence on petroleum imports are limited by its modest energy resource endowment.

Electric power generation is confined to urban areas; demand has rapidly increased and exceeds firm generation capacity. Because of overloaded distribution lines and transformers, the public utility has a very restrictive policy of new connections and many potential customers are awaiting connections.

Major Energy Issues and Problems

- Institutional weaknesses which have developed from inadequate staffing of energy institutions
- Lack of consistent energy planning and development
- Urgent need for expansion and rehabilitation of power facilities
- Poor financial performance of public utility (due mainly to low tariffs)
- High petroleum acquisition costs
- Lack of tools and equipment
- Ineffective manpower planning and personnel management
- Functional illiteracy of many energy sector employees

Recommendations and Priorities

- Additions to power capacity
- Institution building in energy organizations (training, technical assistance)
- Rehabilitation of provincial diesel-based power systems
- Study alternative petroleum supply arrangements

- Greater emphasis on management of natural woodlands to sustain the production of fuelwood and other forest products
- Saving diesel oil and electricity by retrofitting water heating systems in the commercial/industrial sector

GHANA

Overview

Despite a substantial energy resource endowment of biomass, hydropower, and, possibly, hydrocarbons, Ghana's energy sector has been plagued by a weak institutional and policy framework, operational inefficiencies, and the scarcity of financial resources.

Wood meets 73 percent of primary energy demand, petroleum, 17 percent, and hydropower, 10 percent. Two large hydropower plants provide most of the country's electricity. Over the past few years, electricity production fell sharply because of the prolonged drought. Rural electrification is not yet well developed. The utility intends to expand rural electrification to cover the entire country. The vast majority of households depend on wood or charcoal. There are serious prospects for fuelwood scarcity in some areas, particularly in the extreme Northeast. Imports of crude oil meet all of the domestic petroleum requirements and in 1985 absorbed 26 percent of Ghana's foreign exchange earnings. Despite lower oil prices, petroleum imports are still likely to claim close to 20 percent of the country's foreign exchange earnings by 1990.

The government plans to continue petroleum exploration to reduce the need for imports, improve and expand the capacity of the refinery and the storage and distribution system, and, in the power subsector, emphasis is being given to rehabilitating and extending the national electrical network and to rehabilitating the existing thermal generation plant in Tema.

Less than 10 percent of the population has access to electricity supplies. There is continued reliance on fuelwood as the main source for domestic energy supply, resulting in increasing depletion of forests. Isolated diesel generating stations in major towns most of which are old, unreliable and uneconomic to keep in service.

Major Energy Issues and Problems

Ghana's energy sector is plagued by serious constraints, including:

- Scarcity of foreign exchange needed for maintenance and rehabilitation
- High cost of petroleum imports
- Accelerated deforestation, especially in the northeast
- Institutional weaknesses at the sectoral level and in the operating entities
- Poor energy efficiency because of outmoded and poorly maintained equipment and sub-optimal techniques in energy use

- Deterioration in electricity service due to poor maintenance and inadequate reinforcement in generation, transmission, and distribution (Diesel stations as well as the distribution line system are not in satisfactory working condition. The Major reason is the lack of spare parts as a result of foreign exchange shortages)

- Poor maintenance, high energy consumption and losses, and sub-optimal operational practices at refinery

Recommendations and Priorities

- Adopt pricing for woodfuels, petroleum products, and electricity in accordance with economic principles

- Carry out energy audits on industrial and other larger volume energy consumers

- Strengthening of energy planning and policy coordination

- Rehabilitation of generation, transmission, and distribution system

- Reinforcement of existing transmission lines

- Extension of electricity grid to northern Ghana

- Strengthening of forest management and accelerating reforestation

- Improvement of energy demand management through economic-cost pricing and non-pricing measures to increase energy efficiency

- Strengthening of operating entities

- Investments in 11-kV lines and in distribution materials

- Improvement of petroleum product marketing

- Rehabilitation of refinery

- Evaluation of scope for developing hydrocarbon resources

A recent ESMAP report concluded that energy efficiency in industrial enterprises in Ghana is low and could be increased by at least 15 percent through improved housekeeping measures. However, policy, institutional, economic, and financial constraints limit the effectiveness of any government program to rationalize energy use in industry. In addition, substantial amount of residues from wood processing industry

is wasted. These residues could be used to generate steam at mills and to produce charcoal and sawdust briquettes for urban commercial and domestic consumption.

GUINEA

Overview

Guinea has plentiful resources of fuelwood and hydropower. Accessible annual fuelwood production is almost twice the estimated consumption. Only 1 percent of the hydro potential has been developed. No petroleum has been discovered although there may be some deposits offshore. Fuelwood accounts for 85 percent of energy consumption, with hydropower and imported petroleum products accounting for 1 percent and 14 percent, respectively. Households dominate sectoral consumption (73 percent). Energy data are unreliable and incomplete. Information on the fuelwood and renewable energy subsector is limited.

Major Energy Issues and Problems

The country's most urgent energy problems concern electricity and petroleum supply:

In the electricity subsector, the main issues are:

- Virtual breakdown of supply system (at the time of the ESMAP assessment, less than half of the installed capacity in Conakry/Kindia system was in service)
- Weakness and inefficiency of the power company, particularly its lack of autonomy
- Low electricity prices, which have been too low to meet the utility's financial needs

The supply problems are largely the result of the poor organization and management of the utility.

The key issues in the petroleum subsector are:

- Supply and distribution inadequacies
- Low pricing levels
- Demurrage charges because of unloading delays at Conakry
- Low levels of security stocks

In addition, there are organizational problems with the sector overall, including poor coordination, lack of planning, low morale, and overstaffing.

Although there are currently no problems with woodfuel supply at the national level, there are indications of problems emerging at the local level, particularly in Conakry.

Recommendations and Priorities

In the petroleum sector:

- Repair of the unloading pipelines at the Conakry terminal facilities
- Provision of an extra fuel storage tank at Conakry
- Rehabilitation of service stations
- Construction of a storage depot
- Procurement of 50 new road tankers
- Purchase of extra petroleum products to increase security stocks
- Procurement of miscellaneous equipment, including spare parts
- Improvement of petroleum product procurement, importation and internal distribution
- Revision of petroleum price structure
- Technical assistance

In the power sector:

- 5-10 MW of diesel capacity at Tombo
- Data gathering for hydro development
- Establishment of a Management Information System to enable the power utility to function effectively

The World Bank assessment also recommended a technical assistance program for fuelwood and other renewable energy sources, including technical advisors to help coordinate, plan, and supervise activities relating to the supply and utilization of fuelwood; a study of household fuel supply and utilization in Conakry; and an evaluation of the economic justification for developing small-scale hydropower potential and identification of the most promising projects. Technical assistance is also recommended to help the Ministry of Natural Resources, Energy and Environment improve coordination and planning.

Guinea-Bissau

Overview

The energy situation in Guinea-Bissau is characterized by a total reliance on imported petroleum for industry, transport, and household lighting needs and on woodfuels for almost all household cooking and traditional rural, commercial, and artisanal activities. Wood accounts for 89 percent of total energy supply and imported petroleum accounts for 11 percent. Woodfuel supplies appear to be adequate to meet rural demand, but deforestation is a problem in areas where charcoal is produced for urban markets. Households account for the largest share of energy consumption -- 90 percent, followed by transport (7 percent) and industry (3 percent).

The condition and performance of the energy sector has been adversely affected by Guinea-Bissau's severe economic crisis.

Major Energy Issues and Problems

- Increasing deforestation, especially in urban areas, due to pressure of charcoal production and absence of affordable substitutes
- The quality of electricity service has declined in recent years and the public electric power system is in urgent need of rehabilitation. Over half of the installed generating capacity is out of service and about 40 percent of the electricity produced is lost (and stolen) in the distribution network.

Recommendations and Priorities

The ESMAP assessment mission concluded that rehabilitation of the energy sector should be done within the framework of the government's overall Economic Stabilization Program. The immediate priorities in the energy sector should be to rehabilitate existing facilities and to complete and consolidate the organization of energy sector institutions. Only then and once the economy has recovered will there be a need to expand capacity. Specific recommendations include:

- Adjustment of energy prices to reflect real economic costs
- Rehabilitation of power subsector, including adjustment of tariffs, training for plant operators and other staff, technical assistance to strengthen metering, billing, accounting, and administrative systems, strengthening and enforcement of procurement measures, survey of autogenerators and standby plants, preparation of map of existing power supply system, preparation of power system master plan, study of electricity demand, repair

and rehabilitation of generation units and distribution networks, interconnection with major autogenerators, establishment of spare parts inventory

- Strengthening of petroleum subsector, including encouraging petroleum exploration, completing and consolidating subsector organization, repair of storage tanks, and study of proposed unloading facility

- Strengthening of Forest Service to manage exploitation of forests and assist charcoal makers in adopting improved methods and development of national forest management plan

Subsequent UNDP/World Bank reports have identified the need to strengthen the power sector as a high priority. ESMAP and the government are studying alternatives for improving the management of the electric utility through incentive contracts.

LIBERIA

Overview

Liberia's economy has been in decline since 1979 and prospects for future economic growth are uncertain. Between 1980 and 1984, petroleum and electricity consumption declined. Consumption of petroleum and electricity is expected to decline further, both in absolute terms, and relative to the consumption of biomass fuels, especially during the early 1990s. Thus, the Liberian energy economy is in a transition just the opposite of most developing countries where the share of modern fuels increases as urbanization and industrialization proceeds. Most of the growth in energy supply over the next several years is expected to come from woodfuels. Localized fuelwood shortages may develop in the near future.

Households account for 70 percent of total final energy consumption and 99 percent of biomass fuels consumption. Transport is the largest consumer of petroleum products, accounting for 71 percent of petroleum product consumption in 1983, followed by mining and other industry, which accounts for 22 percent of petroleum product consumption. The largest consumer of electricity is mining and other industry, which accounted for 73 percent of total electricity consumption in 1983. Households accounted for 16 percent of electricity consumption.

Major Energy Issues and Problems

- Lack of public investment funds
- Weak energy policy and planning
- Shortage of skilled staff
- Poor management and severe liquidity problems of Liberia Electricity Corporation (LEC) and the Liberia Petroleum Refining Corporation (LPRC)
- High costs of petroleum supply, through poor product procurement practices and operational inefficiencies
- Unreliable and inefficient power supply, including high electricity losses (35 percent of generation)
- Theft of power and failure to enforce payment for all electricity consumption billed; only about 70 percent of electricity officially sold is paid for

Recommendations and Priorities

The highest priority activities proposed in the ESMAP assessment included:

- Formation of energy policy and planning division within the Department of Energy
- Restore financial viability to energy supply and production agencies, which will require upgraded management, revision of consumer billing and accounting procedures, and strict enforcement of payments
- Design, costing and priority ranking of investments required to transfer petroleum depot from refinery to Water Front area and to rehabilitate and reconfigure storage and handling faciiities
- Procurement of management services to establish and operate proposed new Petroleum Supply Company for three years and to liquidate assets of LPRC
- Power system efficiency audit to define economically justified investments in distribution and generation rehabilitation and to review serviceability of all thermal generating plants
- Procurement of management services to manage and implement reforms in LEC
- Review of mining enclave-LEC power exchange capacity
- Rubberwood and other forest energy resource inventory within reach of Monrovia and other urban centers
- Expansion of demonstration project for extensive field trials of simplified metal charcoal kilns
- Charcoal export feasibility study
- Mining company fuelwood supply and conversion pre-investment analysis

Subsequent ESMAP reports (6/85) recommended that technical assistance projects include:

- Improvement of utilization efficiency of charcoal
- Ore-drying using fuelwood
- Power system efficiency improvement

- Review of power exchange possibilities between mining enclave and power utility.

An August 1986 report also recommended a program to improve commercial operations, electricity distribution, and generation plant efficiency and reliability and a complete restructuring of the electric power subsector. The Government has requested a study on the privatization of the subsector.

MALI

No ESMAP country assessment has been completed, although one is planned. However, other World Bank reports have indicated that Mali has a narrow energy resource base aggravated by recurrent droughts, weak institutions, and inadequate policies, particularly for energy demand management. In the power sector, there is a need for policy and institutional reforms, financial restructuring, reinforcement and extension of T&D systems, rehabilitation of hydro and diesel units, and technical assistance and training.

MAURITANIA

Overview

Mauritania has a very limited resource base consisting of a fragile forest cover and wind and solar energy. Hydrocarbon exploration has not yet resulted in commercial discoveries. Mauritania faces two pervasive energy problems: rapid deforestation aggravated by the drought and the high cost of petroleum imports. Woodfuels meet about half of the country's energy consumption needs and over 90 percent of residential energy requirements and are being rapidly depleted. Petroleum imports supply all of the country's non-woodfuel energy needs. The lack of indigenous resources limits the options for alieviating these constraints.

Major Energy Issues and Problems

- Rapid deforestation. Unless fuelwood use is reduced, accessible forest reserves will be totally destroyed within 20 years.
- Low energy efficiency of households, transport, and industry
- Technical, financial, and managerial inadequacies of public utility
- Poor power system reliability
- Heavy dependence on fuel imports
- Inadequate energy policies including, electricity and charcoal prices that are below economic costs and distorted petroleum product prices
- Weak energy sector institutions and lack of coordination and adequate manpower

Recommendations and Priorities

Due to the country's poor economic position, emphasis is placed on least cost solutions through rehabilitation, improvement in the efficiency of energy use, and strengthening energy sector institutions. In view of the limited supply options, energy demand management is especially important. Specific priorities and recommendations include:

- Establishing appropriate energy prices
- Forestry and woodfuels development including forestry management and protection, strengthening of forestry department, tree planting, and dissemination of improved stoves

- Rehabilitation of existing electric power systems, conversion to fuel oil, loss reduction, closer coordination between the public utility and self-producers, assistance to improve project analysis and systems planning, tariff study, and training
- Mothballing of the refinery
- Strengthening of petroleum product marketing system and continued stimulation of petroleum exploration
- Measures to raise the efficiency of use of petroleum products in electricity generation, transport and industry, including energy audits and training for drivers and vehicle maintenance
- Selective wind and solar development
- Strengthening of energy institutions through training and technical advisors

NIGER

Overview

Niger's energy resources consist of uranium, biomass, coal and lignite, hydro, possible reserves of oil, and wind and solar energy. At present, only biomass (for households) and coal (for electricity generation in the mining district) are being exploited for domestic use on a significant scale. Niger's energy consumption -- about 180 kgoe per capita in 1984 -- is one of the lowest in the world. Of this total, 87 percent consists of woodfuel, 11 percent of petroleum products, and 2 percent of electricity. All of the petroleum is imported as is 50 percent of the electricity. Because of the sparse population and large distances, there is no national electricity system and the level of electrification is very low.

Niger faces a double energy crisis: overexploitation of its meager fuelwood resources and a rising energy import bill. The fuelwood crisis is the more serious of the two. Increasing consumption of firewood and the inefficient way it is cut and consumed has had a serious impact on the environment, particularly around urban centers. Firewood is used by 98 percent of households in urban areas for cooking. Firewood prices are low and consumers have no incentive to use energy efficiently. Precise data on woodfuel situation are lacking, but studies have shown that the rate of consumption of firewood greatly exceeds the rate of natural regeneration. If nothing is done and present consumption continues, the immediate area around urban centers will not be able to meet the demand for firewood in the next 10 to 20 years.

Major Energy Issues and Problems

- Deforestation and environmental degradation
- Dependence on oil imports
- Backlog in integrated power system planning
- Serious shortages of qualified manpower, which is the main constraint to planning, and operational work

Recommendations and Priorities

- Development and dissemination of improved cooking stoves
- Development fuelwood substitutes, especially kerosene and lignite
- Tree planting and improved forestry management

- Establishment of appropriate fuelwood prices
- Continued lignite exploration
- Continued petroleum exploration and appraisal of limited finds in the Southeast
- Training in fuel-efficient driving techniques
- Buildings energy conservation
- Strengthening of energy planning (especially in power sector) through technical advisors and training

More recent ESMAP reports have also emphasized that consumption of electricity in public buildings, which has increased rapidly in recent years, is inefficient because of dilapidated equipment and inappropriate operational practices. An estimated 40 percent of electricity consumed in public buildings for air conditioning could be saved through more efficient equipment and practices. ESMAP has also reported that the government would like to initiate a pilot program of testing and dissemination of mini-photovoltaic systems for lighting, refrigeration and small-scale pumping in isolated centers.

NIGERIA

Overview

Nigeria is a major oil exporting country and oil income has traditionally provided the revenues for almost all development and public expenditures. However, known and inferred oil deposits are limited and output is expected to start declining within the next 15 years. Rapidly growing domestic demand for petroleum products may further reduce the exportable surplus if no deliberate steps are taken to diversify the economy and substitute more abundant resources such as gas, LPG, hydro and coal.

Major Energy Issues and Problems

Following the decline in oil revenues, Nigeria's economy has sustained a serious recession. The inadequate operational performance of the energy enterprises, the need for stricter investment priorities, and the consistency of energy investments and macroeconomic objectives have become key issues. Specific energy problems include:

- Lack of integrated energy sector planning
- Lack of adequate manpower for energy planning and management
- Serious imbalances between woodfuel demand and supply in certain areas, especially the northern states
- Unreliable and inefficient power supplies
- Power shortages
- Inefficiency of energy use
- Energy price distortions

Recommendations and Priorities

- Rationalization of energy prices
- Review and construction of gas pipeline systems
- Development and extension of LPG supplies
- Major rehabilitation of generation and transmission facilities
- Review of coal production facilities

- Survey of rural/urban household consumption patterns
- Fast-growing seedlings for firewood production in rural areas
- Dissemination of efficient wood stoves
- Review of plans for large-scale firewood plantations
- Promotion of conservation in industry, commercial buildings, transport, and petroleum refinery. Studies of energy conservation lacking. First step are major studies of energy conservation potential and policies to encourage energy efficiency

SAO TOME AND PRINCIPE

Overview

Sao Tome and Principe has abundant forest resources, which cover about 80 percent of the land mass and can accommodate the country's fuelwood needs until 2000 without threatening the quantity or quality of the forest cover, providing that their exploitation is adequately managed. An important hydroelectric potential has been identified.

Most of the country's energy supply (66 percent) is provided by firewood; 29 percent is provided by imported petroleum products and 4.5 percent is provided by hydroelectricity. Imported energy accounts for 29 percent of total energy supply and 86 percent of commercial energy. All petroleum products are imported from Angola.

Due primarily to the cheapness of energy, per capita consumption, at 422 kilograms of oil equivalent, is much higher than in other countries at similar income levels and has grown rapidly. The share of commercial energy in total consumption (34 percent) is much higher than in other countries at similar income levels. The major consumers of petroleum products are transportation (50 percent), households (16 percent), and the power plants (14 percent). The fishing industry accounts for 13 percent and agriculture 2 percent of total petroleum product consumption. A ready availability of electricity and significant unmetered use (39 percent of consumers are unmetered) provoked an uncontrolled use of electricity by the household sector, which accounted for 35 percent of total electricity consumption in 1984.

Major Energy Issues and Problems

- Inefficient energy prices
- Rapid growth of energy consumption; high consumption of petroleum products has caused balance of payments difficulties
- Weak institutional framework of all energy subsectors, especially forestry
- Technical and financial weakness of electric utility, which requires immediate assistance
- Large losses, lack of preventive maintenance, and shortage of spare parts in the power subsector
- Poor transport infrastructure, which causes disruption of fuelwood supplies to the cities

Recommendations and Priorities

The central recommendation of the 1985 ESMAP assessment was that the Government intervene to reduce the growth of energy consumption to levels that the economy can accommodate, primarily through appropriate energy pricing. The assessment recommended an immediate increase in petroleum product prices and electricity tariffs to reflect the economic costs of supply. Other recommendations included:

- Power plant rehabilitation and power loss reduction program
- Study of the least-cost power expansion path
- Construction of Neves Petroleum Products Terminal
- Performance of a preliminary regional forest inventory
- Study on the supply/demand patterns of woodfuels
- Training and technical assistance to strengthen institutions at the sectoral level and in all subsectors

The Government has markedly increased petroleum product prices.

SENEGAL

Overview

Senegal's energy economy is based on fuelwood and imported oil and faces the two major problems of rapid deforestation and dependence on oil imports. Wood is the country's principal energy source, accounting for 60 percent of total energy consumed. Imported petroleum products are used to meet all commercial energy requirements.

Senegal's natural forest could supply fuelwood equivalent to about 2 million toe annually, but 90 percent of this potential is in eastern Senegal and Casamance, far from the urban consuming centers of western Senegal. Consequently, fuelwood resources closer to urban centers are being rapidly depleted. Wood is the basic household energy source. The residential sector consumes more than 90 percent of firewood and charcoal used in Senegal. To support this, the country is running an annual fuelwood deficit of 400,000 m^3 over sustainable supply, which is contributing to a growing fuel crisis.

There are significant indigenous resources to substitute for imported oil, including hydropower, limited petroleum resources, a small natural gas deposit, pea, and possibly lignite.

Major Energy Issues and Problems

- Rapid deforestation
- Energy sector institutions lack qualified and experienced personnel, particularly in the areas of economics, finance, and specialized fields such as wood and household fuel
- Deteriorating power supply. Rehabilitation of the largest power plant (124 MW) required. The other main facility (60 MW) is obsolete and inefficient and should be replaced. The distribution system in the Dakar region has not been adequately expanded or properly maintained, resulting in poor quality of service and high (about 16 percent) losses.
- Inefficiency of energy use

Recommendations and Priorities

- Eliminate energy price subsidies
- Training and technical assistance for energy sector institutions
- Improved coordination among energy institutions

- Improved management of forest resources and development of rural and state managed afforestation
- Dissemination of efficient cook stoves
- Power sector rehabilitation
- Establish demand management program for electricity, including publicity, technical advice, service, and technical audits
- Analyze possibility of using surplus bagasse to generate electricity for public supply
- Development of household energy strategy for urban consumers
- Promotion of industrial energy conservation

SIERRA LEONE

Overview

Although Sierra Leone has a favorable energy resource endowment, particularly forestry and hydropower, in recent years the country has been plagued by severe energy shortages which have disrupted economic activity.

Sierra Leone's energy situation is dominated by fuelwood (which accounts for 80 percent of energy consumption) and petroleum imports (20 percent of energy consumption). The modern economy is almost totally dependent on imported energy products. Households and transport are the two largest users of energy, accounting for 86 percent and 6 percent, respectively, of final energy demand. Industry accounts for 5 percent of final demand.

A large part of Sierra Leone's forest resources are not economically accessible and there are growing signs of regional shortages near urban areas. Sierra Leone's large hydroelectric power potential, estimated at 1,200 MW, has not been fully evaluated, and only a 4 MW mini-hydro plant has been built. There is a potential for offshore oil reserves, but limited exploration efforts have prevented an evaluation of the potential.

Major Energy Issues and Problems

Sierra Leone's energy sector faces serious problems, including:

- Energy shortages (electricity and petroleum products)
- Lack of foreign exchange to pay for oil imports and maintenance materials for plant and equipment
- Inefficiencies in petroleum procurement procedures
- Physical and financial disrepair of power subsector, due to poor management, maintenance, and foreign exchange shortages
- Unreliability and inefficiency of power supply. In 1986, less than half of the installed generating capacity was in service and between one-third and one-half of the electricity generating was being lost in technical and non-technical losses, and consumers were experiencing frequent and prolonged supply interruptions.
- Weaknesses in energy sector institutions, including lack of single organization to formulate and coordinate energy policy and lack of incentives for parastatals to supply energy at least cost

- Lack of technical expertise for planning and management of energy resources
- Regional shortages of fuelwood

The Government has initiated an economic reform program which, if sustained, would relieve the foreign exchange shortage and lower energy prices have provided the government with an opportunity to develop a coherent policy for the energy sector.

Recommendations and Priorities

The most urgent energy needs are to improve the supply of electricity and petroleum products and to strengthen energy demand management and energy institutions. The ESMAP mission recommended deferring major new generation and transmission projects and major fuelwood plantation investments. Specific recommendations include:

- Technical assistance and training to Ministry of Energy and Power to improve coordination and energy planning
- Adjustments in energy prices to reflect economic costs
- Rehabilitation of existing power generation facilities
- Power loss reduction study
- Strengthening of transmission and distribution networks
- Completion of transmission lines
- Improvement in provincial power systems
- Strengthening of Forestry Department
- Demonstration fuelwood plantations
- Initiation of program to promote use of improved stoves
- Reorganization of crude oil procurement system
- Development of accounting and information systems for petroleum sector
- Promotion of offshore petroleum exploration

TOGO

Overview

Togo's small modern sector relies on imported petroleum products and imported electric power and its large traditional sector relies on fuelwood to meet most of its energy needs. Petroleum products and electricity account for 50 percent of effective energy end use. The southern electricity system is interconnected with Benin and Ghana. Electricity supply is restricted to Lome and major towns. The industrial and transport sectors are the main users of petroleum products and electricity. With proper management, Togo's forests can meet the nation's fuelwood and charcoal requirements

The country's energy resource base has not yet been fully evaluated.

Major Energy Issues and Problems

- Lack of central body in charge of energy planning
- Weak energy sector management
- Shortages of fuelwood in urban areas and progressive degradation of vegetal cover in Northern Togo

Recommendations and Priorities

Given the country's serious economic situation, recommendations focus on promoting better energy management and efficient energy use in all sectors, rather than major new investments. Specific recommendations include:

- Technical assistance and training at for forestry, petroleum, and electricity subsectors
- Adjustments in energy prices
- Development and implementation of policies to promote private sector involvement in energy sector
- Coordination of energy programs with other countries in the region
- Rehabilitation and extension of power transmission system
- Provision of spare parts and equipment

- Consolidation of peri-urban afforestation projects and initiation of rural reforestation projects
- Strengthening of forestry institutions
- Increasing efficiency in charcoal production an both charcoal and fuelwood utilization
- Creation of a research and testing center for agricultural residues, particularly studying the economic and technical feasibility of increasing the use of residues in the industrial sector, and implementation of technology demonstration projects, particularly pilot projects for briquetting residues in rural areas near Lome
- Improvement of petroleum distribution services and build storage capacity to avoid supply disruptions
- Promotion of efficient energy use in all sector of the economy, including households

ZAIRE

Overview

Zaire has abundant energy resources, particularly hydropower and forests, and produces petroleum and coal in modest quantities. Zaire is the most heavily forested country in Africa. The country is potentially self-sufficient in energy, but much of its identified energy potential has yet to be developed. Since the mid-1970s, the energy sector has been adversely affected by the poor performance of the economy. Since 1983, Zaire has been implementing fundamental economic and institutional reforms to stabilize the economy in the medium term.

Biomass energy sources account for 86 percent of total energy consumption, with households accounting for 80 percent. Consumption of petroleum products and electricity is expected to grow at a faster pace than fuelwood, but fuelwood will remain the main energy source for the foreseeable future. In urban areas, drawdown of wood resources is exceeding the rate of regeneration. Rural areas have been less affected, but threats to future rural supply are present from destructive agricultural clearing and over-exploitation of forests by industries.

In 1985, only about 3 percent of the estimated 30.7 million inhabitants of Zaire had access to electricity. About 96 percent of the installed capacity is hydroelectric, with the remainder being higher-cost thermal power, found mainly in isolated areas. At present, installed capacity is underutilized, mainly because demand is much lower than was anticipated at the time capacity expansions were being planned.

Major Energy Issues and Problems

- Lack of sector-wide planning and coordination
- Weak energy infrastructure
- Ill-defined energy pricing policies
- Deficiencies of energy institutions
- Neglect of the rational exploitation of its biomass resources and a tendency to concentrate primarily on the issues of petroleum resources and electric power
- Lack of maintenance and technical expertise in the power sector has resulted in high losses and unreliable supply. Power subsector issues include: poor performance of isolated plants due to lack of maintenance and spares; nearly all power plants, particularly isolated thermal and hydro

plants, need rehabilitation owing to limited technical capability and irregular maintenance during periods of foreign exchange scarcity; lack of regular maintenance; practically all T&D systems, especially those associated with isolated thermal and hydro plants, need rehabilitation.

- Petroleum subsector issues include: shortcomings of institutional framework; petroleum exploration and production; importation, distribution, and marketing of petroleum products, and the role of the local refinery
- Household energy issues include: regional deforestation, fuelwood supply in Kinshasa, and inefficiency of cook stoves
- Lack of an adequate strategy, policies, and institutions for coping with the issues of forestry production and exploitation

Recommendations and Priorities

Main recommendations include:

- Prepare detailed inventory of forest reserves near demand centers for fuelwood in order to determine actual resource availability
- Development and implementation of policies and program to increase fuelwood conversion and end-use efficiency, and promote reforestation
- Promotion and distribution of efficient cook stoves, especially in Kinshasa
- Review optimal technical operation of Inga I, Inga II and Inga-Shaba line (hydropower plants)
- Revision of tariff policy and review petroleum pricing system
- Conduct detailed analysis of proposed program to double number of residential connections to the Inga II power plant
- Carry out household energy survey
- Conduct economic analysis of proposed industrial boiler and furnace conversion program
- Explore possibilities of joint power supply alternatives with the Congo and Zimbabwe
- Development of short- and medium-term strategies to increase quantity and quality of power supply in isolated areas

- Carry out additional studies on petroleum potential of Central Basin and encouragement of exploration
- Preparation and implementation of long-term program to rehabilitate existing petroleum product distribution facilities
- Carry out studies to determine feasibility of converting wood-consuming industries to coal; utilizing coal at cement plants; and converting coal to semi-coke for household consumption
- Carry out study on using surplus bagasse in cement plants
- Carry out program of insolation measurement in isolated areas and prepare experimental investment program for solar power in selected rural communities and hospitals