ENERGY IN CENTRAL AFRICA:

WITH SPECIAL REFERENCE TO ZAIRE

VOLUME I

by

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Submitted to the University of Cape Town
in fulfillment of the requirements for
the degree of Master of Science in Engineering

DECLARATION

I, Kumbu Bisengo, submit this thesis in fulfillment of the requirements for the degree of Master of Science in Engineering. I claim that this is my original work and that it has not been submitted in this or a similar form for a degree at any other University.

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_____ day of _____ 1992

ABSTRACT

In this thesis the energy sector of the Central Africa region is investigated with a special attention to Zaire.

The region's political trends, economic performance, demographic and social patterns as well as their implications in the development of the energy sector are presented. For each country of the region the resource potential and the ability to produce, distribute and use these energy resources, are analyzed. The potential for the development of energy resources of the region is examined and its future energy demand forecast. The scope for energy interchange inside and outside the region is analyzed and regional integration in the energy sector discussed.

The finding of this thesis are:
- there is an abundance of energy resources though not evenly distributed throughout the region,
- there is a heavy reliance on woodfuel, and
- there are many problems constraining the development of the energy sector.

The principal issues facing the energy sector are:
- the shortage of woodfuel due to the non sustainability of supply,
- the low reliability of power supply and the existence of surplus capacity in some countries,
- the high supply cost of petroleum products,
- the limited size of the local commercial fuel market and the lack of finance to develop domestic energy resources,
- the low level of management and financial autonomy for energy utilities,
- the lack of energy trade because of political instability, and
- institutional shortcomings.

Forecasts of future energy consumption in the region indicate that woodfuel will continue to be the dominant energy form, followed by oil and electricity, and that electricity will play an increasing role. Recommendations for the woodfuel subsector relates to improving the production and utilization efficiency - valid also for the other energy carriers -, increasing the supply through reforestation programmes and accelerating electrification.

Other recommendations to improve the development of the energy sector include:
- recovering energy supply cost through adequate pricing and improved collection practices,

- reducing government interference and introducing private participation in the energy sector with the subsequent benefit of the transfer of new technology and managerial competence, and
- strengthening energy institutions to enable them to improve planning, implementations, operations, and ensure the integration of traditional and commercial energy structures.

The possibilities of energy interchange are large for oil and electricity, and energy trade could improve energy utilization, lower supply costs, etc. Under prevailing socio-economic conditions, regional integration is thought to be the only realistic strategy leading to the economic exploitation of energy resources and the adequate supply of energy to support industrial development of the region and to meet the social needs of its people. In this connection, major efforts should be directed towards the establishment of appropriate regional energy institutions, but political stability is a prerequisite to any effective energy integration.

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VOLUME I

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

NOMENCLATURE

BHDC:	Broken Hill Development Company
CEPGL:	Economic Community of Great Lakes Countries
CPC:	Copperbelt Power Company
EDL:	Empressa de Electricidade de Luanda
ENE:	Empressa Nacional de Electricidade
ENERCA:	Energie Centrafricaine
ESKOM:	South African electricity Utility
FPA:	Fina Petroleos de Luanda
GDP:	Gross domestic product
GNP:	Gross national product
INDENI REF:	Indeni refinery
KBO:	Organization for the Management and Development of the Kagera river Basin
kgOE:	Kilogramme of oil equivalent
MPLA:	Movimento Popular de Libertacao de Angola
RUBADA:	Rufiji Basin Development Authority
SADC:	South African Development Community (formerly SADCC))
SNEL:	Société Nationale d'Electricité
SONANGOL:	Sociedade Nacional de Combustiveis de Angola
SONEFE:	Sociedade Nacional de Estudo e Financiamento de Empredimentos ultamarinos
TANESCO:	Tanzania Electricity Supply company
TFC:	Total final consumption
TIPER:	Tanzania-Italian Petroleum Refinery
TOE:	Ton of oil equivalent (1 TOE = 42×10^9 joules)
TPDC:	Tanzania Petroleum Development Corporation
UNDP:	United Nations Development Programme
UNITA:	Uniao Nacional para a Independencia Total de Angola
ZESCO:	Zambia Electricity Supply Corporation

GLOSSARY

Commercial energy:	Energy which is subject of a commercial transaction and can thus be quantified more easily
Conservation:	Careful use of resources to allow for their use in future
Deforestation:	The permanent destruction of indigenous forest and woodlands
Development:	Modification of resources to obtain their benefits and improve human well being.
Fuelwood:	Wood burnt to obtain energy as opposed to wood used for construction or furniture, etc. (include charcoal)
Resources:	Anything which can be used to maintain or improve human well being
Traditional Energy/ (Non-commercial Energy):	Energy forms which are not subject of a commercialexchange and which are difficult to account for in energy balances. For the purposes of this study all wood and charcoal are defined as traditional
Urbanization:	The process by which the number of people living in cities increases compared with the number of people living in rural areas.

1. INTRODUCTION

1.1 General

This work analyses the energy situation in Central Africa. For the purpose of this study, Central Africa is defined as a region consisting of Zaire and its immediate neighbours; Angola, Zambia, Tanzania, Burundi, Rwanda, Uganda, Sudan, Central Africa and Congo. However, two other countries, Cameroon and Gabon, likely to affect energy policies of this region have been included.

The choice of Zaire as a focal point for this study is explained by the fact that it is one of the most strategic African countries because of its geopolitical usefulness, its extensive mineral wealth and enormous energy potential. In fact, located in the heart of the continent, it has more international borders than any other African state. Underground are hidden large reserves of strategic minerals, making it potentially one of the richest countries in Africa. It has enough arable land, and large hydro-generating potential (774 million GWh or about 37%[1] of the total hydro-potential of the continent) to feed and power the entire continent. The estimated hydroelectric capacity of the Zaire river system is about 100 000 MW, which is more than the installed hydropower capacity of the United States of America (84 152 MW in 1987)[2]. Of this potential, 44% is concentrated at the Inga Falls site, which is more than the present 35 000 MW total installed capacity of South Africa. In addition, Zaire accounts for about 48% of the African tropical forests which, besides being an important source of fuelwood, are of great environmental significance and habour significant portions of the World's endangered species of animal as well as plant life. All this shows that Zaire is of unquestionable interest in any regional planning, in spite of its present political and economic difficulties.

The region covered in this study has a land area of about 9812 thousand sq km, with Sudan and Zaire being the first and the third largest countries on the African continent respectively. Climatic conditions vary considerably. Vegetation cover includes desert zones (Northern Sudan), humid equatorial and tropical forests, and savanna grasslands. The various countries display a number of similarities. Their economies are fragile and too dependent on a few export crops and minerals, a sad legacy of colonial exploitation that three decades of independence has not corrected. In general, their GDP per capita has been declining over the last decade and they are indebted to foreign banks.

The population of the region was estimated at 155,4 million in 1990. Demographic patterns show a very young population with a high growth rate, high illiteracy and a shortage of skilled labour. There is a decline in health and educational

infrastructures. Life expectancy is low. Poverty, disease and famine ravage the region and the continent in general, and are becoming the entrenched natural order. In the energy sector, both the traditional and commercial energy subsectors are facing serious problems: an increasing depletion of forest resources to meet growing woodfuels demand, a great dependence on imported oil products (for non oil producers) accounting for a large share of their export earnings, and a poorly coordinated and unreliable electricity supply infrastructure. The region is endowed with large commercial energy resources required for its development. However, the limited size of the domestic markets and the high development costs are very serious constraints to the harnessing of these commercial energy resources.

Politically, most of the countries in the region have had frequent periods of instability (civil war, invasion, rebellion, military coup, etc.). Strong dictatorships and single party systems have been common place, and the lack of accountability has led to economic mismanagement, civic and human rights abuses. In a regional context, the obsession with national security imperatives, the alignment on conflicting ideologies, and the support for each other's opposition movements have resulted in division and mistrust between neighbouring countries. As a result, the confidence and stability needed to ensure a true cooperation in the various sectors of the economic and political life have been destroyed.

Fortunately, there is now a global shift away from authoritarianism in favour of pluralistic politics and accountable democratic governments. Political changes are being coupled with economic reforms as they are complementary and mutually supportive. Failed socialist style economic systems are being replaced by market driven systems. The end of the Cold War is leading to a peaceful settlement of internal and regional disputes, which, one hopes, will reduce the diversion of military funding towards economic upliftment.

As prospects for democracy, peace and stability in the region are brighter and more tangible than ever before, regional integration and cooperation can begin taking place. Regional cooperation could be part of the solution to many energy-related difficulties in the region. Common projects can best achieve the provision of adequate and secure energy for all at reasonable cost as opposed to individual country's schemes. By making the market larger, they can guarantee an effective and efficient utilization of the harnessed energy. Moreover these common projects bear more credibility in finance collection and can attract overseas investment. Cooperation also means a regional rationalization of existing facilities such as refineries and hydropower dams, setting up common electricity grid, development and investment plans, etc. Cross-border cooperation will enhance working

relationships and stability. By helping to generate economic wealth and broaden economic activities, it will help to overcome poverty, making a dynamic contribution to the well being in the region. Cooperation could assure a collective self-reliance.

In order to analyze the energy situation in the region, this study gives an overview of the demographic and economic situation of each country, the energy resources, supply and demand and analysis of the regional aggregate situation. An assessment of energy interchanges and possible contribution of countries outside the region (such as South Africa) is made.

1.2 Objectives

This work aims at:

(a) Providing a fundamental analytical framework of the energy scene in Central Africa by setting up data bases for individual countries as well as providing a regional data base.

(b) Providing a regional base for the consideration of energy issues in order to identify options for achieving integration and cooperation within the energy sector, which is already considered as an objective in other fields by many African states.

1.3 Methodology

Some energy profiles for countries found in the region as defined above had already been written and published by the Energy Research Institute. The first part of this work therefore consists of completing energy profiles for the remaining countries namely: Burundi, Rwanda, Uganda, Sudan, Central Africa and Congo, Cameroon and Gabon. In this regard, significant statistical data on the energy sector and connected issues have been collected. They include energy resources, energy supply and demand, energy institutions, the gross domestic product, demography, etc. Where possible, some functions such as the energy flows within the different economic activities, population growth, GDP growth, etc. have been analyzed. The energy profiles of the countries mentioned above are found in Volume II.

A special emphasis has been placed on Zaire's possible role in a regional energy context. For this reason, a complete energy profile of this country is included in the main text of Volume I.

These individual data bases have been integrated in a regional data base which is a starting point for a regional planning process. In order to get an overall view, relevant information from the country profiles has been collected in the regional

analysis, according to topics such as demography, economy, energy resources, energy supply demand, etc. A discussion on rethinking the collective self reliance, interchange of energy, potential for growth, etc. precedes the conclusion of the study.

1.4 Thesis Outlines

This work is divided into 6 chapters.

Chapter 1 presents the overview of the region and outlines the main objectives of the thesis.

Chapter 2 provides short descriptions of the countries of the region. These descriptions contains the main features of these countries and form the background for the regional analysis.

Chapter 3 summarizes the energy situation of Zaire, the focus of the study, and its possible role in a regional energy cooperation. Its political history, demographic and economic trends are also provided in order to get a better understanding of this country.

Chapter 4 deals with the analysis of the Central African region. The global political, economic, demographic trends as well as the overall energy sector are described. The energy sector covers the demand and supply, the resources and market, the institutions, the technology transfer and the environment.

Chapter 5 discusses the realization of regional integration and collective self-reliance through energy interchange, the potential for regional growth, South Africa's influence on the region, the implications of energy interchange, and the future role of Zaire.

Findings are highlighted and the conclusions are drawn in Chapter 6.

The graphs and figures for the various chapters are collected at the end of Volume I. Volume II has the collection of the energy profiles of the selected countries in more detail.

1.5 Limitations

The main handicap to an accurate analysis of the energy situation in the region has been the lack of accurate data. Efforts to obtain reliable information from energy ministries and institutions of various countries have been largely unsuccessful. Very often, reliance had to be placed on the estimations found in the energy statistical yearbooks published by the United Nations. Significant use has been placed on various publications of the World Bank.

2. COUNTRY DESCRIPTION

2.1 Introduction

This chapter provides short descriptions of the countries of the region with the exception of Zaire. These descriptions contain the main features of these countries and form the background for the regional analysis. However, for more details, a series of individual reports on each country, except Angola, Tanzania and Zambia, are provided in Volume II.

2.2 Angola

2.2.1 General:

After a Portuguese presence of five centuries, Angola became independent on November 11, 1975. The country has known three decades of nearly nonstop guerrilla warfare and civil strife, including an anti-colonial war since 1961, and a constant and bloody civil war since independence. A peace agreement was signed on May 31 1991, between the MPLA government, backed by the former USSR and by Cuba, and the UNITA rebel movement, supported by Western countries and by South Africa. After the settlement of the civil war, Angola is returning to stability. However, independent movements remain very active in the oil-rich enclave of Cabinda. Multiparty legislative and presidential elections are scheduled for the end of September 1992.

Angola is potentially one of the richest countries of Africa. It has large oil reserves, vast hydroelectric potential, valuable minerals - including diamonds and iron ore, and large areas of agricultural land. Formally agrarian, the economy of the country was dominated, until 1910, by the slave trade. This was progressively overtaken by the cultivation of coffee. By the 1970's Angola was the fourth largest producer of coffee and diamonds in the world. Oil and various agricultural exports were becoming increasingly important. The country inherited, at independence, one of the most diversified industrial economies in sub-Saharan Africa[3], with a large fishing fleet, a growing manufacturing sector, and good transport and communication infrastructures.

However the high economic expectations of independence have never been fulfilled. All sectors of the economy have shown a dramatic decline as a result of the acute skill shortage, the restructuring of the economy on Marxist-Leninist lines and the long civil war. The massive emigration of the economically dominant Portuguese settlers, and the departure of a significant part of educated Angolans are the cause of the acute shortage of trained and skilled labour in the country. The long civil war

has taken a heavy toll on human life and has led to enforced urbanization, destroying the traditional farming sector and placing a growing burden on overstretched urban services. In addition, it diverted funds to the defense sector (40% of government's total budget expenditure in 1988[4]), and inflicted large scale infrastructural damages.

The economy is dominated by state enterprises. However, in the oil industry, the mainstay of the economy, there is a substantial foreign presence. Oil extraction, refining and distribution, accounted for 93% of the export earnings and 52% of GDP in 1987. The oil industry was largely spared by the civil war because production was confined to the enclave of Cabinda and to offshore blocks[3]. The next largest exports are diamonds and coffee which accounted for 5,6% and 3,9% of the export earnings in 1983 respectively. The GDP per capita, US$ 485 in 1986, is low compared to other sub-Saharan African oil producing countries, among whom it ranks as the second largest exporter, after Nigeria.

Major reforms are underway to introduce a market economy, restore private property, and increase productivity. If stability and peace prevail, Angola is likely to have one of the most successful economies of the continent.

2.2.2 Energy:

Angola possesses significant and diverse energy resources which are far in excess of its own energy needs. They include large reserves of petroleum and gas, huge hydroelectric potential from the Kwanza, Cunene and other rivers, and ample woodfuel resources. However the energy infrastructure has not been adequately maintained during the difficult years of the civil war. The country faces difficulties in reconstructing power supplies and developing a good internal electricity system.

Dense forests cover 53,1 million ha or about 43% of the total land area. In addition, there are some 55 million ha of woodland and savanna. Forests resources are not evenly distributed inside the country resulting in wood-fuel surpluses in parts of the country and shortages in other areas. The most important resources are the tropical rainforests found in the north, especially in Cabinda.

Proven recoverable reserves of crude oil were estimated at 2,1 billion barrels in December 1987[4]. About half of the oil output come from the enclave of Cabinda. Outside Cabinda, the Angolan coast has been divided into 24 exploration blocks. Gas is not adequately explored however, reserves are estimated at 37 billion m^3[5], two-fifths of which are in association with crude oil. Most of the gas exploited is used for oil well injection in order to increase oil recovery. Some LPG (about 2 million

barrels in 1985) is produced offshore and is exported to Brazil. Consideration is being given to LPG production for local consumption, and the manufacture of ammonia/fertilizers, using natural gas.

There are about 13 foreign oil companies involved in the oil sector. Interest in the Angolan oil is explained by the favourable geological terrain, low production costs, and attractive incentives regarding profit sharing and profit repatriation offered to foreign companies.

Angolan hydropotential is estimated at between 70 000 GWh and 150 000 GWh annually or 16 000 MW at a load factor of 50%. Electricity is mainly hydro-generated. The completion, in mid-1994, of the enormous 520 MW (4 X 130 MW) Capanda power station, will double the installed power capacity of the country. This power station which is being built by a Brazilian-Russian consortium on the Kwanza river, 450 km from Luanda, in the middle of northern region of Angola, will have an annual output of about 2400 GWh. A 220 kV transmission lines will connect Capanda to the national grid(6). There are attempts to export this power either to Namibia or to South Africa. Considerations are also being given to a possible hydroelectric station at Epupu Falls on the border with Namibia, just down stream the existing Namibia's Ruacana dam, on the Cunene river. The scheme, a joint venture with Namibia, is expected to have an installed capacity of 400 to 450 MW, and seems to be viable for Namibia and Southern Angola. However Angola is not very supportive of it because of its own overcapacity.

Three electrical utilities (ENE, SONEFE, EDEL) operate three non-interconnected systems. The state owned SONANGOL, an administrative wing of the Ministry of Energy and Petroleum, controls the oil sector. There is an under-recovery of energy costs. The electricity tariffs for instance have not changed since 1960's. It is estimated that the electricity tariff is some one-eighth of the true cost of electricity and that in 1985 the utilities had a net deficit of US$ 46,7 million(7).

2.3 Burundi

2.3.1 General:

Burundi is a small land-locked country. It is one of the most densely populated country of the continent, with a population density of about 185 inhabitants per sq km. About 95% of the population live in rural areas. Ethnic conflicts between the ruling Tutsi minority and the Hutu majority have exploded several times since independence. A multiparty constitution was adopted in March 1992.

Lake Tanganyika is crucial to the transport system of the country. Agriculture is the main economic activity, providing more than 50% of GDP and using about 92% of the labour force. The main cash crop is coffee (of which 95% is Arabica) which accounts for 90% of total exports earnings. It is followed by tea and cotton. Cattle play an important traditional role.

Apart from the processing of agricultural products, industrial activity is limited to textile, soap and shoe factories, cement works, and a brewery. Gold and tungsten are mined on a small scale. Deposits of nickel (280 million tons or 5% of world resources[8]) and vanadium remain to be exploited.

Burundi is a low income country, with a GDP per capita of about US$ 213 in 1988. Debt service payments took up 38,5% of the export earnings in 1987[9]. Economic life, especially trade and communication, was disrupted by the instability in Uganda in the past. The country's economic development is hampered by overpopulation, the lack of natural resources, its land-locked position and the long distances from the coast (about 1400 km to Dar es Salaam [Tanzania] and 2000 km to Matadi [Zaire]).

2.3.2 Energy:

For most of the population, traditional fuels, mainly wood, are the main form of energy, supplying over 90% of the country's final energy demand. Forest resources are dwindling and the country is embarking on a long term reforestation programme in order to increase the supply of woodfuels. Reforestation projects are however limited by the modest size of the country and by the extension of agricultural lands to feed the fast growing population.

The country has no proven oil reserves and no natural gas. Traces of oil have been found under Lake Tanganyika but the drilling tests have been inconclusive. Petroleum products are completely imported and provide the bulk of commercial energy. Due to location patterns, oil products are expensive (about US$ 100 per barrel in 1988). They use up 20-30% of foreign exchange earnings.

Domestic hydropotential is sufficient to cover the country's electricity needs. However, on one hand it is costly to develop, and on the other, some potential schemes fall across the borders with its neighbours, requiring some international arrangements prior to their exploitation. The country is planning for a medium and

long term reliable supplies of electric power, and hydroelectric schemes have been receiving wide attention. This policy should significantly reduce the country's dependence on electricity imports from Zaire. Present electric installed capacity is about 32 MW, mainly in the form of hydro. The grid is connected to Zaire and Rwanda.

Peat is being developed as an alternative fuels. Reserves of peat are enormous and their extent is being assessed. Production is presently carried out on a very small scale.

2.4 Cameroon

2.4.1 General:

The GDP per capita was US$ 1133 in 1988. Debt service took 27,9% of export earnings in 1987[9]. The economy is based on a wide range of agricultural products and on oil. Petroleum, coffee and cocoa accounted respectively for 46%, 10% and 13% of export revenue in 1987. The economy has performed relatively well in the past. Oil revenues had been protecting the country from the fluctuations in export crops earnings. However, an economic crisis started in 1989, resulting from the exhaustion of oil funds, the sustained weakness of world oil prices and the decline of oil output. Oil reserves are becoming exhausted and long term recovery prospects are unsure. The country is currently engaged in economic restructuring programmes.

The country is self-sufficient in food, and primarily agricultural and forest products provide about one-half of total export earnings. Coffee and cocoa are the most important cash crops.

Industry, dominated by oil mining, is an important sector of the economy, accounting for 28,6% of GDP in 1988. Apart from oil and limestone, minerals (bauxite, uranium, iron ore, and natural gas) are not yet exploited. Manufacturing is essentially engaged in the processing or the assembly of raw material and imported components.

The country is currently in a transition towards democracy. A multiparty system has been introduced, but the government has refused to renegotiate a real new political deal unless defeated at elections[10]. This is underlined by its resistance to organize a sovereign National Conference. Legislative elections have been largely boycotted by most opposition parties. The first democratic presidential elections have been scheduled for October 11, 1992.

2.4.2 Energy:

Cameroon is endowed with abundant energy resources. About 43% of the total land area is covered by dense tropical forests, with the south being better endowed than the north. Hydropower potential is estimated at 23 000 MW (100 000 GWh/year) and one third of this potential is economically and environmentally exploitable. Oil resources are declining. Natural gas, estimated at 119 billion m^3, has yet to be exploited.

Traditional fuels accounts for about 70,6% of the total final consumption. Crude oil output was 8,48 million tons in 1988. Domestic crude oil is processed to meet local demand but more than half of the refinery output is surplus and must be exported. Oil products provide 79% of the final demand of commercial energy.

Electricity comes mainly from hydroplants. The three hydroplants located at Edea, Song-Loulon and Lagdo account for 87% of the total installed capacity and about 97% of the electricity generated in the country. More than half of the total electricity generated is consumed by the aluminum smelting industry. A new hydroelectric power station of 200 MW is planned at the Nachtigal Falls on the Sanaga river.

2.5 Central African Republic

2.5.1 General:

With a GDP per capita of about US$ 390 in 1988, the Central African Republic is a low income country. Its transportation system is dependent on the Ubangui and Zaire rivers. The land-locked position of the country, combined with the long distance from the sea (about 1815 km from Pointe Noire in the Congo) and the internal transport difficulties have retarded the development of the country.

However the country has potential for development. It enjoys a relative ethnolinguistic unity, boasts considerable mineral resources, including iron, tin, chromium and above all, gem and industrial diamonds, and significant uranium ore. In addition, there are extensive forests and great hydroelectric potential which are both virtually untapped.

The economy is small. Debt service payments was 12,1% of the value of export in 1987[9]. Agriculture is the mainstay of the economy, accounting for 40% of GDP in 1988 and using about 83,3% of the labour force. Coffee and cotton are the most important export crops and the major source of revenue. Timber exploitation is hindered by the lack of adequate roads.

The industrial sector is small and includes factories producing cotton fabrics, footwear, and beer. Diamonds and gold are mined.

Politically, the country has been under successive authoritarian regimes since independence. Transition to full democracy is difficult. Political parties have been legalized. The opposition parties have asked for a sovereign National Conference but the government has organized a national debate with limited power. It has been largely boycotted by the major opposition parties, the church and the trade unions. Presidential elections are scheduled for the end of October.

2.5.2 Energy:

The Central African Republic has large potential energy resources which have not been adequately explored or exploited. They includes a significant forest cover, a large hydropotential from its numerous rivers and valuable ore-rich deposits of uranium.

The energy supply is overwhelmingly dominated by traditional fuels. Commercial energy amounted to only 8,2% of the total final consumption in 1988 and is highly dependent on imported oil products. This situation has a serious effect on foreign exchange. There was an acute oil shortage in 1979/80. Petroleum products are widely used to fuel thermal stations.

Electricity is generated and distributed by the state owned ENERCA. Thermal generation accounted for 56,3% of the total installed capacity and 26,9% of electricity production in 1990. In order to reduce the share of thermal generation and conserve oil, the government is committed to harness local hydro resources. There are two hydroelectric stations, Boali-I and Boali-II on the Mbali Falls. In 1990 Enerca had a total installed capacity of 42,72 MW and produced 99,95 GWh. In addition, in a joint venture with Zaire, the 10,5 MW Mobayi Mbongo hydroelectric power station has been built on the Ubangui river, on the border with Zaire.

Uranium it is not yet mined and is likely to remain untapped due to low uranium prices.

2.6 Congo

2.6.1 General:

The Republic of Congo-Brazzaville is moving quickly towards a full democracy. The introduction of a multiparty political system was followed by a Sovereign National Conference in 1991. A new president was democratically elected in August 1992.

The Republic is a middle income country with a GDP per capita of about US$ 1038 in 1988. Large scale nationalization seriously hurt the economy in the 1970's. The economy had been predominantly agricultural before being overtaken since 1979 by oil which led to an economic boom in the 1980's. However the economy is fragile. Known oil reserves are being exhausted and the bulk of the state's resources is absorbed in paying its civil servants (75% of the budget). The relaunching of the economy on sound foundations is now the Congo's top priority.

About 62% of the working force is engaged in agriculture though its contribution to GDP is small. The industry is oil-based. Manufacturing is increasing and includes food processing, textiles, cement, metal industries and chemicals. Lead, copper, zinc and gold are the main minerals. There are reserves of phosphates, bauxite and iron.

2.6.2 Energy:

About 65% of energy needs are met by traditional fuels in final consumption terms. Forest resources are important and cover about 21 million ha or 62% of the total land area.

Proven recoverable oil reserves amounted to 114 million tons in 1990[4], and the output was 7,04 million tons in 1988. Elf-Congo and Agip-Congo are the major oil mining companies. There is a refinery at Pointe Noire. Natural gas resources are estimated at 70 million m^3[11].

Hydroelectric potential is important and only a small fraction is presently harnessed. Thermal generation is small. The hydroelectric power stations are Djoue in the Brazzaville region and Moukoukoulou in the Pointe Noire region. Imports from the Inga power stations in Zaire makes up the shortfalls in the Brazzaville grid which is connected to the Kinshasa system. Talks are underway to link the Inga power stations to the Pointe Noire grid via the Angolan enclave of Cabinda.

2.7 Gabon

2.7.1 General:

Gabon has officially been a one-party state since 1968. However, with the wind of change blowing on the continent, the country moved quickly in 1990 to a national conference to facilitate return to multiparty politics. The first democratic presidential elections will be held in 1994.

With a GDP per capita of about US$ 3003, Gabon has the highest level of income per head in Sub-Saharan Africa. This is accounted for by the modest size of its population and its successful economy. Unemployment is virtually non-existant in the country and the economy is dependent on imported labour. The main feature of the economy is the coexistence of a highly intensive export sector (mining and forestry industries) with a predominantly subsistence agricultural sector.

Agriculture production is inadequate and food is also imported. Forestry is important and accounted for 16% of total export earnings in 1988. Gabon is well known for the Okoume timber of which it is world's largest producer. The principal agricultural exports are cocoa, palm oil, coffee and refined sugar.

The economy is dominated by the mining sector activities. Oil accounted for 63% of export earnings and 32% of GDP in 1988. Oil extraction from offshore fields totalled 11 million tons in 1989. The other mineral resources currently exploited on a large scale are manganese (2,25 million tons in 1988) at Moanda in the south-east, and uranium (850 tons in 1988) nearby at Mounana. Gold, zinc and phosphates also occur. However the output of uranium declined sharply as a result of international economic slowdown. Gabon has also large iron deposits which await exploitation. The most important of them are located at Mekambo (one of the world's largest deposits) and at Belinga in the north-east. Manufacturing is mainly based on the processing of food, timber and mineral resources.

In order to revive the timber industry in inaccessible zones and to facilitate transportation of minerals, two sections of the Transgabonais railroad project have been built at the cost of US$ 3 billion. They are the 340 km Owendo-Booue line, inaugurated in January 1983, and the 330 km Booue-Franceville line, inaugurated in December 1986. The third section of the project, linking Franceville to Belinga has been suspended. It was intended to be a support infrastructure for the exploitation of the large iron ore deposits in the Northeast of the country.

2.7.2 Energy:

Gabon has relatively large energy resources which are far in excess its needs. This potential consists of oil, natural gas, hydropower, uranium, and renewable energy such as wood and solar.

More than three-quarters of total land area is covered with forest. Proven oil reserves amounted to 133,4 million tons in 1987. Total proven natural gas is officially estimated at between 40 and 45 billion Nm^3, and natural gas production totalled about 2 billion m^3 in 1985. Exploitable hydropotential is around 6000 MW and

33500 GWh per year. Uranium reserves are significant. The country enjoys a high degree of insolation.

Gabon has a very high level of commercial energy final consumption per capita, 440 kgoe according to IEA statistics. With the exception of some oil imports to make up the shortfall of production from the local refinery, Gabon is self sufficient in energy.

Electricity production and distribution are in the hands of the Société d'Energie et d'Eau du Gabon (SEEG). Production was mainly from diesel or natural gas fired thermal plants until the early 1970's, when the first hydroplant at Kinguele was completed. Since then, hydroelectricity has been increasing, accounting for 168,8 MW on a total installed capacity of 251,9 MW in 1988. There are now four hydroelectric plants in the country: Tchimbele and Kinguele on the Mbei river, Poubara-I and Poubara-II.

2.8 Rwanda

2.8.1 General:

Rwanda displays the same geographic and socio-economic patterns as Burundi. The country is land-locked, almost bereft of natural resources, and very distant from the sea. Compared to its modest size, Rwanda is overpopulated. It has a very high population density of about 282 inhabitants per sq km. That is why Rwanda has always refused to accept a large of number of refugees who are in neighbouring countries. A multiparty political system has been instituted. Negotiations are underway to settle peacefully the military conflicts between the government and the Front Patriotique Rwandais, formed of Rwandan exiles, mainly from the Tutsi ethnic group, based in Uganda.

The GDP per capita was US$ 350 in 1988. The past instability in Uganda contributed to the disruption of economic life in Rwanda. The economy is based on agriculture. Coffee and tea account for more than 80% of all export earnings and 45% of the GDP. Food resources are increasingly strained by population pressure. There is a pilot rice-growing project. Cattle play an important traditional role. Food processing is the main industrial activity (64%) followed by construction (15,3%) and mining (9%).

2.8.2 Energy:

About 25% of the land area is covered by trees. However, fuelwood is becoming increasingly scarce as a result of the heavy reliance on traditional fuels. In fact,

traditional fuels accounts for more than 92% of the total final consumption. Reforestation projects exist but they remain weak. They are often accompanied by public education on traditional fuel economy. As a result of the both the high population density and the large growth in the population, reforestation efforts are in competition for land with agricultural production.

All petroleum products are imported. They represent about 5% of total energy consumption and 86% of commercial energy final demand. The transport cost is a major determinant of the oil products prices.

Rwanda has some domestic hydro resources but they are costly to develop because potential sites are generally of small capacity. Important hydro sites are found on the border with neighbouring countries and thus bilateral arrangements are necessary for development. Electricity is mainly hydro-generated. The grid is connected to Zaire and Burundi. Imports from Zaire's Ruzizi-I dam has been declining due to the harnessing of domestic resources and the commissioning of the Ruzizi-II dam. The Ruzizi-II plant belongs to Zaire, Rwanda, and Burundi.

The other important energy resources are peat, papyrus, and methane gas. Peat and papyrus are abundant but are not yet exploited. Significant reserves of methane gas are dissolved in deep water of Lake Kivu, on the border with Zaire. They are estimated at about 60 billion Nm^3 but are increasing as a result of decomposing vegetable matter. A pilot plant extracts the methane gas on a small scale and production is almost exclusively sold to a local brewery. Tests are being carried out to compress methane into CNG for a pilot study in converted gasoline vehicles.

2.9 Sudan

2.9.1 General:

Sudan has the distinction of being the largest African country, with total land area of 2,5 million sq km. The Muslim Arabs inhabit the north of the country and dominate national affairs. The South is inhabited by Animist or Christian Black Africans. The imposition of Islamic laws on Southerner Blacks, their economic backwardness and their tendency to political distinction has resulted in a civil war since 1983. A 300 member-transitional Parliament was appointed on mid-February 1992 by the ruling military dictator in order to pave the way for democracy. However political parties have been banned since 1989.

The economy is predominantly agricultural. Widespread nationalization of financial and manufacturing sectors, and the taking over of substantial amounts of property,

begun in 1969, have led to economic disruption. Since 1973, there has been a return of nationalized assets. Liberalization moves were enhanced by the abolition of most state trading monopolies in 1980. Islamic economic laws, regarding taxation and banking practices, introduced in 1983, had serious repercussions on the economy before being abandoned in 1986[9].

The Nile and its tributaries are the lifeblood of Sudan, as the agriculture is highly dependent on irrigation. Agriculture is the source of almost all foreign exchange earnings. Cotton is the major cash crop. Gum arabic is the sole forest produce exported on large scale. The country is not self-sufficient in food, and food shortages are acute in the South of the country as a result of droughts and civil war.

Industry is based on the processing of agricultural products. Sudan has a wide range of valuable mineral resources which remain largely unexploited. They include commercial quantities of oil, reserves of metallurgical grade chromite, huge reserves of chrysotile asbestos, deposits of manganese, marble, mica, gypsum, iron and uranium. Mining operations are small.

2.9.2 Energy:

Forest are the most abundant energy resource of the country. However the resource is not evenly distributed, the bulk of the forest cover being found in the relatively humid and tropical South. In addition the human settlement is such that the arid and desertic North accounts for 78% of the total population, resulting in increasing fuelwood scarcity, rising prices and environmental degradation[12]. Traditional fuels accounted for 76% of the total final consumption in 1988.

The 1987 official figures estimate oil reserves at 273 million tons, of which 68 million are recoverable. There are five known oil fields, including Abu Jabra, Unity-Talih, and Igligli. Unity-Talih and Igligli are the most promising and are found in the south. They are estimated to yield 4,8 to 5,5 thousand tons/day and 2 to 2,7 thousand tons/day respectively. However their exploitation has been hampered since February 1984 by the deterioration in security conditions following the civil war in the south, which forced Chevron Oil Company to suspend operations. A local firm, Concorp, reportedly supported by Iran and the Rumanian state oil company Rompetrol, is said to be extracting oil from two wells in the Abu Jabra field, in the western province of Kordofan. These wells have been leased by Chevron, which has been under pressure by successive governments to resume operation. Production is about 2,7 thousand tons per day, and the crude will be processed at a semi-refinery being built near the site[13].

Petroleum products accounts for 94% of commercial energy final consumption. The country imports both refined products and crude oil. Imported crude oil is processed by the domestic refinery located at Port Sudan. Large quantities of excess fuel oil are exported each year.

Exploitable hydropower potential is estimated at 2000 MW while the total potential is 2700 MW. However, the rivers have a low gradient and hydroelectric schemes has to satisfy flow regulation purposes and irrigation requirements. The share of electricity in energy demand is small. Total installed capacity was 450 MW in 1988. Thermal generation is important in the country, accounting for half of the total installed capacity. Public supply reliability is a major problem. This has led to the growth of private generation. Electricity consumption is concentrated in Khartoum and the Central region. These two regions accounts for about 87% of the total consumption.

2.10 Tanzania

2.10.1 General:

Tanzania is a low income country (GDP per capita: US$ 127 in 1988), with heavy dependence on agriculture. About 84% of its population, estimated at 24 million in 1988, live in rural areas. Rural development efforts had placed emphasis on collective agricultural production and relocation of the scattered population into villages. These villages were also intended to be social and infrastructural services centres. The villagization policy had some disrupting effects on the agricultural sector. Aids incidence is increasing, especially on the border with Uganda, where there has been a massive displacement of people in the past. Moves towards democracy have been slow. However, in April 1992, the Tanzanian parliament amended the constitution in order to introduce multiparty democracy in the country.

The economy has suffered from repeated droughts, the command management of important economic sectors (major industries, distribution and marketing systems), the heavy reliance on oil imports, and the general world recession. In 1988 the contribution of the different sectors to GDP was as follows: agriculture about 66%, industry 7% (manufacturing 4%), and services 27%. Agriculture accounts for up to 80% of export earnings[4]. A five-year economic recovery programme (ERP), launched in 1986, led to the liberalization of imports, the reform and partial privatization of agricultural marketing boards and the tightening of monetary policy[3].

2.10.2 Energy:

Tanzania enjoys a wide range of energy resources, which remain inadequately explored and largely untapped. They include a significant hydropotential from its abundant rivers and waterfalls, important coal and gas reserves, large forest resources, confirmed reserves of uranium, some geothermal potential and other renewables.

Traditional fuel accounts for 96% of the total final energy demand. Woodfuels are the domestic source of energy for heating and cooking in both urban and rural households. Forests resources are important, covering about 40% of total land area. They include 43,2 million ha of natural forests, 950 thousand of closed tropical forests, 29 000 ha of planted trees woodlots, 60 000 ha of softwoods, and 6000 ha of hardwoods[14]. However, the heavy reliance on woodfuels and the low annual volume of forest increments have resulted in forest depletion and woodfuel scarcity.

Tanzania has no known oil deposits. Although potential oil bearing sedimentary basins have been identified in the Rift valley region and in eastern coast, no oil find has been made. Oil accounts for 85% of commercial energy final demand and oil imports drain about 60% of foreign exchange earnings. A large part of oil usage is for electricity generation. The Tanzanian Italian Petroleum Refinery (TIPER) in Dar es Saalam refines the imported crude oil, but operates below its initial rated output of 700 000 tons/year of refined products. In order to reduce the excess residual fuel, exported at reduced price, it has been switched to lighter crude, leading to a reduction of the plant capacity to 67 000 tons/year of refined products.

In order to reduce oil imports and save the badly needed foreign exchange, the country has embarked on the development of its large hydropotential estimated at 6000 MW and 20 000 GWh/year[14]. More than 70% of the country's electricity is generated by hydropower. The installed hydro capacity is about 333 MW. A hydro-based rural electrification programme has been launched and many diesel fired plants are going to phased out. This programme includes the extension of the national grid and the development of mini hydroplants. In this regard, about 80 potential sites have identified and more than 20 small hydroplants were operational by 1987. Tanzania has a 15 MW power import contract with Uganda. This power is intended for the northwestern banana growing region of Kagera. It will be delivered once the proposed 132 kV line between Masaka (in Uganda) and Bukobo is built. Electricity represents about 11% of the commercial energy final consumption.

Coal resources are estimated at 1,9 billion tons, with 304 million tons being considered proven. Coal accounted for 4% of commercial energy final demand in 1988 and is mostly used in industry. In order to increase the consumption of coal, large scale coal exploitation started in 1988 at the Songwe-Kiwira coal field, with the Kiwira and Ilema mines having a respective annual capacity of 100 000 tons and 20 000 tons. A 6 MW coal fired power station, the first coal fired generating plant in the country, has been built at the Kiwira mine to provide power for the mining operations and to neigbouring areas[15].

There are large gas reserves, which remain unutilized. The most important gas field is located at Kimbiji (130 billion m^3). The other gas fields are found at Songo Songo on the Kilwa Island (42,89 billion m^3) and Mnazi bay (17,24 billion m^3).

2.11 Uganda

2.11.1 General:

Uganda, is a landlocked country, with a GDP per capita of about US$ 302 in 1988. The very high incidence of AIDS in the population is likely to affect the demographic patterns and the economic productivity of the country in the future.

Uganda has known relative peace with the assumption of power by Museveni in 1986. The economy is recovering slowly after the decline due to the dictatorship of Amin and the long political instability that followed his overthrow. There is a renewal of confidence of investors, donors and aid-communities in the country. However, the government is accused of widespread human abuses, especially in the north of the country where some rebel factions are still fighting government troops. Transition to democracy is slow. A proposal by Museveni to continue to ban political parties prior to the 1994 elections has been rejected by the parliament. Talks over free political activities started in September 1992, between the government and the opposition.

The economy is dominated by agriculture which accounts for about 95% of total export earnings, 64% of the GDP, and provides more than 65% of government revenue. Increasing production is a major priority and in order to revive the agricultural sector many projects, funded locally and externally, have been set up. The principal export crops are coffee, cotton, tea and tobacco. The industrial sector is very small and is operating far below its full capacity (15% in the late 1980). Mining activities are very limited.

2.11.2 Energy:

The energy sector is overwhelmingly dominated by traditional fuels which accounts for about 94% of total final energy consumption. Approximately 12% of the country is covered in forests. The high reliance on woodfuels is seriously eroding the forest resources. In addition the rate of woodfuel consumption exceeds the overall rate of natural growth. Some reforestation programmes have been undertaken but they remain weak.

All petroleum requirements are met by imports. The country has an hydropotential estimated at 2000 MW, with a annual production of 10 000 GWh. However, only a small fraction is harnessed at present. The main source of electricity in the country is the Owen Fall hydroelectric station at Jinja. The plant is expected to be modernized and its capacity expanded from 150 MW to 210 MW. Uganda exports power to Kenya (30 MW) and has a 15 MW power export contracts with Tanzania. A second dam is expected to be built at the Murchison Falls despite environmental objections.

The other energy resources, not yet exploited, are geothermal power (about 450 MW) in the volcanic areas of western Uganda, substantial peat and papyrus resources, and abundant solar energy.

2.12 Zambia

2.12.1 General:

Zambia is a land-locked country. As such, it has suffered from economic and political disruptions in Zimbabwe, Mozambique and Angola. The closest port is Beira in Mozambique, situated 1000 km from Lusaka. With 50% of the population living in urban centres, it is the most urbanized sub-Saharan African country outside South Africa. The major political achievement of Zambia has been the surprisingly fast and peaceful transfer of power to a new government, a case which remains unique in the continent[16]. This is the product of the November 1991 general elections, the first to be held in the country in a multiparty context since 1972.

However, the new government has inherited a country confronted by a worsening economic crisis, spiralling debt, and harsh droughts. The GDP has fallen during the 1980's and real income per capita has declined at an annual rate of 4% for more than a decade[3], creating a climate of discontent among the population. Dominated by copper, the economy collapsed in 1975, due to the dramatic decline in the world copper price which reduced copper export's contribution to GDP from 33% to

15%[14]. Over the years, copper production has been falling due to worsening ore grades and increased processing costs. In addition the strong nationalization drive and the system of price subsidies on basic commodities led to economic distortions and mismanagement. The nationalization policy has now been abandoned and the country is embarking on a reform and austerity programme.

The main export commodity is minerals of which the most important are copper, cobalt and zinc which accounted for 91%, 6% and 2% of export earnings in 1991[9]. Mining's contribution (especially copper) to GDP has declined significantly since the mid-1985 and presently represents 9%, while manufacturing and agriculture account respectively for 22% and 18% of GDP.

With copper resources being expected to be exhausted near the end of the century, the revival of the economy depends on the exploitation of the country's enormous agricultural potential, improvement of the manufacturing sector and the development of tourism.

2.12.2 Energy:

Energy resources in Zambia are relatively abundant. They include hydropower, coal, uranium and renewable such as fuelwood, bagasse, mollasses, wind, solar and geothermal. Zambia has placed a lot of emphasis on terminating its heavy dependence on Zimbabwe for its commercial energy needs. Since independence, it has developed its coal industry, built its own oil refinery and pipeline linking it to the Indian ocean, and harnessed its electricity resources. Oil, electricity and coal represent 42%, 39%, and 19% respectively of commercial final energy demand.

Forests cover about 55% of the total land area or nearly 413 000 sq km, of which 74 300 sq km are reserved forests (forest estate). Woodfuel provides about 64% of the energy consumed in Zambia and is the source of domestic energy for about 95% of the Zambian households. Deforestation is more due to the clearing of new farmland than to woodfuel demand.

Coal reserves are estimated at some 280 million tons with only 58 million tons being considered proven. Coal is mined at Maamba in Southern province by Maamba Collieries Limited. The mine has produced substantially below its nominal capacity of 1,3 million tons per year, as result of shortages of equipments and of spare parts. A rehabilitation programme has enabled the mine to reach 560 000 tons/year in March 1988 and to export to coal to Zaire, Malawi and Tanzania[4]. The Copperbelt Power Corporation is the largest consumer of coal, accounting for 40% of the total demand in 1980.

Zambia has no proven oil deposits but its sedimentary basins (the Zambezi river basin and the Luangwa valley) may have some accumulations of petroleum or gas. These basin areas have been divided in four blocks for exploration but results are currently inconclusive. All petroleum requirements are met by imports. Crude oil and refined products are pumped through the Tazama pipeline running from the port of Dar es Saalam in Tanzania to Ndola. Crude oil is refined at the Indeni refinery in Ndola, which has a installed capacity of 1,1 million tons/year. In 1988, Zambia exported 5400 tons of LPG and 800 tons of fuel oil[17].

Exploitable hydropotential is estimated at 6000 MW with an annual energy potential of 17 233 GWh. Cooperation with Zimbabwe is required for the development of many potential sites. The country's total installed capacity amounted to 2235 MW at the beginning of 1989, including 50 MW of old waste-heat plants and 80 MW of gas fired turbines. The most important hydroelectric assets are the 900 MW (6 X 150 MW) Kafue Gorge plant, the 108 MW (2 X 1 MW + 2 X 3 MW + 10 X 10 MW) Victoria Falls plants and the Kariba dam complex, jointly owned and evenly shared with Zimbabwe. It consists of the 666 MW Kariba South commissioned in 1960, and the 600 MW Kariba North commissioned in 1976 and run by the Zambia Electricity Corporation (ZESCO). Most generating plants are located in the south of the country. The larger consumers are situated in the Copperbelt and in Lusaka. The Grid is interconnected to Zimbabwe (through the Kariba scheme), which has been a power importer in the past, and to Zaire (Shaba province) to ensure a reliable power supply for the mines in the Copperbelt region. Drought is affecting hydroelectricity production, and ZESCO recently announced a significant load-shedding programme.

A 1600 MW hydroelectric plant is planned at the Batoka Gorge, on the Zambezi river, some 54 km downstream of Victoria Falls and upstream from Lake Kariba. The Zambezi River Authority, the joint body of the Zambia and Zimbabwe governments, successor to the Central African Power Corporation, has already awarded the contract for a feasibility study of the project. The dam is expected to cost US$ 3 billion[18].

3. ZAIRE DESCRIPTION

3.1 Introduction

This chapter gives a profile of the energy sector of Zaire and discusses its energy institutions, resources, supply and demand, and pricing. An overview of the political history, demography, and economy of the country are also provided. The overall picture of the country will assist in understanding the potential of Zaire in energy trade, its contribution to regional planning, and the possible influence of other countries of the region in the development of its energy sector. The figures and graphs relating to this chapter are given at the end of Volume I.

3.2 Country Profile

3.2.1 Political History:

Zaire, formerly known as the Congo, was born out of the personal vision of the Belgian king, Leopold II who unified a wide range of previously independent African entities. In order to enhance his small country's economy and international prestige, he wanted to acquire a colony. With this in mind, he founded, in 1876, a philanthropic European organization, the Association Internationale Africaine (AIA). Its aims were to encourage the exploration of Africa and to seek the abolition of slavery.

In 1877, the explorer Stanley made a historic trip down the Congo River, after his encounter with David Livingstone whom he had been sent to find. Although it awakened European interest in the Congo basin in general, it failed to attract the attention of British government to the region's potential for trade and resource. In 1878 King Leopold II founded the Association Internationale du Congo (AIC) to further the exploration of the Congo Basin and to 'civilise' its indigenous peoples. He recruited Stanley and commissioned him to chart the Congo, open it up for trade and to bind the local chiefs by treaties. Stanley went back to the region in 1879 and worked his way up the river. He created a chain of stations and concluded about 450 treaties that bolstered the King's claim of being actively engaged in the Congo Basin.

With all these treaties and by masterful diplomacy, the King secured, at the Berlin Conference in 1885, his sovereignty over the huge Central African territory, eighty times the size of his own country. In exchange, he promised his Europeans partners that he would uphold the principles of free trade and navigation, neutrality in war and the efforts to improve the lives of the indigenous peoples. Shortly after the

Conferenece, on November 26, 1885, he formed the Etat Independent du Congo (EIC). From that time until 1908, the Congo was a private property of the King. He used the territory for commercial purposes, making substantial profits from the boom of the red rubber, so called because of atrocities involved in its collection. As a result of the international outcry over these grave human abuses and subsequent diplomatic pressures, Belgium reluctantly took over the territory from its king in 1908 and attempted to transform it into a well-run colony known as the Belgian Congo.

The colonial rule, with its structure shaped by the alliance of the administration, the church and giant corporations, was authoritarian. It prevented political debate and African advancement, and relied on the forced labour system.

For Belgium, the independence of its colony had been considered a long term prospect, probably in 1990. Consequently they did not prepare the indigenous people to run their country and assume power responsibly. However, this long term plan vanished following riots and political unrest that began on January 4, 1959. At the January 1960 Round Table Conference, Belgium agreed to grant independence to the country, precipitately, on June 30, 1960. The country became independent with Kasa Vubu as President and Lumumba as Prime Minister. Unfortunately, with such an inadequate preparation, the birth of the country was an agonising one. Political turmoil, bloodshed, instability, and economic disruption became the order of the day and the decolonization process failed completely.

In the month after independence, there was a mutiny in the army over low pay and advancement opportunities. A powerful secessionist movement was formed in copper-rich Katanga (today Shaba) province, followed by the breakaway of South Kasai province backed by foreign interests. The deterioration in general conditions resulted in the sudden withdrawal of skilled Belgian nationals, resulting in a labour crisis and the precipitous flight of foreign capital. Furthermore, the lack of a viable constitutional framework soon brought a political standoff between the President and his Prime Minister. This deadlock led the army chief, Colonel Mobutu to neutralize the government between September 14, 1960 and February 1961. The assassination of Lumumba, during that period, on January 17, 1961, led to a widespread rebellion by his followers in the eastern provinces. The country began to fall apart. For many years thereafter, it was the battlefield for UN troops, rebel factions, the Congolese army and assorted foreign mercenaries before the central authority was again restored.

Following another constitutional crisis between president Kasa Vubu and prime minister Tshombe, leader of the Katangese secession, and in the face of a new rebellion in the eastern Congo, Mobutu, for the second time, took over the reign of power in a military coup on November 24, 1965. Other attempts to take the Shaba province led, in 1978 and 1979, to the invasion of separatist Katangese rebels of the Front National pour la Liberation du Congo (FNLC) from Angola.

As a result of revolutions in Eastern Europe in 1989, a tide of democratic reforms started sweeping the African continent. Popular unrest and Western pressure led president Mobutu to announce on April 24, 1990, the return of his country to multi-party politics. A national conference has been held since mid-1991. This forum of about 2700 delegates from political parties, public institutions and civil society, has to lead transition to democracy by drafting a new constitution, setting up parliamentary and presidential elections timetables.

3.2.2 Geographical situation and demography:

Zaire is a vast country in Central Africa, lying across the equator. With a land area of 2 345 000 sq km, it is the third largest country on the Continent. It shares borders with nine countries: Congo and the Angolan enclave of Cabinda to the West, Central Africa and Sudan to the North, Uganda, Rwanda, Burundi and Tanzania to the East, and Zambia and Angola to the South. It is an almost landlocked country, with a coastline of only 40 km on the Atlantic ocean.

The 4700 km long Zaire (formally Congo) river forms the backbone of both the country and national infrastructure. It rises in the southeast, flows north across the equator and then south again, and finally empties into the Atlantic ocean. It is not navigable for its whole length because of cataracts found between Kongolo and Kindu, Ubundu and Kisangani, and Kinshasa and Matadi. The river network provides more than 11000 km of navigable waterways inside the country, of which the Zaire river accounts for 3000 km.

The country is divided into three main physical areas: the Central Basin, the surrounding region and the mountains in the East. The low-lying central Basin covers two thirds of the territory. It is characterised by a heavy rainfall of 1800-2200 mm per year[19], equatorial forests and swamps. The surrounding region consists of mountainous terraces (Cristal mountain range) with a small coastline plain in Western Zaire, plateaux covered by savanna in the south and southeast, and dense grasslands in the northwest. A range of high mountains with altitude rising as high as 5000 metres are found in the East where the lakes of the Great Rift valley constitute the country's international borders.

Figure 3.1 shows the population and population growth for the period 1967-88. Overall population was estimated at 36 million[20] in 1990 with 46,2% under 15 year of age. The national average population density is 15,3 persons per sq km. About 30% of the population lives in cities with more than 100 000 inhabitants. The major cities are the capital Kinshasa with more than 3 million people, and Kisangani and Lubumbashi with about 1 million inhabitants each. Life expectancy is 52 years while the literacy level is 79% among adult males and 45% among adult females[20]. Population patterns will be affected by the high incidence of AIDS.

About 80%[19] of the population consists of Bantu peoples. The remainder is divided between Sudanese, Nilotic and Pygmy peoples. There are over 200 different tribes which can be grouped into diverse ethnic groups. The main ethnic groups are the Kongo, Luba, Mongo (of the Bantu family) and the Zande[21] (of Sudanese origin). The official language is French, but Kikongo, Tshiluba, Swahili and Lingala are the four national languages.

The labour force, according to 1982 statistics, is mainly engaged in agriculture (73,7%) followed by mining and manufacturing (13%). It is estimated that at least two-thirds of the population lives mainly or wholly within a subsistence economy based on traditional primitive farming activities[21].

3.2.3 Economy:

Zaire has an enormous potential for economic development. It has large tracts of farming land and exploitable forests, a wide range of mineral resources, thousands of kilometres of navigable waterways, a large potential consumer base, and vast reserves of hydroelectric power to fuel industrial development. However, little progress in economic development has been achieved. The economy is still largely export orientated with very little value added and lacks a significant internal base. The country remains predominantly dependent on mineral exports, making it vulnerable to international market conditions. "Its trading and productive capabilities have been frequently disturbed by political considerations and upheavals"[22]. Decades of fiscal indiscipline, official mismanagement, neglect, and corruption have ravaged the economy. Its total collapse came with recent civil and military unrest which culminated in the army-led looting spree in September 1991.

With a GDP per capita of US$ 220 in 1989 terms, Zaire ranks among the poorest countries of the World. Both its overall GDP and GDP per capita, shown by Fig. 3.2 and Fig. 3.3 respectively, have been declining for more than a decade.

The country's economy, based largely on copper and cobalt exports, collapsed due to low world prices and plummeting production. The yearly output of copper, the main mineral export, has dropped from 500 000 tons in 1987 (about 6% of world production) to 210 000 tons in 1991. The other important mineral export is industrial diamonds, but large smuggling problems exist. Uranium, tin, gold, petroleum, zinc, manganese, silver, cadmium, tungsten, germanium, columbium, tantalium, lithium, and monazite are also exploited to a lesser extent. Iron ore and bauxite are not yet exploited. In 1988 the mining sector accounted for 22% of GDP and provided 85% of export earnings[8].

The contribution of manufacturing to GDP in 1988 amounted to 10%. It mainly consists of consumer goods: textiles, cigarettes, and beer. It has been badly affected by post-independence political unrest and disastrous nationalisation policies but also by the lack of spare parts due to foreign exchange difficulties and the decline of domestic purchasing power. As a result, the sector is estimated to have operated at about 30% of its installed capacity throughout the 1980's[8]. The shares of the overall industry and other sectors of the economy are shown in Fig. 3.4.

In addition to the turmoil following independence and the widespread expropriations of privately-owned plantations, agriculture has been hard hit by the lack of reliable transportation infrastructures and marketing channels. The GDP ratio: agriculture/industry, shown in Fig. 3.5, recorded its lowest values around 1973 when mineral prices on international markets were very high. Since then it has been increasing before declining significantly around 1984. A quarter[19] of the land is considered arable and rainfall is regular and abundant over the entire country. Except for some recurring cases in the south-west, droughts are not a problem. However, only 6% the land area is under cultivation and the country has become a net importer of food while it was a net exporter at the time of independence. In 1985 estimates of food imports ranged between 157 000 tons[1] and 393 000 tons[8]. The major export crop is coffee but smuggling activities are prevalent. Export earnings from agriculture have declined from 40% of total revenue in 1960 to only 12% in 1984[22]. Other cash crops are palm oil and palm kernels, rubber, cotton, sugar, tea, and cocoa. Palm oil is, however, no longer competitive on the world market. The major food crops - cassava, maize, rice, and plantains - are grown by small scale subsistence farmers. Forestry is currently exploited on a very limited scale. Agriculture accounted for 33,8% of GDP in 1988.

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1 Official figures.

Devastated by post-independence events, the economy of the country recovered in the late 1960's and early 1970's. This recovery is accounted for by the relative peace in the country and the high prices of copper which accounted for nearly two-thirds of foreign exchange. This copper boom was not considered as a temporary phenomenon and government embarked on massive expenditure programme supplemented by international loans. In order to transform the country into a regional industrial power, funds were directed towards ambitious and unproductive development projects such as the Inga hydroplants, the Sozir oil refinery and the Maluku's steel mill. These projects were intended to transform Zaire rapidly into a regional industrial power. Agriculture, transportation and other productive schemes received very scant attention. As can be seen from the growth rates of both GDP and GDP per capita (see Fig. 3.6 and Fig. 3.7), the year 1974 marked a turning point in the decline of the economy following nationalisation. It was followed by the drastic fall of copper prices in 1974-75, heavy dependence on imported oil, the closing of the Benguela railroads through Angola resulting from the civil war in that country, and the political instability in the period 1975-79. In addition corruption has been rife and fiscal mismanagement significant. The free-fall of the economy, reflected in the decline of its GDP, has resulted in the debt to foreign banks exceeding US$ 8 billions. The situation worsened in 1989 as a result of political and social strains. Basic survival became a daily question as wages could not keep up with living costs. Inflation rates increased from about 100% in 1989 to more than 30 000%[23] in the last quarter of 1991. The last blow came with the September 1991 rioting spree. In fact the looting brought the country to the brink of complete devastation by destroying its physical infrastructure, and by grounding both industry and commerce. State banks closed, educational and health system declined catastrophically and malnutrition rose, particularly among children[23]. Furthermore, it led to the departure of the largely expatriate community involved in the fundamental aspects of the economy.

To summarize, there are two important structural deficiencies in the Zairean economy. The first is its heavy dependence on mineral exports whose income is very volatile due to the vagaries of international market prices. The second is the lack of adequate transportation and communication network which has an impact on domestic agricultural production and hampers development in all other sectors.

State revenue is reduced by tax evasion as well as active and elaborate smuggling of coffee and diamonds. Political reforms are needed to redress these imbalances, to eradicate corruption, stabilise the economy and boost production.

3.3 Energy General

3.3.1 Introduction:

Zaire possesses abundant energy resources. The most important are fuelwood from its large forest cover and hydro-electricity from its extensive rivers network. Both of them have the advantage of being renewable. Known petroleum reserves are relatively poor. Deposits of low grade coal, solar and geothermal resources are supplementary energy resources. There are also reserves of uranium and oil shale. This important energy resource base remains largely untapped. However, its development has been poorly planned and coordinated, with overinvestment in electricity sector, poor cost control, and institutional shortcomings.

Energy supply is dominated by traditional fuels. The per capita total final consumption in 1988 was estimated at 290 kg of oil equivalent, of which only 43 kg was supplied by commercial fuels. This is shown in Fig. 3.8.

Costly investment has led to overcapacity in the generation of hydropower and left little money for the distribution infrastructure and maintenance. Consequently power delivery in remote areas has been impeded. Although forest resources are very important, signs of increasing deforestation near urban areas are emerging.

3.3.2 Energy institutions:

The Ministry of Mines and Energy, through its Energy Department, oversees the activities of the power and petroleum subsectors. A Petroleum Technical Unit has been set up to monitor petroleum activities.

Forestry management is in the hands of the Ministry of Environment, Nature Conservation and Tourism. However, it does not cover fuelwood supply and demand. Its main agencies are the National Reforestation Service, which is concerned with reforestation programmes in threatened areas, and two joint Zairo-Canadian organisations: SPIAF and CATEB. The Service Permanent d'Inventaire et Amenagement Forestier (SPIAF) carries out an inventory of forest resources and is responsible for general forest management. The Centre d'Adaptation des Techniques de l'Energie Bois (CATEB) develops techniques and equipment for wood exploitation and carbonisation.

The Entreprise Pétrolière du Zaire (Petro-Zaire) is the main government agency in the petroleum sector but has no policy-making responsibility. There are four private marketing companies and one service company. Oil companies are regrouped into two consortiums. The first is involved in exploitation of the concession off the Atlantic coast and is headed by Gulf Oil (now Chevron) which has a 50% share. It operates together with Teikoku oil of Japan (whose operating company is the Zaire Petroleum Company) and Union Oil of California, Unocal (whose operating company is the Muanda Oil Company). The second is the Société de recherche et d'exploitation des pétroles au Zaire (ZAIREP), owned by Petrofina and Shell. This Belgo-Zairean consortium mines the concession in the Zaire river estuary. In addition, the Japan National Oil Company (JNOC) has been carrying out exploration outside the coastal region.

In the electricity sector, the Société Nationale d'Electricité (SNEL), a state corporation, is responsible for generation, transmission and distribution of electricity throughout Zaire.

There are other agencies and ministries dealing with energy matters such as the Atomic Energy Commission, and the Ministry of Economy. In order to address the issue of poor coordination among all these government energy related institutions, the National Energy Council was created in 1981. However, it has not fulfilled its expectations.

Regional energy-related institutions found in Zaire are the Société Internationale d'Exploitation, de Transport et de Commercialisation du Gaz Methane du Lac Kivu (SOCIGAZ), the Société Internationale d'Electricité des Pays de Grands Lacs (SINELAC), and the Energie des Pays de Grands Lacs (EGL). SOCIGAZ is a joint venture with Rwanda and is responsible for the exploitation and marketing of the methane gas found in Lake Kivu. SINELAC builds and operates the Ruzizi-II hydroelectric plant and is jointly owned by Zaire, Rwanda and Burundi, countries which form the Economic Community of Great Lakes Countries (CEPGL). The EGL is the energy wing of the CEPGL and has been involved in some planning works (e.g. the planning of the Ruzizi-II power station), in pilot testing programmes of new technologies, and in activities aimed at a better coordination of the interconnected regional power network operation.

3.4 Energy resources

3.4.1 Fuelwood:

Forest resources cover over 122 million ha and were thought to have, in 1970, a total potential of 8,3 billion TOE[24]. They represent the most important forest system in the continent and one of the largest remaining tropical rain forest in the world. Their composition is not well known. Of the total potential, the amount exploitable on a sustainable basis was theoretically estimated at 2%[24] each year. However the actual value of the commercially exploitable part is probably lower than the figures given in Table 3.1 as a result of many practical constraints such as the seasonal and perennial floods affecting a large part of the central basin, long distance from demand centres, accessibility difficuties, etc[2].

Table 3.1 Theoretical forest energy potential in Zaire (without reforestation)[14]

SOURCE FOREST	AREA ha MILLION	DENSITY m^3/ha	GROSS ENERGY POTENT. Mtoe *a	MAXIMUM ANNUAL DRAWDOWN t/ha/yr *b	NET ANNUAL ENERGY Mtoe *c
Central	101,000	300	7800	4,0	83,2
Mayumbe	0,24	135	8	2,5	0,2
Peripheral	21,00	100	540	1,5	10,8
TOTAL	122,24		8348	8,0	94,2

*a Based on 25% moisture, 0,75 tons/m^3 and 0,343 toe/ton
*b Assuming a regeneration of 5 m^3/ha/year
*c Exploitable annually on sustainable basis

There are three forests reserves of commercial interest. The largest is found in the Central Basin and is estimated to cover 101 million ha[24]. Lying in the inaccessible heart of the Zaire river basin, they remain relatively virgin, and only 60% is considered exploitable. They are followed by peripheral forests extending over

2 Domestic estimates [12] give lower figures: 250 million m^3 or 64,3 million TOE.

about 21 million ha on the east and southeast. These are being degraded by frequent fires (burn-and-slash cultivation method) and industrial exploitation. The remainder of the reserves covers 240 000 ha and is made up of the Mayumbe forests in Bas Zaire, a region with easy access to the port of Matadi and overseas markets. They have undergone intense log cutting activities since the colonial period and have provided wood energy for the local people. They are heavily depleted today, and restrictions have been imposed on logging. Signs of recurrent drought in this area are emerging.

More than 90% of the forests are state-owned and only 1,5% of forests are worked[21].

3.4.2 Hydro Electricity:

Zaire has an enormous potential for hydropower generation thanks to an extensive river network which straddles the equator, draining areas in both the northern and southern hemispheres, which have opposite rainy seasons.

Most of the rivers found in Zaire are part of the Congo Basin hydro-system, which is dominated by the Zaire River. However, in the eastern part of the country, a few rivers pour their water into the Great Rift lakes'network. The saucer shaped Congo basin extends over 3 831 400 sq km and is the second world largest basin after the Amazon basin (6 300 000 sq km). It covers almost two-thirds of the total Zairean territory as well as parts of the Congo, the Central African Republic, and south-eastern Cameroon. The Zaire River, with a length of 4700 km, is the longest river in Africa after the Nile. It has an average flow of 42 000 cubic metres per second, a figure exceeded only by the Amazon, and that is 18 and 194 times greater than the flow of the Zambezi and the South Africa's Orange river respectively. As its configuration straddles the equator, it has the benefits of compensating rainfall patterns in both hemispheres, ensuring a regular flow. For a period of eighty years, the highest and lowest registered flows were respectively 81 000 and 20 000 cubic metres per second, giving a ratio of about 4:1[3].

Given the country's size and the lack of extensive data collection, the accurate magnitude of the hydroelectric resource is not known at present. However, in 1977 the theoretical and technical hydropower potentials were estimated at

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3 According to Historical Dictionary of Zaire[16], it is 20:1 for the Mississipi River and 48:1 for the Nile

1 397 000 GWh/year and 774 000 GWh/year respectively, and the economically exploitable potential amounted to 419 200 GWh/year in 1991[25].

For a load factor of 75%, the technical potential translates to an installed capacity of about 100 000 MW. Of this total amount, a short stretch of the Zaire River, the Inga Falls situated about 40 km upriver from Matadi, has an estimated potential of 44000 MW. The site has the benefit of a natural steep drop of about 140 m over a distance of 35 km (102 m over 15 km). In addition a bend in the river enables the construction of dams on successive stages without diverting the river and without environmental damages (see section 3.5.4). Studies for an electrical power plant were made in the 1950's.

3.4.3 Petroleum:

Petroleum reserves are found in the Coastal Basin. Offshore exploration started in 1956. Recoverable proven reserves were initially estimated at 127,7 million barrels and production began in 1975. Onshore explorations started in 1959 and production began in 1979. Original recoverable proven reserves were 101,0 million barrels. These reserves have been substantially depleted and fell to 64,4 million barrels in 1990.

Table 3.2 gives the names of oilfields and the years of their discovery. The Mibale wells represent 48% of the recoverable reserve found in the basin. In 1984 they accounted for 80% of the total production and 85% of offshore production[24], but their yield has been declining.

Table 3.2 Oil fields

OFFSHORE FIELDS		ONSHORE FIELDS	
NAME	YEAR OF DISCOVERY	NAME	YEAR OF DISCOVERY
GCO	1970	KINKASI	1972
MIBALE	1973	LIAWENDA	1972
MWAMBE	1979	EAST MIBALE	1978
LIBWA	1981	MUANDA BANANA	
LUKAMI	1982		

Offshore and onshore petroleum production in 1990 reached 30 000 and 11 000 barrels/day respectively, and the yearly output is shown in Fig. 3.9. Cumulative production by the end of 1983 was 61,9 million barrels in the offshore fields and 1,5 million barrels for the onshore fields. Production is carried out by US, Japanese and Belgian companies in partnership with the Zairean government. Production volume is sufficient to meet internal demand.

There are two other areas of prospective interest: the Central Basin and the Great Rift Valley region. The Central Basin is large (about 1 million sq km), covered by dense forests and swamps and is not easily accessible. Exploration started in 1951. In early 1980's, after positive seismic tests, exploratory wells were drilled near Mbandaka in the Equator province. They did not yield commercially exploitable fields and work was terminated in 1984. However, there were some encouraging signs in 1988 when the bitiminous shale of Alolo proved to be a source rock. INTERA-ECL is responsible for the promotion of petroleum exploration in the Central Basin[25].

Exploration started in the 1920's in the Great Rift Valley region as oil seepages along its sharp fault line had been known for a long time. The most attractive segment is the Lake Mobutu (Albert) area on the border with Uganda where some very shallows wells have had oil and gas finds. Exploration has also been carried out in Lake Tanganyika. However, to get meaningful information, cooperation with other countries of the region is required and common development activities need to be encouraged. There are now four exploration blocks. Petrofina is negotiating an exploration contract on block 1 (5240 km^2) and block 2 (95690 km^2). Petro Zaire has an exploration agreement on blocks 3 and 4 (24 070 km2) and is looking for partners[25].

3.4.4 Gas:

Gas reserves in the Coastal basin are estimated at 286 billion m^3, 99% being offshore[25]. The bulk of these gas reserves are associated with oil. The average gas/oil ratio is 41-62 m^3/ton in offshore fields, and much more variable 26-9344 m^3/ton in onshore fields. Gas production, about 32 billion m^3/year, is mainly flared and remainder is injected into oil fields to sustain oil production.

Oil exploration in lake Kivu, on border with Rwanda, led to the discovery of considerable deposits of methane gas, dissolved in deep water. Reserves are estimated at 60 billion Nm^3, of which some 50 billion Nm^3 (equivalent to about 40 million TOE) are considered recoverable. These reserves are thought to be the largest in the World. Observations suggest that the resource is being renewed

naturally by 250 million Nm^3 annually. About 1,4 Nm^3 of gas is dissolved in each cubic metre of water in the lower strata[26]. Only a small fraction is methane pt 6(25%)pt 8; other components of the gas are carbon dioxide (73,5%), hydrogen sulfide (0,05%) and other, mainly nitrogen, (1,55%).

A pilot plant, built in Cap Rubona, on the Rwandan shore of Lake Kivu, is operated by the Rwandan electricity corporation ELECTROGAZ. Cumulative production by the end of 1987 was 20 million Nm^3. All production is sold to the Gisenyi brewery in Rwanda, which use the bulk as a boiler fuel. Small quantities are compressed into CNG for pilot use into converted gasoline-fuelled vehicles.

3.4.5 Coal:

There are two operational coalfields in Lukuga and Luena basins in the Shaba province. Half of the 20 million metric tons proved reserve of Luena deposit are considered recoverable and 8,6 million metric tons commercially exploitable. The Lukuga basin has reserves of about 700 million metric tons of which 78 million metric tons are thought to be recoverable and 50 million metric tons commercially exploitable[24]. Both coalfields produce poor quality non-coking coal.

A third coal deposit, thought to be significant, is found at Walikale in the Kivu province. However its true extent and composition are not well known. Moreover, it is located in an isolated area, making transportation costs prohibitive and its exploitation not economically viable.

3.4.6 Uranium and oil shales:

Uranium deposits are located at Shinkolobwe Swala and Kalongwe in the Shaba province. Reserves are estimated at 110 600 tons[25]. Uranium was mined at Shinkolobwe during the colonial period but production was stopped before independence. However some uranium is obtained as a by product of copper mining.

Oil shales reserves are estimated at 66 million tons[25].

3.4.7 Other energy resources:

The other energy resources are agricultural residues, solar and geothermal energy. However, their contribution to the energy balance will remain marginal because they have a low potential for economically viable application on a nationwide scale.

Agricultural residues are used either as energy source or fertilizers by some agro-industries.

Potential for solar energy is good as average insolation is 4,7 kWh/day/m^2. Little is known about the daily variations and numbers of sun days.

Geothermal resources are found in the Rift Valley System which forms the Eastern borders of the country. Their true potential has not yet been completely assessed. Interesting sites exist near Bukavu and along the shores of Lake Kivu. In the 1960's Zaire operated the first geothermal plant on the continent, generating several hundred kW for a copper mine in the Shaba province. However, this potential is likely to remain unexploited for many years to come, as the country has a tremoundous hydropower potential.

3.5 Energy supply and demand

3.5.1 General:

In 1988 traditional fuels, principally fuelwood, accounted for 85,1% of the total final consumption. The remainder of the energy requirements were met by commercial fuels: petroleum, electricity and coal, which represented 8,7%, 4,6% and 1,6% of the total final consumption respectively. The estimated contribution of various energy forms to the TFC for previous years is shown in Fig. 3.10 and Fig. 3.11.

The energy consumption pattern, as well as the energy sectorial distribution, highlights the traditional character of the Zairean economy. In fact, households are the largest consuming sector, accounting for 80% of final consumption in 1983. Household needs are met by woodfuels (firewood 93% and charcoal 6%) and by small quantity of kerosene (0,6%) and electricity (0,4%). Transport and industry, the main users of commercial fuels in any economy, remain underdeveloped. Only the mining industry is a large user of commercial energy. It accounts for over 60% of electricity, 90% of coal and coke, and 22% of diesel oil consumption[24]

In the commercial energy scene, there is an excess hydropower generating capacity and plants are being operated far below their potential production (see section 3.5.4). Although the country produces enough oil to meet its domestic needs, the local refinery cannot process this heavy-grade petroleum. Consequently Zaire remains dependent on imported oil for its petroleum requirements.

As can be seen from Fig. 3.12, the GDP and commercial energy final consumption display the same trend in their growth rates. Figure 3.13 gives the energy intensity

of the economy. A big difference is noted between commercial energy intensity and total energy intensity, highlighting the large share of traditional fuels in total energy.

3.5.2 Traditional fuels:

Traditional fuels constitute the most important fuel used in the country. In the lack of reliable data, their final consumption has been estimated at 0,85 m^3 of fuelwood equivalent per capita per year or 247 kg of oil equivalent per capita per year. This gave a total consumption of 8241 thousand TOE in 1988.

The country is, and will remain for a long time, highly reliant on traditional fuels to meet its energy needs. Firewood is very important, representing about 86,5% of traditional fuels net supply in 1983. The remainder is shared by charcoal and agricultural residues, which accounted for 5,5% and 8% respectively. Losses in charcoal production are very large. The traditional earth kilns often used have a weight efficiency of 10%, and an energy efficiency of between 12% and 20%.

Sectorially, the households sector accounts for the bulk of woodfuels consumption (about 99%). Fuelwood usage is predominant in rural households where it is used for cooking, home heating, and lighting. Charcoal is often limited to ironing uses. In urban households, charcoal becomes important and is the favourite cooking fuel. The ratio of charcoal use to fuelwood is typically 6:4, but reaches 17:3[14] in Kinshasa. The charcoal demand of Kinshasa is estimated at 220 000 tons/year[27]. The remainder of woodfuel is used in small scale industrial activities such as food smoking, metalwork, tobacco curing and brickmaking. Agricultural wastes are often used as fertilisers, but some agro-industries also use them as energy sources.

The fuelwood market is informal in rural areas. It becomes formal in urban areas, where it is transported, packed in bundles for wood and bags for charcoal, by trucks from producers stalls, and sold to wholesalers. Market regulations are non-existent. Woodfuel is bought along the main roadways through urbans areas, from either local inhabitants or small charcoal producers who buy cutting rights from them. Hard wood is often reserved for charcoal production which is dependent on the availability of packing bags.

The overwhelming dependence of Zairean households on woodfuels is associated with socio-economic conditions. At least two-thirds of the population operate outside the modern trading economy[21]. The majority of them live of subsistence agriculture and dwell in rural areas. Here, fuelwood is collected freely from natural surrounding. In urban areas, woodfuel remains an affordable commodity and requires lower investment than commercial fuels. With the progressive decline of

purchasing power for more than a decade, many people from low-income strata of the population cannot afford to pay the electricity wiring and connection bills. In addition, access to electricity is very limited. Culinary habits have also to be taken into account.

Important forest reserves, that can be used as fuelwood supply sources, exist in the country. However, they are not always located at economic distances from demand centres. Forests near large towns are being depleted. This is the case in Kinshasa, which, with a population of more than 3 million people, has the highest fuelwood demand in the country. Its supply bases has shifted to more and more distant plantations, 50 to 100 km away. There are plans to supply it from the Bateke Plateau forests, a distance of 150 km.

3.5.3 Petroleum products:

Locally produced crude is traded for imported oil. The domestic refinery cannot handle this local heavy grade crude oil which has a high wax content. In addition, if it were refined locally, there would be an imbalance between the domestic demand and the refinery output, which would lead to the export of some products, mainly fuel oil, at unfavorable prices. As a result, all the petroleum requirements are met by imports.

Petroleum imports consist of both finished products and light crude. As the country does not have a deep-sea harbour, imported crude is trans-shipped into barges at the mouth of the Zaire river and brought to the refinery which is located near Muanda/Banana. It was designed to refine Iranian crude but switched to Arabian crude after the fall of the Shah regime. As a result of agreement with the Chevron Corporation, it has processed Nigerian light crude since 1987. The refinery yearly output, as shown in Fig. 3.14, is far below its annual capacity of 750 000 tons. Sometimes, it operates intermittently. It happens that certain market conditions, such as the sharp fall in world prices in 1986, make it cheaper to import products. Commissioned in 1967, the refinery is operated by the Société Zairo-Italienne de Raffinage (SOZIR) in which the government is a 50% shareholder. In order to process the Zairean crude, SOZIR is looking for foreign funding to buy a conversion unit (US$ 80 million) and build an asphalt plant (US$ 20 million)[13].

Figure 3.15 shows the oil product consumption of the country for the period 1970-88. The bulk of finished products are imported from Brazil (96% in 1984) to the Ango Ango depot at the Matadi port, where refined products from the local Moanda

refinery are also barged. The remainder of the finished products that the country needs comes by road tankers from Kenya, for Eastern Zaire, and from Zambia, for the Shaba province.

Distribution of petroleum products inside Zaire is costly and suffers from age and poor maintenance of the transport infrastructure. Distribution starts at the Ango Ango depot at Matadi port in Bas Zaire province. All oil products, except fuel oil, are pumped about 350 km by two above-ground pipelines to Kinshasa depots (Masina, Kinshasa Proper, and N'Djili international airport). Pilfreage is significant. Fuel oil is carried by rail tankers. From Kinshasa, petroleum products are barged to the major ports inside the country such as Mbandaka, Bumba and Kisangani via the Zaire river; and Bandundu and Ilebo via the Kasai river. From these ports, oil products are transported either by road or rail tankers. Of particular interest is the port of Ilebo in the province of Kasai Occidental, which is linked by railways to the mining centres of the Shaba province and Kindu in Kivu. Oil products imported by roadtankers from Kenya are delivered at Bunia and Bukavu, those imported from Zambia are delivered at Lubumbashi. Pipelines between Muanda/Banana and Ango Ango/Matadi (200 km), and between Kisangani and Walikale (350 km) are planned in the future[25].

As can be seen from Fig. 3.16, petrol and diesel are the most important products consumed in the country. Supply of oil products is generally below potential demand (between 85% and 93%). The interior of the country is undersupplied. Kinshasa accounts for half of oil consumption. Because of high inflation rates, petroleum companies have been unable to recover the true costs of petroleum products. This has led to the closure of most oil outlets in May 1992 in Kinshasa. Sectorially, transport is the major oil consuming sector, accounting for 62,9% of oil final consumption in 1983[24]. It is followed by industry which represented 24,6% of oil final consumption in 1983, of which more than half (about 56,7%) was consumed by the mining industry. Households consumed 6,7%, the remainder being accounted for by the Public sector.

The country has a storage capacity of 202 000 m^3, representing 2,9 months supply at the 1984 consumption level. The most important storage capacities are found at Ango Ango depot (65 000 m^3), in Matadi port, and Masina depot (57 000 m^3) in Kinshasa. Additional storage capacity is found at the Sozir refinery in Moanda. Its capacity is about 160 000 m^3, of which 70 000 m^3 is for crude oil.

The oil market is shared by five companies: Fina, Mobil, Texaco, Shell and the parastatal Petro Zaire. Together they own the Zaire Services des Entreprises

Pétrolières (Zaire-SEP) which operates the two pipelines mentioned above. The monopoly right of Petro Zaire to import crude and refined products, and the fixed market quota system were abolished in 1985.

3.5.4 Electricity:

Zaire has a total installed capacity of about 2600 MW, capable of producing about 11 000 GWh/year[24], and hydropower accounts for about 2500 MW. Howwever, this potential remains largely underutilized. The trends in installed capacity and electricity production are showns in Fig. 3.17 and 3.18 respectively.

The public supply system consists of five networks: the Western, the Southern, the Eastern, the Northern and the Central systems. The two major networks, the Western and the Southern, are linked by a 500-kV High-Voltage-Direct-Current transmission line running over 1740 km from the Inga-II power station in the Bas Zaire province to the copper city of Kolowezi in the Shaba province. The Inga-Shaba power line was designed to carry a capacity of 1120 MW though currently it has been downgraded to 560 MW. Two additional converters are needed to make full use of the line's capacity.

Table 3.3 Regional distribution of the total installed capacity in 1983[24]

	PUBLIC SUPPLY		PRIVATE SUPPLY			SHARE OF TH.GEN	SHARE OF PRI.GEN
	Hydro (MW)	Therm (MW)	Hydro (MW)	Therm (MW)	TOTAL (MW)	(%)	(%)
West.grid							
B.Z & Kin	1860,5	4,5	0,0	7,3	1872,3	0,6%	0,4%
South.grid							
Shaba	993,2	2,6	35,6	18,0	549,4	3,7%	9,8%
East.grid							
Ht. Zaire	18,8	13,4	16,2	7,0	55,4	36,8%	41,9%
Kivu	28,2	3,1	18,8	6,0	56,1	16,2%	44,2%
North.grid							
Equator	0,0	12,4	0,4	3,0	15,8	97,5%	21,5%
Central.grid							
Bandundu	0,0	2,0	0,2	6,0	8,2	97,6%	75,6%
Kasai Occ.	1,6	7,9	0,4	3,9	13,8	85,5%	31,2%
Kasai Or.	0,0	13,9	8,6	3,9	26,4	67,4%	47,3%

The Western system covers the Bas Zaire province and Kinshasa. It is centered on the 1424 MW (8 X 178 MW) Inga-II and the 351 MW (6 X 58,5 MW) Inga-I hydropowerplants whose respective generating capacities are 10400 GWH and 2400 GWH per annum. It also has some small hydroelectric stations: the 75 MW (2 X 18 MW + 3 X 13 MW) Zongo plant on the Zongo river east of Matadi; the 12 MW (6 X 2 MW) Sanga station and the 2,2 MW (2 X 1,1 MW) Mpozo power station.

The Southern system serves the southeastern part of the country, ie most of Shaba province. Its main assets are the 262 MW (4 X 65,5 MW) Nseke station, followed by the 108 MW (4 X 27 MW) Nzilo plant. Other hydroelectric stations are: the 70,5 MW (3 X 11 MW + 3 X 12,5 MW) Mwadingusha, the 42 MW (3 X 14 MW) Koni, the 28,2 MW (2 X 6,3 MW + 2 X 7,8 MW) Kiyimbi at Kalemie, and the 9,9 MW (3 X 3,3 MW) Kilubi at Kamina. The system is linked to the Inga-II power plant.

The Eastern system supplies Haut Zaire and the Kivu provinces. The Kivu province is served by the Ruzizi schemes. The Ruzizi-I hydropower plant has an installed capacity of 28,2 MW (2 X 6,3 MW + 2 X 7,8 MW) and is the property of the Zairean government. The Ruzizi-II plant, jointly owned by Zaire, Rwanda and Burundi, came on stream in 1989 and is operated by the Société Internationale d'Electricité des Pays du Grand Lacs (SINELAC). Its present installed capacity is 26,6 MW (2 X 13,3 MW) but a third 13,3 MW unit is scheduled to be installed around 1995. The Haut Zaire province has one hydroelectric station, the 18,8 MW (2 X 6,15 MW + 1 X 6,5 MW) Tshopo at Kisangani.

The Northern system supplies the Equator province primarily from thermal units. A 10,5 MW (3 X 3,5 MW) hydropower station was built between 1987 and 1989 on the Ubangui river. The Mobayi Mbongo station as it is called, is joint scheme with the Central African Republic. Located in the North West, it supplies the remote towns of Mobayi Mbanga in the Central African Republic and Gbadolite in Zaire.

Like the Northern system, thermal generation is very important in the Central region which consists of the provinces of Bandundu and the two Kasais (K.Occidental and K.Oriental). The supply to Bandundu is completely thermal. In the Kasais there is one hydropower plant: the 1,56 MW (2 X 0,78 MW) Lungudi plant at Tshikapa.

The grid is interconnected with Burundi, Rwanda, Congo, Central Africa and Zambia. The Eastern system is linked to Burundi and Rwanda through the Ruzizi-I and Ruzizi-II schemes. The Inga-I dam in the Western system supplies power to Brazzaville in the Congo through Kinshasa. The interconnection with Zambia, through the

Southern system, is now mainly used as backup as Zambia is generally self sufficient in electricity. It proved to be very useful when, following a fire at the Kafue dam, Zambia had a shortfall of power and imported an average of 100 MW in 1989. The Mobayi Mbongo power plant in the northern system, supplies power to the remote town of Mobayi Mbanga in the Central African Republic.

Power supply is mainly in the hands of the state-owned Société Nationale d'Electricité (SNEL). However autoproducers (mainly mining companies) play a vital role in many parts of the country as shown in Table 3.3. The Bas Zaire and Shaba systems represented 72% and 21% of the total installed capacity respectively, of the country in 1983. Generation capacity is far above the present needs of Zaire. Nationwide power production was 43%[24] of potential annual production in 1983, and the Inga-I and II hydroplants were being operated at 30%[1] of their installed capacity in 1991. However, for so vast a country, the concentration of this excess generation in two areas implies very high transmission costs for user centres. This is the main obstacles to the national and profitable operation of this enormous potential. A number of potential mini and micro-hydroelectric power sites have been identified. However, the population distribution pattern is such that many of them are either to remote from consumption centres, cannot cover long term needs, or bear a higher investment cost per unit compared to the Inga site[1].

Table 3.4 Transmission facilities of snel in 1990[28]

	SUBSTATIONS	LINES (km)
500 kV	6	1740,O
220 kV	14	1087,3
132 kV	8	305,3
120 kV	33	1198,7
70 kV	33	509,5
50 kV	1	144,4
TOTAL	95	4985,2

In 1983 the distribution network consisted of about 3700 km of medium voltages lines (6,6; 15, 20 and 30 kV) and 6500 km of low voltage lines (0,2-0,4 kV)[24]. Electricity consumption is concentrated in Shaba and Bas Zaire-Kinshasa. The Bas Zaire- Kinshasa represented 22,8% of public supply in 1984; and the Shaba

province, due to the mining industry, accounted for 73%. 69,5% of public supply was consumed by 9 high voltage consumers, the most important being the state mining company, Gecamines, which consumes about 64% of all electrical power sold in Zaire. 14,1% of consumption was accounted for by medium voltage consumers and the remainder by low voltage customers[29]. Access to electricity is limited to a small fraction of the population (about 3,5% in 1983). The number of connections also remains low relative to other countries in the region. With a population of 22 million in 1973, Zaire had only 70 000 connections compared to 190 000 connections in Sudan where the population was 15 million. The number of connections grew to 106 765 in 1984[29]. Consumption per capita (159 kWh in 1987) remains far below that of Zambia (925 kWh), which has a similar economic structure.

The Inga project has been critized for its high costs, and its poor coordination and planning that did not guarantee an effective use of the harnessed energy:

(1) It accounts for at least one-third of Zaire's foreign debt[22]. The Inga-II power plant and the transmission line Inga-Kolowezi cost US$ 840 million and US$ 1,46 billion respectively in 1984 prices. An additional high voltage network was built from Kolowezi to other mining centres of Shaba, at a cost estimated at US$ 253 million in 1984 prices[24]. As the optimistic economic conditions forecast did not materialize, the Inga-II and Inga-II are presently operated at only 30% of their installed capacity, and their usage rate is expected to be 45% of their full capacity in 1995. The transmission line also remains underutilized, transmitting only half of its designed capacity of 1120 MW. Thus the system does not provide a good return on investment.

(2) It is accepted that the scheme provides some of the cheapest power in the world. Without it, and especially without the Inga-II plant, the country would currently be short of power. However, the shortage of electricity in the Shaba province[4], whose mining operations motivated the construction of the costly transmission line, could be resolved by building several cheaper medium-sized power stations closer to demand with lower transmission costs[30].

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4 Shaba bought power from Zambia from 1973 until the completion of the Inga shaba transmission line.

(3) The two Inga plants are not synchronized onto the same system. Inga-I supplies the western grid and Inga-II the southern grid. In addition, the project has not been able to deliver electricity to any of the rural areas crossed by the transmission line. The situation will remain so as long as technology enabling the drawing of power from the line is not available. In fact, it is cheaper to build small plants than to use costly converters for these rural areas.

The completion of the Inga scheme, by the construction of Inga-III and Inga-IV, is not envisioned in the near future as far as financing and marketing are concerned. Under the prevailing situation, it can only be undertaken within the context of joint use with other countries. The proposed 3500 MW Inga-III would be built in three phases: 1350 MW (7 X 190 MW), 950 MW (4 X 190 MW) and 1200 MW (4 X 750 MW). Its annual production would be 23500 GWh[1]. It is also possible to build Inga-III in two phases of 1500 MW each[25]. The last power station proposed, Inga-IV or Big Inga, would be carried out in 13 stages of 3000 MW each (4 X 750 MW) and each stage would yield 20 500 GWh annually. Inga IV will have an installed capacity of 39 000 MW and annual production potential of 266 500 GWh[1]. This is a very big project, even by international standard.

Zaire needs a market to sell its power and put the potential of Inga to good uses. Efforts to attract consumers has not yet yielded any significant results. Amongst the proposals put up were the acceleration of the electrification of Kinshasa, the setting up of an industrial free zone called ZOFI (zone franche d'Inga) on the Zaire river estuary to attract foreign investment with cheap power, duty and tax concessions, increasing the use of the Inga-Shaba line, and increasing export to neighbouring countries. In this regard Zaire is looking forward to supplying power to certain towns in Northern Angola. The enclave of Cabinda (Angola) and the town of Pointe Noire (Congo) are also targeted. Finance for this link is expected to come from the German Kredietanstalt für Wiederaufban (KFW)[31]. The interconnection with Pointe Noire could pave the way for linking Inga to West Africa as shown in Table 3.5. Nigeria is interested in the project and talks have already started. It is worth mentioning that the distance between Inga and Sapele in Nigeria is a little shorter than the length of the transmission line Inga-Kolowezi.

Table 3.5 Possible future links with West Africa[31]

	LINKS		LENGTH
Zaire (Inga)	- Congo	- Gabon (Mbei)	700 km
Gabon (Mbei)	- Cameroon (Sanaga)		450 km
Cameroon (Sanaga)	- Nigeria (Sapele)		500 km
Nigeria (Sapele)	- Ghana (Akosombo)		650 km

South Africa, with its large economic base, could provides a great opportunity if the proposed grid, linking Southern and Central Africa was to be established. With its huge potential, the Inga scheme could be linked to the Ugandan Owen Falls dam in East Africa. The Owen Falls dam is already linked to the Kenyan grid and is expected to deliver power to Northwestern Tanzania. There is also an ambitious interconnection project between Inga and the Egyptian Aswan dam in North Africa. Zaire and Egypt have already signed protocols of agreement as a basis for cooperation. However, the Inga-Aswan link project, if carried out, would be confronted by many problems. Firstly, the building of a high voltage transmission line would prove to be financially and technically difficult. Secondly, the ongoing civil war in Southern Sudan which has to be crossed by the transmission line would lead to guerrilla sabotage.

All these projects show that Inga could play a vital role in integrating African grids. Inga's power is environmentally clean and is renewable. The enormous hydropotential of the site and its cheap generation costs make power exportable to Europe. It has been calculated that the cost of energy to be generated by the Big Inga (Inga-IV) plant would be less than US$ 0,009/kWh at the plant, and supplied to Europe through 750 KV Direct Current transmission lines of about 70000 kms, would be less than US$ 0,25/kWh[1].

3.5.5 Coal:

About 130 000 metric tons of high quality coke and coal, used for mineral processing, are imported each year from Zimbabwe. In 1983 total domestic production was about 110,4 thousand tons of which 11 thousands tons came from Lukuga, which is mined by the cement factory Ciments-Lacs for its own needs. The remainder is produced from Luena fields. It is mined by Gecamines for its own needs, those of the Société Nationale de Chemins de Fer du Zaire (SNCZ) and the CimShaba cements plants at Lubudi and Kakontwe.

in petroleum products prices[13]. Oil companies were subsequently requisitioned until early September 1992, when a new government took office and put an end to the crisis. Prices were increased by 340%.

Like oil, electricity pricing is controlled by the government. In 1987 the price was USc2/kWh for residential and commercial users (up to 400 kWh/month), USc1,97/kWh for small industries (>400 and <2000 kWh/month), and USc1,02/kWh for large industries (>2000 and <100 000 kWh/month). The average revenue was USc1,49/kWh[33]. There is an underecovery of electricity costs and tariffs do not include provision for debt servicing. Low voltage consumers and consumers of thermally- generated electricity are heavily subsidized. The introduction of a realisitic tariff is complicated by the fact the viabilitiy of the state mining industry Gecamines, which accounts for about two-thirds of electricity consumption, depends on a relatively low power tariff. The World Bank[24] advised the government to revise the power pricing structure for the Inga free Zone, taking into account present generation overcapacity and the economic cost of expanding installed capacity when necessary. This means that long-run marginal costing considerations should prevail in order to avoid financial embarassment to the country.

3.7 DISCUSSION

Despite its vast natural resources, Zaire is among the poorest countries in the world in per capita terms. There is however an anticipation that the economy will improve with political democratization and the subsequent introduction of an effective system of accountability.

The country is endowed with large wood and hydropower resources, moderate petroleum resources. In addition it has resources of coal, uranium, methane, solar and geothermal energy.

Woodfuel is, and will continue to be, the most important fuel for Zaire's overall energy needs in the medium term, and there are enough resources to meet demand. However there are signs of deforestation around major urban centres.

The country remains completely dependent on imported oil for its petroleum requirements, despite producing enough oil to meet its needs. The heavy grade domestic crude cannot be handled by the local refinery, and it could not yield the correct range of products needed in the local market. Unless there are new finds, the reserves could be exhausted in less than a decade at 1990 recovery rate.

There is an over-supply of generating capacity, mainly in the west of the country where the Inga power stations are located. The distribution of the excess capacity is hindered by the high cost involved in transmission across parts of the country. Local generation may be more profitable and in this regard, a number of potential mini and micro-hydroelectric power sites have been identified. In order to increase the utilization of existing capacity, there are plans for increasing the penetration into the domestic market and attracting foreign investment for energy intensive export orientated industry in the Inga free zone (ZOFI). However, there is concern that short-run marginal costing considerations are being used in setting power tariffs.

With the largest hydroelectric potential in Africa, Zaire is a potential power-house which could supply the surrounding countries. Because of the low level of local demand and the high capital requirements, the development of large scale hydroelectric projects in Zaire is expected to be carried out on a regional basis, and the country has therefore an important role to play in the integration of Africa's national grids.

Demand management, in the form of sound economic pricing of energy and energy conservation, better planning and coordination in development of energy resources hold the solution to Zaire's energy plight.

4. CENTRAL AFRICA: REGIONAL ANALYSIS

4.1 Introduction

This chapter deals with the analysis of the Central African region. It describes the global political, economic, demographic trends as well as the overall energy sector. The figures and tables relating to this chapter are given at the end of Volume I.

4.2 Politics

Postcolonial developments in the region resulted in political systems with a high degree of centralized single party systems, largely influenced by the socialist ideology. The absence of a workable style of governance, including political accountability, participatory politics and market driven economy, has prevented the region from attaining sustainable development. With the end of superpower rilvary and with the collapse of worldwide communism, the continent is entering a new era. The world changes have catalyzed external support and pre-existing internal pressure for democratic changes and the resolution of internal and regional conflicts.

On the whole, the political developments happening in the region are encouraging. Except Sudan, all the countries of the region are moving away from dictatorship. Some countries have been engaged in the process of national conference followed by transition period (Congo, Gabon, Zaire). Other countries have been or will go through direct elections (Cameroon, the Central African Republic, Zambia, etc.). The end of the civil war and the democratization of Angola will be beneficial for the region and increase its stability. Southwards, the prospect of peaceful settlement in South Africa and the cease fire between the warrying factions in Mozambique signed on October 4, 1992 will have positive implications for the region on the economic and energetic fronts. Only in Sudan is there no sign of new democracy.

Against this background of political stabilization, it is now possible to expect an economic improvement and with it a growing demand for energy and a greater willingness to trade in energy.

4.3 Economy

Table 4.1 shows the Gross Domestic Product (GDP) of the national economies of the countries in the region as well as their structure. The region is formed mainly of low income countries, with a mean GNP per capita of less than US$ 500 in 1989. The exceptions are the major oil producing countries (Cameroon, Congo, Gabon,

Angola) which are middle income economies, and Sudan which achieved a GNP per capita of US$ 641 in 1989.

The aggregate GDP for the region totalled US$ 67 billion in 1989. This is less than half the size of the economy of Belgium, which has only a population of 10 million or about 6,7% of the total population of the region. The nature of the economic structure remains dependent on agriculture. In general, its contribution to GDP has been declining since the independence time, representing about 35,4% in 1989. Nevertheless, it remains the larger source of employment for the labour force in all the countries of the region. Agriculture is in general dependent on rain, making it vulnerable to the fluctuations of climatic conditions. Oil and minerals are prominent features of many economies, raising the share of the industrial sector in the GDP. However, industry, which is largely extractive, is not deeply integrated into the economic structure and has limited linkage effects. This is reflected by the size of manufacturing and its contribution to the total GDP. The economy is also characterized by a form of dualism where a large informal sector operates beside and with a poor linkage to the formal sector, representing organized agriculture, mining, manufacturing and commerce. The informal sector has no sectorial reporting and is beyond the control of institutional structures, which are designed to deal with the formal sector.

Since 1975, the economic performance of the region has been poor. The average annual GDP growth rate has been 2,42% for the period 1975-89 in real terms, while the population growth averaged 3,1% for the same period. Consequently the real GDP per capita has been falling. This has been particularly acute over the last ten years (see Fig. 4.1). There has also been an increasing foreign indebtedness and a loss of self-sufficiency in food.

This economic decline is mainly accounted for by the economic management mistakes, the general trend towards a worsening terms of trade against primary commodities, the impact of two major oil prices rise in the 1970's, the recession in the industrialized countries in the early 1980's (which affected the volume of Africa's exports as well as their prices), and also the greed of the ruling classes.

Table 4.1 GDP and production's structure in the region[9,14,34,35,36]

COUNTRY	GDP IN 1989 (MIL. US$)	PERCENTAGE SHARE OF AGRIC.	INDUSTRY TOTAL	MANUF.	SERVICES
ANGOLA	7720	47	24	-	29
BURUNDI	1062	56	15	10	29
CAMEROON	11083	27	27	15	46
C.AF.REP	1105	42	15	8	43
CONGO	2269	14	35	9	51
GABON	3439	11	43	8	46
RWANDA	2169	37	23	15	41
SUDAN	16348	37	15	-	48
TANZANIA	2865	66	7	4	27
UGANDA	4713	67	7	5	26
ZAIRE	9607	30	32	10	38
ZAMBIA	4704	13	47	24	40
REGION	67084	35,4	24,2	7,6	40,4
% OF ZAIRE	14,3				

The most important economic management mistakes of independent Africa is the adoption of a state-run economy in order to realize the required economic development. This was largely encouraged not only by the seemingly success of socialist planning in China and the former Soviet Union, but also the colonial economic policies which were interventionist. Large scale nationalization hurt the economy and scared away prospective investors. Governments found themselves on a treadmill of increasingly uncompetitive monopolistic industries, inefficient marketing boards, glutted payrolls and escalating costs. Interventions benefited the ruling class (enrichment) and the urban population (subsidies, town upgrading), at the expense of the long-term economy, and of rural areas.

The priority given to rapid industrialization as a means to increase growth was a further mistake. This was carried out at the expense of agriculture and tourism which can be a source of significant foreign exchange earnings when correctly tapped. Mauritius, for instance has achieved a consistently high growth rate (expected to exceed 6% in 1992), through a strategy directed primarily at tourism. In addition one in every 18 workers around the world is employed in tourism[37]. Industrialization, combined to the lack of attention paid to the agragarian/rural

populations, led to the rapid urbanization noted in the region. This rapid urbanization and the high population growth, eroded self-sufficiency in food. A third mistake was the investment in uncompetitive or prestigious projects which produced little economic results. The prevailing political climate and the lack of accountability bred great economic mismanagement: tax evasion, smuggling and corruption. Even worse, it led to capital flight, as a large part of these diverted resources was exported and safeguarded abroad.

The region, as well as the entire continent, was integrated into the global economy as a source of raw materials for the colonial powers. These primary commodities continue to play a fundamental role in the economy of the region. This is shown in Table 4.2 which gives an idea of the extent of their role in export earnings. The purchasing power of these exports have been decreasing with steady decline of their prices on the international market. This reliance on a few export crops and minerals was found inadequate in earning adequate amounts of foreign exchange to service debts and spur the development process. In addition, it made the region extremely vulnerable to the vagaries of international market prices. The region and the continent has, therefore, to diversify exports beyond traditional commodities. The linkage between the raw material base and manufacturing has to be improved and increased.

Table 4.2 Dependence on primary commodities[4,8,14,34,35]

CONTRIBUTION OF PRIMARY PRODUCTS TO EXPORT EARNINGS: FUELS, METALS

	MAIN EXP. PRODUCT	PRODUCT % CONTR.	(YEAR)	MINERALS 1989	OTHER 1989	TOTAL 1989
ANGOLA	Oil	91%	(1989)	95%	2%	97%
BURUNDI	Coffee	86%	(1988)	0%	93%	93%
C.AF.REP	Diamonds	50%	(1988)	50%	47%	97%
CAMEROON	Oil	46%	(1987)	48%	49%	97%
CONGO	Oil	90%	(1985)	76%	15%	91%
GABON	Oil	63%	(1988)			
RWANDA	Coffee	82%	(1986)	1%	98%	99%
SUDAN	Cotton	65%	(1979)	1%	95%	96%
TANZANIA	Coffee	39%	(1984)	4%	84%	88%
UGANDA	Coffee	98%	(1988)	0%	99%	99%
ZAIRE	Copper	67%	(1985)	85%	6%	91%
ZAMBIA	Copper	91%	(1991)	92%	3%	95%

The region's external debt position in 1989 is shown in Table 4.3. The total debt of the region has been increasing rapidly since the early 1980's, as a result of high interest rates and low export prices, for non-oil commodities. The dramatic fall of petroleum prices after 1985 brought difficulties to the few producers in the region. In 1989, the debt of the region amounted to about US$ 26 billion. Although this debt is not large by Latin American standards, it is nevertheless excessively burdensome, representing about 86,5% of the region's total GNP. Individual countries of the region have built up high debt service ratios. Problems in meeting debt service requirements have resulted in an overall decline in capital inflows in the region. In addition the opening up of Eastern Europe's economies has increased the competition for the available development capital around the world(38).

Table 4.3 Debt profile of the countries of the region(3)

COUNTRY	TOTAL DEBT		DEBT STRUCTURE (%) (OFFICIAL)			DEBT SERVICE 1989 (ACTUAL)		DEBT SERVICE 1990 (OBLIGATION		DEBT/ GNP	GNP PER CAPITA
	1980 (MIL US$	1989 (MIL US$)	BI-LATERAL	MULTI-LATERAL	PRIVATE	MIL US$	AS % OF EXPORTS	MIL US$	AS % OF EXPORT	1989 (%)	1989 (US$)
ANGOLA	NA	5523	76	1	23	447	13.4	NA	NA	71.5	610
BURUNDI	166	867	22	70	8	38	33.0	49	42.6	81.9	220
CAMERO	2513	4743	39	26	35	365	19.4	691	36.7	42.2	1000
C.AF.REP	20	716	40	52	8	30	14.1	36	16.9	65.8	390
CONGO	1496	4316	35	13	52	320	27.0	914	77.1	214.9	940
GABON	1513	3176	48	11	41	223	11.9	199	10.6	108.9	2960
RWANDA	190	652	18	74	8	29	18.5	25	15.7	30.2	320
SUDAN	5163	12965	42	18	40	97	7.9	1202	97.5	82.9	641
TANZANIA	2572	4918	55	34	11	87	16.6	365	69.1	186.1	130
UGANDA	733	1808	22	66	12	209	81.2	148	57.4	44.7	250
ZAIRE	4860	8843	59	24	17	513	21.5	862	36.1	96.6	260
ZAMBIA	3266	6874	34	31	35	171	12.3	529	37.9	137.9	390
REGION	22492	55401	46	25	29	2529	17.4	5020	44.7	90.3	420
AFRICA *	108994	260551	41	21	38	23123	26.5	35452	47.1	86.53	756

*: WITHOUT SOUTH AFRICA

The domestic saving of the region cannot meet investment needs. The region needs funds, equipments, and skill to improve economic growth. In order to make the investment climate appealing to foreign capital, many countries are embarking on harsh economic structural adjustment programmes. More and more privitization is expected to occur in the future.

Recent political development will have a good effect on the economy of the region. The stabilization of Angola will lead to the rebuilding of its shattered economy. Peace in Angola will unlock its vital natural resources such as oil and its important hydroelectric potential for other countries in the region and in Southern Africa. Zaire could make substantial savings with the reopening of the nearly 2000 km long Benguela railroad, closed since 1975. This railroad is the most cost effective way to

transport minerals from the Shaba province to the coast. It is also the shortest west coast line for the landlocked Zambia. The settlement of the civil war in Mozambique will be beneficial to Zambia and its other neighbours which could share its ports'infrastructure and resources (hydro, gas and coal).

Given the size of its economy, its infrastructure, managerial and technical skills, a democratic South Africa has the potential to stimulate growth in sub-Saharan Africa. South Africa can achieve this only through trade, tourism promotion and transfer of expertise and skill. Aid or investments funds must not be expected because of the important task of the redressing the legacy of Apartheid. However, some friction could result, the immigration of skilled Africans to South Africa and the unequal trade balance being sensitive points. In 1990, for example, South African exports to Africa amounted to about R12 billion (including at least R8 billion to members of the Southern African Customs Union) against imports from Africa of a little over R2 billion[39].

In terms of regional and continental markets, and in tune with political developments, there is a plan for the creation of the ambitious African Economic Community, a five-point continental economic power-grid. These five points are regional economic integration groups, aimed at stimulating foreign trade. In Central Africa, this regional economic organization is the Economic Community of Central African States (ECOCAS), formed in 1983, with the ultimate goal of establishing a common market in the region in long term. Its members are Burundi, Cameroon, Central African Republic, Chad, Congo, Equatorial Guinea, Gabon, Rwanda, Sao Tome and Principe, and Zaire. However, little progress has been made because of the absence of a regional leadership, the lack of infrastructure, and the widely diverging economic and political policies[19]. Angola, Zambia and Tanzania are members of the South African Development Community.

4.4 Demography

4.4.1 Size, density and growth of population:

Figure 4.2 gives the population of the region and its annual growth rate for the period 1967-89. The population of the region totalled 148,8 million in 1989, giving an average population density of 152 person per 1000 ha. However, as Table 4.4 shows, there are big differences between various countries in the region. Gabon accounts for the lowest population and population density of the region. Burundi and Rwanda are the most densely populated countries of the region (their densities are among the highest on the continent). Almost ten time smaller than Gabon, their population sizes are five to seven times larger than that of Gabon. Demographic

growth is inordinately high at about 3,1%/year. But it is much higher in large cities where it approaches 6%/year. As a result of this high population growth rate (and the low life expectancy), the population has a very young profile, with about 46,6% of the total population of the region in 1990 falling in the under-15 age group.

This important built-in demographic momentum has resulted in a rapid rundown of resources, soil erosion and land degradation. In the prevailing context of poor economic performances, the GDP per capita has been declining, and the social services severely strained.

4.4.2 Urbanization:

Urban population in the region has increased from 12% of the total population in 1960 to 30% in 1990. This rapid urbanization has been fostered on one hand by the drive towards industrialization, and on the other hand by development policies which have a clear urban bias and rural development neglect. For instance, basic services such as water, sanitation and electricity are found only in towns. Migration to cities is motivated mainly by prospects for jobs, participation in a cash economy, access to a modern life infrastructure (health and social facilities). These requirements are difficult to meet in rural areas. Capital cities have been particularly hard hit by the urban drifts and in 1990, they accounted for about 30% of the region's urban population and 9% of the total population. Table 4.5 gives some urban indicators of the countries in the region, compared with some selected developed countries.

Urbanization growths are far higher than population growth rates. However, as shown by industrialized countries'statistics, this trend can be expected to fall in long term, as greater proportions of the population come to be located in towns and cities.

Problems created by the rapid urbanization are important and difficult to solve. Migration to towns has a negative impact on the agriculture which remains dependent on human labour in rural areas. Urban areas are congestioned, their social services severely strained and unemployment and crime are severe. Another important feature of the urban sprawl is the proliferation of peri-urban squatter settlement. There is also an increase of homeless people. This is linked to the decay of the traditional extended family and the decay of African solidarity that should provide support system for migrants[19].

Table 4.4 Population indicators[14,20,34]

COUNTRIES	LAND AREA (km^2)	POPUL. (mil.) (1989)	POP. GROWTH (%/year) (1985-90)	POPUL. DENSITY (1000 ha)	% OF POP. UNDER 15 (1990)
ANGOLA	1247	9,70	2,70	78	44,9
BURUNDI	28	5,30	2,88	1893	45,6
CAMEROON	475	11,55	2,60	243	43,5
C.A.REP.	623	2,95	2,46	47	43,2
CONGO	342	2,21	2,73	65	44,0
GABON	268	1,10	3,45	41	32,3
RWANDA	26	6,89	3,40	2650	48,9
SUDAN	2506	24,42	2,88	97	45,3
TANZANIA	945	25,63	3,67	271	49,1
UGANDA	236	16,77	3,49	711	48,5
ZAIRE	2345	34,44	3,17	147	46,1
ZAMBIA	753	7,84	3,76	104	49,1
REGION	9812	148,81	3,09	152	46,6
% OF ZAIRE	23,9	23,14			

4.4.3 Social development:

4.4.3.1 Social indicators

In general there has been, since independence, some gains and improvements in region with regards to key human development indicators such as life expectancy, literacy rate, health cares, etc. However, living standards remains low compared to those in developed countries.

Life expectancy in the region ranges from 45,5 years for Angola to 54,4 years for Zambia (1990). Birth rate are high, but they are partly offset by the high infant mortality rate. It is estimated that 12,5% (Zambia) to 29,2% (Angola) of children die before they are five years old. This high mortality rate is due to poverty, low women's education, poor health care and poor sanitation facilities, especially in rural areas. The high mortality rate encourages parents to have large family, as they are less confident that their children will survive. This situation is likely to persist until living

conditions improve. In general, population control programmes meet resistance on religious, social, economic or political grounds. However, universal education can help a great deal as it is one of the most effective population control policies[35].

Table 4.5 Urban population statistics[35,36,40]

COUNTRIES	URBAN POPULATION AS % OF TOT. POPULATION		GROWTH RATE (% per year)	CAPITAL'S POPUL. AS % OF URBAN POPUL.	CAPITAL'S POPUL. AS % OF TOTAL POPUL.
	1960	1990	(1960-90)	1990	1990
ANGOLA	10	28	5,9	61	17
BURUNDI	2	6	5,5	82	4
CAMEROON	14	41	6,5	16	6
C.AF.REP	23	47	4,8	51	24
CONGO	32	41	3,6	68	28
GABON	18	46	6,3	57	26
RWANDA	2	8	7,4	54	4
SUDAN	10	22	5,4	35	8
TANZANIA	5	33	10,3	21	7
UGANDA	5	10	6,1	38	4
ZAIRE	22	40	4,8	25	10
ZAMBIA	17	50	7,1	24	12
REGION	12	30	-	30	9
CANADA	69	77	1,7	4	3
FRANCE	62	74	1,3	20	15
GERMANY	76	85	0,6	1	1
GREECE	43	62	1,9	55	34
JAPAN	63	77	1,6	19	15
SWEDEN	73	84	0,9	23	19
UK	86	89	0,4	14	13
USA	70	75	1,3	-	-

4.4.3.2 Health

Central Africa is a tropical region and is affected by tropical diseases such as malaria and sleeping sickness. Malaria is one of major cause of adult mortality in the region. The decline of the economy and civil strife has led to the deterioration of public health

services. This is noticeable in the increase of malnutrition, particularly among children, and the reappearance of some diseases already eradicated during the colonial period. In parallel with modern medicine, traditional medicine remains widely used. Table 4.6 gives the health profile of the countries in the region, compared to some selected industrialized countries. It also compares public health expenditure and military expenditure.

The region is one of the most Aids hard hit part of the World. Uganda, Zaire, Zambia, Burundi, and Rwanda have publicly and openly recognized the Aids crisis. The other countries are not spared. Massive displacements of people (Uganda-Tanzania, Burundi, Angola, etc.) due to political instability and civil strife have also contributed to spread of the disease.

The soldiers, the elite class (with its affluent life and greater access to travel), and the more productive workers are infected by Aids in larger proportions. This situation has dreadful consequences on the society. In the long term, it could cripple the national security and the leadership of many countries. The economic development could be threatened as job skills are wiped out by premature death. Foreign investors could reduce their operations, for the sake of their personnel's health and in response to collapsing economies[41]. In addition, the economically active people leave behind them a significant number of dependent: children, parents, and others. The social costs in treating ill people is also quite high.

4.4.3.3 Education

Literacy levels and primary schools enrollment ratio are increasing. Primary school dropout rate is high as a result of poverty, long distance to schools (in rural areas), and children starting work at an early stage. From 6 to 7 years, children help with cultivation, cattle herding, and baby sitting and other households cores, at the expense of education. If this trend is allowed to continue, it will badly affect the overall pace of development in the longer term.

Table 4.7 gives some selected indicators on the education sector. The countries of the region spent between 1,7% (Tanzania) to 5,3% (Central African Republic) of their GNP to public education. Zaire is remarkable exception, with only 0,4% of its GNP in 1986 devoted to education.

Education facilities are lacking because of the fast population growth rate and decreasing government spending. Much has to be done to make education accessible to a large proportion of the population. Investment on human development and basic education brings high economic returns, in terms of increased

Table 4.6 Health profile[40]

COUNTRY	% OF POPUL. WITH ACCESS TO HEALTH SERVICES 1985	MATERNAL MORTALITY (PER 100 000 live births) 1987	POPULATION PER		EXPENDITURE AS % OF GNP	
			Doctor 1984	Nurse 1984	PUBLIC HEALTH 1986	MILITARY EXPEND. 1986
ANGOLA	30	-	17790	1020	1,0	12,0
BURUNDI	61	-	21120	3040	0,7	3,5
CAMEROON	41	300	-	-	0,8	1,7
C.AF.REP	45	600	23530	2210	1,2	1,7
CONGO	81	1000	8320	590	2,0	4,6
GABON	90	-	2790	270	2,0	3,8
RWANDA	28	210	34680	3650	0,6	1,9
SUDAN	51	660	10100	1250	0,2	5,9
TANZANIA	81	340	26200	8130	1,2	3,3
UGANDA	60	300	21900	2060	0,2	4,2
ZAIRE	26	-	-	-	0,8	3,0
ZAMBIA	75	150	7150	740	1,2	3,2
CANADA	100	3	510	-	8,6*	2,2
FRANCE	100	14	320	-	8,6*	3,9
GERMANY	100	12	380	-	8,2*	3,1
GREECE	100	9	350	-	5,3*	5,7
JAPAN	100	16	660	-	6,8*	1,0
SPAIN	100	11	320	-	6,0*	2,3
UK	100	9	-	-	6,1*	5,0
USA	100	8	470	-	11,2*	6,7

* as % of GDP in 1987

job skills for increasingly skilled labour needs. A special emphasis has to be placed on the education of women who are generally given a lower social status by the society in the African continent. Better education for women is vital for successful family planning, efficient child cares, etc. In addition, women constitute a large part of the labour force (from 21,5 to 48,5%). An improvement of their educational background can make a large contribution to the running of the economy. Another cause of concern is the increasing migration of better educated African people to developed countries, in search of better economic opportunities.

Table 4.7 Eductation Indicators[40]

COUNTRY	LITERACY RATE FOR THE OVER 15 AGE GROUP			TERTIARY GRADUATES (% OF CORRES-PONDING AGE GROUP)	SCIENTISTS & TECHNICIANS (/1000 PEOPLE) (1980-88)	PUBLIC EXPEND ON EDUCA-TION (% OF 1986 GNP)
	MALE	FEMALE	TOTAL		(1986-88)	
ANGOLA	50	23	36	-	-	3,4
BURUNDI	53	32	42	0,2	-	2,8
CAMEROON	61	36	48	0,3	-	3,0
C.AF.REP	45	19	32	0,4	-	5,3
CONGO	66	38	52	1,2	-	5,0
GABON	70	43	56	0,8	-	4,8
RWANDA	59	32	45	0,1	0,2	3,2
SUDAN	39	10	24	0,4	0,4	4,0
TANZANIA	-	-	-	0,1	-	1,7
UGANDA	57	29	43	0,1	-	1,5
ZAIRE	79	53	66	0,2	-	0,4
ZAMBIA	77	59	67	0,2	4,4	2,2
BRAZIL	80	77	79	2,5	29,5	3,4
CANADA				14,0	257	7,2*
FRANCE				12,1	83	6,6*
GERMANY				7,2	131	4,5*
GREECE				5,4	166	3,1*
JAPAN				11,5	317	6,5*
USPAIN				5,1	130	3,2*
UK				10,4	-	5,0*
USA				15,5	55	6,8*

* % of GDP in 1986

4.5 Energy Resources

4.5.1 Fuelwood:

As shown in Table 4.8, the aggregate fuelwood resources are large in the region with closed and open forests covering about 457 781 thousand ha or about 47% of the total land area.

The part of the region covering Zaire, Congo, Gabon, the Southern belt of Cameroon, the south-western corner of the Central African Republic and northern Angola (especially the enclave of Cabinda) is heavily forested. This subregion bears one of the largest remaining virgin tropical forests in the world. The bulk of the dense tropical forests of the region are found in Zaire, which accounts for about 48% of the African tropical forests.

Tropical forests near the coast, have been under severe pressure (log cutting, fuelwood gathering, clearance for farmland extension, etc.). However the major parts of these forests remain largely untouched. They are located deep in the interior far from ports and large cities and where the low population densities and difficult access have helped preserve most of them from the invasions of shifting cultivators, permanent farmers and lumbermen(42).

The annual rate of destruction of closed forests in the countries of the region remains small compared to other countries such as Cote d'Ivoire and Nigeria in West Africa where it is respectively 6,5% and 5,0% of available forests (see Table 4.8). Rwanda and Burundi, the two smallest countries of the region, are the most hard-hit by deforestation problems. They are followed by Sudan and Uganda.

There is a high dependence on woodfuel which has led to depletion of available resources around villages and towns. In some part of the region, woodfuel consumption is reaching its environmentally sustainable limitation.

4.5.2 Hydropotential:

The Central African region has the largest hydropotential on the continent. The region receives a high rainfall due to the humid climate in the tropical and equatorial parts. In addition, it has a network of strong and free flowing rivers, with extensive catchment basins and valley gorges. This network includes the Zaire, Nile, Zambezi and their tributaries, Sanaga (Cameroon), Kwanza and Cunene (Angola), Rufiji and Ruhindji (Tanzania), the Great Lakes system, etc.

An accurate assessment of the hydro-potential has not been made due to the large size of the region and its often inaccessible nature. However, the impact of the two major oil price rises in the 1970's stimulated a more comprehensive survey of the hydropotential of the region.

Table 4.8 Forest resources in the region[20]

	FOREST RESOURCES (THOUSAND HECTARES)			AVERAGE DEFORESTATION IN THE 1980's (%/YEAR)		
	CLOSED FOREST	OTHER	TOTAL	CLOSED FORESTS	OTHER	TOTAL
ANGOLA	2 900	50 700	53 600	1,5	0,1	0,2
BURUNDI	27	14	41	4,6	2,9	2,7
CAMEROON	16 500	6 800	23 300	0,6	1,3	0,8
C.AF.REP	3 590	32 300	35 890	0,1	0,2	0,2
CONGO	21 340	-	21 340	0,1	-	0,1
GABON	20 500	75	20 575	0,1	-	0,1
RWANDA	120	110	230	2,6	1,8	2,3
SUDAN	650	47 000	47 650	0,6	1,1	1,1
TANZANIA	1 440	40 600	42 040	0,7	0,3	0,3
UGANDA	765	5 250	6 015	1,3	0,8	0,8
ZAIRE	105 750	71 840	177 590	0,2	0,3	0,2
ZAMBIA	3 010	26 500	29 510	1,3	0,1	0,2
REGION	176 592	281 189	457 781	0,26	0,4	0,35
ZA/REG(%)	60	26	39			
AFRICA	219 811	464 591	684 402	0,6	0,5	0,6
ZA/AFR(%)	48	16	26			

Table 4.9 gives the present estimate of the exploitable hydropotential of the region. With a potential estimated at 1227 753 GWh/year (203 400 MW), the region is a real powerhouse for the continent, and can support economic growth for decades. While many countries in the region are richly endowed with hydropower resources, a special mention has to made of Zaire, which stands out as possessing 120 000 MW or 41% of the annual potential of the continent.

The important hydropotential of the region contrasts sharply with the low demand for electricity, due to low economic activity. Only a small fraction of the total potential is at present harnessed, however, there is already a surplus capacity. Although there is underutilization in general, the recent drought has badly affected the electricity output of countries such as Zambia. The realistic approach to the future development of the region's hydropotential is a joint use of available power within the

region and outside the region. Apart from large projects, there is also a large scope within the region for small hydro schemes (mini and micro-hydroplants). These small projects are very suitable for the rural electrification and can provide a considerable potential for economic expansion.

Table 4.9 Hydropower potential of the region[7,14,34,43,44]

COUNTRY	TECHNICALLY HYDROPOWER (GWH/YEAR)	EXPLOIT. POTENTIAL (MW)	ECONOMICALLY EXPLOITABLE HYDROPOTENTIAL (GWH/YEAR)	(MW)	PRESENT INSTALLED CAPACITY* (MW)
ANGOLA	100 000	23 000	-	8 000	434
BURUNDI	4 000	800	1 445	300	39
CAMEROON	115 000	23 000	-	8 000	528
C.AF.REP	-	-	-	1 200	19
CONGO	50 000	11 000	-	3 000	120
GABON	80 000	18 000	33 500	6 000	164
RWANDA	3 000	600	-	150	56
SUDAN	19 000	2 700	1 900	2 000	225
TANZANIA	40 000	9 500	20 000	6 000	333
UGANDA	14 000	2 800	10 048	1 955	156
ZAIRE	774 000	120 000	419 210	45 000	2 510
ZAMBIA	28 753	12 000	17 233	6 000	2 245
REGION	1 227 753	203 400	-	87 605	6 829
ZA/REG(%)	63	59	-	51	37
AFRICA	2 091 892**	293 276	-	109 545	19 162
ZA/AFR(%)	37	41	-	41	13

* hydro only
** estimate

4.5.3 Coal:

Known coal resources are summarized in Table 4.10. Resources are unevenly distributed within the region. They are found in Tanzania, Zaire and Zambia, but the lack of extensive exploration makes difficult a proper of assessment of the their magnitude. In addition, the Central African Republic has about 4 million tons of proven recoverable lignite[11]. The other countries of the region do not have any reported coal reserves.

Table 4.10 Coal resources (In million tons in situ except for the proven recoverable which is sealable coal)[7]

	HYPOTHETICAL	PROBABLE	PROVEN	TOTAL	PROVEN RECOVERABLE
TANZANIA	0	1596	304	1900	200
ZAIRE	720	0	86	806	54
ZAMBIA	222	0	58	280	29
REGION	942	1596	448	2986	283
% OF ZAI.	76,4	0	19,2	27,0	19,1

There are two known coalfields in Zaire and a third one which is not yet explored. Coal quality is poor and generally non coking. Production is small and limited to local industries. Tanzania has nine coalfields located mainly in the southern part of the Rift Valley. The three most important are Ketewaka-Mchuchuma (681,6 million tons), Songwe-Kiwira (615 million tons), and Ngaka (249,7 million tons). Significant exploitation started in 1988. Zambia has many coalfields in the south and the northeast. Since 1965, the country has been developing its coal production, but the industry needs to be rehabilitated and modernized.

4.5.4 Petroleum and gas:

The bulk of the petroleum reserves in the region are found along the Atlantic coast which has been largely explored. The Central African coastal basin is very rich in oil, and the major oil producers are Angola, Cameroon, Congo and Gabon - all countries which have long coastlines. Zaire, with only 40 km of coast on the Atlantic Ocean, is a small producer. Important oil deposits have also been found in Southern Sudan.

The region's numerous interior basins are potential oil-bearing areas, but exploration is generally weak. Among these basins are the central basin of the Zaire river (Zaire and Congo), the Great Rift Valley, especially the Tanganyika Graben (Zaire, Burundi, Tanzania), the Zambezi river basin and Luangwa valley in Zambia, and the eastern coastal basins of Tanzania.

Table 4.11 Oil and gas resources in 1990[4,11,14,34,36,45]

COUNTRY	OIL - MILLION TONS		NATURAL GAS - MILLION m^3	
	TOTAL RECOVERABLE	PROVEN	TOTAL RECOVERABLE	PROVEN
ANGOLA	286	286	39 000	9 000
CAMEROON	55	55	119 000	110 000
CONGO	114	114	70 000	70 000
GABON	100	100	45 000	17 000
SUDAN	273	68	85 000	85 000
TANZANIA	0	0	190 000	163 000
ZAIRE	9	9	286 000	286 000
REGION	837	632	834 000	740 000

Apart from Tanzania, natural gas is found mainly in countries with proven oil deposits, partly in association with petroleum. Gas associated with oil is either flared or reinjected. In addition to the natural gas resources given by Table 4.11, there is an important methane gas reserve dissolved in Lake Kivu on the border between Zaire and Rwanda, estimated at 60 billion Nm^3.

4.5.5 Uranium:

Gabon is the only country of the region which produces uranium on a large scale. Zaire has significant exploitable deposits in its copper ores, but systematic exploitation stopped with the closure of the Shinkolobwe mine in 1960's. However, some uranium is obtained as a by product of copper. The Central African resources are not yet exploited as a result of infrastructural problems and current low demand. Tanzania has confirmed reserves of uranium, and Zambia is also thought to have some uranium deposits.

favourable geothermal potential whereas in Burundi and Rwanda, investigation on geothermal potential is at an early stage. However, the prospect for developing this

geothermal potential is poor, given the abundance of conventional and economic sources of energy in the region.

Zaire has 9 thermal springs with an average temperature of 60°C and a geothermal plant has been operational since the 1960's. Uganda's potential, estimated at 450 MW in 1971, remains unexploited, but a seven year-exploration programme was launched in 1986. In Tanzania, geothermal potential is considered large but has not yet been adequately explored. Zambia has more than 100 thermal springs but they are in general uneconomical because workable temperatures occurs at great depths. However, two binary cycle plants totalling 200 kW where scheduled for completion at Kapisya in 1988.

4.5.6.3 Solar and wind energy

Data about solar energy and wind energy are fragmented and their true potential remains to be assessed. These resources are not expected to play a major role on the regional energy scene in a near future because of technical and economic constraints. Nevertheless, they can be useful for specific purposes in isolated areas.

The climate offers good potential for solar for all the countries of the region. Wind energy is important along the coast and in desert areas (coastlines of Tanzania and Angola, desertic northern Sudan, etc.). Except on the plateaux and the high plateaux, wind resources are poor inside the region. Tanzania is among the 13 developing countries around the world, identified by the US Department of Energy and the World bank, that have the greatest potential for economic commercial wind energy development[11].

4.6 Energy supply and demand

4.6.1 General

Table 4.14 gives the energy demand in each country of the region in each carrier sector in 1988. Traditional energy forms (fuelwood, charcoal, agricultural waste) meet a very high proportion of the energy needs of the region, about 83% of the total final demand. Commercial fuels are mainly oil and electricity which account respectively for 75,6% and 18,3% of commercial energy final consumption.

More information about the supply and demand in the region is given at the end of Volume I.

Table 4.14 Energy balance in 1988 for the countries of the region in terms of final energy demand. Energy units are thousand tons oil equivalent (TOE)[7,14,34,46]

	COAL & PEAT	OIL	GAS	ELECT	TRADI	TOTAL
ANGOLA	0,0	1064,4	0,0	62,1	1441,4	2572,9
BURUNDI	3,4	54,5	0,0	9,1	1192,5	1259,5
CAMEROON	0,0	766,6	0,0	204,3	2327,0	3297,9
C.AF.REP	0,0	60,8	0,0	6,3	748,8	816,0
CONGO	0,0	204,4	0,0	28,9	428,0	661,3
GABON	0,0	340,8	0,6	63,3	638,0	1042,7
RWANDA	0,0	94,2	1,0	13,9	1737,5	1846,5
SUDAN	0,0	1446,1	0,0	91,2	4862,0	6399,3
TANZANIA	35,9	746,6	0,0	95,3	12625,2	3503,0
UGANDA	0,0	285,1	0,0	35,4	5301,0	5621,5
ZAIRE	151,0	844,9	0,0	415,9	8241,4	9653,3
ZAMBIA	331,6	588,5	0,0	553,0	2565,2	4038,3
REGION	522,0	6501,9	1,6	1578,7	4210,8	00712,1
% of TOT. EN.	1,0	12,8	0,0	3,1	83,0	
% of COM. EN.	6,1	75,6	0,0	18,3		

4.6.2 Traditional energy:

Traditional energy, principally in the form of fuelwood, is dominant in the energy balance of the region. The degree of dependency on traditional fuels, as shown in Table 4.15, varies from one country to another. However, the higher percentage of traditional fuel in the final demand are found in Tanzania, the Central African Republic, Burundi, Rwanda and Uganda - countries with mainly agricultural economies. Except Tanzania, all these countries are land-locked. In addition, Burundi, Rwanda and Uganda have the lowest urbanization level in the region.

Table 4.15 Dependency on traditional fuels[14,34,46,47]

	TRAD ENERGY AS % OF TOTAL FINAL CONSUMPTION (1988)	% OF POPULATION WITH ACCESS TO ELECTRICITY	YEAR
ANGOLA	56,0	-	-
BURUNDI	94,7	1,5	1989
CAMEROON	70,6	-	-
C.AF.REP	91,8	-	-
CONGO	64,7	-	-
GABON	61,2	-	-
RWANDA	94,1	1,4	1988
SUDAN	76,0	8,0	1982
TANZANIA	93,5	13,3	1985
UGANDA	94,3	3,0	1982
ZAIRE	85,4	3,5	1983
ZAMBIA	63,5	8,0	1982

Traditional fuel consumption is generally difficult to estimate because of the lack of reliable data. However, it is thought that the bulk of traditional energy (about 90%)[47] is accounted for by the domestic sector. This reflects the poverty of the region's households, especially in rural areas where the majority of the population live, engaged in the informal and subsistence agrarian sector. In rural areas, wood is the favourite fuel and is sometimes supplemented by agricultural waste and dung. Wood is mainly a free good collected in the vicinity of settlements. Low income urban households cannot afford to buy commercial fuels and rely on wood and charcoal for cooking and heating. The woodfuel market is formal in urban areas. The remainder of traditional energy is consumed by small factories in rural areas (coffee and tea processing, brick burning, food processing, etc.).

Although woodfuel resources are important, they are not evenly distributed in the region or within individual countries. In addition they do not follow population distribution patterns. Very often, when resources are abundant, they are either inaccessible or far from demand centres. The high reliance, combined with the rapid growth of the population, has resulted in growing pressure on available woodfuel resources and forest clearing for agricultural production. Forests around major cities are being depleted as the consumption of fuelwood exceeds the rate of natural

growth. Supply base are shifting to more and more distant forests, increasing transport costs, and fuelwood collection is an increasingly difficult and time-consuming task.

A shift away from wood can be excepted in the longer term as a result of the depletion of available resources, or the improvement of the economic situation. This will change the energy mix of the region. The low percentage of the population with access to electricity (see Table 4.15) and the abundance of hydropower resources in the region shows that electricity could, in the long term, relieve the pressure on the traditional energy sector. The strong urbanization drive noted in the region has not resulted in a switch in favour of commercial fuels. However, by concentrating people in small areas, urbanization is a positive factor for increasing electrification. Rural electrification, preferably from small hydro schemes, could also help to alleviate the deforestation problems.

Depletion of forest resources is more serious in Burundi and Rwanda because of their small size and their very high population density. Also threatened by the dwindling forest resources are Uganda, Tanzania and Sudan (in its northern part) where there is an imbalance between wood consumption and sustainable supply. In order to alleviate the situation, programmes aiming at fuelwood conversion and end-use efficiency, and reforestation or afforestation are being undertaken in some countries. But in general, these programmes are weak. In addition, establishment and maintenance costs make wood from these plantations (especially peri-urban plantations) uncompetitive with wood from natural forests.

4.6.3 Commercial energy:

4.6.3.1 Introduction

The commercial energy scene of the region, as given in Table 4.16, has two striking features. The first is the preponderance of oil, representing from 39,9% to 94,5% of commercial energy final demand of individual countries. The second is the underutilization of coal and peat (6,1% of commercial energy or 1,0% of TFC in 1988) and the almost non existence of gas. This is in contrast with developed countries where coal and gas are important energy carriers.

Sectorially, for most countries of the region, the transport sector is the largest user of commercial energy, followed by industry (see Fig. 4.3). However the trend is reversed for Zambia and Zaire because of their large (copper) mining operations.

Table 4.16 Percentage of various energy carriers of commercial energy final demand and cost of commercial fuels imports as a percentage of merchandise exports[14,34,35,46,47]

	% SHARE OF COM. FUELS IN COM.ENERGY FINAL DEMAND (1988)			ENERGY IMPORTS AS % OF MERCHANDISE	
	COAL & PEAT	OIL	GAS	ELECT	EXPORTS IN 1987
ANGOLA	0	94,5	0	5,5	-
BURUNDI	5,1	81,3	0	13,5	31*
CAMEROON	0	79,0	0	21,0	1
C.AF.REP	0	90,6	0	9,4	1
CONGO	0	87,6	0	12,4	5
GABON	0	84,2	0,1	15,6	1
RWANDA	0	86,4	0,9	12,7	45
SUDAN	0	94,1	0	5,9	38
TANZANIA	4,1	85,1	0	10,9	56
UGANDA	0	89,0	0	11,0	17
ZAIRE	10,7	59,9	0	29,5	-
ZAMBIA	22,5	39,9	0	37,5	11
REGION	6,1	75,6	0,0	18,3	-
FRANCE	10,2	56,2	16,4	17,2	9**
JAPAN	13,4	61,2	4,9	20,5	21**
UK	10,3	46,2	28,2	15,3	5**
USA	10,1	52,1	22,1	15,5	11**

* petroleum imports only
** % of merchandise exports in 1989

4.6.3.2 Petroleum

Oil is important not only as the major commercial fuel used in the region but also as a significant source of foreign exchange for certain countries in the region. In addition, taxes levied on petroleum products constitute a substantial part of government revenue in the whole region. Angola, Cameroon, Congo and Gabon refine part of their crude to meet their oil requirements. For the other countries of the region, petroleum is imported, draining a significant part of their foreign exchange earnings (see Table 4.16). In this regard, a special mention has to be made of

Tanzania. Oil imports generally absorb about 60% of Tanzania's exports earnings, reaching 80%[4] in 1990 as a result of the Gulf War. Sudan, Tanzania, Zaire and Zambia refine imported crude oil.

Most refineries are inefficient and uneconomic. Besides operating below their nominal capacity, there is an inadequacy between their product mix output and local market requirements. Consequently, some refined products (mainly fuel oil) are exported on the international market at a loss. A weak transportation infrastructure makes oil supply inside the countries unreliable. In addition, shortages of foreign exchange lead countries to buy oil in small batches, which allow little flexibility to take advantage of market conditions[48].

Figure 4.4 shows the sectorial distribution of oil final consumption for the countries of the region. Transport is the main oil-consuming sector.

4.6.3.3 Electricity

Table 4.17 summarizes the electricity situation in various countries of the region in 1988. The region's total installed capacity was 8526 MW, of which about 80% was hydro. The largest installed capacities were found in Zaire (2603 MW) and Zambia (2436 MW).

There is currently an over-supply of generation capacity in the region, leading to underutilization. This is particularly important in Zaire. With 7% more installed capacity than Zambia, Zaire generated 32% less power than Zambia in 1988. The drought affecting Southern Africa has however reduced the generating capacities of Tanzania, Zambia and Zimbabwe.

There is small scale electricity interchange in the region or with countries outside the region. The national grids of Uganda and Kenya, and Zambia and Zimbabwe are connected. The grid of Zaire is interconnected with Burundi, Rwanda, Congo and Zambia. Zambia and Zimbabwe are considering importing power from Zaire in order to lessen electric load-shedding and avoiding more disruptive power shortage threatening their economies.

The sectorial distribution of electricity final consumption is shown in Fig. 4.5.

Table 4.17 Some electricity indicators in 1988

	INSTALLED CAPACITY		POWER GENERATION		IMPORT
	TOTAL (MW)	HYDRO (MW)	TOTAL (GWh)	HYDRO (MW)	- EXPORT (GWh)
ANGOLA	617	412	842	758	0 - 0
BURUNDI	39	32	56	54	12 - 0
CAMEROON	605	528	2419	2325	0 - 0
C.AF.REP	35	19	87	68	0 - 0
CONGO	149	120	292	289	55 - 0
GABON	252	164	877	676	0 - 0
RWANDA	60	56	172	168	15 - 0
SUDAN	450	225	1061	517	0 - 0
TANZANIA	519	333	1377	1250	0 - 0
UGANDA	162	155	599	595	0 - 110
ZAIRE	2603	2497	5762	5618	3 - 112
ZAMBIA	2436	2245	8485	8445	20 - 1480
REGION	7927	6786	2202	20763	

4.6.3.4 Coal and Peat

The region's known coal resources are estimated at about 2986 million tons of coal, 283 million tons being proven recoverable. However, in 1988, coal production within the region totalled about 670 thousand tons, and coal final consumption amounted to 800 thousand tons only. This underlines the under-utilization and under-exploitation of coal in the region. Coal consumption within the region is limited to Zambia, Zaire and Tanzania, and is accounted for by the industrial sector. Recently Tanzania launched a large scale coal exploitation programme for replacing household and industrial firewood, for electricity generation, and in order to reduce costly oil imports.

Peat is a very small commercial energy carrier, accounting for 0,04% commercial energy final demand in 1988. Peat resources remained largely unexploited. Only Burundi has been developing, on a very small scale, peat as an alternative source of energy. Large scale peat exploitation, especially from wetlands, is subject to environmental constraints and require special hydropeat technology. The market for peat as fuel is still limited to institutions, mainly the army. Peat seems to be a viable substitute fuel for industry. As to the domestic sector, technical problems related to

inconvenience in use have to be overcome for households to be interested in peat for cooking, in addition to the question of cost[49].

4.6.3.5 Gas

In final demand terms, gas is virtually not used. Oil producing countries in the region have ready access to gas. However, of the total production of oil associated gas, a small fraction is consumed for electricity generation and petroleum production, and the rest is flared. Non associated gas remains unexploited. Small amounts of LPG, consumed in the region, are generally included in oil product statistics.

4.6.4 Energy indicators:

The total final consumption of energy for the countries of the region is given on a per capita basis in Fig. 4.6 and 4.7 while the commercial energy/capita is shown in Fig. 4.8 and 4.9. As shown in Table 4.18 which summarizes the per capita energy situation in 1988, the level of energy usage in the region is very low. The average TFC per capita is about 351,9 kg oil equivalent, of which about 292,2 kgoe come from traditional fuels. This low energy usage can be attributed on one hand to the low needs for heating in a largely tropical region, and to the low level of urbanization. On the other hand, it can be attributed to the region's low level of economic development in general and industrialization in particular[9].

The TFC per capita level varies from country to another. Gabon, followed by Zambia, have the highest level of TFC per capita within the region. This is also true for commercial fuels where they are followed by Congo, Cameroon and Angola - which are oil producing countries. In regional terms, there has been a steady decline in the per capita energy consumption (see Fig. 4.10 and 4.11). This can be attributed to a high population growth, the decline of the economy with the subsequent problem of foreign currency for oil imports and the fuelwood shortages in some countries.

The energy intensity, defined as the energy per unit of GDP, is given in Fig. 4.12, 4.13, 4.14, and 4.15 for member countries and in Fig. 4.10 and 4.11 for the region. The use of local currencies in the calculation of energy intensity has been avoided. Rather, the 1985 US$ has been adopted in order to get a common denominator for all the countries of the region. For this purpose, current local currencies have been successively converted to real local currencies (using the 1985 deflators) and real US$ (using the 1985 exchange rates). It is difficult to estimate the true energy intensities and the total energy intensities do not reflect the efficiencies of energy in the generation of GDP. This is because of the high reliance on traditional fuels and

Table 4.18 Energy final consumption per capita in 1988. Energy units are kilogram oil equivalent (kgOE)

	COAL & PEAT	OIL	GAS	ELECTRI-CITY	TRADI-TIONAL	TOTAL
ANGOLA	0	113,8	0	6,6	153,3	273,7
BURUNDI	0,7	10,6	0	1,8	232,0	245,0
CAMEROON	0	68,5	0	18,3	208,1	294,9
C.AF.REP	0	21,2	0	2,2	261,0	284,4
CONGO	0	95,6	0	13,5	200,1	309,2
GABON	0	316,4	0,6	58,8	592,4	968,2
RWANDA	0	14,2	0,1	2,1	261,0	277,4
SUDAN	0	60,8	0	3,8	204,5	269,1
TANZANIA	1,5	30,2	0	3,9	510,6	546,1
UGANDA	0	17,6	0	2,2	327,0	346,8
ZAIRE	4,5	25,3	0	12,5	247,0	289,3
ZAMBIA	43,9	77,9	0	73,2	339,5	534,5
REGION	3,6	45,1	0,0	11,0	292,2	351,9

the use of the large proportion of them in the household sector on one hand, and on the other hand, because of the existence of a large informal sector with poor statistics. Commercial energy intensity might give a better description of energy in the economy.

In general the total and commercial energy intensities do not have a clear historic trend and vary from one country to another, however they have been declining in regional term. The variations in energy intensities among countries can largely be attributed to variations in development, the low end-use efficiency and varying availability of traditional fuels, the availability of local commercial energy resources, as well as the effect of civil wars in certain countries[47]. Total energy intensities are high while commercial energy intensities are low, reflecting the underdevelopment of the region and the widespread absence of commercial energy intensive productive sector. The high total energy intensities can mainly be attributed to the prevalence

of traditional fuels with a low end use efficiency. They can also be partially attributed to inadequate demand side management, the low priority of conservation and efficiency issues, inadequate pricing structures, price subsidies, as well as the large informal sector which is not accounted for in the measurement of GDP[47].

Figure 4.16 links the energy per capita to the GDP per capita. Oil producing countries and Zambia which have the higher level of GDP per capita have higher level of commercial energy per capita, and this confirms the relationship between wealth and energy.

4.7 Energy institutions

In general, the responsibility for different aspects of energy matters is split between various government ministries, public bodies and organizations, but detailed arrangements vary from country to another. The three main energy subsectors, electricity, fossil fuels and biomass fuels are covered by these energy institutions which are mainly state controlled.

Table 4.19 presents the main oil marketing companies, oil refineries and electricity corporations found in individual countries of the region. See Nomenclature and Volume II for the meaning of these abbreviations.

There are three main regional energy institutions which are the energy wings of SADC (South African Development Community (formerly SADCC)), CEPGL (Economic Community of Great Lakes Countries), and KBO (Organization for the Management and Development of the Kagera river Basin). To these institutions can be added the Zambezi River Authority (successor of the Central African Power Corporation).

The EGL (Energie des Pays de Grands Lacs), the energy wing of the CEPGL, formed by Burundi, Rwanda and Zaire, has been very active and a common electricity company SINELAC (Société Internationale d'Electricité des Pays de Grands Lacs) has been set up (see section 3.3.2).

Angola, Tanzania and Zambia are members of SADC which plays a role in formulating energy policy and encouraging cooperation between certain countries on energy issues. SADC energy coordination is entrusted to Angola which has set up the Energy Technical and Administration Unit (TAU) to act as the coordinator for energy planning on behalf of SADC[47].

Table 4.19 Power utilities and oil companies of the region

	ELECTRICITY SUBSECTOR	OIL SUBSECTOR
ANGOLA	EDL, ENE, SONEFE	FPA*, SONANGOL
BURUNDI	DGHER, REGIDESO	COBUCO, ERCOIL, FINA/BP, PETROBUR, HYDROBUR, SICOPP
CAMEROON	SONEL	SHELL, SNH, SONARA*
C.AF.REP	ENERCA	TOCAGES
CONGO	SNE	CORAF*, HYDROCONGO
GABON	SEEG	AGIP, BP, MOBIL, SOGARA*, TEXACO, TOTAL
RWANDA	REGIDESO	BP-FINA, ERP, PETROLGAZ, PETRORWANDA, SGP, SHELL
SUDAN	NEC	GPC, PORT SUDAN REF.*, WNPC
TANZANIA	RUBADA, TANESCO	TIPER*, TPDC
UGANDA	UEB	AGIP, CALTEX, ESSO, MOBIL, SHELL, TOTAL
ZAIRE	SNEL	FINA, MOBIL, PETROZAIRE, SHELL, SOZIR*, TEXACO
ZAMBIA	BHDC, CPC, ZESCO	INDENI REF.*

* oil refinery

Burundi, Rwanda, Uganda and Tanzania are members of the KBO which plans the integrated development of the Kagera Basin region. The KBO energy wing is concerned with the development of a 60-100 MW hydroplant to be situated 2 km downstream of the confluence of the Kagera and Ruvuvu rivers. Feasibility studies have been carried out.

The Zambezi River Authority is a joint body of the Zambia and Zimbabwe governments which plans the development of the Zambezi River hydropotential and supervises the operation of existing power stations. Its parent, the Central African Power Company, controlled the supply of electricity from the Kariba Dam power stations but was dissolved by joint Acts of Parliaments.

4.8 Analysis of energy issues

4.8.1 Institutional shortcomings:

The energy institutional structure in the region is weak, poorly coordinated and in many cases suffers from shortage of skilled manpower. Most countries have no institutions capable of dealing with energy demand side management and have poor statistics records. The problem is more acute for the major energy source of the region, fuelwood.

Energy institutions have been badly affected by inappropriate macroeconomic policies. The adoption of a command economy has translated into overall planning, strong state control in energy institutions, through ownership or rationing regulations. Regulation mechanisms include statutory monopoly powers, distribution controls, price controls, subsidies, and taxes[47]. This has led to the production and distribution of energy according to social priorities and political goals rather than via the price mechanisms. A remarkable example of such distortions is found in Angola where subsidies to consumers in the form of below marginal cost of electrical energy have undermined corporations' financial and technical viability (see Section 2.2.2). As with other parastatals, production and supply utilities suffer from excessive government interferences which hinder their effective management. They include politicized appointments, making decision on ideological grounds rather than technical or economic reasons, etc.

Political instability and ideological conflicts have strengthened national security imperatives. This has resulted in a strong drive towards self-sufficiency and has prevented the establishment of viable regional institutions with a few exception.

While the governments can retain some regulatory functions in order to achieve certain national objectives (such as guiding the development process, assuring social justice), financial automony for the energy utilities should be established. This would promote the development of autonomous commercially viable power companies. Appropriate energy policies in which the economic cost of supply is considered as the most important instrument for demand management should be envisaged, and could be conducive to private participation in energy supply.

Government should address the shortage of skilled manpower by subsidizing the cost of technical education, and by providing adequate funding and technical support service needed for effective training of personnel. Adequate funding should also be made available for energy research and development[36].

4.8.2 Energy resources, supply and markets:

4.8.2.1 Woodfuel

Because of low earning power of communities the consumption of energy is largely based on woodfuels. The major problem is the declining sustainability of supply, due to population pressure and worsening economic situation. The subsequent woodfuel shortages have negative effects on the larger traditional energy consumer, the domestic sector (longer collection time, higher transport costs, higher prices) and on the environment (deforestation, degradation of land).

As no sudden changes in population growth is expected and in the context of the persisting economic crisis, the most effective solution to woodfuel crisis, in the short term, is to encourage conservation by increasing fuelwood conversion and end-use efficiency, which will translate into lower overall demand in both households and rural industries. Traditional three stone stove efficiency ranges from 12 to 18% while conversion losses in charcoal kilns average 60-90%[36]. This shows that an efficiency improvement could significantly contribute to reducing the imbalance between supply and demand. In the medium and long term, reforestation programmes have to be implemented. Market regulation policies are difficult to implement. On the one hand, the bulk of traditional fuels is traded outside commercial channels and used in the informal sector. On the other, suppliers do not fully perceive the total cost of wood, the resource itself being rarely included in the price.

The possibility of large scale woodfuel substitution does not appear realistic. In rural areas, substitution has been limited to less efficient and lower value agricultural waste and residues, which are also used as valuable manure or fertilizer[12]. The provision of alternative commercial sources of energy has met with less success, even in urban areas, because of their higher investment requirements such as expensive end-use appliances, electricity wiring and connection bills, the supply constraints for oil products for instance, and the low income level of the population. The countries of the region lack the technology and capital to develop or expand commercial energy infrastructures (e.g. power grid in rural areas). In addition there are more pressing needs like health, water, and sanitation services, to be satisfied in rural areas. However, it is expected that growing woodfuel scarcity and increasing urbanization will ultimately lead to shift in demand for commercial fuels (electricity, LPG, kerosene) in urban areas.

Traditional energy has represented more than 80% of the total final consumption of the region over the last 20 years. Under all optimistic economic growth scenarios,

this dominant role of traditional fuels in the energy picture is expected to remain for the next two or three decades. Considering that commercial energy fuels will remain beyond the economic means of the majority of the population, woodfuel will be the only reliable energy source in the region, especially for the domestic sector. Within the framework of national economies, wood offers more advantages when compared to commercial fuels. It is indigenous (no foreign exchange spending), cheap, widespread, renewable and environmentally benign if consumed on a sustainable basis, provides significant rural employment[47], and is easily exploitable. It therefore plays an important role in the socio-economic development of the region.

Reforestation is a high-cost alternative to natural forests management which has been neglected. It should receive adequate attention and financing in rural areas in order to ensure security and sustainability of supply for the rural population. Reforestation is more likely to succeed if left to communities and individual initiatives. However, the lack of expertise and land tenure problems (communal land system) are some constraints to setting up communities based and managed woodlot programmes. Peri-urban plantations are probably not a solution to the woodfuel shortages in urban areas for the moment. While they reduce transport costs, they are not competitive with wood from natural forests, which is largely underpriced, not even with some commercial fuels, because of the establishment and maintenance costs. In urban areas, interfuel substitution should receive more attention.

For conservation effort to be viable, there must be a development and dissemination of more efficient techniques (improved cookstoves, ovens, charcoal kilns). Local firms should be encouraged to produce them through incentives such as tax credits. These techniques must be supported by promotional campaign, public education on woodfuel economy, training of woodfarmers and charcoalers. People use equipments with lower conversion efficiencies because they are less expensive. Some form of subsidies should be considered to make improved equipment affordable. Other incentives should be considered. For instance, Rwanda is planning to introduce a charcoal tax with a reduced rate on charcoal from improved techniques. For such a practice to have good results, control must be transferred to local communities.

Both woodfuel conservation and reforestation have to be part of a long term integrated forestry development and effective woodfuel demand management (research, monitoring, survey, analysis). Population policies need to be considered in parallel because deforestation is not only caused by woodfuel gathering but also

and to a larger extent - by the expansion of agricultural land (with the associated slash and burn technique) to feed the fast growing population. Log cutting and cash crop farming also contribute to the deforestation.

The role of government institutions in the biomass subsector has been nominal, limited to some reforestation efforts and some supporting actions to make consumption of traditional fuels more efficient. The integration of the informal energy sector (traditional fuels) into the institutional structure is imperative, given the large share of fuelwood in overall energy consumption and the gravity of social and environmental problems associated to it. For this purpose, institutions should be reviewed and strengthened in order to deal with fuelwood supply and demand questions in a systematic way. Data collection should receive a special attention as statistics are important for rational decision making.

4.8.2.2 Oil

There are six oil producing countries in the region, Angola, Cameroon, Congo, Gabon, Sudan and Zaire, with the production of Angola alone being about three time the region's needs in crude oil. All of these countries have refineries, in addition to Tanzania and Zambia. These refineries use old technology and have low utilization factor (sometimes periodic shutdowns), costly output-demand mismatch, inappropriate maintenance, and high operating costs. Average refinery operating costs in Africa are U$2/barrel, compared to US$0,75[48] in the major international oil refining centres.

As shown in Table 4.20, the domestic oil markets of the member countries of the region are small. Pooled together, they represent almost the market of Algeria alone. Distribution (transport and storage) systems are inadequate, inefficient and costly, and skills in logistics and service management are poor. Supply security is a serious problems for land locked countries. Burundi, Central African Republic, Rwanda, and Uganda rely on river or land routes through neighbouring countries while Zambia is dependent on a 1704 km pipeline from Tanzania. This dependence makes their supplies vulnerable to interruption. The constitution of strategic stockpiles involves capital immobilization and additional maintenance costs.

Apart from refinery and distribution problems, the petroleum sector is affected by procurement inefficiencies, unfavourable environment for investment and inadequate institutional set up. The sources of procurement problems are import financing constraints (limitations on foreign exchange for petroleum sector expenditures and the inadequate access to internationally available import financing alternatives), the lack of proper purchasing skills or proper bidding procedures, and the

monopolization of procurement activities. All this combined with the limited size of the domestic markets make it difficult to keep track of world oil market trends and developments. Monopolistic procurement of supply and fixed market quotas which are common within the region result in the absence of competition in importing and marketing activities. Given the size of the domestic market, it is not economically viable for a potential entrant to invest in parallel distribution facilities. Government regulations are important. They include direct involvement in refining and marketing activities, price determination and control. The economic environment is not good to attract investment. There are high level of uncertainty, unpredictable changes in pricing, high levels of inflation, currency devaluation and restriction on the repatriation of dividend or capital[47]. These fundamental problems have to be solved for the oil sector to become attractive.

Table 4.20 Some oil indicators in 1988 (Quantities in thousand metric tons)[34,46,50]

	REFINERY CAPACITY	OIL PRODUCTS CONS. PRODUC	TOTAL	PER CAP.*	CRUDE OIL CONS	PRODUC
ANGOLA	1450	1382	1085	115	1470	22283
BURUNDI	0	0	53	10	0	0
CAMEROON	NA	1810	1100**			
C.AF.REP	0	0	63	22	0	0
CONGO	800	496	257	120	516	7038
GABON	1200	844	460	427	1070	7750
RWANDA	0	0	92	14	0	0
SUDAN	1200	818	977	41	1013	0
TANZANIA	700	555	717	29	605	0
UGANDA	0	0	267	16	0	0
ZAIRE	750	308	865	26	370	1795
ZAMBIA	1000	625	592	78	688	0
REGION		6838	6528	45	7742	47346
ALGERIA	NA	39087	6431	270	22455	33200
LYBIA	NA	6360	4767	1126	7600	49200
NIGERIA	NA	6595	7986	76	6800	69330

* oil consumption/capita in kg

** estimate

Zaire could rely on imports rather than expanding its local production because of the lack of finance. Given its large exploitable hydroresources, a substitution of coal by hydropower could also affect coal consumption patterns of Zaire.

For landlocked countries with no coal resources, coal use is not envisageable mainly because of logistic problems. In addition, these countries do have alternatives resources. The Central African Republic has enough fuelwood. Burundi, Rwanda and Uganda - countries with woodfuel shortages - have enough peat and papyrus. The other countries of the region produces oil and Sudan which has a serious woodfuel crisis in its Northern (desert) part could use oil to alleviate the crisis. However, potential for increased coal use exist in steel manufacturing and metallurgy, if these industries are developed in the future.

4.8.2.4 Gas

Gas production in the region is mainly flared and this constitutes an important waste. Given the current state of the region's economies, gas could remain underutilized for a long time. The main obstacles for the development of the gas resources[48] are:

- uncertain prospects for foreign exchange earnings from the export of liquid hydrocarbons,
- small markets for natural gas,
- long gestation periods for investments, and
- the high cost of infrastructure.

Gas is considered as the world fastest growing energy source. Its consumption in Europeans countries as a whole represents about 18% of TFC and it appears that the saturation level in these country is approximately 25% of total final demand[7]. This increasing gas use is expected to reduce dependence on oil and to reduce the environmental problems associated with other fossil fuels[20]. However, prospects of gas production in the region for exports markets in Western countries are bleak for many reasons. There is a downturn in world demand. Other African countries, such as Algeria and Nigeria, which account for about 70% of Africa's 1991 gas reserves, may be more interesting supply sources. Furthermore well established export networks exists in North Africa. Algeria exported 60% of its gas production to Europe and Japan in 1989. There is a LNG pipeline linking Algeria to the Italian mainland through Tunisia and Sicily and its capacity is expected to be expanded. A 2000 km pipeline is proposed from Algeria to Spain via Morocco. An other proposal include a Transmaghrebine gas system linking Algeria, Tunisia and Lybia[52].

Gas utilization for electricity generation will also remain small because of region's large hydroresources. The alternative use of natural gas (chemical industry, CNG

for motor fuel) should be investigated. Domestic consumption of gas in the region could either reduce oil imports or free oil for export markets.

4.8.2.5 Electricity

Electricity in the region is predominantly hydro-generated. The hydroresources of the region are large and only a small fraction has been exploited. There is therefore considerable scope for increasing role of hydropower, provided the necessary technical and financial means are made available.

Table 4.21 Power system performance in 1987[33,36]

	TOTAL SYSTEM LOSSES (%)	CAPACITY FACTOR (%) (TOTAL PUBLIC)
BURUNDI	20	32
CAMEROON	6*	10
C.AF.REP	28	24
CONGO	28*	18
GABON	12**	50
RWANDA	40	33
SUDAN	22	30
TANZANIA	24	23
UGANDA	18	45
ZAIRE	7	20
ZAMBIA	6	42

* 1982
** 1985

As shown in Table 4.21, the power subsector in the region is characterized a poor performance, low reliability and efficiency. Losses are large and are due to pilfering, obsolete transmission and distribution equipments, and poor maintenance. There are shortage of skilled manpower and the cuts in imports of spare parts and new equipments due to foreign exchange constraints. As a result the maintenance of generating and distributing equipments is badly affected, leading to frequent breakdowns and lengthy unit outages. Seasonal fluctuations and drought also brings operational constraints.

Besides these operational problems, the financial viability of power utilities is threatened by poor cost control. Tariffs are too low to generate adequate revenue for basic operations, let alone maintenance and investment[48] and collection practices are poor. Overinvestment has resulted in surplus generating capacity in a number of countries and local electricity markets are small. A full use of this available capacity should be made. This can be achieved by exporting power to neighbouring countries, by increasing electrification, and by substituting fossil fuels by electricity (when cost effective). However, the possibility of widespread electrification is not achievable at present. Lack of finance, inadequate infrastructure, the squatter nature of the peri-urban housing, large transmission, lack of suitably large local market and large rural populations are hampering electrification projects[47].

While hydropower is renewable, has low operational cost, and the resources are large, the realization of this potential will be influenced by the economic and political situations in individual member countries of the region and by environmental concerns. Hydroelectric developments are capital intensive and the countries of the region lack of ability to finance large scale investment projects from domestic sources. In addition, their borrowing capability, which helped them to finance major public investment programmes, especially in the energy sector[53], has been reduced as result of high debt ratio and debt servicing problems. It is therefore clear that this large hydropotential should be developed on a regional basis to allow the economies of scale required for massive investments. However, this can only be achieved in a climate of political stability and mutual trust. Hydropower schemes might have some harmful environmental and socio-economic impacts on areas affected by the reservoirs. In this ecological conscious age, this point will be of special relevance as major funding organizations such as the World Bank and a growing number of large international corporations have commitments to environmental standards[20].

Small scale hydro schemes constitute a complementary approach to the development of the region's hydroresources, and should be provided with adequate resources. Although not contributing to large increases in power, they can be cost-effective means to electrify rural or isolated areas. However, there should not be a deliberate move away from large schemes. Economic growth is stimulated primarily by activity in the principal urban and industrial areas and such growth benefits also development in the outlying areas. This is why both large and small hydro schemes should be promoted[54].

Electricity supply is almost the exclusive mandate of public corporations. High centralization and political regulation are common. There is a need for decentralization, greater management autonomy and financial capacity for power utilities. Some forms of privatization and private sector participation should be envisaged as they could bring new capital and technology into the energy sector.

Electricity is an important tool for socio-economic attainments as it stimulates the economic growth and the development process. Electrification in itself generates employment opportunities and GDP directly in activities like erecting pylons, wiring an area, supplying materials. Electrification provides the kick-start for economically productive potential through increased demand for domestic electrical appliances, development of small businesses, launching of new projects for large companies. It improves the quality of life and provides health, education and other social advantages. Electricity can help to alleviate the pressure on traditional fuels and reduce their negative impact on the environment[2,55,56]. Substitution of fossil fuels by electricity can help to reduce the dependence on oil imports or save oil for exports. For these reasons, electrification must be a priority if governments intend promoting economic growth and social benefits. This also applies to place where biomass is still freely available because electricity provides far more significant productive potential than fuelwood which is in this case the least cost option but might degrades the environment. To this end, governments should use subsidies, or tax incentives to protect the financial health of both the supplier of electricity and the end-use customers[56].

4.8.3 Energy technology and technology transfer:

4.8.3.1 Energy technology

The region is technologically dependent on industrialized countries. Technology has been generally financed by commercial lending until the early 1980 - when the creditworthiness of many indebted countries was lost - and by Multilateral and Bilateral agencies which have shrinking investment funds. Associated with this outside financing is the supply of expert advice with attempts to influence the specification of projects in support of the goods of a particular company or of a particular (donor) country.

Beside the financing problems, the transfer of technology is a major issue (see Section 4.8.3.2), as adequate planning, specific climatic, cultural and economic environment are not always considered sufficiently. Such environment includes the lack of water, humidity, temperatures, dust, the poor maintenance capability, the need to keep the cost and import of spares to minimum. In addition, some of the

needs of the region are no longer technological preoccupations of developed countries. This is the case of improved wood stoves and charcoal kilns which can make a significant impact on the domestic sector. There is therefore a need for technological work within region rather than always relying on third parties and imported application of technology.

It can be said that financing and foreign exchange constraints make difficult the acquisition of competitive technology and spare parts. This coupled to the old age of much of region's energy technology, the lack of technical expertise, the non economic cost pricing of energy supply result in poor performances of the energy sector.

4.8.3.2 Technology transfer

In general the technology transfer in the energy sector has been largely unsuccessful for many reasons. First, developing countries are considered as a market for developed countries'goods and expertise, so emphasis is placed on equipment exports rather than technology transfer. Second, the technology is conceived by people with little knowledge of the environment in which equipment is required to operate, and with little regard for the social and economic conditions into which it will be applied. For instance, ice loadings and high velocities criteria were also applied in the design of a large transmission line of a Central African country. Third, low level of technical capacities (shortage of skilled manpower and lack of manufacturing capabilities) make the absorption and maintenance of transferred technology difficult. The lack of skills is also reflected in the difficulty to adequately specify requirements and to analyze offers made[57].

Before the region reaches technological maturity, solutions to the region's problems will be imported from abroad. However they have to adapted to local circumstances and needs. South-south technology transfer and cooperation with countries that are at a similar stage of development should be encouraged. Learning from the experience of South Africa and the awakening East Asian nations should fruitful. Local expertise should be developed, mobilized and associated with the design, planning and construction of energy projects so that they can learn by doing. In this regard arrangements should be made to allow local people to gain experience through collaboration with international energy firms doing business in the region. Provision should be made for adequate funding for energy research, development and demonstration institute/centres in the region[36]. The pooling experience on a regional basis and developing skills on a integrated basis would be beneficial to the region as a whole.

4.8.4 Environment:

It is difficult to make an accurate assessment of the environmental situation of the region because of the lack of monitoring systems. However, the major environmental problems are related to the degradation of land and water resources, and the pollution from the sprawling peri-urban settlements due to unregulated urbanization.

Land degradation results from deforestation. About 1602 thousand ha of forest or 3,5% of the region's forest cover have been lost annually during the 1980's. Deforestation is due to demand for fuelwood, clearing and burning of land for agricultural purposes, logging, overgrazing, etc., with the expansion of agricultural land being the main cause of deforestation in developing countries.

Table 4.22 summarizes the contribution of the region and some selected countries to the net attributed additions of the heat-trapping greenhouse gases (carbon dioxide, methane and chlorofluorocarbons), which are responsible for the global warming. Land use change (deforestation) is the first human source of carbon dioxide in the region before the burning of fossil fuels whilst for the rest of the world the burning of fossil fuels comes first. The frequent savanna fires are an important source of carbon dioxide and pollution. They produce three to four times more carbon dioxide than deforestation in the tropics, which is luckily offset by the newly grown savanna. Savanna fires are also responsible for the very high surface ozone concentrations (40 parts per billion)[5] frequently found in tropical Africa during the dry seasons, and other trace gases, and for acid rain over the rainforests of Central Africa[20].

The main energy environmental concerns in the region are related to fuelwood and the burning of fossil fuels. Fuelwood contributes to net release of carbon dioxide through deforestation and combustion. In addition, its smoke is a major health hazard for people, mainly women, working in a smoky environment. Fuelwood smoke affects eyesight, and in the case of incomplete combustion, it contains a variety of carcinogenic and non-carcinogenic substances leading to chronic lung cancer in women and acute respiratory diseases in children[11,36]. The combustion of fossil fuels, especially in transport and industry, and the flaring of natural gas in the petroleum industry contribute to global warming and air pollution. Other environmental concerns arise from hydro schemes and peatbogs extraction.

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5 This is exceptionally high compared to the Canadian standard which is 15ppb.

As shown in Table 4.22, gas emissions in the region are relatively low compared to international standards, and this can be partly attributed to the lack of substantial coal utilization. In view of more pressing need for development and economic growth, global warming concerns are not a priority. The public is not generally concerned with environmental matters though this is slowly changing.

Table 4.22 Net additions to the greenhouse heating effect in 1987. Quantities in thousand tons of carbon[20]

	CARBON DIOXIDE FOSSIL FUEL & CEMENT	CARBON DIOXIDE LAND USE CHANGE	METHANE EMISSIONS*	CFC USE*	NET TOTAL ATHOMSPHERIC INCREASE
ANGOLA	540	2 400	470	-	3400
BURUNDI	20	-1	120	-	140
CAMEROON	720	15 000	580	-	16 000
C.AF.REP.	31	1 500	210	-	1 800
CONGO	210	1 400	26	-	1 600
GABON	600	780	12	-	1 400
RWANDA	43	130	140	-	310
SUDAN	390	12 000	3 300	-	15 000
TANZANIA	250	2 100	2 300	-	4 600
UGANDA	86	950	780	-	1 800
ZAIRE	420	15 000	790	-	16 000
ZAMBIA	320	1 800	340	-	2 500
REGION	3 630	53 059	9 068	-	64 550
RSA	34 000	-	7 800	5 800	47 000
AFRICA	75 000	170 000	57 000	42 000	340 000
USA	530 000	2 600	130 000	350 000	1,0 E04
USSR	450 000	-	60 000	180 000	690 000
CHINA	260 000	-	90 000	32 000	380 000
INDIA	67 000	61 000	98 000	700	230 000
UK	69 000	-	14 000	71 000	150 000
JAPAN	110 000	-	12 000	100 000	220 000
BRAZIL	23 000	540 000	28 000	16 000	610 000
WORLD	2,5 E06	1,2 E06	800 000	1,4 E06	5,9 E05

* equivalent carbon dioxide heating effect

Fortunately, forest cover, which is significant in Central Africa (see section 5.1.1), is helping to absorb carbon dioxide emissions, and many countries in the region have undertaken forest preservation schemes. Apart from the prevention of global warming, world's tropical forests are vital to the stability of the global climate, to the maintenance of soil productivity, and the prevention of erosion, flooding and the siltation of reservoirs. They also harbour about half of the world's animal and plant species[42].

4.9 Energy demand forecasts: 1990-2020

4.9.1 Introduction:

There is no firm foundation for projecting the region's future energy consumption because of the considerable uncertainty surrounding the evolution of its overall economic development, its energy pricing, conservation and interfuel substitution policies.

The economy of the region is underdeveloped, with the major proportion of GDP being generated in agriculture and mining. The region's economic growth rate has been unstable but it is expected to improve in the future, resulting in an overall growth of energy requirements to sustain it. Structural changes in economy are also expected to change the energy mix of the region. The economic recovery will depend on the achievement of a number of favourable outcomes such as the structural adjustment programmes, substantial inflows of external assistance, and positive political developments. However, the unfolding debt will continue to restrain access to foreign capital and investment in energy sector while the high population growth will continue to place pressure in the region's meagre resources. It may therefore be difficult to achieve a satisfactory GDP growth rate, especially in per capita terms.

Energy pricing will have a significant impact on energy demand. For instance, a rising trend in energy prices will hold down the demand for energy by encouraging more efficient energy use and having a depressive effect on the economies[58]. The future patterns of energy consumption will also be affected by substitution between fuels and by energy conservation. Conservation will depend on the penetration of more efficient production and end-use technologies as well as on the transfer of know how and expertise from developed countries. Urbanization, increasing scarcity of wood, good economic performances and good energy pricing may lead to a switch from traditional to commercial fuels.

As shown by the energy intensity versus time curves of South Africa and United States of America in Fig. 4.17 and 4.18, there is a classic pattern of energy intensity followed by countries around the world, which changes with the sectorial changes of the economy. Energy intensity (energy consumption per unit of GDP) is initially low and grows as a country moves from an agrarian economy to one based on primary industry. Thereafter, it peaks and falls as the dependence of the economy shift from raw material exploitation to high value added activities. At this stage, secondary industry replaces primary industry, energy utilization efficiency increases and services (banking, insurance, etc.) become important. The period of time necessary to follow this path varies from one country to a another. It took longer for more industrialized countries and it is shorter for newly developed countries as more efficient technologies become available. Technical progress, restructurization of the economy and energy-conscious consumer attitude and policies are usually projected to reduce the amount of energy needed per unit of GDP[58].

For the region, the bulk of energy consumption is in the form of traditional fuel and is mainly accounted for by the domestic sector. Commercial energy, used in GDP generation activities, has a low energy intensity (see Fig. 4.10). This underlies the large share of manpower-driven agriculture and shows that the region is at an early stage of industrial development. With no significant changes in the sectorial economic activity and energy efficiency, the region's commercial energy intensity (CEI) has been decreasing over the period 1971-88 at an average rate of 0,5% per annum. Except electricity - whose intensity had a positive growth rate (0,62%/year) over that period - the annual growth rate of the intensity of other commercial energy carriers has been negative: -3,2% for coal and peat, -3,1% for gas, -0,3% for oil. The decrease of CEI is mainly related to oil output and pricing, showing the fundamental role played by oil in the region. Figure 4.10 shows that when oil prices increased (1973-74, 1981), the CEI decreased. This can be explained by the increase of the earning power of oil exporting countries and by imports constraints for oil importing countries. In the same way, the CEI decreased when oil prices decreased (1986). It may be expected that the region's CEI will increase with the oil output declining and the developmental path directed towards heavy industry.

4.9.2 Methodology:

Against the background of uncertainty in GDP growth, sectorial changes in the economy, energy pricing, substitution and conservation policies, a number of assumptions have been made and three economic growth scenarios have been proposed in order to predict the region's future energy consumption. Since planning cannot be done on a worst case scenarios, the three economic scenarios, the low case, the base case and the high case, all have positive growth rates.

These three scenarios are shown in Fig. 4.19 and their resultant trends in GDP per capita are given in Fig. 4.20. The low case scenario has a growth rate starting from 1,5% in 1989, reaching 3% in 2011 and remaining constant thereafter. Since the growth rate remains for a long period of time below the population growth rate (3%/year), such a scenario is likely to lead to social disruptions. The base case scenario starts at 2,5% in 1989, rises above 3% in 2001, reaches 3,5% in 2009 and remains constant. It could lead to marginal improvement of per capita income in the long term. The high case scenario is optimistic and is for a growth rate rising from 3% in 1989 to 5% in 2016.

It is assumed that:

- the economic growth scenarios affect only the consumption of commercial fuels.
- traditional energy, which is mainly used in the domestic sector, will grow as in the past at a rate nearly equal to projected population growth rate (3%/year). It is also assumed for the purpose of this study that because of the non-sustainability of woodfuel resources in some part of the region, an increasing part of traditional energy demand will be met by commercial fuels. This part starts by 1% of theoretical demand forecast in 1989, rising progressively to 32% in 2020.
- the energy intensity versus time curve of the region will follow that of South Africa over the forecast period. The energy intensity relative to 1988 for the period 1970-2020 is given in Fig. 4.21. The choice of SA as a model of the region's future energy intensity trend is justified by the fact that this country is close to the region and shares with it the same problems of development, and many natural and geographical features.
- substitution between commercial fuels and energy savings remain weak and therefore negligeable.

Future energy demands in the region have been assessed with 1988 as a base year. The first estimate has been made using the population growth for the traditional energy, energy intensities and GDP growth for the total commercial energy. The quantity shares of commercial energy carriers have been calculated using almost the percentage shares for the year 1988: 75,6% for oil, 18,3% for electricity, 6,05% for coal and peat, and 0,05% for gas.

The second estimate is a correction of the first. The projected traditional energy shortfalls have been subtracted to the theoretical demand to get the sustainable supply. Considering that commercial fuels are about 3 times more efficient in utilization than traditional fuels, the traditional component taken up by commercial fuels has been divided by 3 to get its equivalent in commercial fuels. The distribution of this amount of

energy into commercial fuels as been made assuming 5/10 of electricity, 3/10 of oil and 2/10 of coal and peat. The larger share has been given to electricity because electricity is expected to increase significantly. Hydroresources are large and their development is particularly attractive. In addition, the potential of supplying electricity to a growing section of the population is important, and electricity has been the only commercial fuel to achieve a positive average intensity growth rate for the period 1971-1988 in the region. These shares have been added to the first estimates to get the real shares.

4.9.3 Results of demand analysis:

The demand forecast for different energy forms as well as their percentage increases over the base year of 1988 are summarized in Table 4.23 and 4.24.

Under the three economic growth scenarios, the consumption of traditional energy is increasing in absolute value, but it is decreasing relative to total energy final consumption as shown in Fig. 4.22 and 4.23. The decline of the percentage share of traditional fuels in overall energy consumption is a normal expectation as the region has to move in the path of development.

Figure 4.24 to Fig. 4.27 give the percentage shares of commercial fuels. Trends point towards a decreasing share of petroleum products and increasing share of electricity in overall commercial energy consumption. Coal and peat consumption will be increasing slightly both in absolute and relative values while gas will remain negligeable under the envisaged economic scenarios.

Table 4.23 Total final demand for various scenarios. Million tons oil equivalent per annum.

	COAL & PEAT	GAS	OIL	ELEC-TRICITY	COMM. ENERGY	TRAD. ENERGY	TOTAL ENERGY
1988	0,5	0,0	6,5	1,6	8,6	42,1	50,7
Low case scenario							
1995	0,9	0,0	8,8	2,7	12,4	48,1	60,5
2000	1,2	0,0	10,6	3,6	15,4	52,8	68,3
2005	1,7	0,0	12,3	4,7	18,7	57,7	76,4
2010	2,2	0,0	14,4	6,0	22,6	62,9	85,5
2015	2,8	0,0	17,1	7,7	27,7	62,3	96,0
2020	3,5	0,0	17,9	9,3	30,7	73,7	104,4
Base case scenario							
1995	1,0	0,0	9,4	2,8	13,2	48,1	61,3
2000	1,3	0,0	11,8	3,9	17,0	52,8	69,8
2005	1,8	0,0	14,4	5,2	21,4	57,8	79,2
2010	2,4	0,0	17,2	6,7	26,3	62,9	89,2
2015	3,1	0,0	20,7	8,6	32,5	68,3	100,8
2020	3,8	0,0	22,0	10,2	36,0	73,7	109,7
High case scenario							
1995	1,0	0,0	9,8	2,9	13,7	48,2	61,8
2000	1,4	0,0	12,7	4,1	18,2	52,8	71,0
2005	1,9	0,0	15,7	5,5	23,1	57,8	80,9
2010	2,6	0,0	19,1	7,1	28,8	62,9	91,7
2015	3,4	0,0	24,3	9,5	37,2	68,3	105,5
2020	4,2	0,0	27,2	11,5	42,9	73,7	116,7

Table 4.24 Percentage increase in the various energy carriers in the final demand sector from the base year of 1988

	COAL & PEAT	GAS	OIL	ELEC-TRICITY	COMM. ENERGY	TRAD. ENERGY	TOTAL ENERGY
PERCENTAGES ABOVE 1988							
Low case scenario							
2000	143	321	63	127	80	25	35
2005	222	377	90	196	118	37	51
2010	321	439	122	281	163	49	69
2015	446	523	163	390	222	62	89
2020	565	518	176	488	257	75	106
Base case scenario							
2000	161	371	81	145	98	25	38
2005	254	464	121	227	149	37	56
2010	363	557	164	324	206	49	76
2015	502	677	219	446	278	62	99
2020	627	690	238	550	319	75	116
High case scenario							
2000	176	411	95	160	112	25	40
2005	274	520	142	248	169	37	60
2010	393	640	194	353	235	49	81
2015	556	828	273	500	332	62	108
2020	707	913	319	630	399	75	130

In terms of absolute quantities the energy required to supply the amounts of these various energy carriers in the year 2020 is given in Table 4.25. These quantities are in the form of final consumption not in primary energy terms. They therefore do not reflect the conversion and transmission losses nor do they take into account the amounts of oil and gas used in power generation.

Table 4.25 Quantities of the various energy carriers required for final consumption in the year 2020

Low case scenario		
	Trad. Energy	254 Million cubic metres
	Coal&Peat	5 Million tons
	Gas	11 Million cubic metres
	Electricity	108 GWh
	Oil	18 Million tons
Base case scenario		
	Trad. Energy	254 Million cubic metres
	Coal&Peat	5 Million tons
	Gas	14 Million cubic metres
	Electricity	119 GWh
	Oil	22 Million tons
High case scenario		
	Trad. Energy	254 Million cubic metres
	Coal&Peat	6 Million tons
	Gas	16 Million cubic metres
	Electricity	134 GWh
	Oil	27 Million tons

Table 4.26 gives the ratio of energy demand for the high case scenario in 2020 to (proven and probable) resources. The ratios are high for gas and hydroelectricity. This shows that the region has enough resources to meet its energy requirements for decades to come. Oil is more likely to be exhausted before any other commercial fuels unless new finds occur. Capital to develop local resources and cooperation between countries will be necessary before the region can enjoy a measure of energy self reliance.

Table 4.26 Ratio of energy demand for high case scenario in 2020 to (proven and probable) resources

	RECOVERABLE PROV & PROB RESOURCES	DEMAND PER ANNUM	UNITS	RATIO
Coal&Peat	2 104	6	M tons	351
Gas	834 000	16	M m^3	52 125
Oil	837	27	M tons	31
Electricity	1 227 753*	134	GWh/year	9 162

* hydropotential only

More details about energy projections are given at the end of Volume I.

4.9.4 Conclusion:

As discussed in section 4.8.2.1, in terms of availability and costs, there is no alternative households fuel which can, on any significant scale, replace woodfuel. Domestic consumption of energy will therefore still be heavily dominated by the use of fuelwood over the medium term. Therefore dangers of environmental degradation and domestic energy scarcity exist in some countries or in some parts of member countries.

Oil will remain the main commercial fuel, especially in the transport sector where electricity is not expected to make important breakthroughs. However, as the region has large hydro resources, hydroelectricity is expected to become increasingly important and electrification is likely to be - in the long term - the most effective means of providing adequate commercial energy supplies. Despite the severe economic problems, the power subsector has received a special attention and it can be expected that it will receive more attention if the economic situation improve. Coal could be more and more used and together with peat, it could help to alleviate the pressure on traditional energy subsector in countries where resources are available. Gas will continue to play a marginal role in the energy sector of the region.

A shift from traditional energy towards commercial fuels is expected as a result of shortages due to increasing non-sustainability of fuelwood resources, urbanization, etc. With the subsequent increase in conversion efficiency, the demand is likely to decrease.

None of these projections should be interpreted as precise forecasts. They are simply intended to illustrate a range of possible developments and to highlight the major issues facing the energy sector of the region.

5. ENERGY INTERCHANGE IN THE REGION AND BEYOND

5.1 Introduction

This chapter is an assessment of present and possible energy interchanges within the region, and the possible contribution of countries outside the region. Special emphasis is given to South Africa, which is the economic giant of the continent, and an analysis is made of its effects on the region.

5.2 Wood

In general, woodfuels trade between countries is not viable. Because of their low price values, it is difficult to recover the high cost involved in transporting such a low grade energy sources. Some traditional energy interchange and potential for trade exist but they are very site specific[7]. For instance, the capital of Zaire (Kinshasa) could constitute a viable market for charcoal from the Brazzaville peri-urban plantations in the Congo because of reduced transport costs.

5.3 Gas

Prospects for gas trade within the region are slight. The only viable gas market at present is South Africa. However the South African additional gas needs could be easily met by imports from the Kudu field off Namibia for the Western Cape and Pande field in Mozambique for the Transvaal. Mozambican gas could also be exported to Swaziland, Zimbabwe and Zambia. There is therefore no good prospect for developing the region's resources. Kenya, Malawi and Zambia could be outlets for the gas from the Songo Songo field in Tanzania when it has been developed.

5.4 Coal

Potential for coal trade is limited in the region for reasons mentioned in Section 4.8.2.3. Coal trade in the region will be probably limited between Zaire and its neighbours (Zambia and Tanzania). Zaire needs good quality coal (coking coal) for its mining industries which could also come from Zimbabwe. Most countries south of the region are major coal producers and no exports to them could be envisaged. Metallurgical and steel industry needs could lead to coal interchange within the region. Angola will need coal when it resumes its iron production interrupted by the war. Cameroon and Gabon, with their large iron deposits, could also become coal importer in the future if they develop their steel industry. These three countries have access to the coast and could import their coal requirements by sea from South Africa for instance. Angola could also use the Benguela railroad to get coal from Zambia.

5.5 Oil

The scope for oil interchange in the region is large but political instability, poor transport infrastructure, and the fact that some refineries are not designed to process the region's crudes have prevented oil trade. At present, all oil producing countries in the region have access to the sea and sell their oil on the international market. The small oil trade noted in the region is in form of re-export from coastal countries to landlocked ones: Burundi, Rwanda and Uganda on from Kenya and Tanzania, and Central Africa from Congo. Zaire which is almost landlocked imports part of its needs from Kenya (for Eastern Zaire) and Zambia (for the Shaba province).

Subregional or regional rationalization of oil infrastructure (refinery and supply systems) could provide the economies of scales needed to improve refinery performances and lower the cost of oil supply and distribution. As far as refineries are concerned, this means modernizing or converting some of them, which could serve as regional supply centres, and closing the others. For instance, Kenyan and Tanzanian oil refineries could be used for the eastern part of the region but also for other countries of that part of Africa. Angola, due to the significance of its resources, its position and its infrastructure, could play a pivotal role in the oil supply of the region. Agreements exist for Angola to supply Namibia with refined products and Congo with the more suitable Palanca crude oil. Angola could supply Zambia and Southern Zaire using the Benguela railroad. The Angolan products from the Luanda refinery could also be shipped to the Ango Ango depot which is the starting point for oil distribution inside Zaire. South Africa also constitutes a potential market for the Angolan oil. Such a cooperation could help to fight oil smuggling across national boundaries and lead to a decreased dependence on imported oil. Consequently the outflow of scarce foreign exchange from the region could be reduced and regional economy could be revived by the circulation of important amounts of money within its framework. It must be remembered that energy import, mainly in form of oil, constitutes a significant part of export earnings of many countries in the region (see Table 4.16).

However former examples of cooperation in the oil sector in the region have not been encouraging. The Equatorial Refinery Company, designed to supply the Central African market did not work properly and Gabon purchased the shares of the other Central African states in 1974. The refinery agreement between Uganda and Kenya has brought Uganda some disadvantages such as the higher unit cost of the Mombassa refinery (five time greater than that of the major international refining

centres in 1982), and the obligation to use the Mombassa-Nairobi pipeline for the transportation of white products. There is a long way to go before effective cooperation can take place.

5.6 Electricity

Electricity interchange takes place between Zaire and its neighbours (see Section 3.5.4), between Zambia and Zimbabwe through the Kariba Dam power stations, and between Uganda and Kenya through the Owen Falls scheme. As shown in Table 4.17, the extent of this trade is at present limited.

More than any other fuel, the possibility of increasing electricity trade inside and outside the region is large. The concentration of hydro resources in Central Africa is such that the region could supply the entire continent for decades. Africa's total installed capacity amounted to 68380 MW[50] in 1988 while the technically exploitable hydropotential of the region is 203400MW with Zaire alone having 100-120 thousand MW. However, given the high capital cost of installing productive capacity, large demand bases are required to make projects economically viable. This combined with the region's low power demand make necessary trade with countries outside the region. South Africa is targeted for power export as it has large market and it is beneficial for her to import part of its electricity needs. A three-hub power grid covering the subcontinent south of the Equator, from Cape Agulhas in South Africa to Zaire, is proposed over 20 years and costing as much as US$ 7 billion (R20 billion). The three hubs of the sub-Equatorial African grid are Inga Falls (Zaire), Cahora Bassa (Mozambique) and Eskom (South Africa)[59,60].

The Inga Falls scheme has a high generation potential estimated at 44 000 MW but only 1775 MW has been harnessed. The Cahora Bassa power station, built specifically to transmit power to South Africa, has an installed capacity of 2075 MW (firm capacity 1660 MW) and a further 1200 MW is possible for an extension. Eskom (South Africa) is a large load centre with an installed capacity 35 673 MW[61] in 1990. There is no technical obstacle to transferring large amount of power over long distance as shown by the Inga-Shaba line inside Zaire and by the transmission line between Cahora Bassa and Apollo (near Pretoria in South Africa). The 1740 km 500 DC Inga-Shaba line is currently used at half its rated capacity of 1120 MW. The 1360km 533kV DC Cahora Bassa-Apollo is rated at 1920 MW but has been out of commission for about 11 years because of sabotage of the power lines due to guerrilla activities in Mozambique.

The foundation of the grid is already organized around Eskom in Southern Africa. Eskom's grid is interconnected to Botswana, Lesotho, Mozambique, Namibia and

Swaziland. Electricity interchange is expected to take place soon between South Africa and Zimbabwe which is running short of power because of the drought. Zaire's power exports to Southern Africa could be made using the west coast leg of the grid involving Angola (Capanda and Matala power stations) and Namibia (Ruacana and Epupu (to be built) power stations towards the Western Cape. However it is the Transvaal, the industrial heartland of South Africa, which is likely to need more power than the Cape. So using the Inga Shaba line, the grids of Zambia, Botswana or Zimbabwe is not excluded.

The grid could be extended to span the entire continent. Zaire could help to connect the sub-Equatorial African grid with the rest of the continent. By the size of its potential, the Inga fall dams could be linked to West Africa as far as Nigeria, North Africa (Aswan Dam in Egypt) and East Africa (Owen Fall in Uganda) (see Section 3.5.4). The Owen Fall is already linked to the Kenyan grid and is expected to supply power to northwestern Tanzania in the future. Egypt is considering an ambitious interconnection plan with the Middle East, European and African power grids, at a cost estimated at US$ 25 billion and lasting 25 years. Contracts are expected to be awarded soon for the linking of the 500 kV Egyptian and the 400 kV Jordanian grids. Accords have been signed between Egypt and Lybia for interconnection of the two countries. This link would then be joined to Europe through the Moroccan-Spanish link. Another Middle East-European link is to go through Turkey[18,31].

There is an excess generating capacity in the subcontinent, mainly in South Africa, Mozambique and Zaire. South Africa has a spare capacity of 4686 MW[61], in Mozambique the Cahora Bassa dam is hardly used, and in Zaire the Inga plants were being operated at 30% of their installed capacity in 1991. In normal condition, Zambia generates excess power that is sold to Zimbabwe. Additional spare capacity is expected to come from the 520 MW Capanda power station (Angola) scheduled for completion in 1994, and the 400-450 MW Epupu Falls dam, a joint Angolan-Namibian scheme, to be built in the future. This spare capacity could be used before new developments take place.

Despite its present over-supply of generation capacity, South Africa is expected to need an extra 3400 MW by the year 2000[62]. It could be beneficial for South Africa to import this amount of power. By sharing with other countries their cheap and clean hydro energy in general and using their present excess capacity in particular, South Africa could profit from reduced capital expenditure, defer investment in new and costly coal-fired power stations and combat the threatening pollution. In addition and above all, it could stimulate the economic growth in the subcontinent. Being cheap, the 3400 MW could be used as load base and generate about 25000

GWh/year. At an export cost of 2 USc/kWh, this amount of power could produce about US$ 500 million. There would therefore be a flow within the region of foreign exchange earned by the sales of power for exporting countries and tax for countries crossed by the grid, and the region as a whole would get access to more affordable power. This would lead to an increased demand for South African manufactured goods which have the advantages of competitive prices, comparatively shorter delivery times and compatibility with African conditions. The erection of the grid will create jobs and require an industrial support that South Africa could provide for the same reasons.

Apart from these advantages, the grid could lead to:

- a more efficient utilization of resources and productive capacities, and an improvement of supply reliability and security.
- improved economies of scales resulting in lower supply cost.
- a coordinated help system in emergency cases such as power shortfall during droughts (as it is the case in Southern Africa) or power station damage (as was the case of the fire at the Zambian Kafue Gorge Dam in 1989).

5.7 Limitation of energy interchange

The main limitations to effective energy trade are political instability and civil war, the lack of mutual trust between countries, the lack of appropriate regional institutional structures, land accessibility difficulties, the lack of transport infrastructure, and the lack of finance resources. In addition, national security reasons must be taken into account. In order to avoid being vulnerable to outside interference or being held to ransom by suppliers, there is, for every country, a limit to the size of energy imports and this is particularly true for electricity because disturbance are difficult to accommodate. Import of 10-15% of one country's total electricity needs and 4-5% from one country will be reasonable, until political stability allows countries to go beyond these limits.

5.8 Discussion

5.8.1 Collective self-reliance: rethinking regional integration:

It is obvious, despite its important energy resource potential, that the region faces formidable obstacles in securing economic supplies needed to sustain growth. The variation in distribution of primary energy sources, the lack of capital to develop local energy resources and the limited size of domestic market make urgent regional cooperation and integration. Regional interchange and rationalization could open up the possibility of economic development in many parts of the region and maximize the economic benefits to the region as a whole.

There is scope for joint development, ownership and operation of energy facilities, intra-regional and cross-border consultation in the planning and the formulation of projects, and in the design of supply and tariffs agreements. Cooperation in these fields is the best way to ensure the coordinated optimum utilization of energy resources, and the reliability and security of supply. The resultant benefit sharing and interdependence will help to build collaborating communities and trusting relationships between countries in the region and outside the region. Without neglecting each country's specific needs, the attainment of collective self-reliance at sub-regional and regional levels is the realistic perspective for any strategy aimed at finding solutions to energy problems of the region.

5.8.2 Implications of energy integration:

5.8.2.1 Institutions

The regional energy interchange will certainly require political stability, collective will and individual discipline, but also and mainly, the creation of an appropriate regional institutional and policy framework for energy trade. Such a framework should include joint enterprises to develop resources, regional infrastructural authorities (for water, power grid, railways, etc.), a coordinating structure for existing institutions. It should also include planning and harmonization units for setting tariffs, formulating energy strategies and investment plans in prevailing social, economic, environmental and technological contexts.

In the process of building local expertise, regional education, research and training centres of excellence in various fields should be established in order to avoid duplication, inefficient use and wastage of money. For the same reasons, energy utilities should pool manufacturing capabilities, spares holdings, catastrophes recovery units, etc.

5.8.2.2 The South African reality

Although not included in the region covered by this study, South Africa should have an active participation in energy projects in the region in view of a broader integration of the whole sub-Equatorial Africa.

As explained in Section 4.2, with the improvement of the political climate, South Africa is expected to fulfill the role of engine for growth in sub-Saharan Africa. Benefits of cooperation between the region and South Africa in energy industry and economic development are evident. South Africa contributes 20% of Africa's GDP and accounts for about 54% of all the electricity generated on the continent. It has a manufacturing capability, maintenance, operating and training facilities that could be

used by energy utilities of the region. South Africa has a technology adapted to the African context and could act as technology bridge between developed countries and Africa. The management and organizational experience of South African institutions like ESKOM should be tapped whenever possible to make region's energy utilities more viable.

5.8.3 Future role of Zaire:

The possible future role of Zaire in the energy integration of Africa lies in the generation of large amounts of hydroelectricity and the interconnection of national grids which could help to sell this power. Because of its position in the centre of Africa and the magnitude of its hydro resources, Zaire can be physically and economically linked to power grids of any part of the continent as explained in Section 3.5.4. In this regard, the Inga Falls with its large, clean, renewable and cheap energy, far in excess of the country's foreseeable needs, could be the powerhouse of the sub-Equatorial African grid. However, its total potential capacity is not realizable in the near future because of market and finance requirements that the country cannot fulfill. For these reasons, cooperation with other countries is necessary.

The local oil refinery is not economically viable, and the size of the country and its poor transport infrastructure make it difficult to transport oil. Zaire should therefore be part of oil supply rationalization projects in the region. However, improvement of relations with Angola - a neigbouring country with significant oil resources - will be necessary to get a satisfactory rationalization of the petroleum subsector in the future.

Although large mineral resources are known to exist, Zaire has not been effectively explored and surveyed. Given the size of the country and its numerous geological features, there is an enormous potential for the discovery of more energy resources like oil and coal, and other minerals. Therefore consideration should be given to large scale exploration projects. Joint petroleum exploration or exploitation with neigbouring countries in Rift Valley region could be envisaged.

Due to its special location, Zaire could in long term, form an important link in the integration of road and railway systems of Africa which could facilitate the interchange of goods and energy. Already the Benguela railroad running from Angola to Zambia crosses Zaire, and so will the Pan African highway under construction linking Lagos in Nigeria and Mombassa in Kenya.

6. CONCLUSIONS

As a result of popular pressures and the detente in the political climate, the Central African region is in transition towards participatory political systems and the settlement of conflicts which will enhance the stability of the region. The failure of past macroeconomic policies and the demanding conditions from donors and lending organizations in view of the region's continuous slide into debt have directed policy designs towards competitive and self-sustaining economies, and the implementation of structural adjustment programmes.

There is an urgent need to improve human welfare and alleviate poverty in the region. This will require that the economy of the region grows at a rate exceeding the population growth rate. But the achievement of an adequate economic level and social upliftment will depend a great deal on the provision of satisfactory energy supplies.

Enhancement of energy supplies is not possible without correcting present institutional deficiencies. There is a need for financial autonomy for energy utilities, less government intervention, more accountability, access to private capital and to new technology in the energy sector. Energy efficiency and conservation, economic pricing, and responsible environment management should be given absolute priority. Energy institutions should be reviewed and strengthened in order to deal with the demand management of both traditional and commercial fuels, and to take economic advantages of numerous opportunities for regional cooperation in the energy sector.

Economic development and the population growth are the most important factors impinging on the energy demand in the region. The developing nature of the region's economy is reflected by the use of a large proportion of traditional energy mainly for domestic purposes, and the dominant role of woodfuel is expected to remain in the future. This high reliance on woodfuel and the increase of the consumption at a rate close to the population growth rate is resulting in declining sustainability of supply and environmental degradation. Reforestation, improvement of conversion and end-use efficiency, and rural electrification based on hydro resources are the best way to alleviate the woodfuel crisis. However, there is no immediate possibility of large scale electrification or substitution by any other commercial fuels.

The region is endowed with significant commercial energy resources. In this regard a special mention must be made of hydro resources which are very large and widely

distributed throughout the region. Hydro resources are also renewable, can provide a cheap and environmentally clean energy, but have not been significantly harnessed. It is therefore clear that electrification is the best option for providing adequate commercial energy supplies. Electricity is expected to take an increasing share in the energy mix of the region, even though oil will remain the major commercial fuel. The share of coal (and peat) in the commercial energy consumption is expected to increase while that of gas will remain marginal. Oil, coal and gas are not evenly distributed through the region.

Energy cooperation and integration is at present limited. There are opportunities for cooperation in the rationalization of refineries and the bulk procurement of oil, in the joint development and ownership of hydroplants, and in the integration of national grids. Institutional development, training and technology transfer, and fossil fuel explorations offer additional fields of cooperation. Regional cooperation could save significant capital expenditure, improve energy utilization and security, increase the stability of the region and stimulate its economic growth.

The limited size of domestic energy markets and the lack of financial resources to develop local resources make cooperation a necessity, and unless cooperation becomes a reality, the region cannot expect to get a reliable and secure energy supplies. The urgency in dealing with the region's energy problems through enhanced regional cooperation is reflected in the proposition of establishing a sub-Equatorial electricity grid. But political will and stability will be required before effective cooperation take places.

Further work needs to be done in order get a complete picture of the energy sector in the region. The shortage of information and the scope of this study made it difficult to cover areas like energy pricing, scope for private initiatives, institutional reforms, concrete regional planning, etc.

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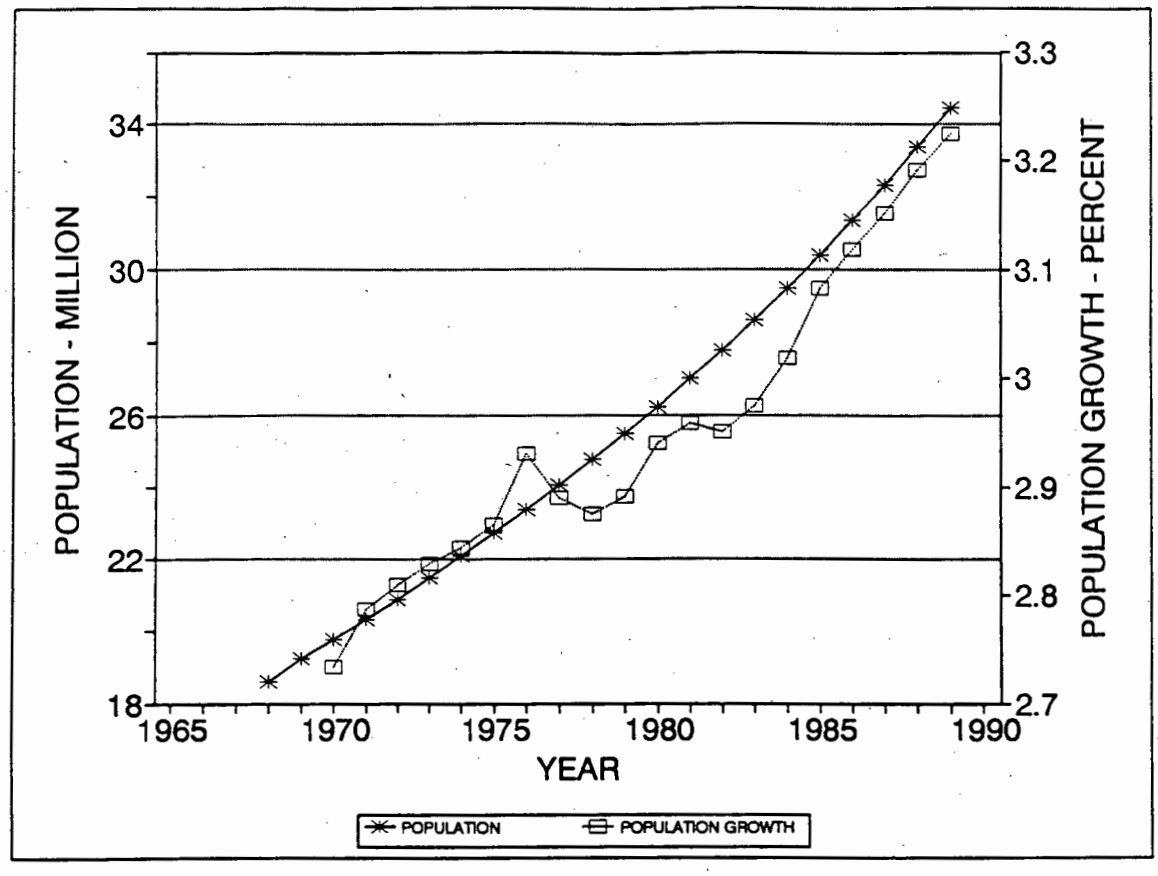
FIGURES



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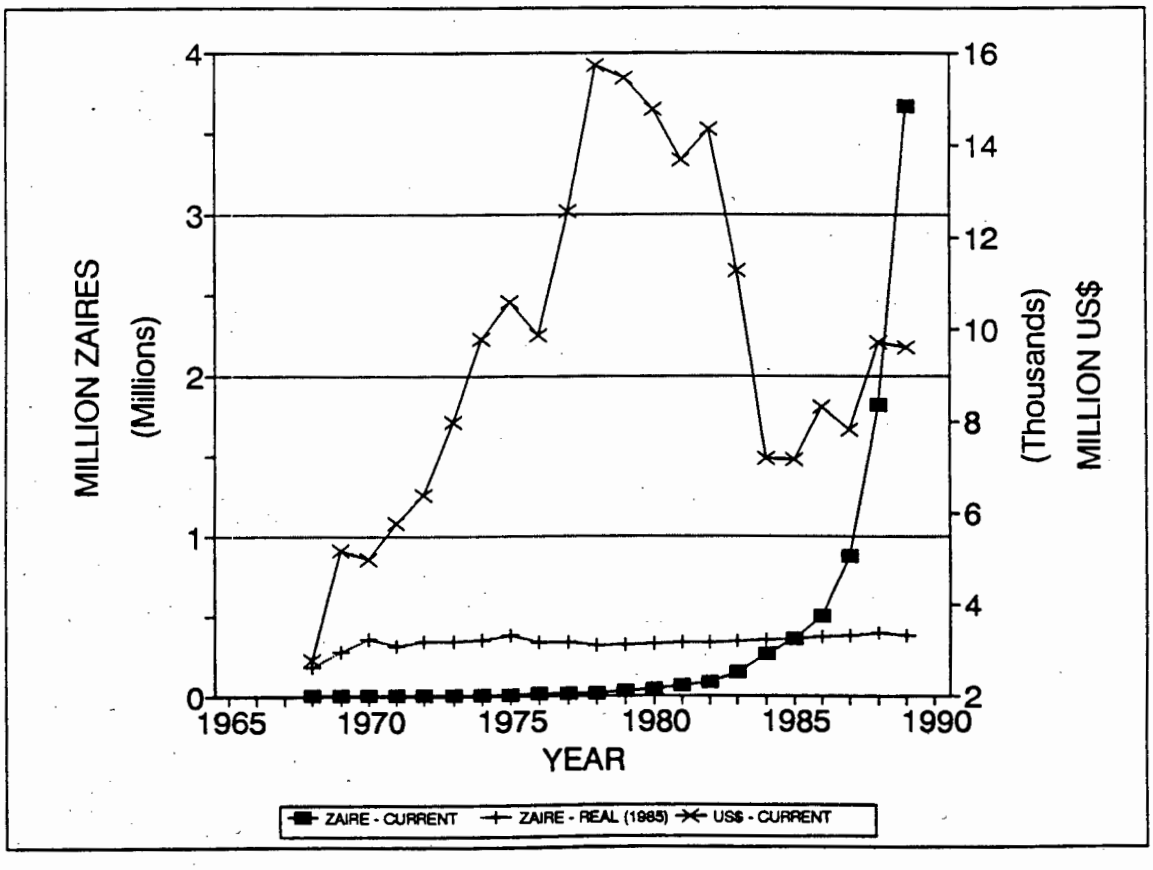


Figure 3.2 Gross Domestic Product (at Market Cost)

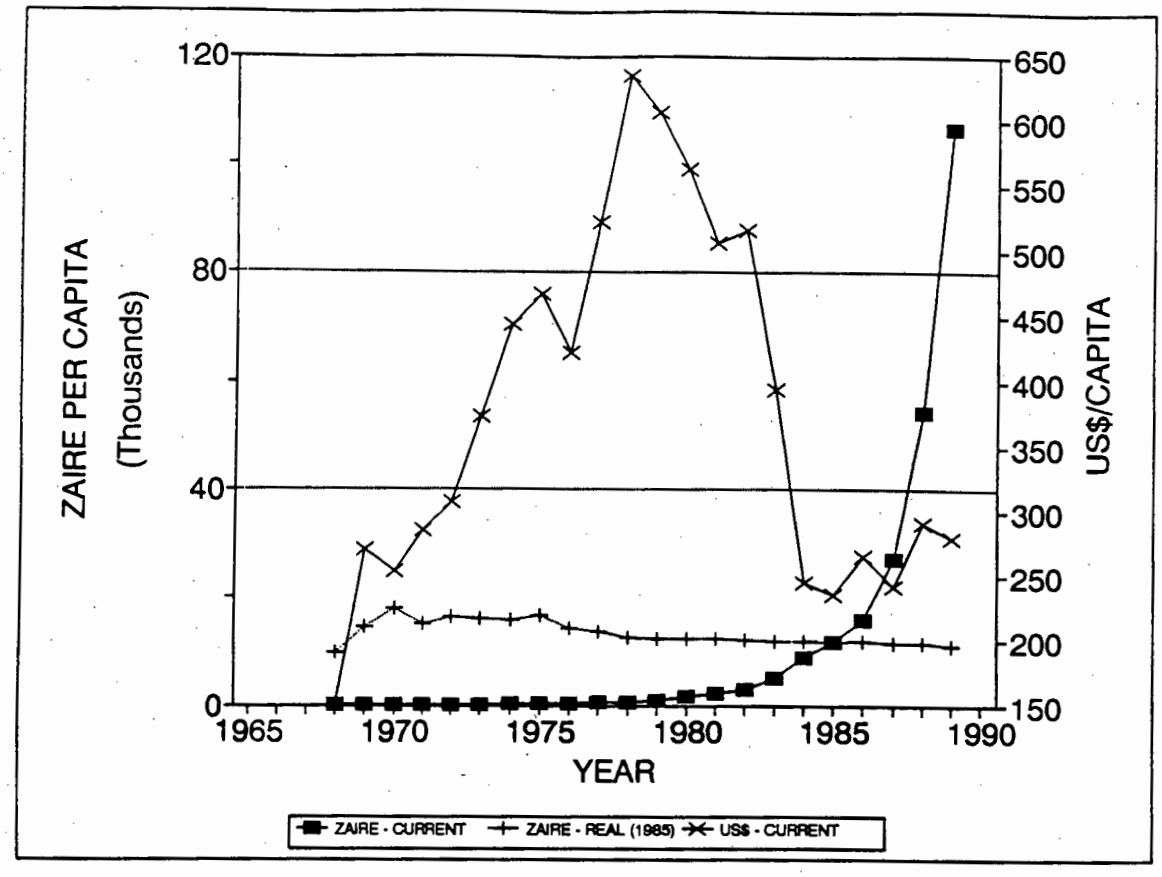


Figure 3.3 GDP per Capita

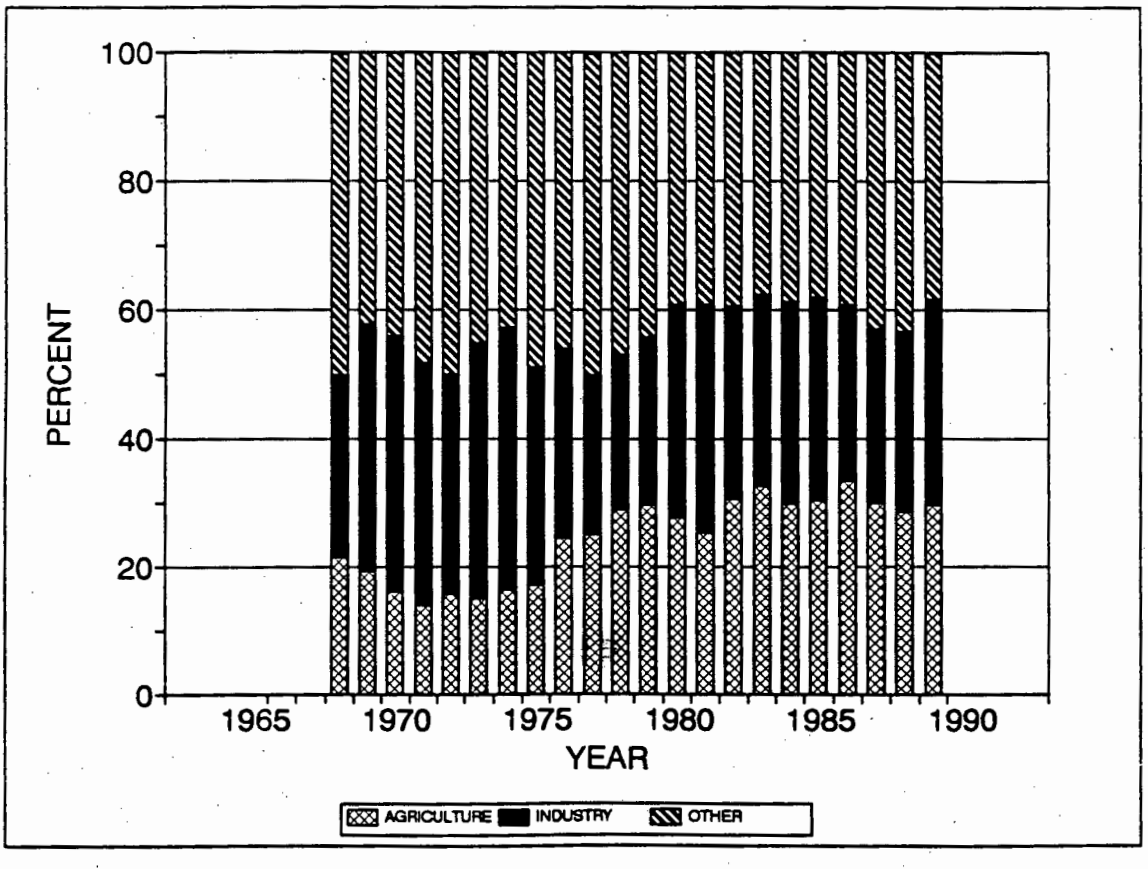


Figure 3.4 GDP Components as Percentage of Total

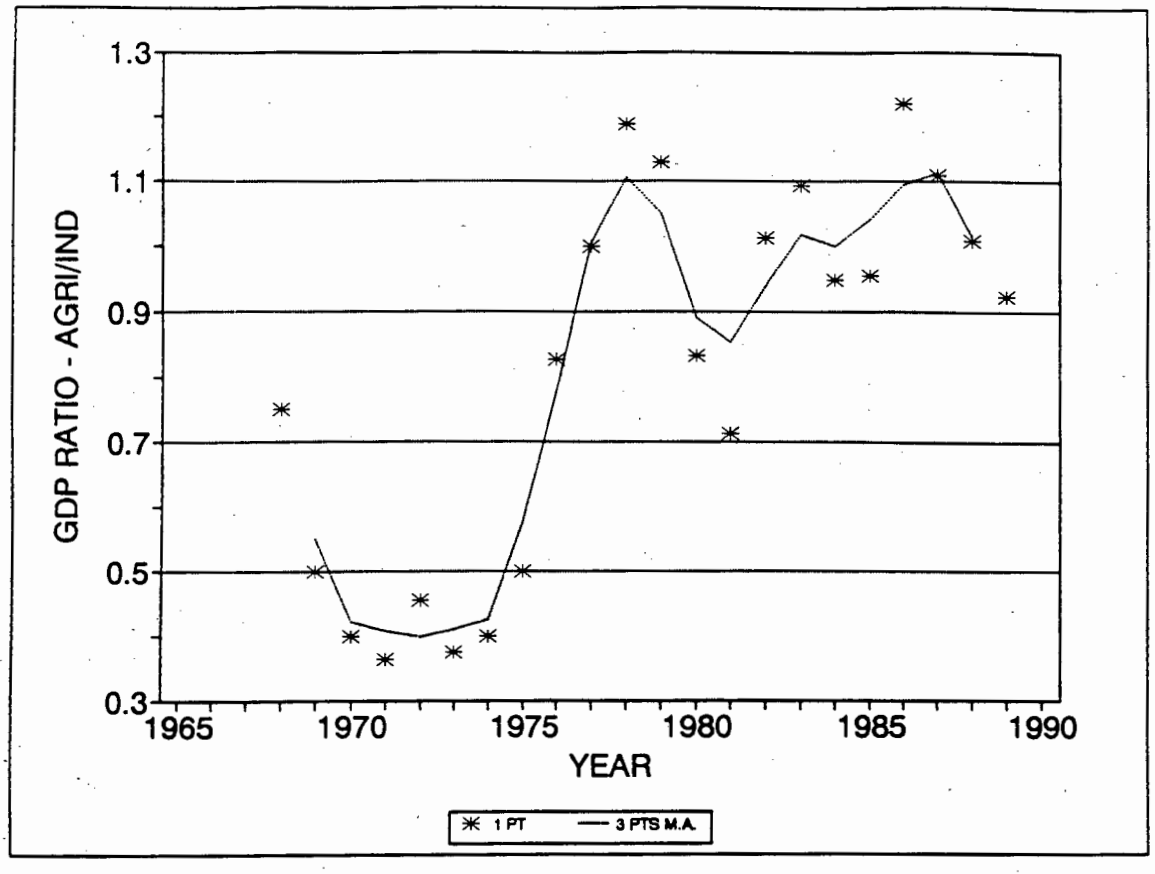


Figure 3.5 GDP Ratio: Agriculture/Industry

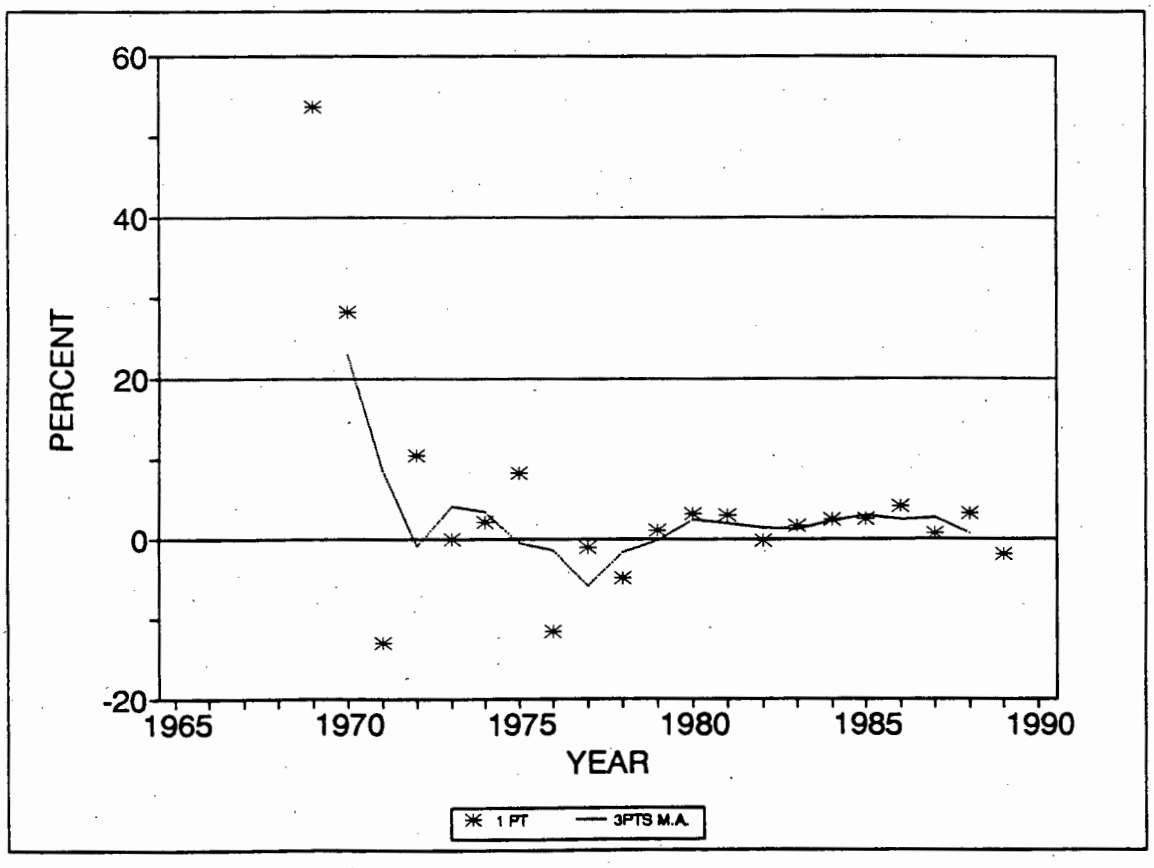


Figure 3.6 GDP Growth Rate. %/Year (real 1985)

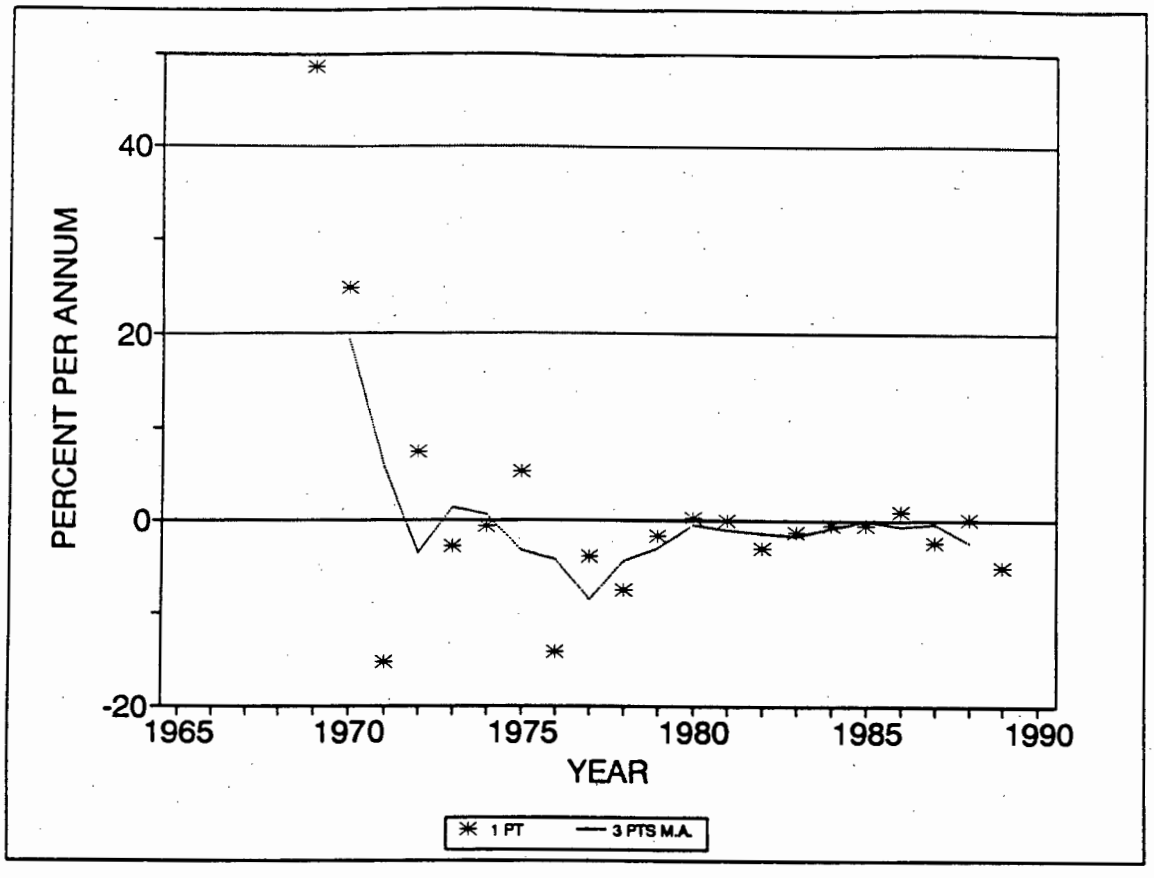


Figure 3.7 GDP per Capita Growth Rate. Percentage/Year (real 1985)

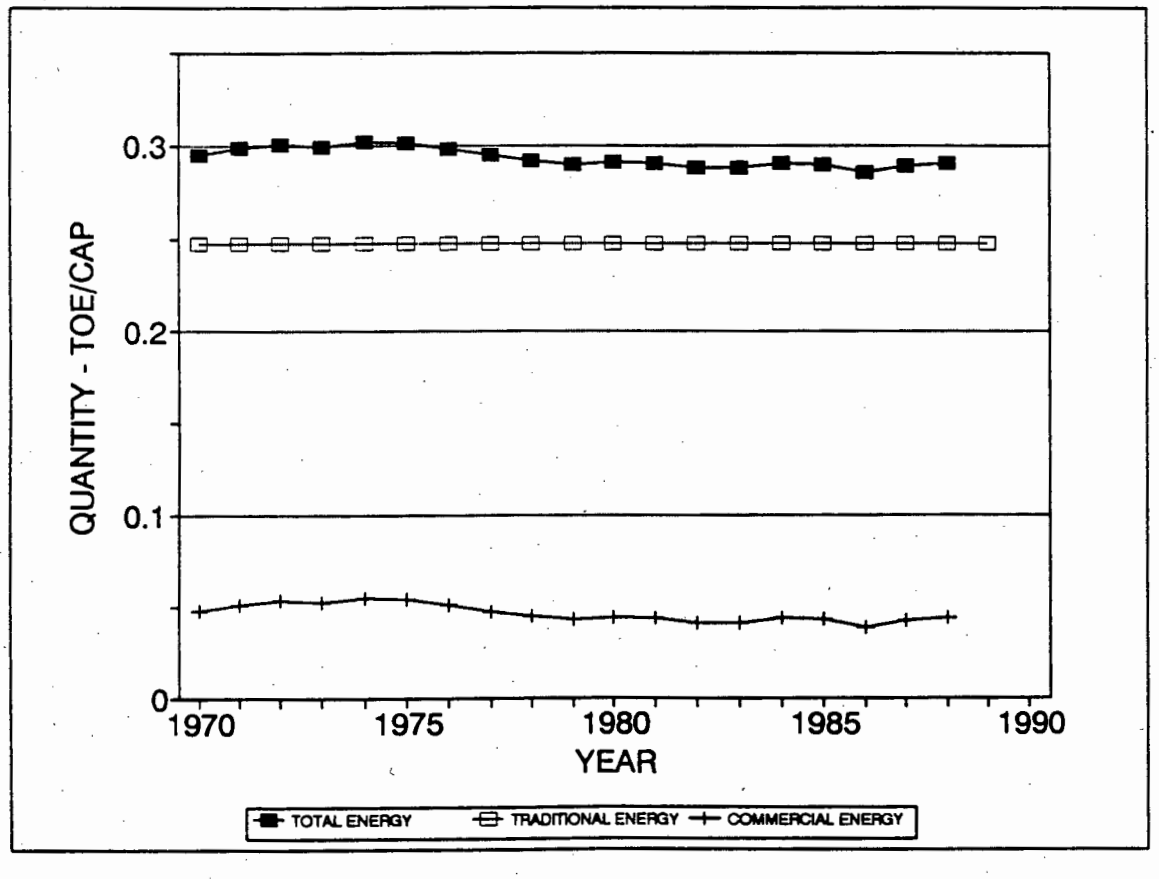


Figure 3.8 Total Final Consumption per Capita: Quantity Share of Components

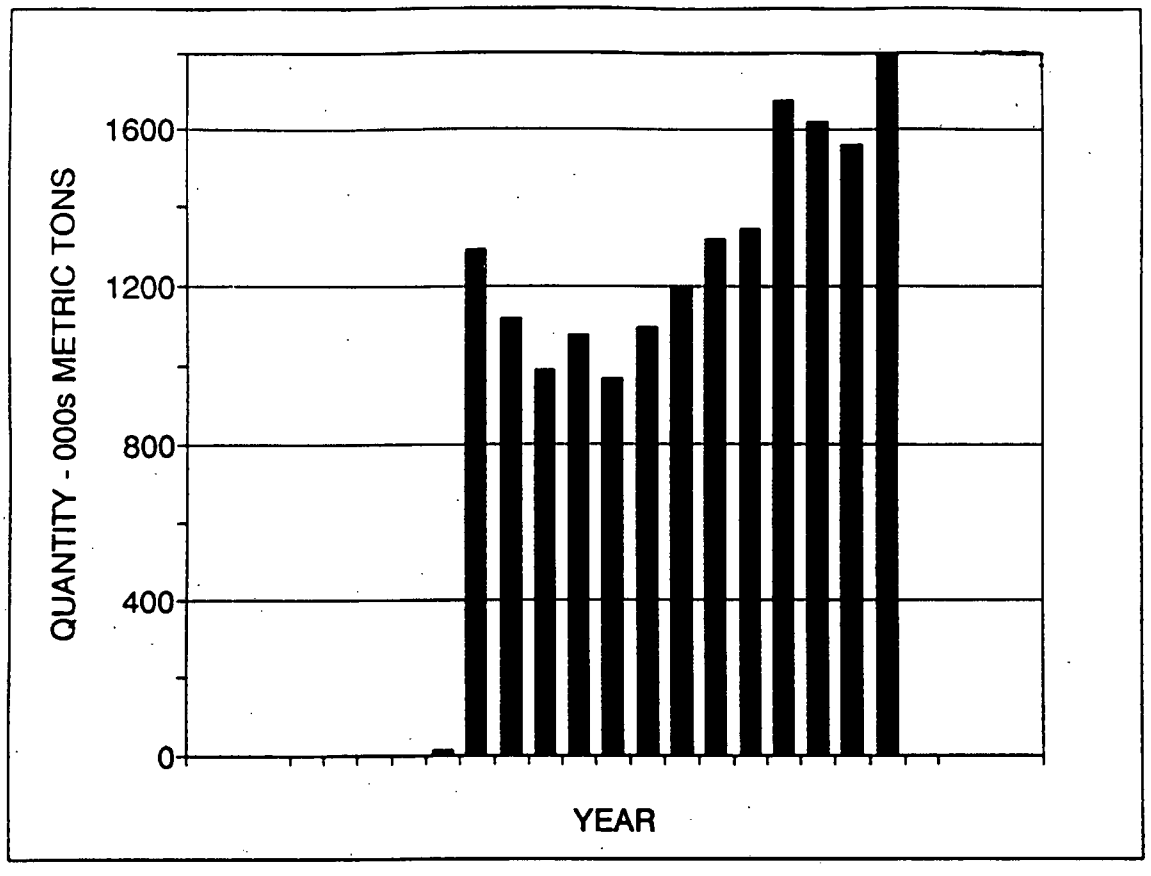


Figure 3.9 Crude Oil Production

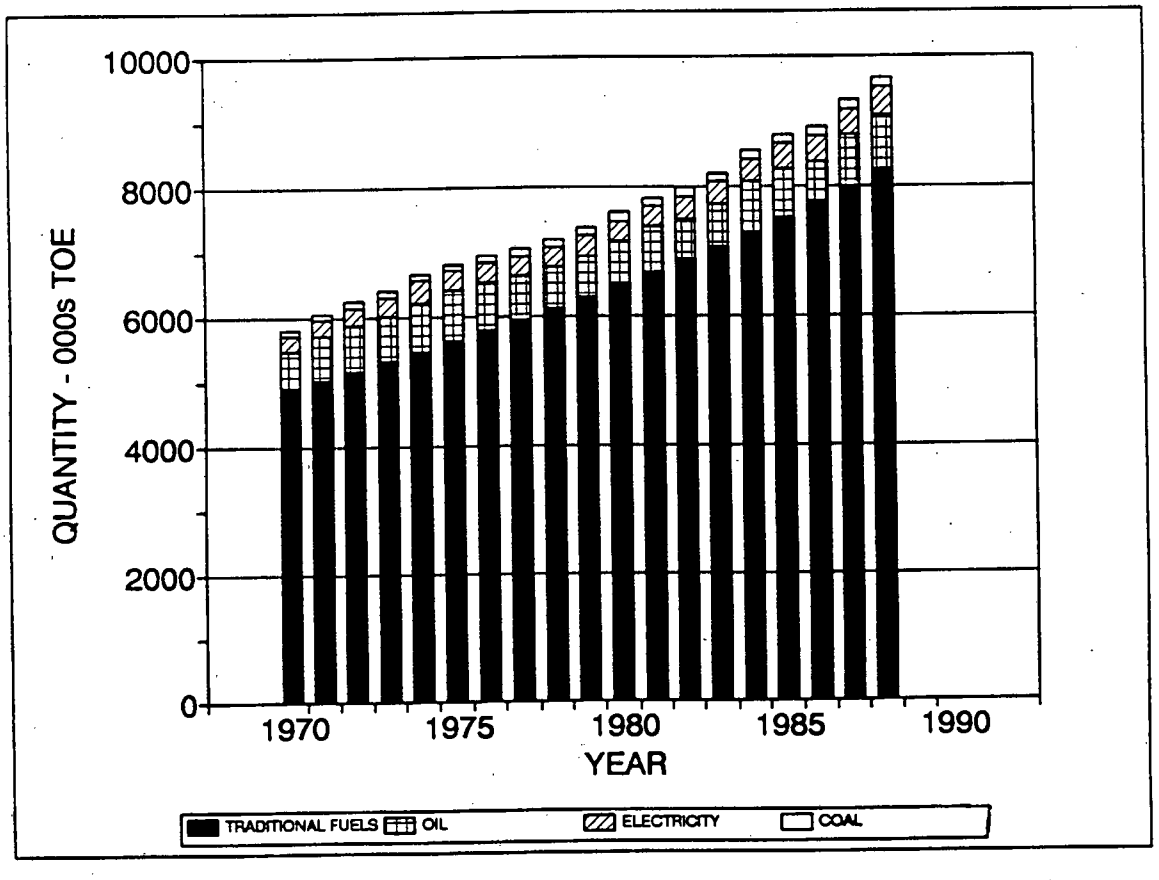


Figure 3.10 Total Final Consumption: Quantity Share of Components

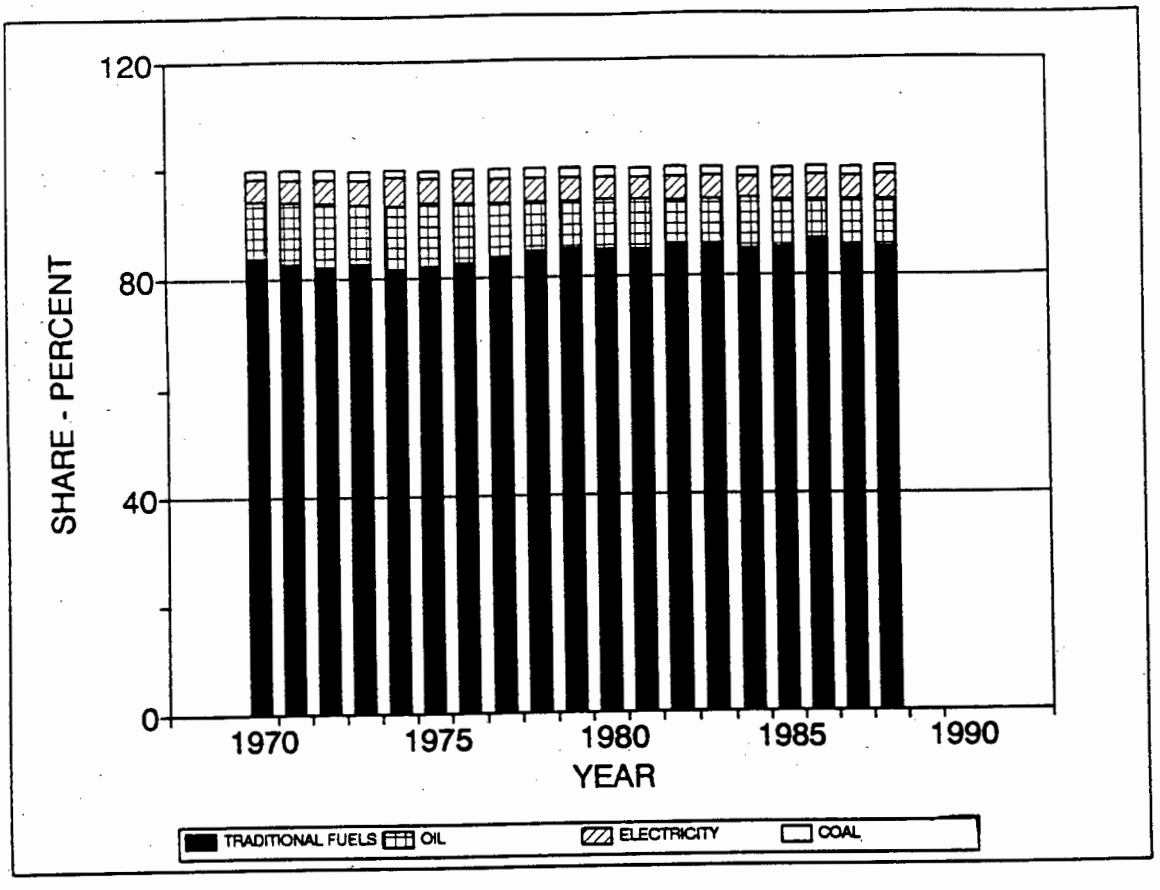


Figure 3.11 Total Final Consumption: Percentage Share of Components

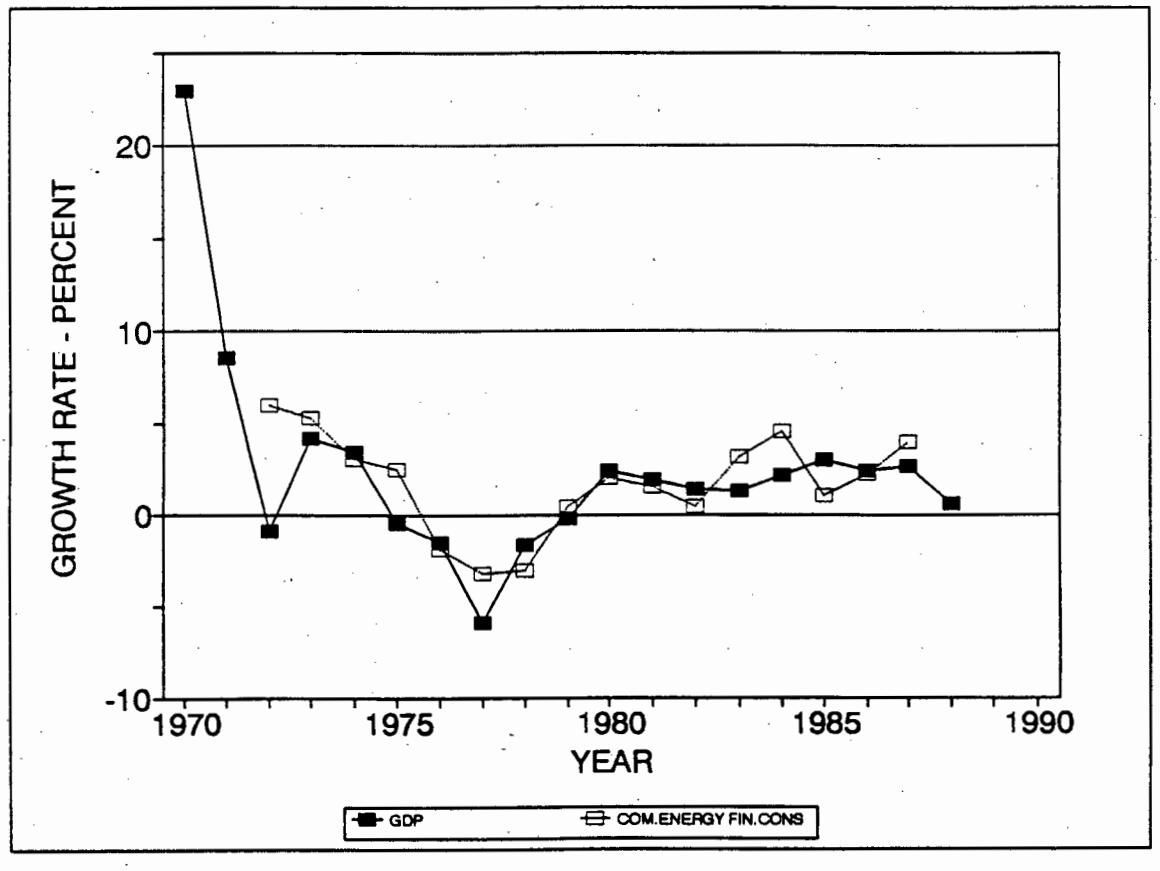


Figure 3.12 Growth Rates of GDP and Commercial Energy Final Consumption

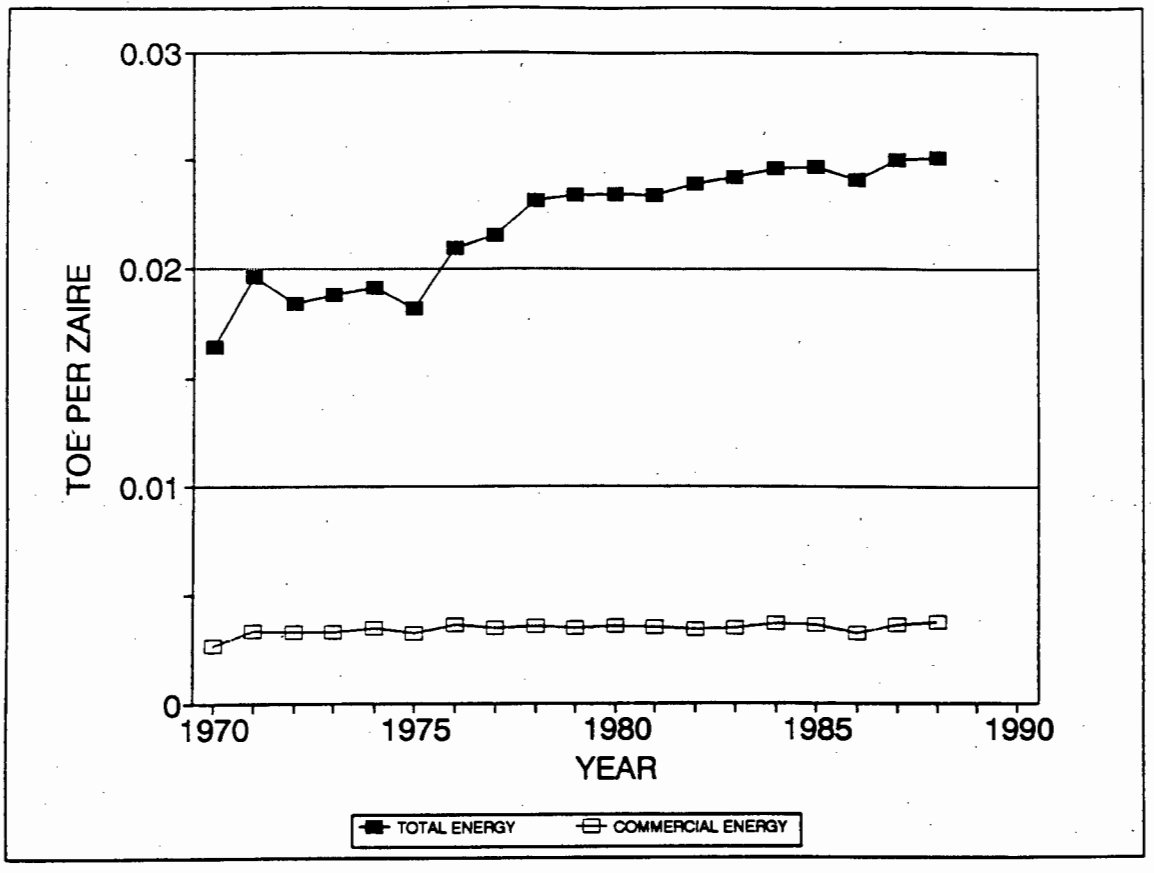


Figure 3.13 Energy Intensity: Final Consumption/GDP (real 1985)

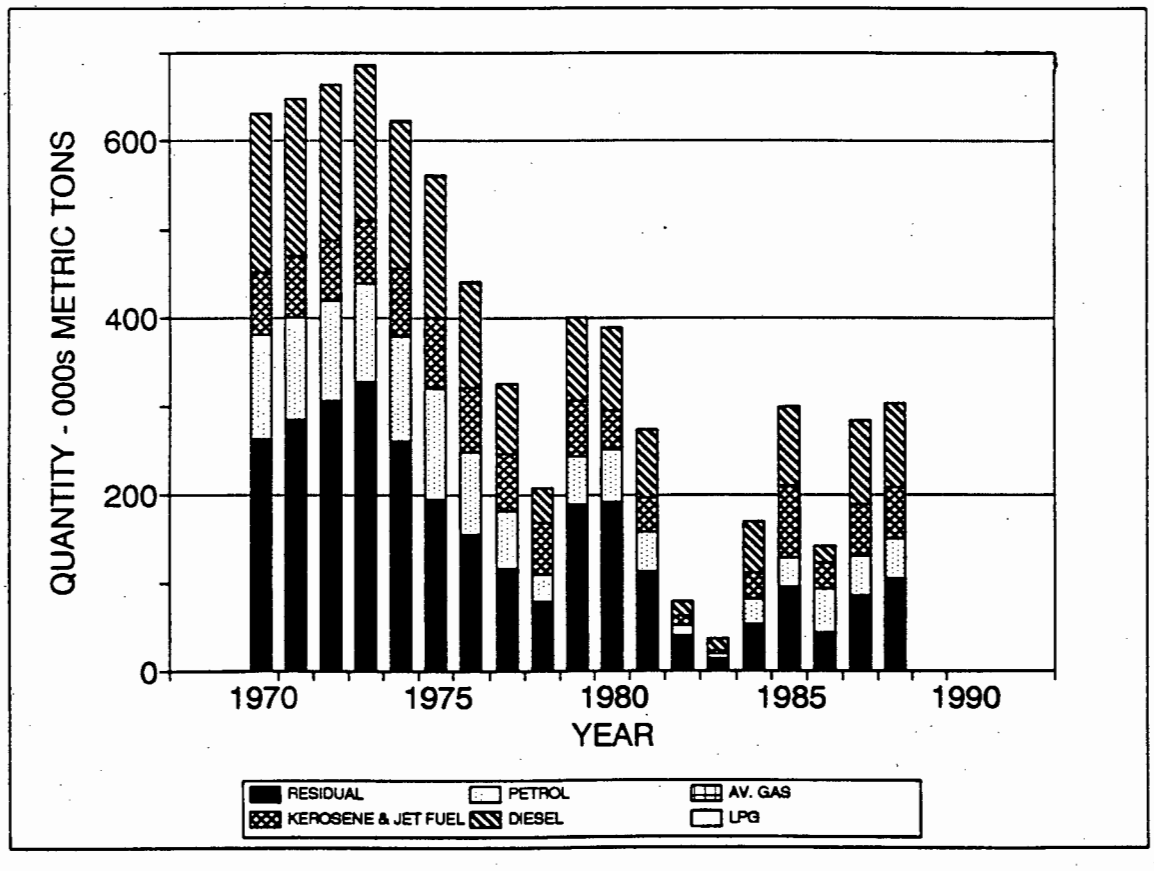


Figure 3.14 Production of Oil Energy Products from Refinery

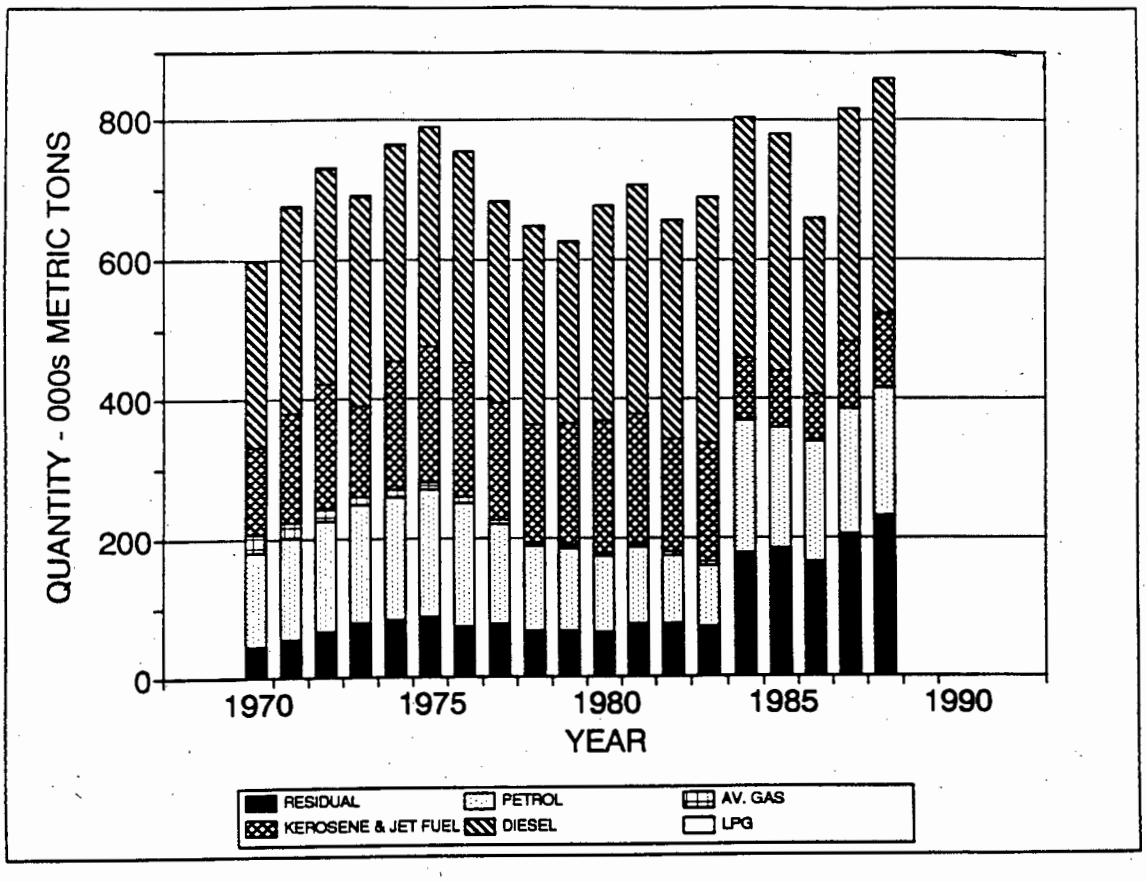


Figure 3.15 Oil Products Consumption

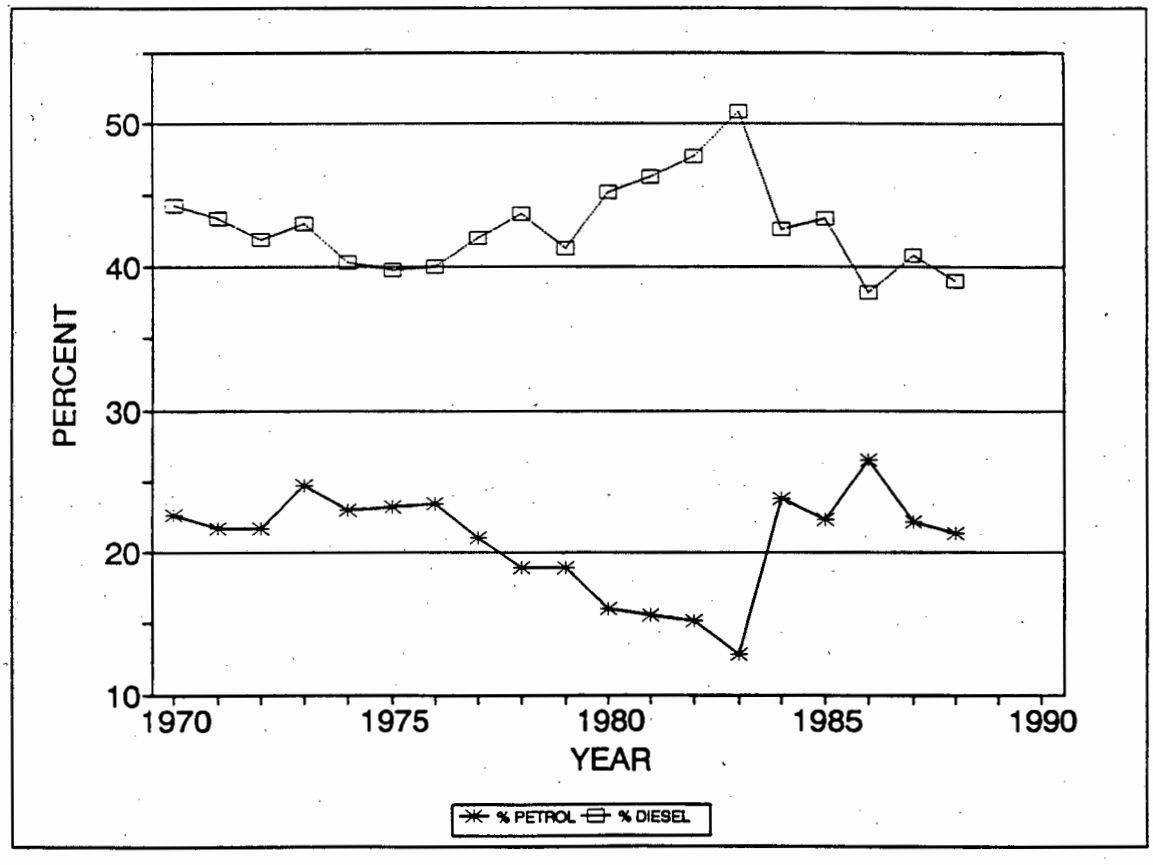


Figure 3.16 Petrol and Diesel as Percentage of Oil Consumption

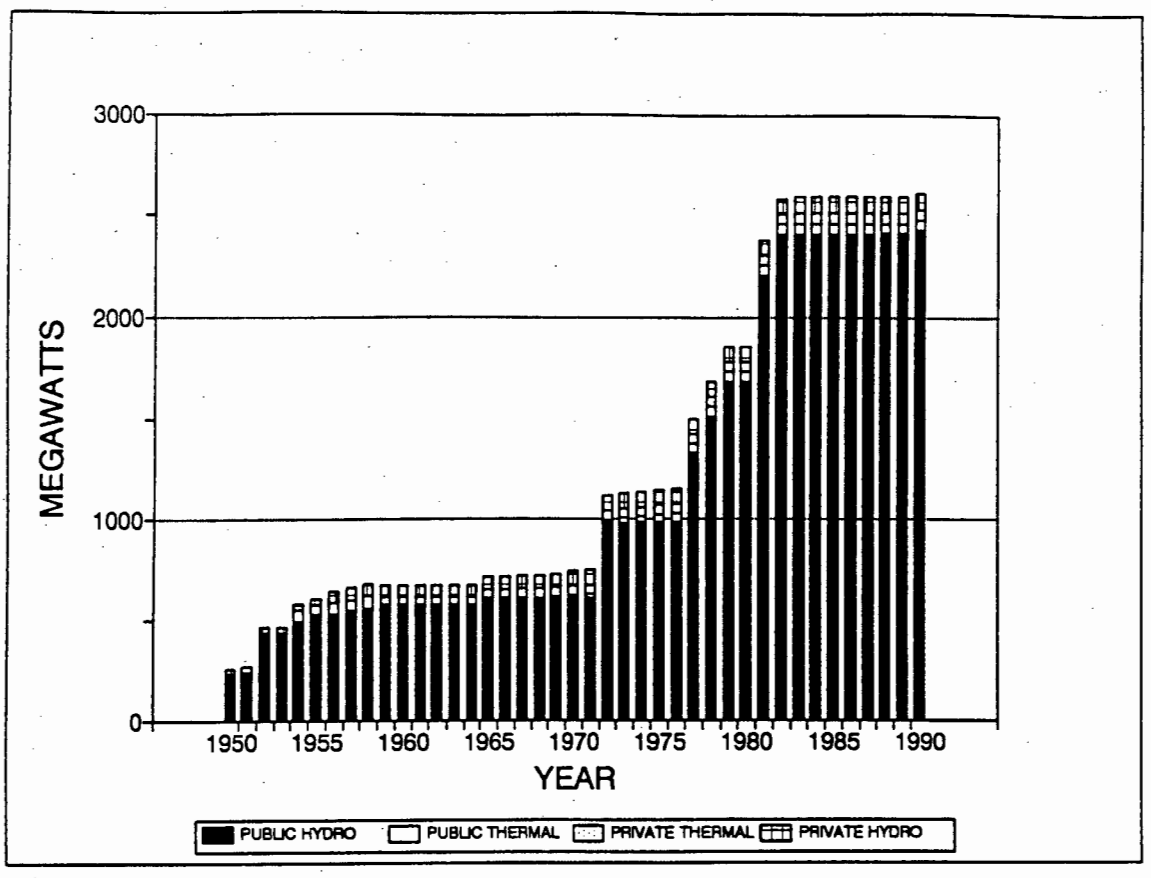


Figure 3.17 Electric installed Capacity

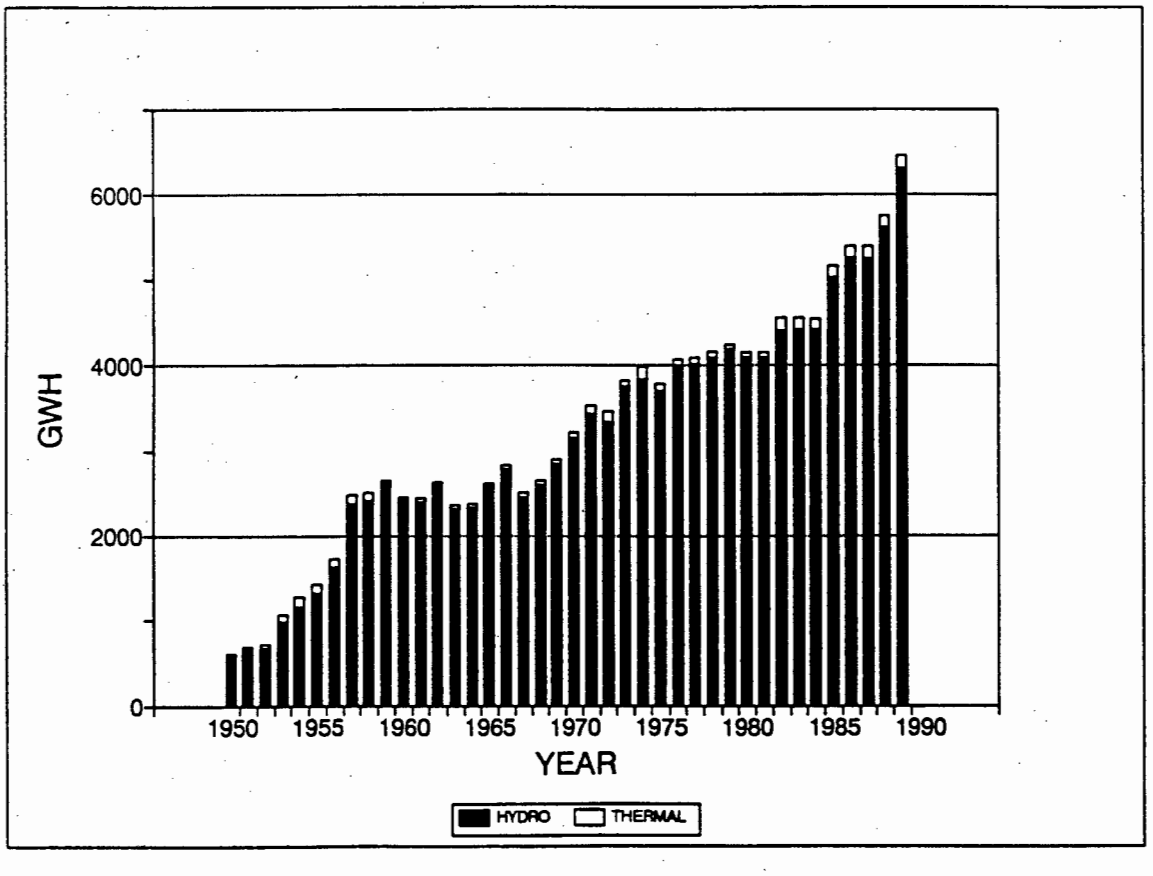


Figure 3.18 Electricity Production

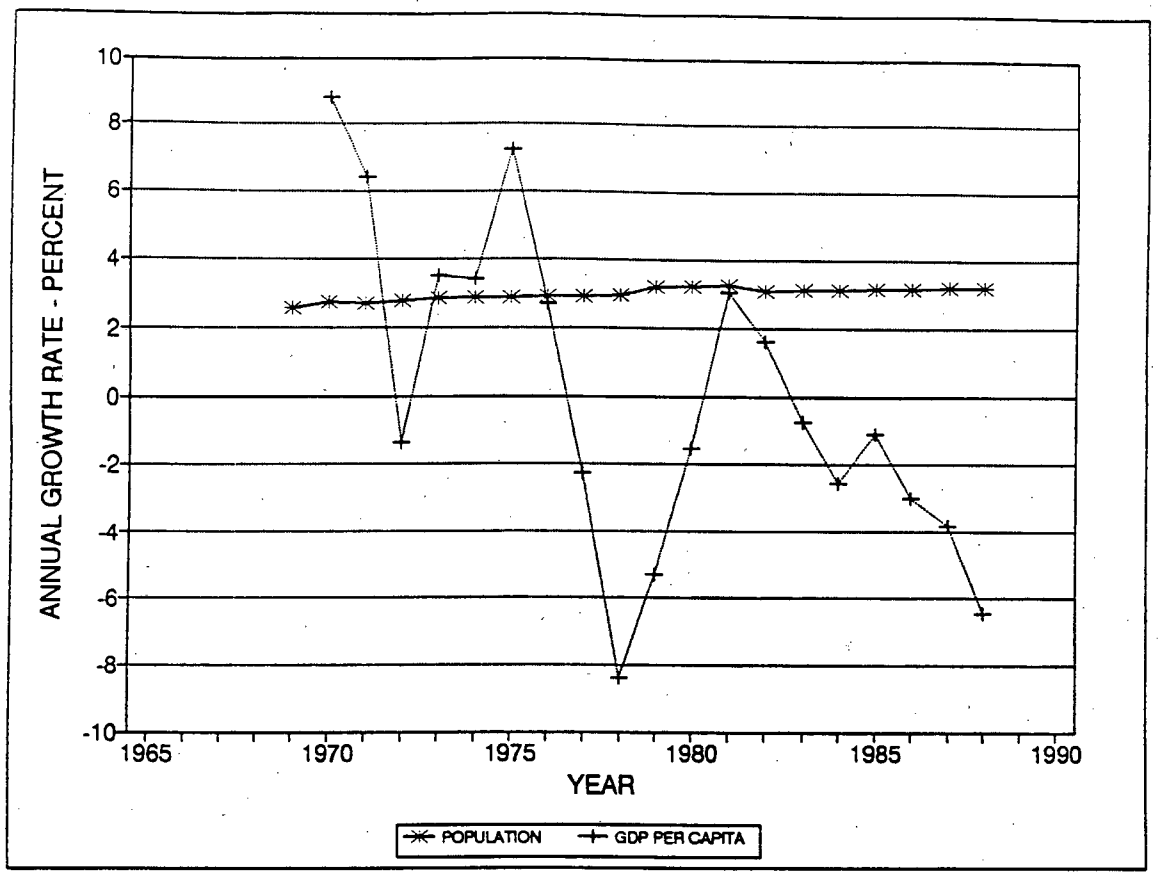


Figure 4.1 Growth Rates of Population and GDP per Capita

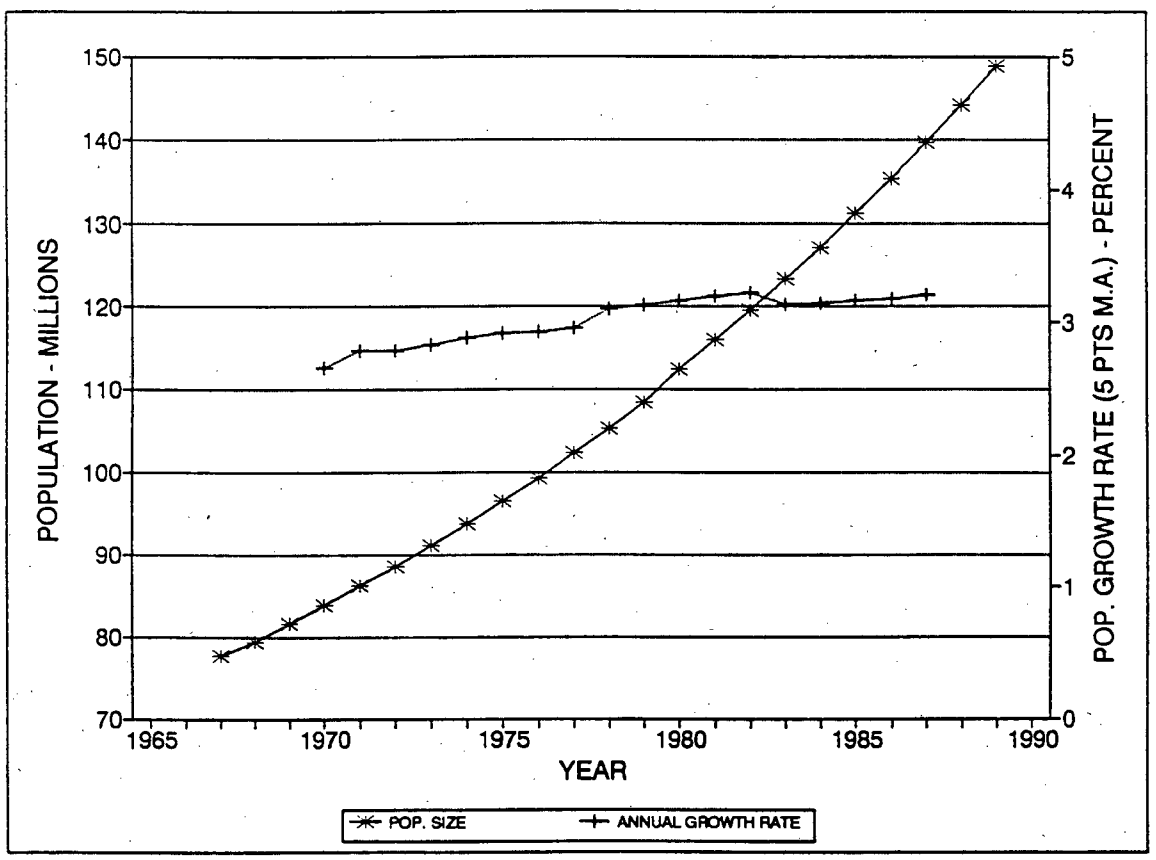


Figure 4.2 Population of the Region

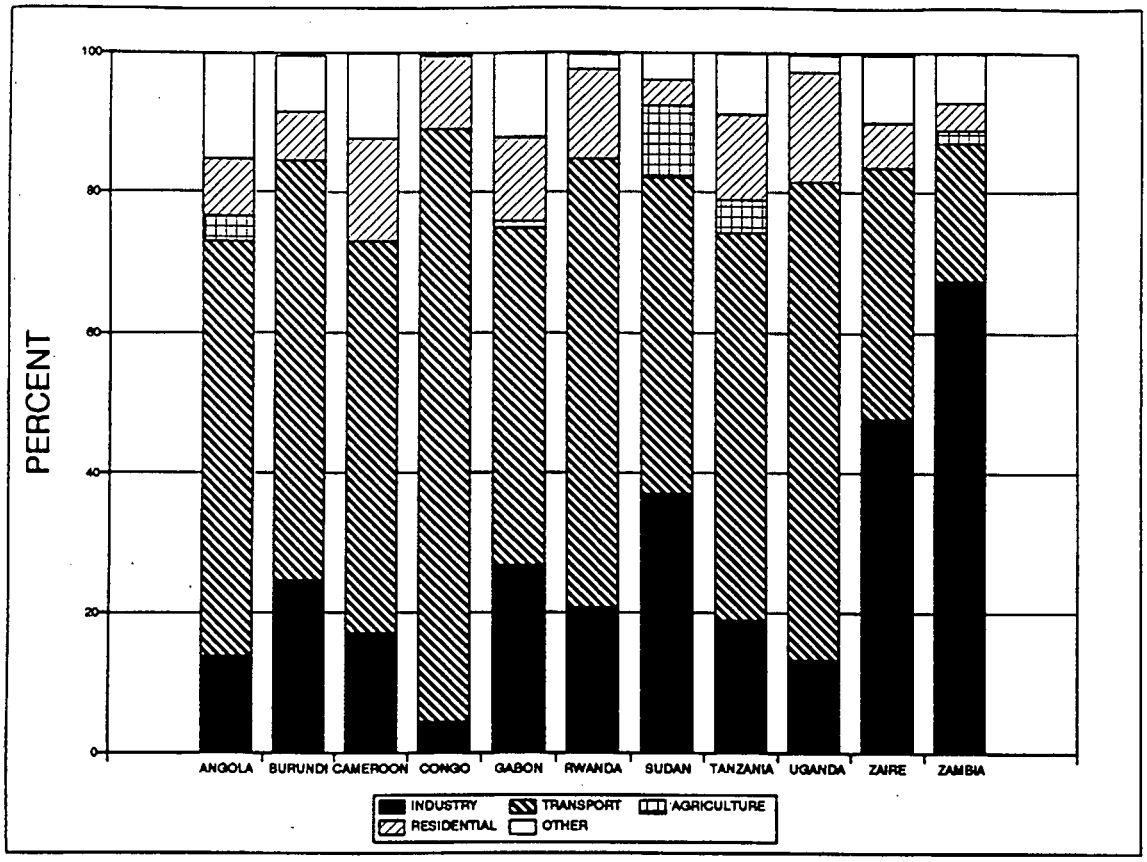


Figure 4.3 Sectorial Distribution of Commercial Energy Final Consumption

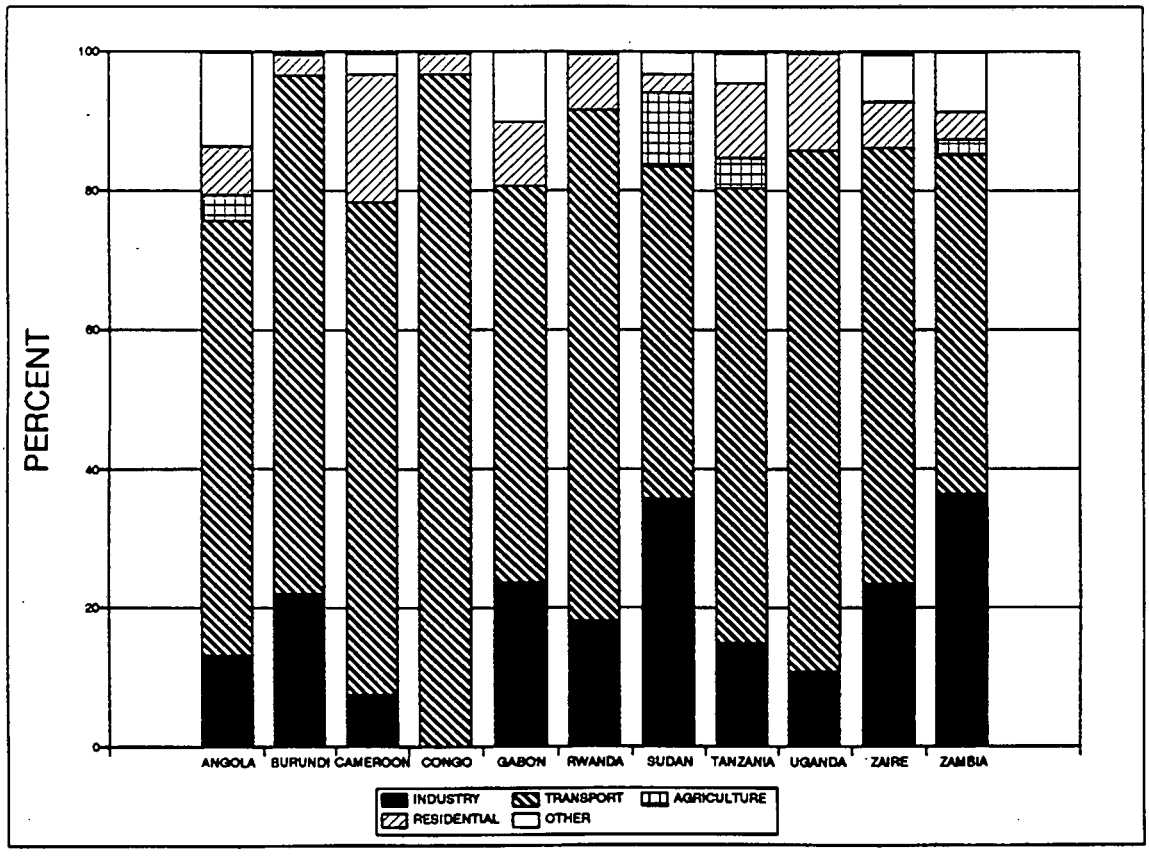


Figure 4.4 Sectorial Distribution of Oil Final Consumption

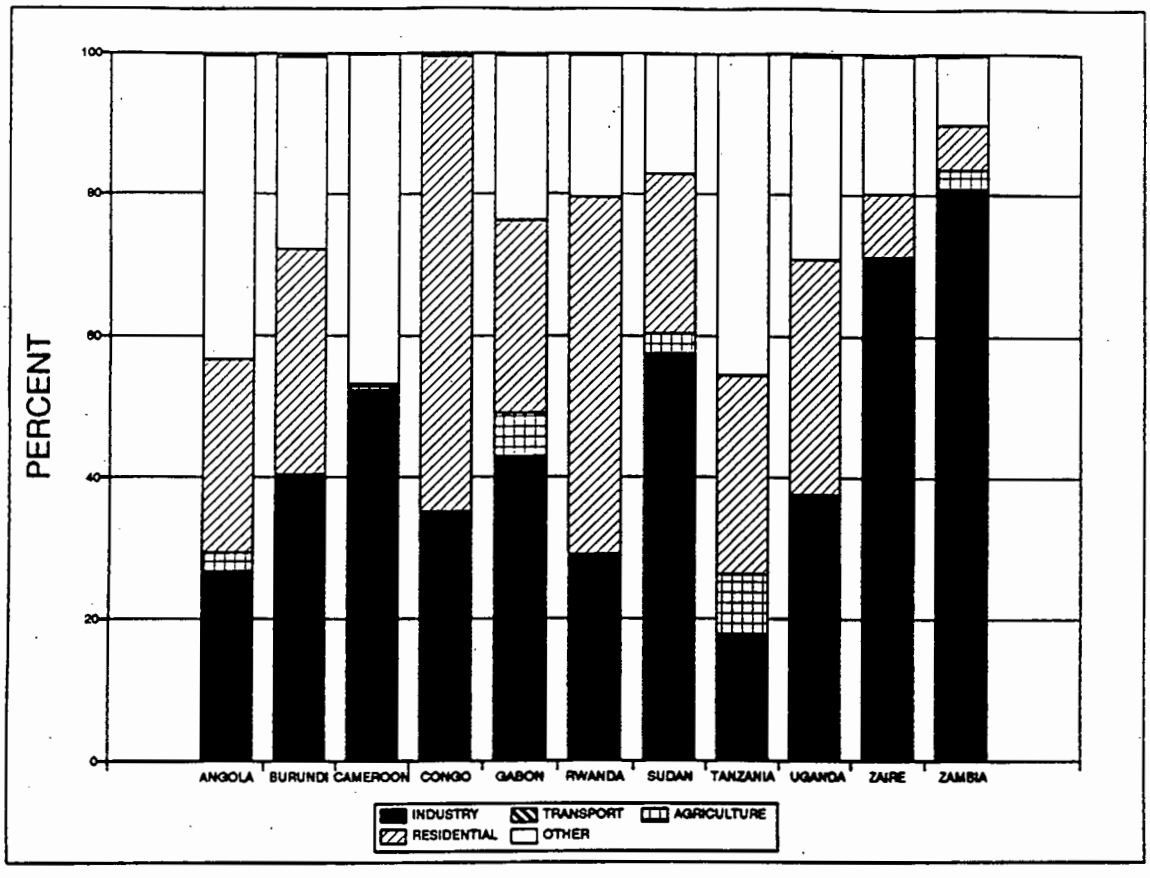


Figure 4.5 Sectorial Distribution of Electricity Final Consumption

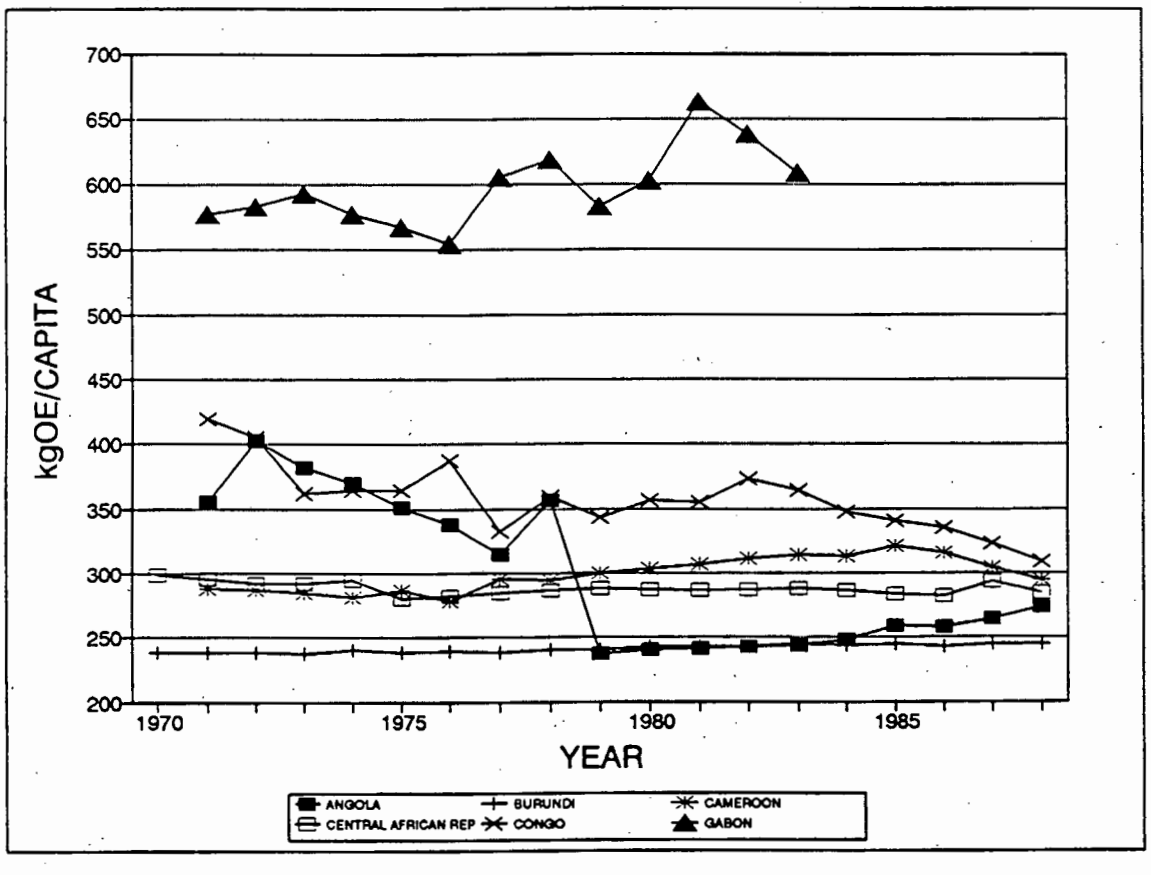
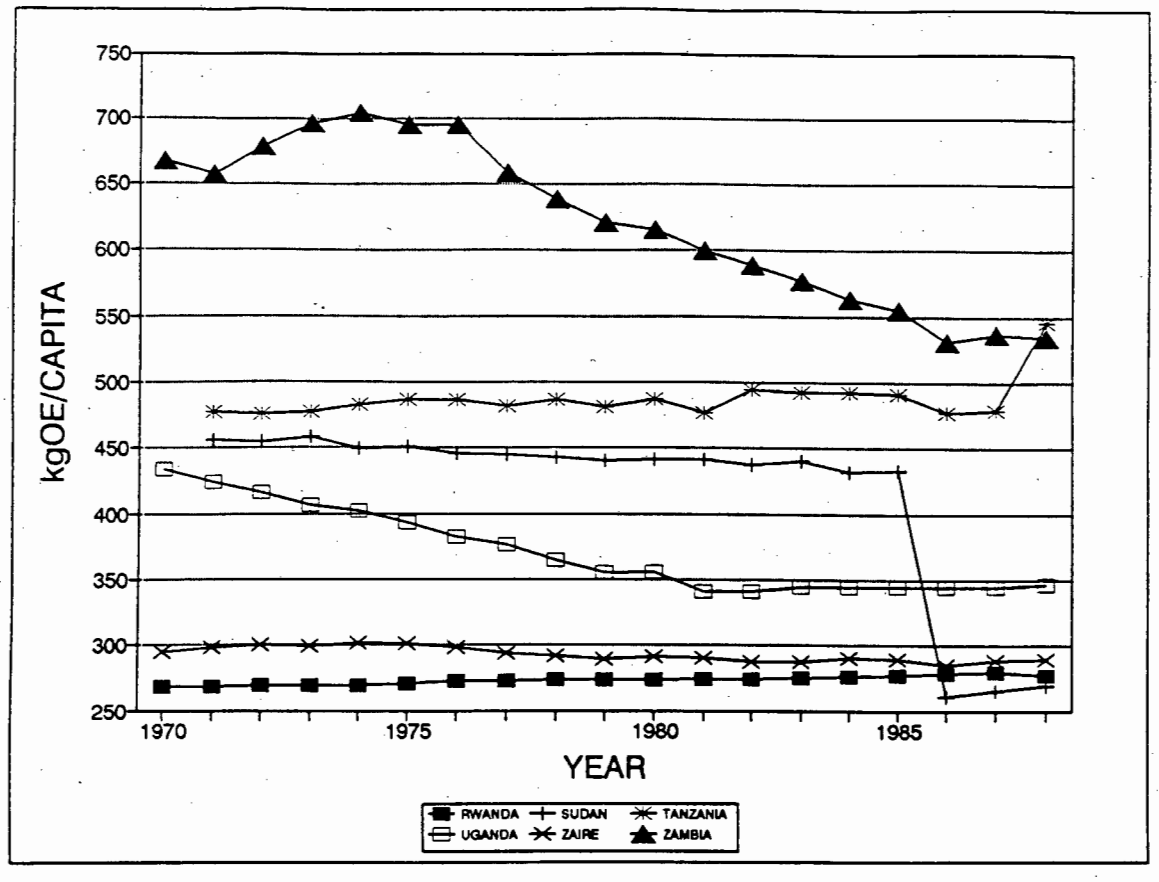


Figure 4.6 Total Final Consumption per Capita for Member Countries of the Region



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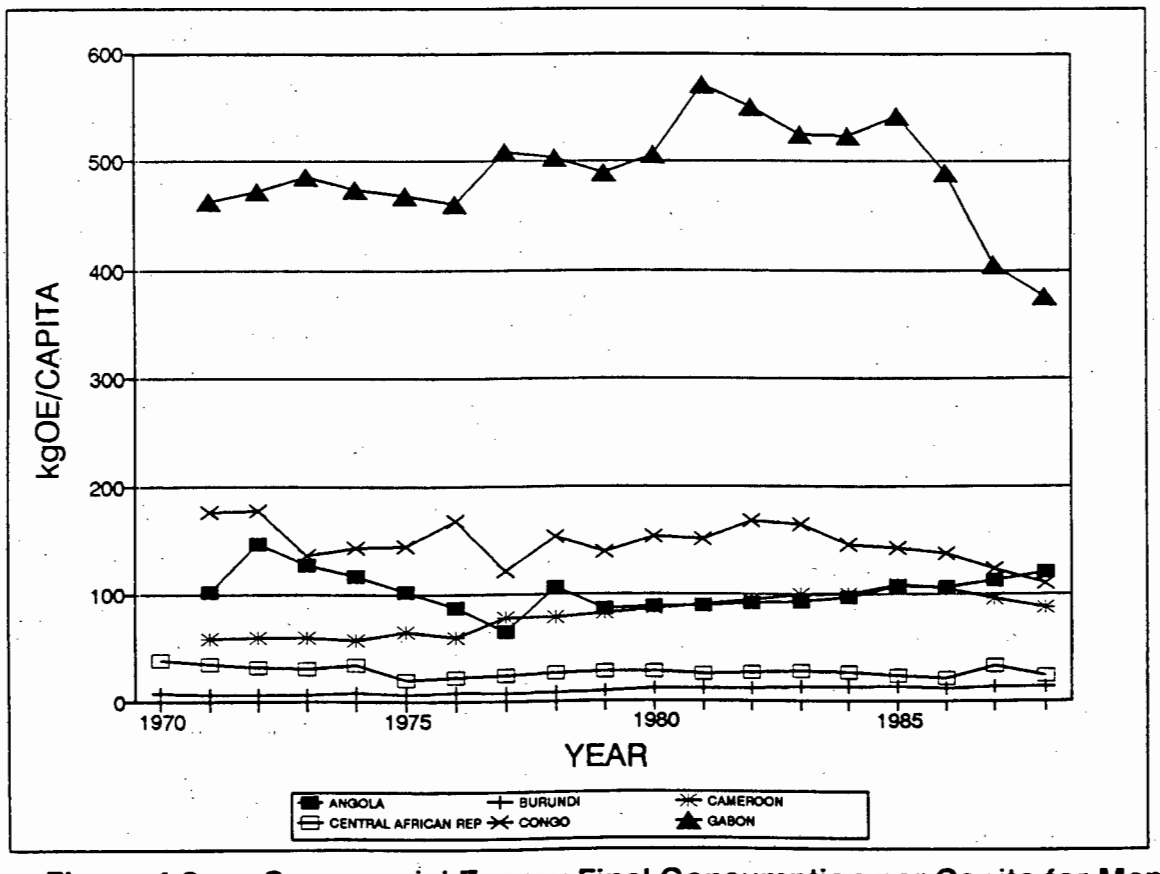


Figure 4.8 Commercial Energy Final Consumption per Capita for Member Countries of the Region

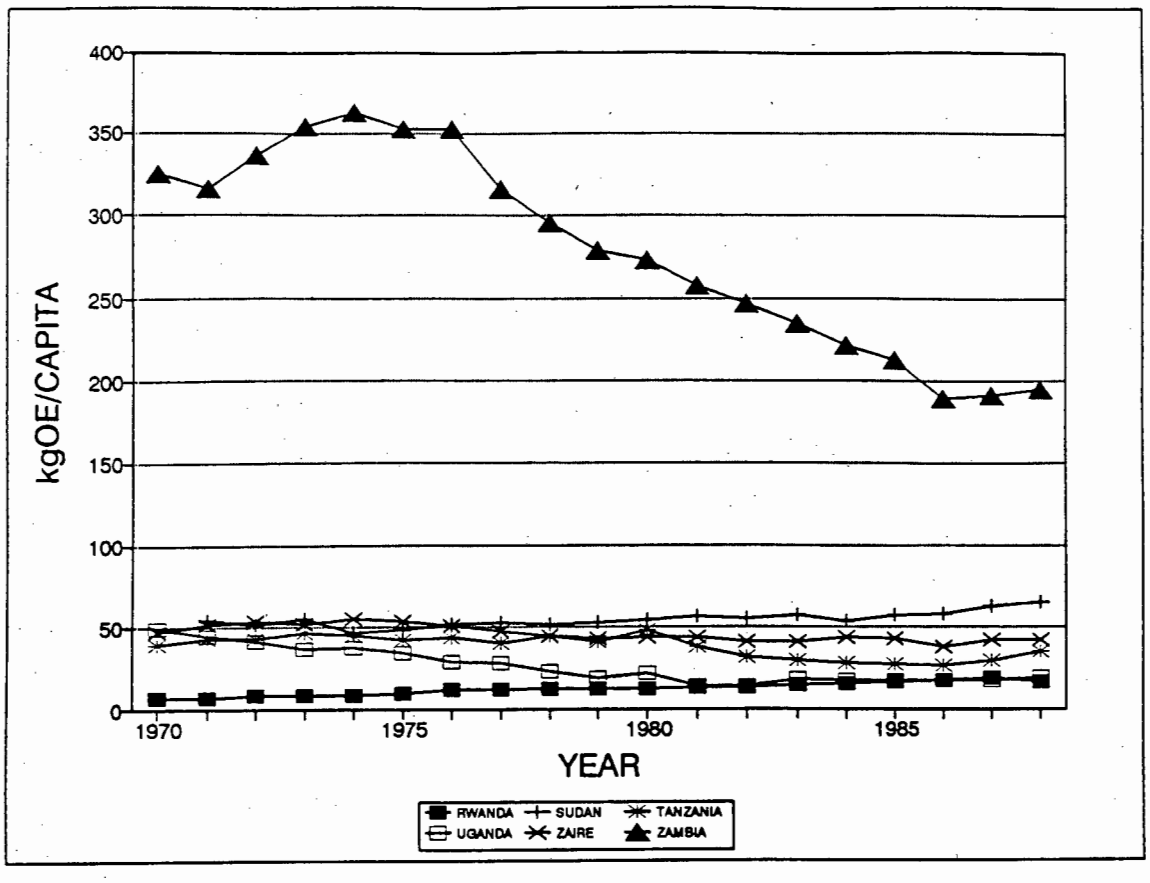


Figure 4.9 Commercial Energy Final Consumption per Capita for Member Countries of the Region

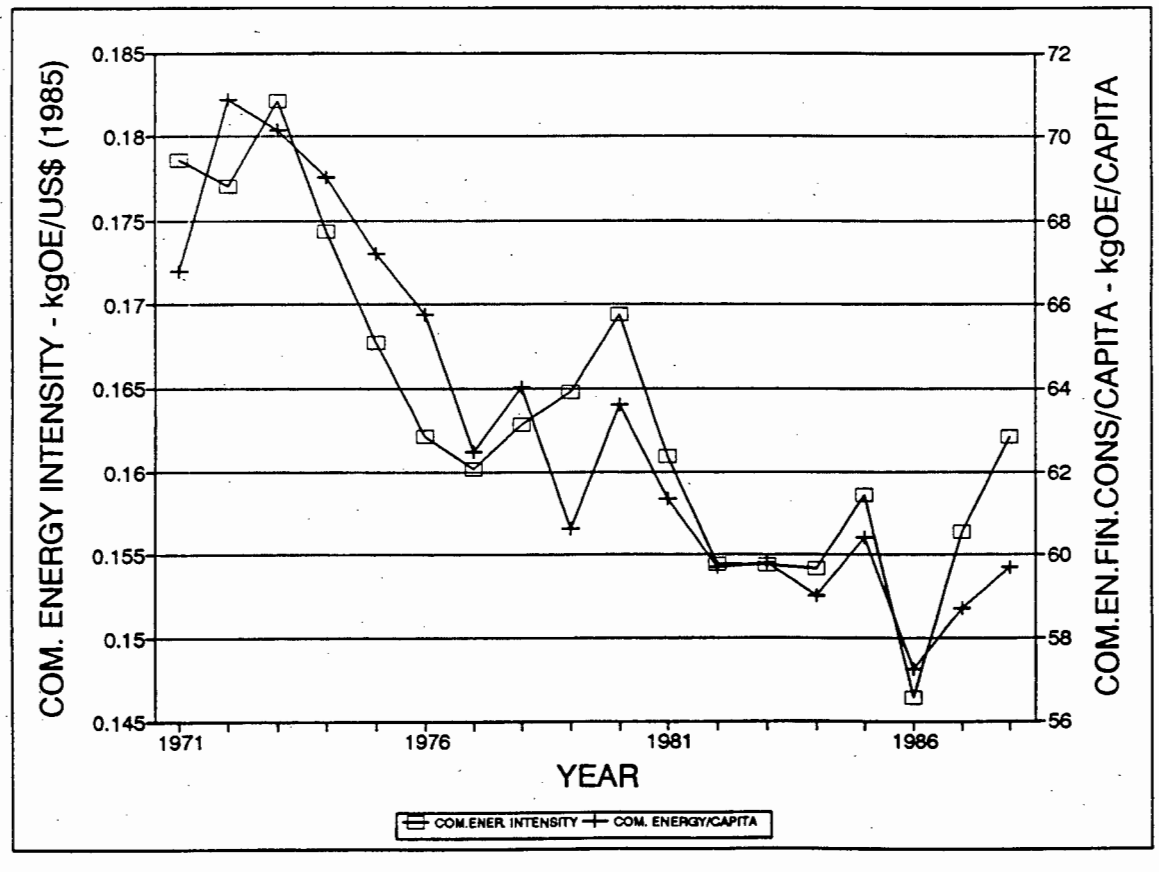


Figure 4.10 Commercial Energy Intensity and Commercial Energy per Capita of the Region

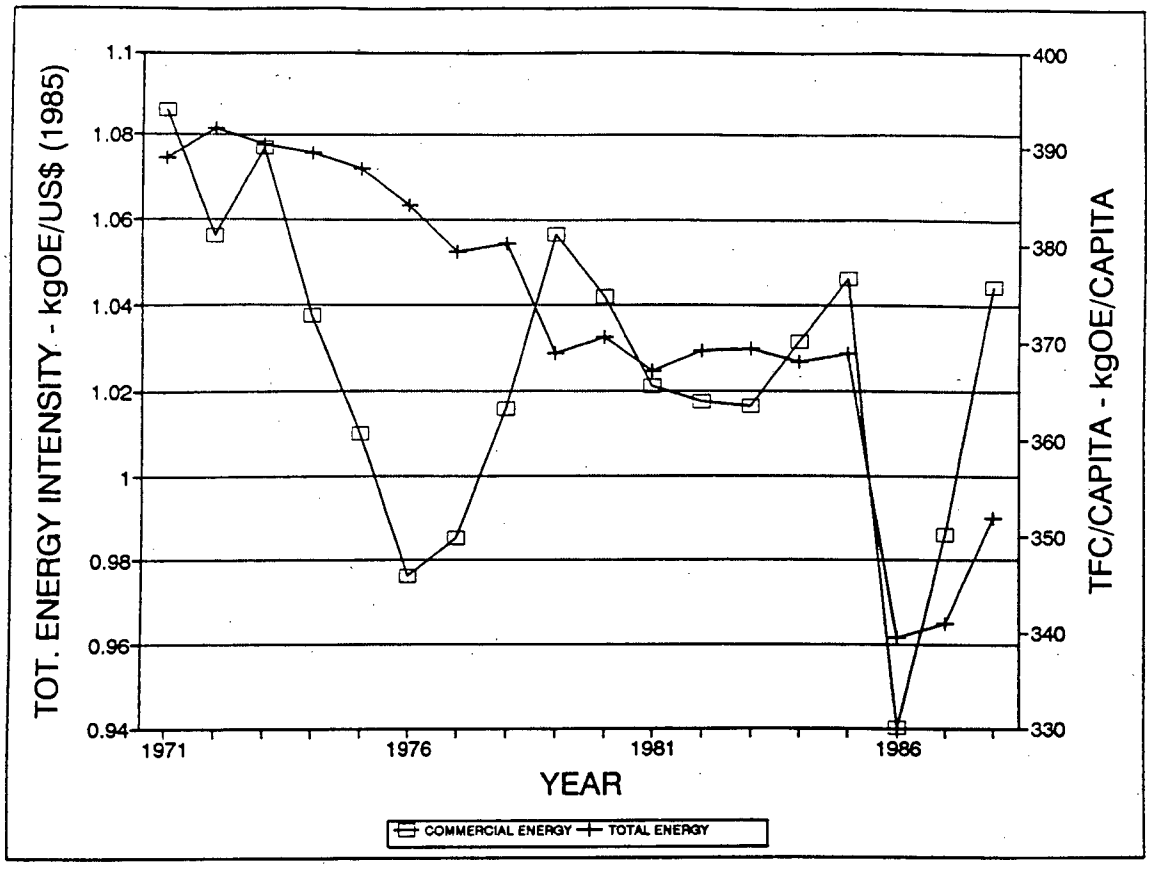


Figure 4.11 Total Energy Intensity and Total Energy per Capita of the Region

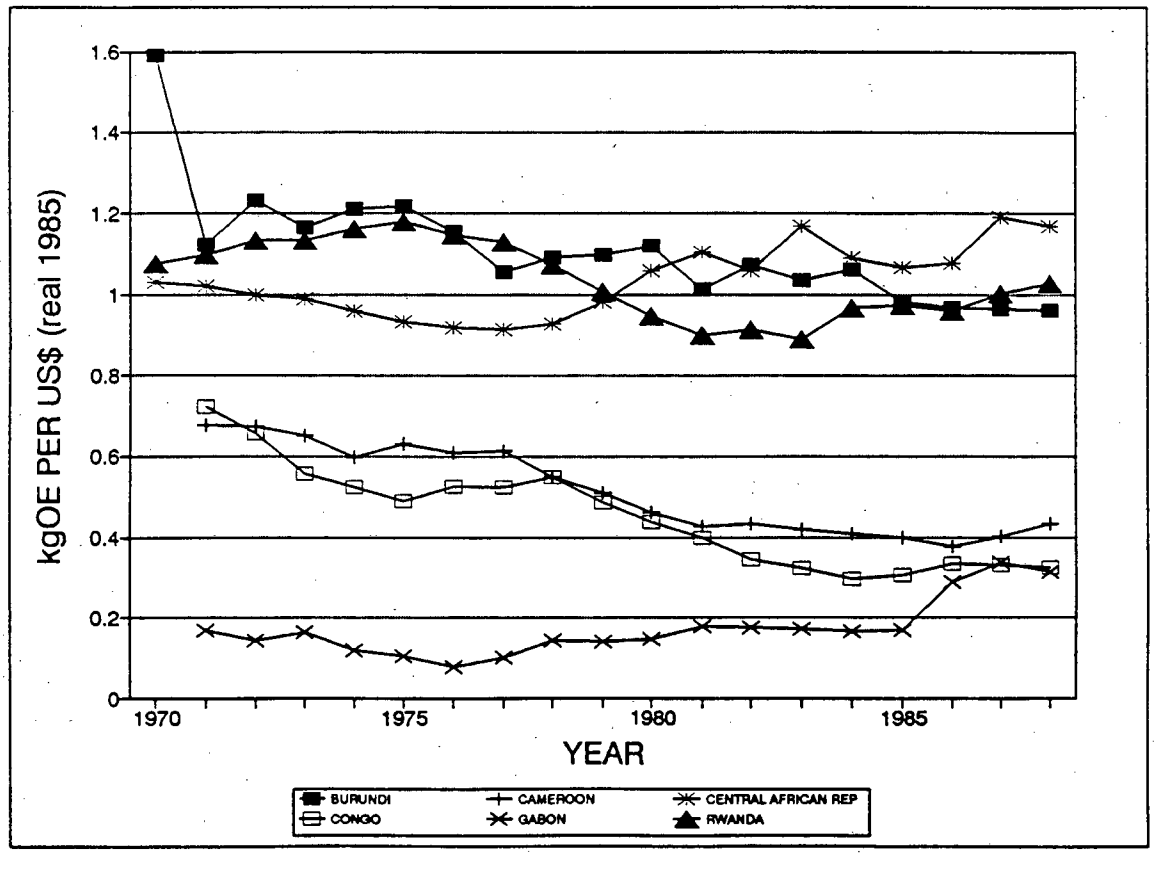


Figure 4.12 Intensity of Total Energy Final Consumption (GDP in 1985 US$)

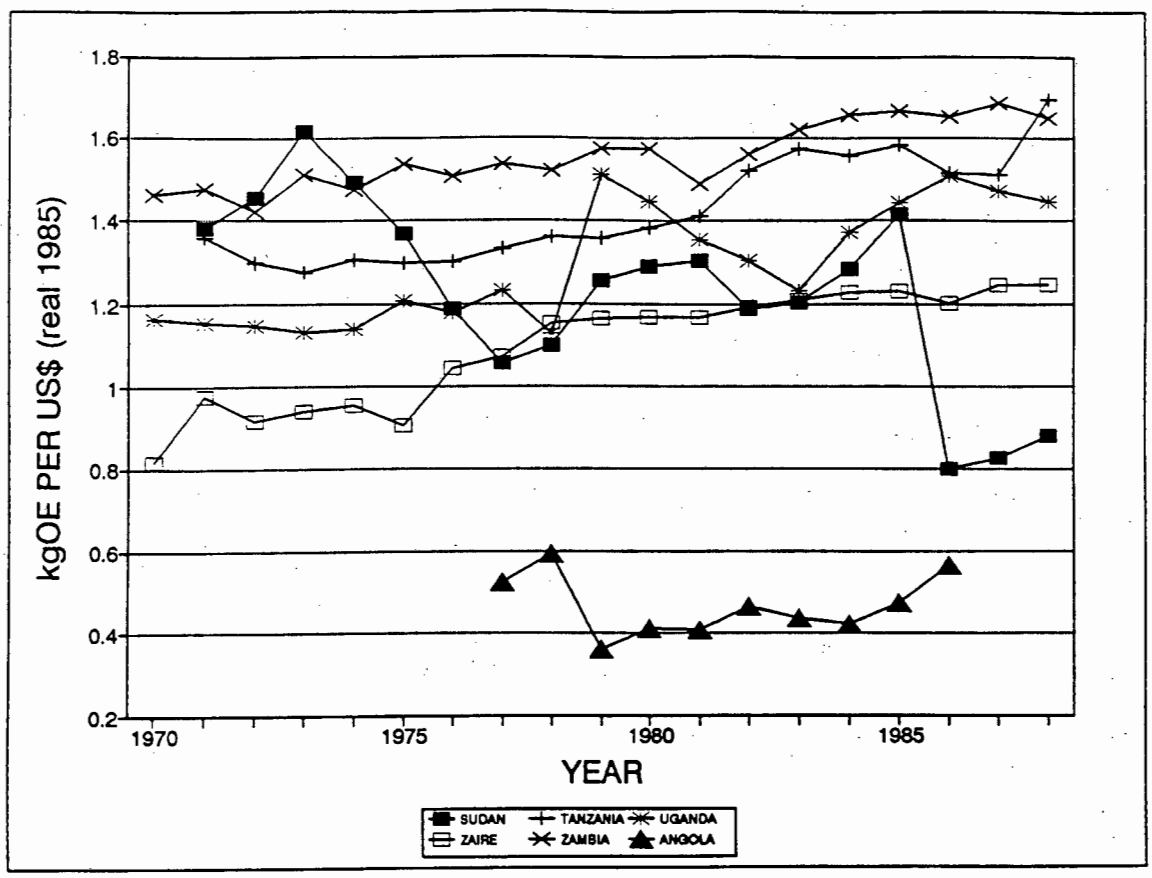


Figure 4.13 Intensity of Total Energy Final Consumption (GDP in 1985 US$)

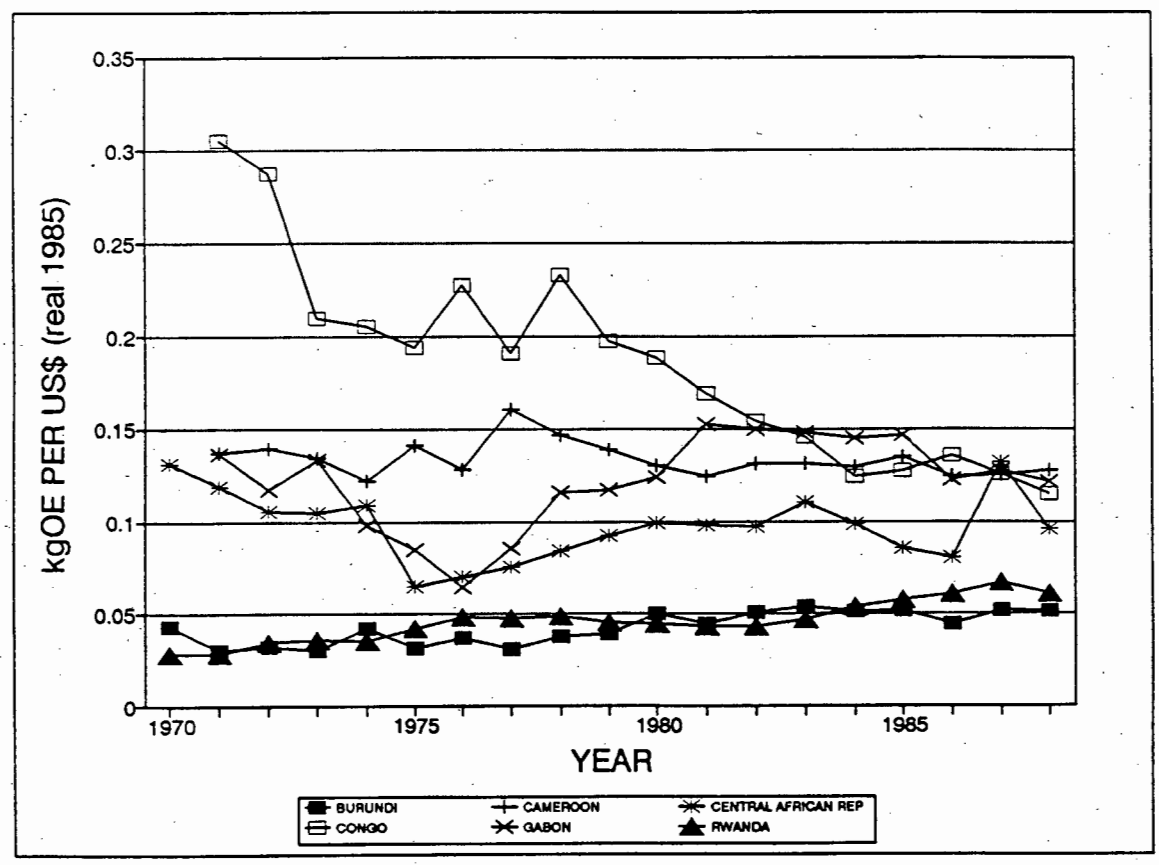


Figure 4.14 Intensity of Commercial Energy Final Consumption (GDP in 1985 US$)

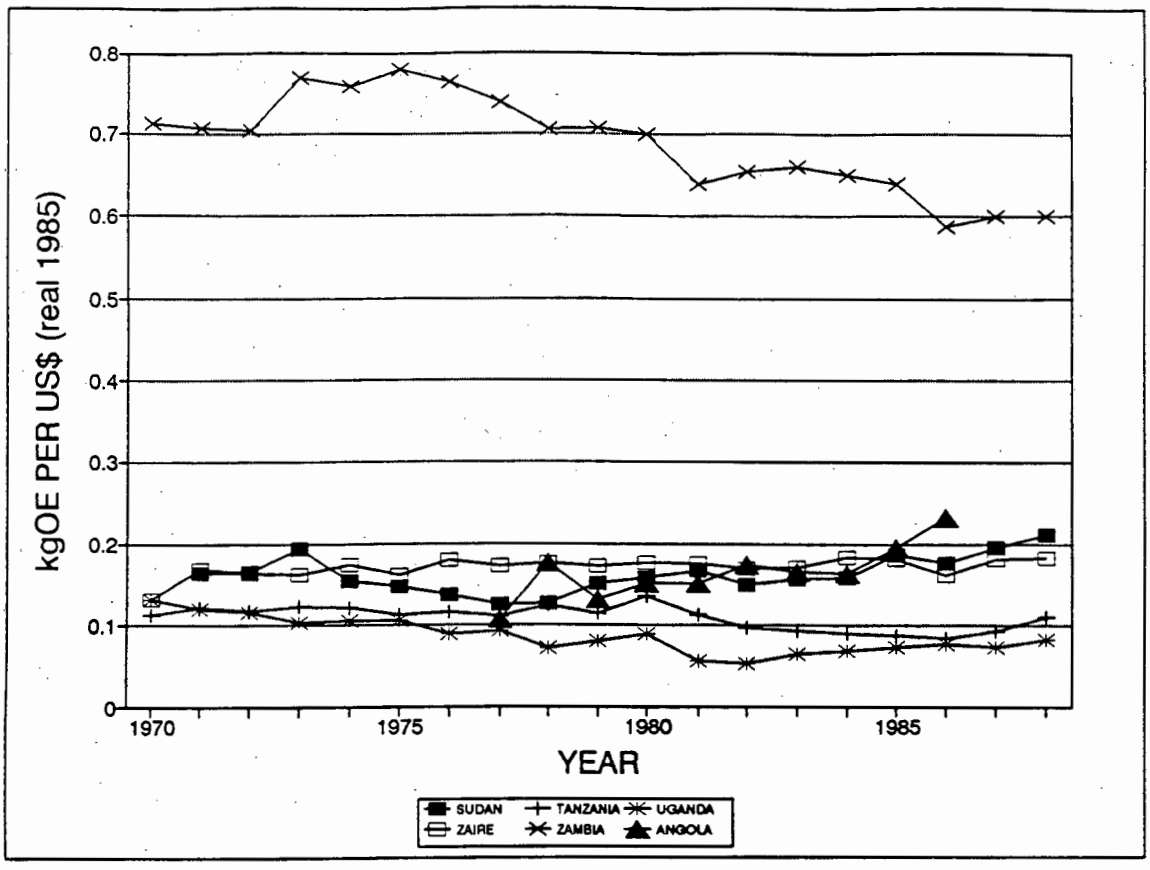


Figure 4.15 Intensity of Commercial Energy Final Consumption (GDP in 1985 US$)

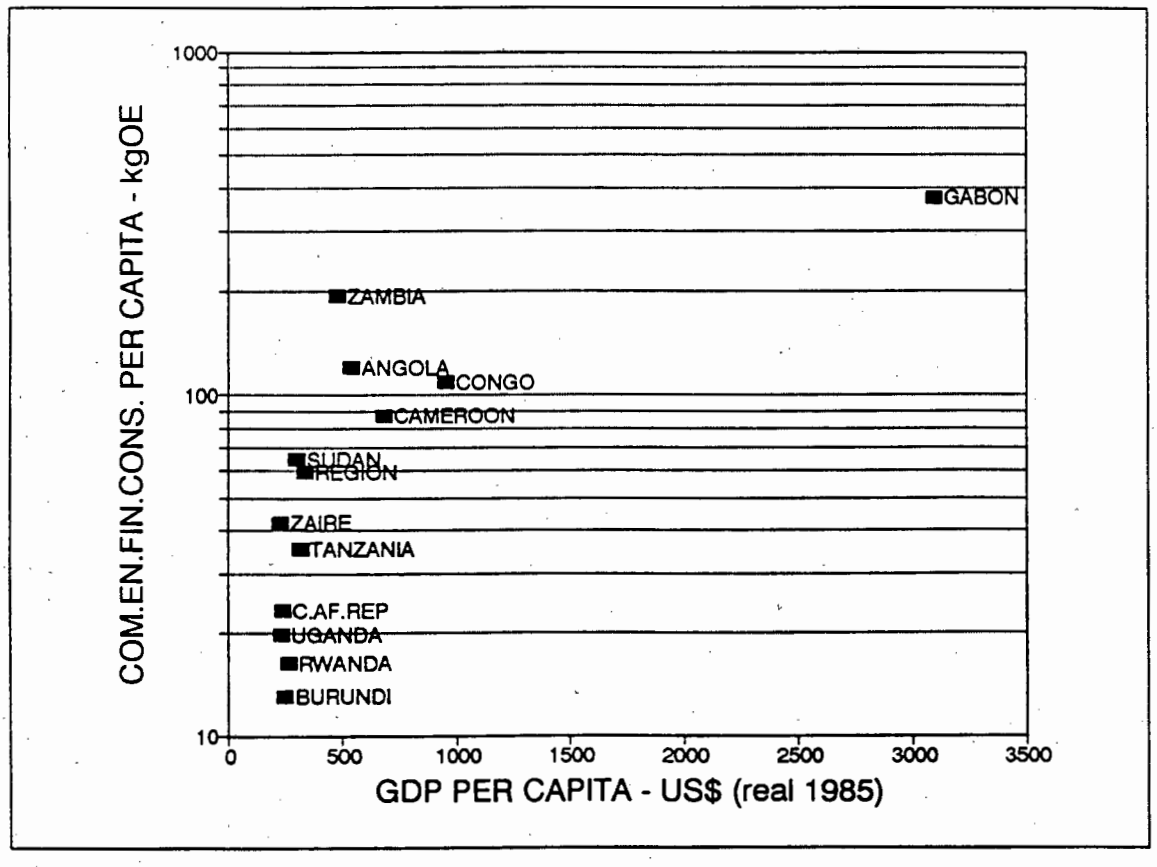


Figure 4.16 Commercial Energy per Capita vs GDP per Capita

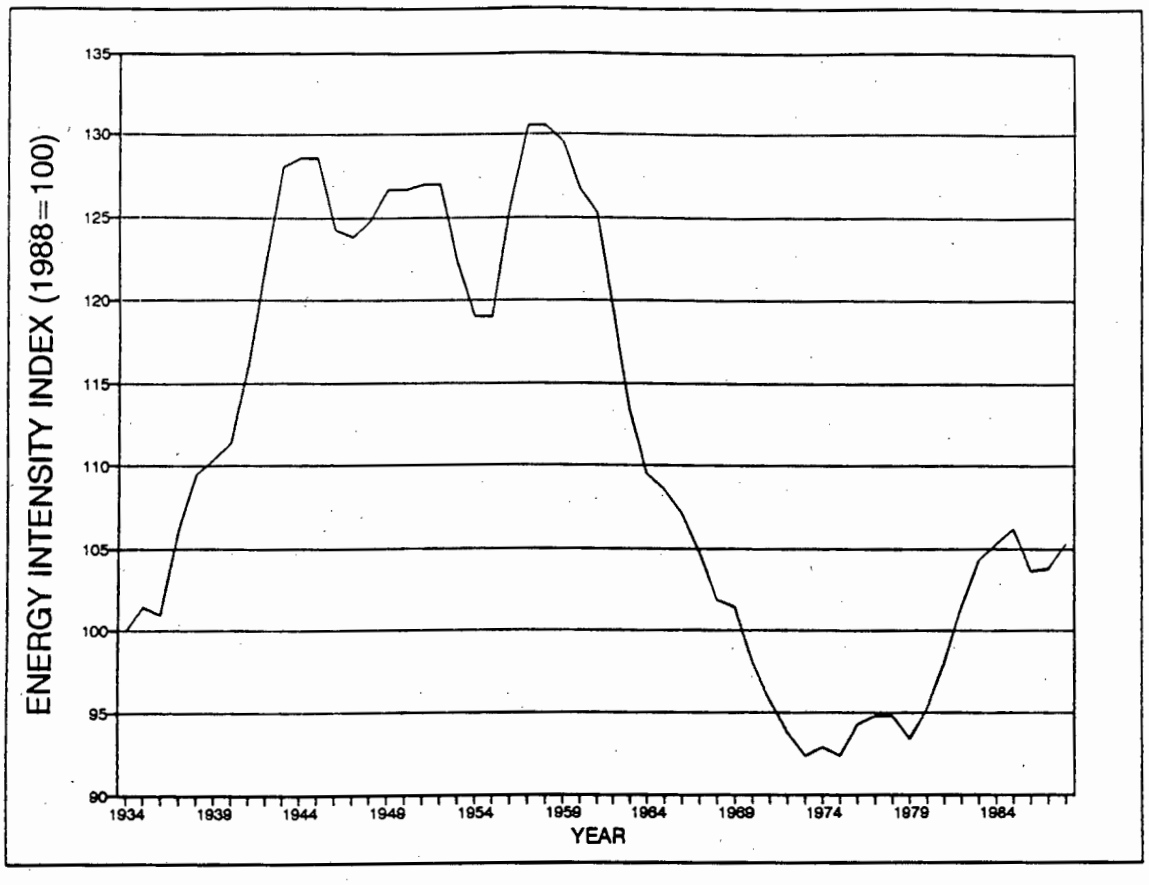
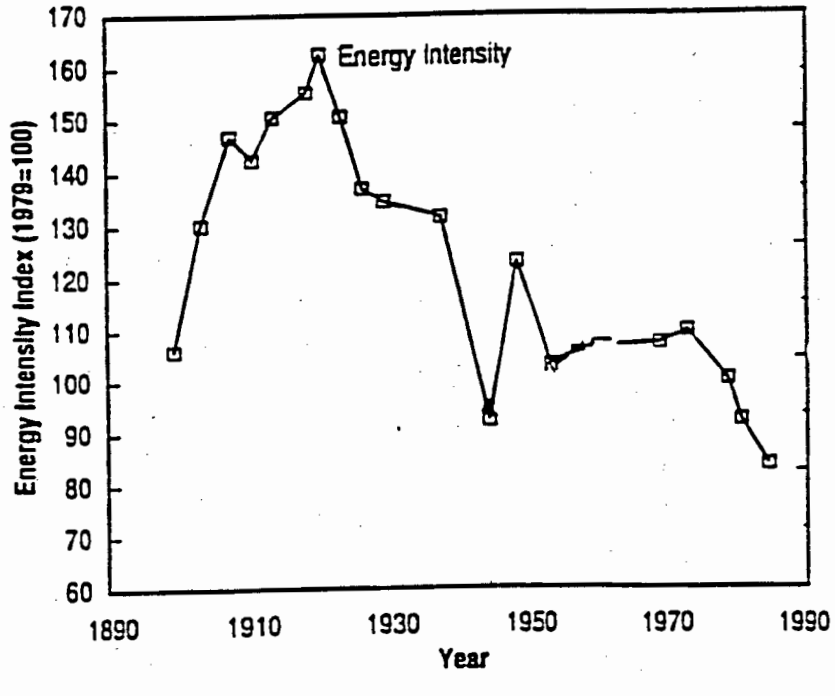


Figure 4.17 Energy Intensity of South of Africa

UNITED STATES



NOTE: Energy intensity measured as ratio between total energy input in U.S. and the gross national product (GNP). Data points refer to business cycle peak years, except for last year shown.

Figure 4.18 Energy Intensity of USA

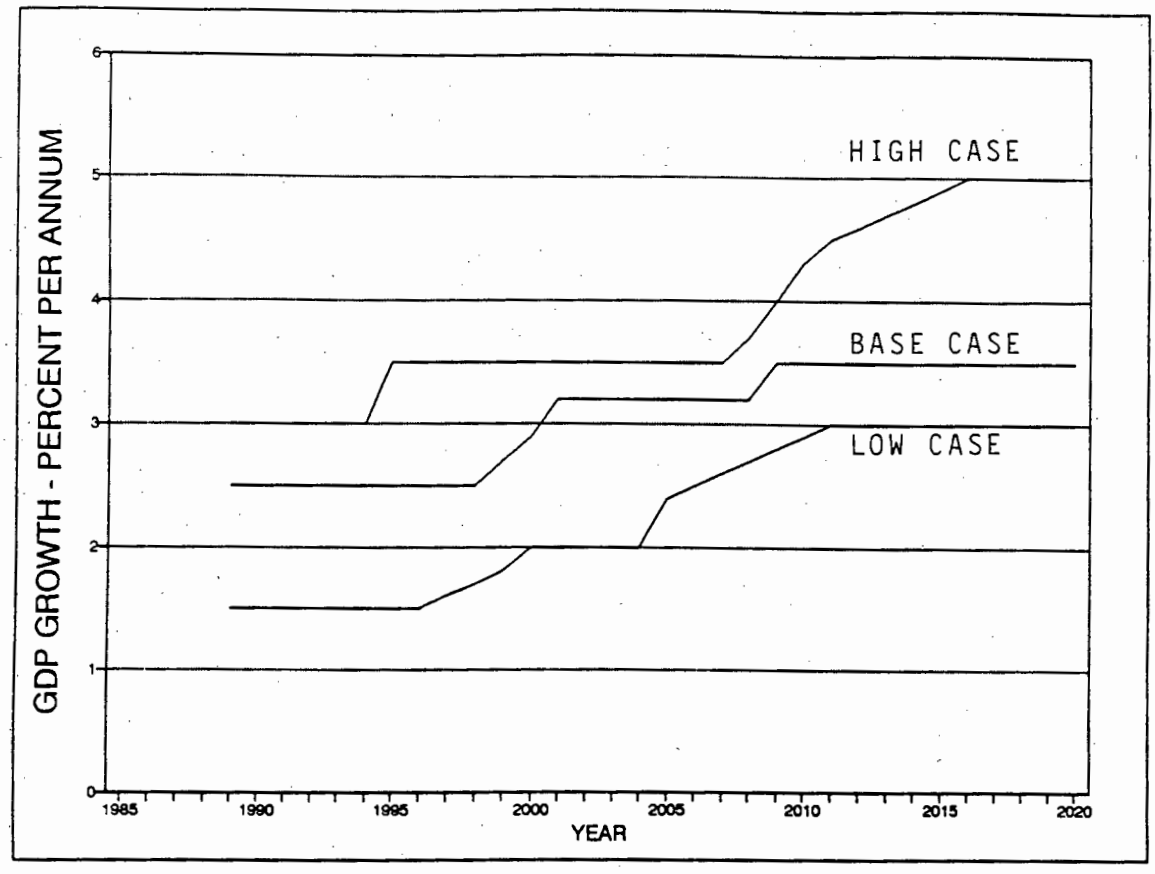


Figure 4.19 Real GDP Growth Rate Scenarios

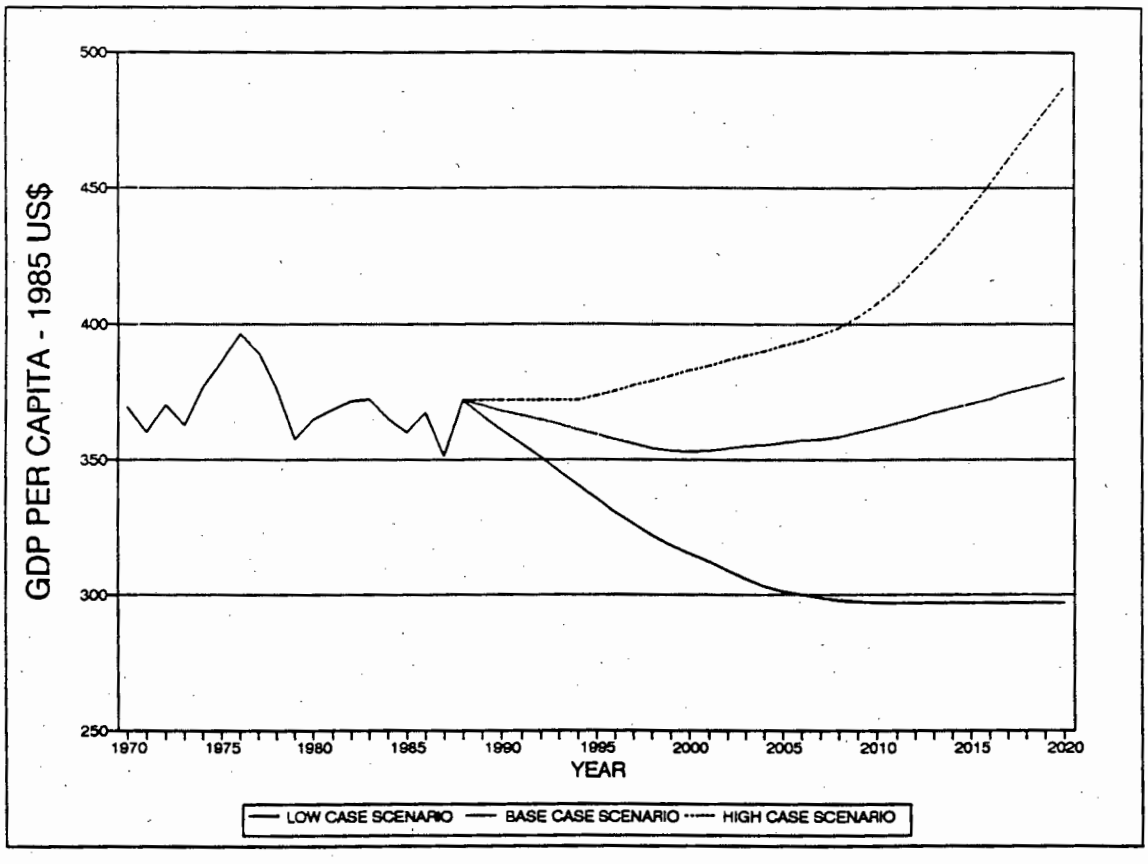


Figure 4.20 GDP per Capita: Historic and forecast

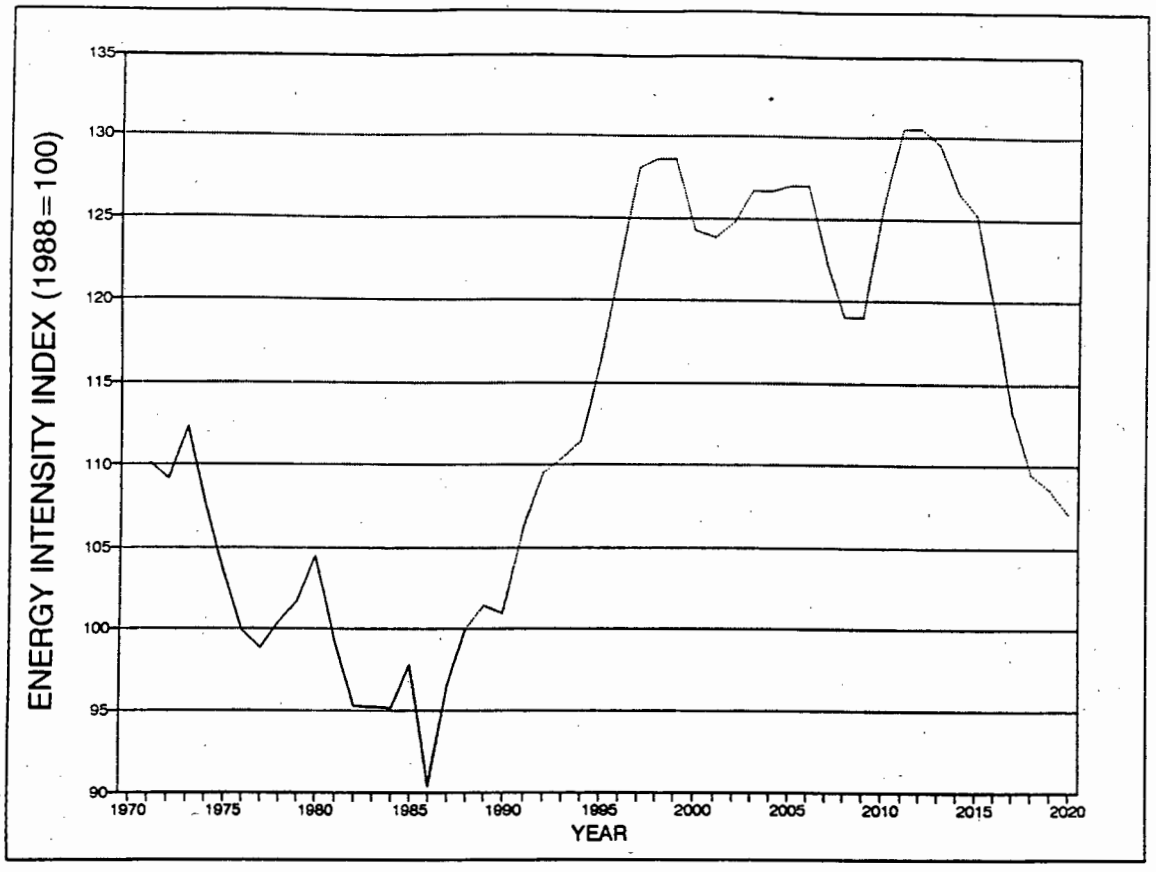


Figure 4.21 Energy Intensity of Central Africa

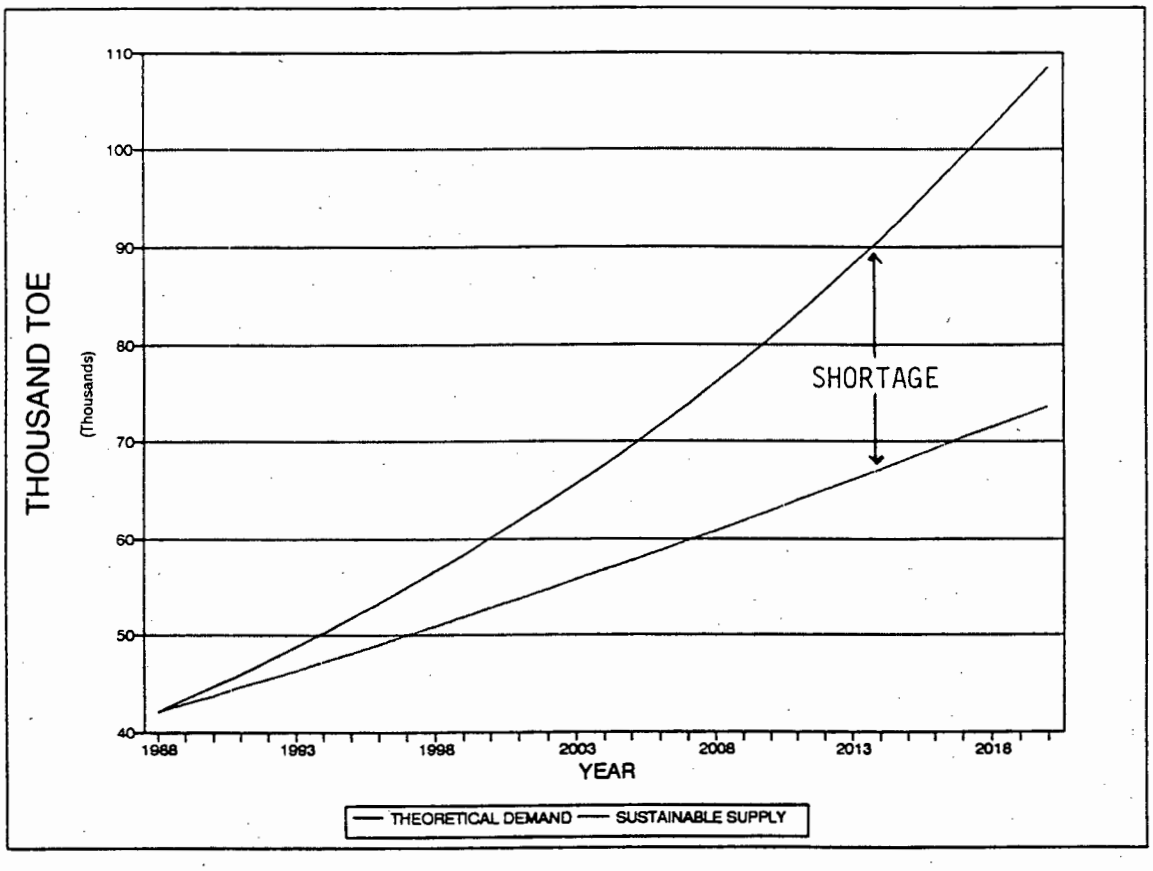


Figure 4.22 Traditional Energy Consumption: Predictions 1989-2020

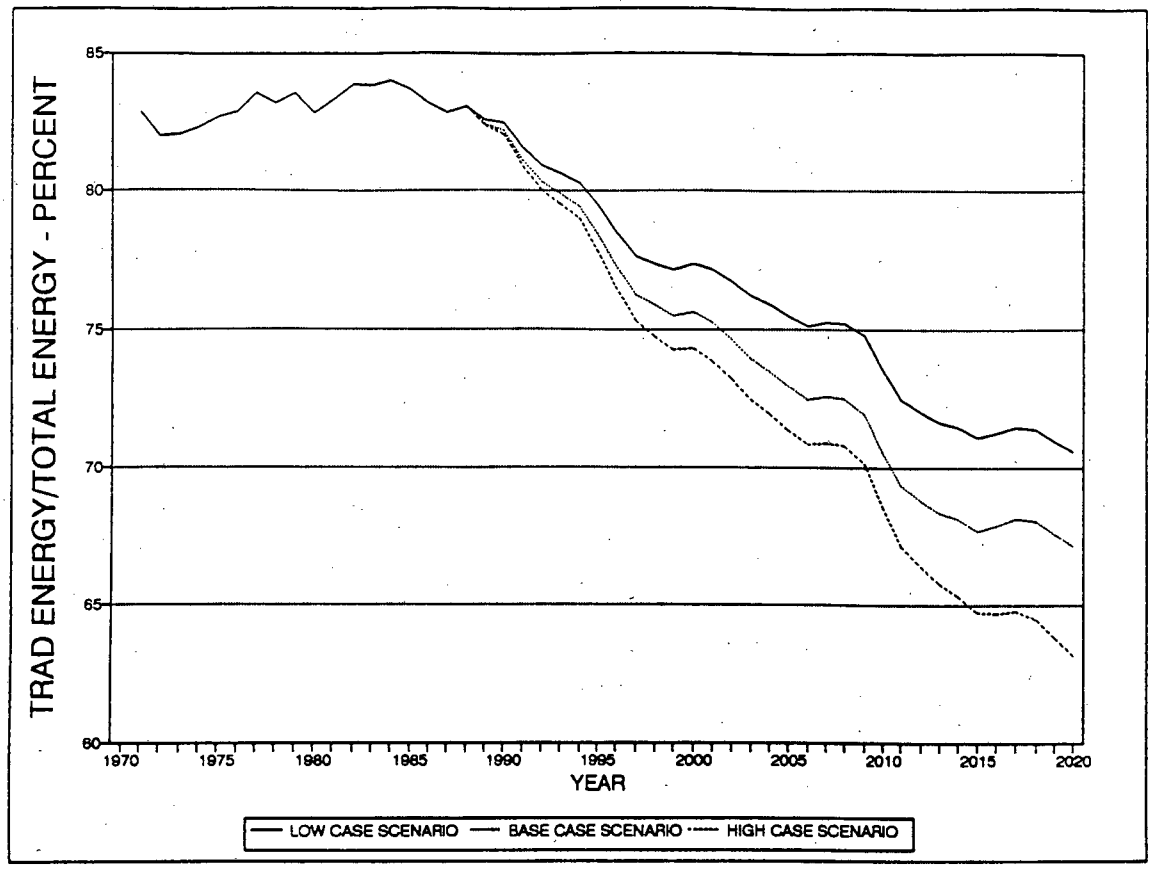


Figure 4.23 Traditional Energy as Percentage of Total Energy

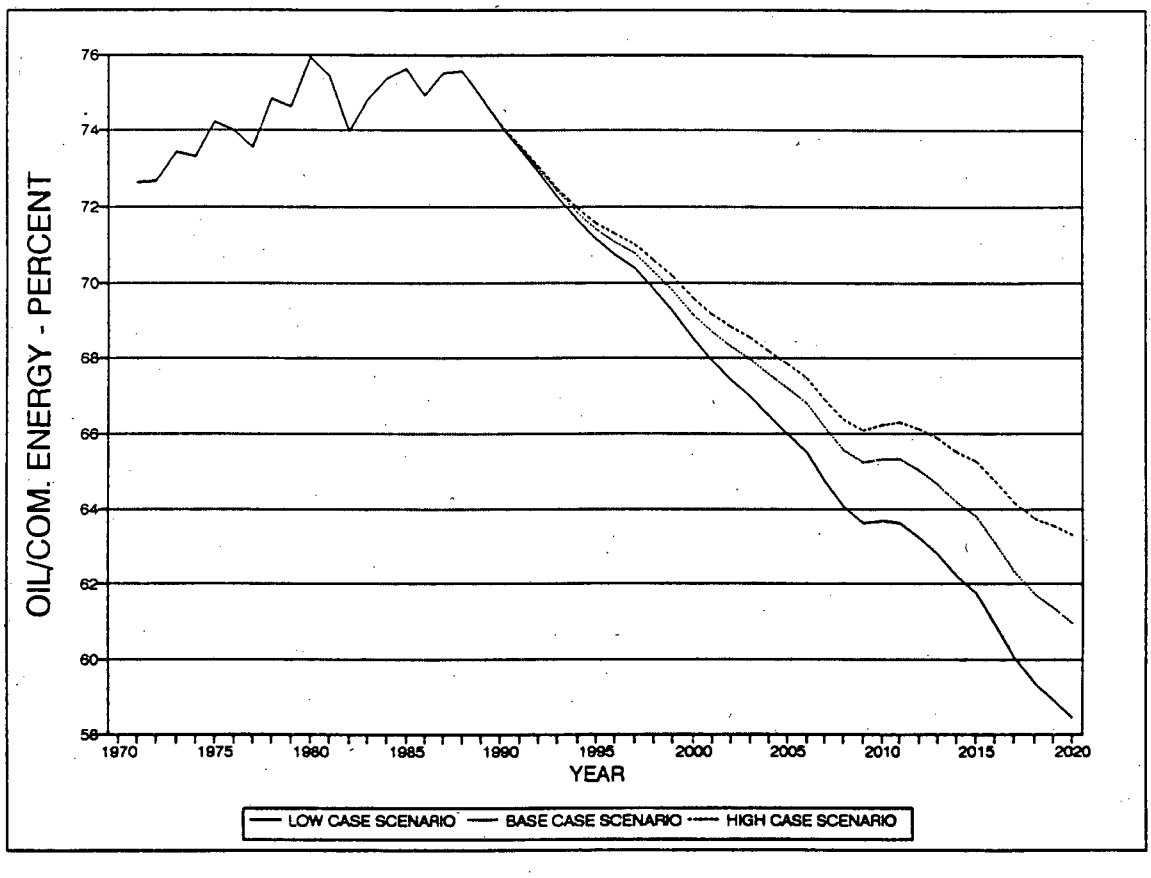


Figure 4.24 Oil as Percentage of Commercial Energy Final Consumption

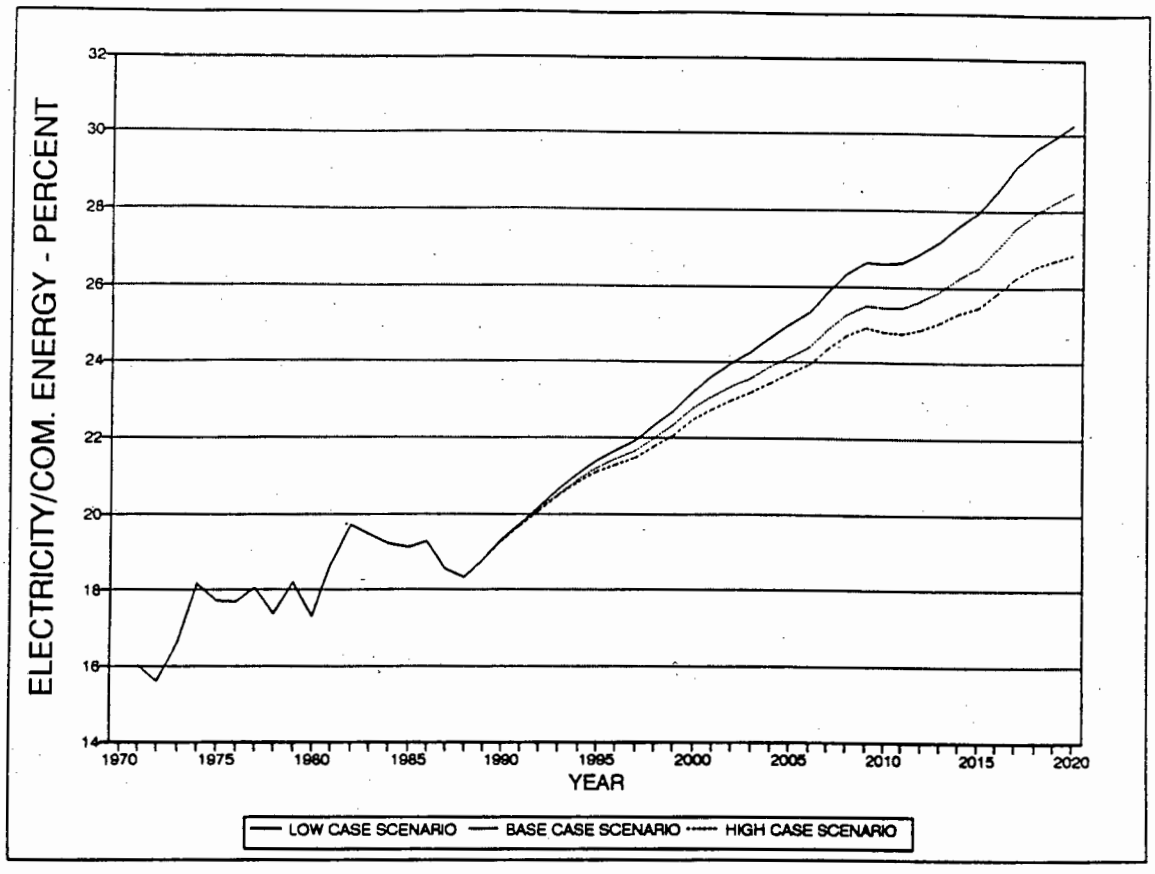


Figure 4.25 Electricity as Percentage of Commercial Energy Final Consumption

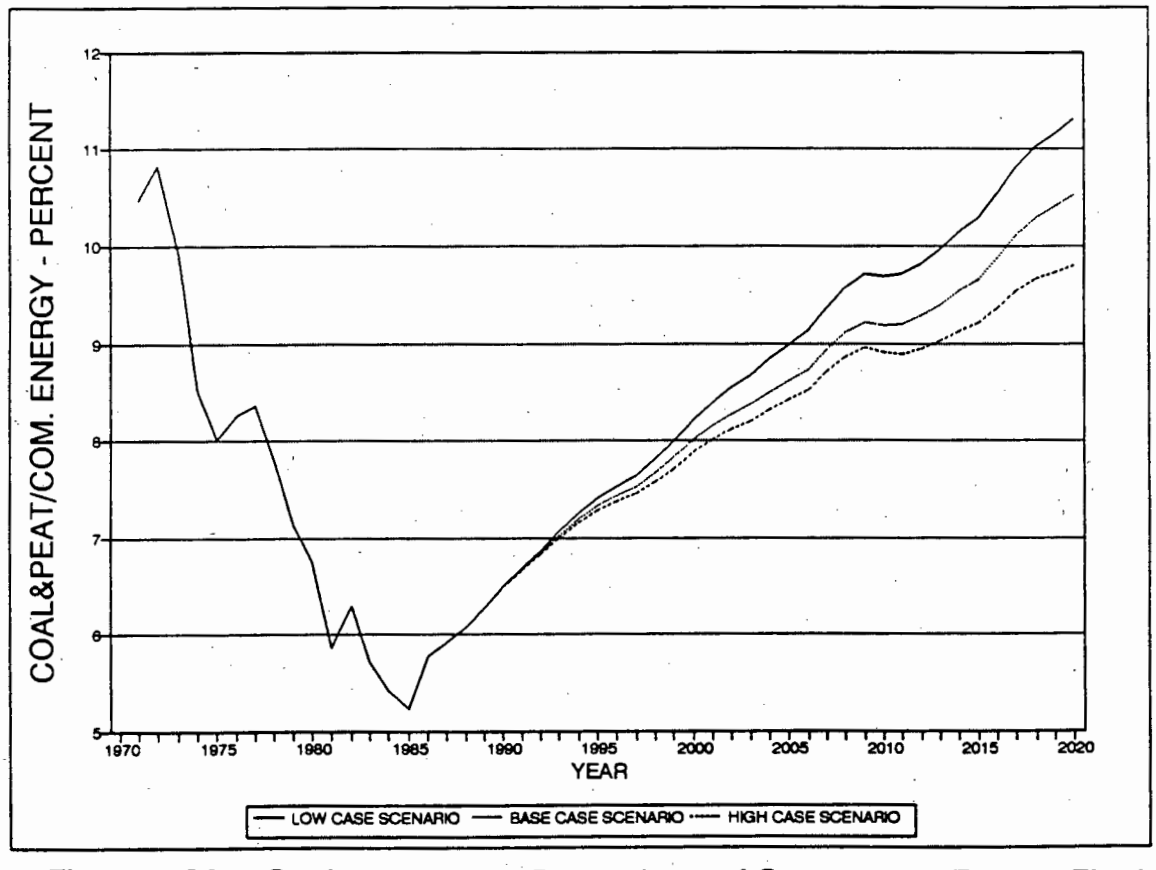


Figure 4.26 Coal and Peat as Percentage of Commercial Energy Final Consumption

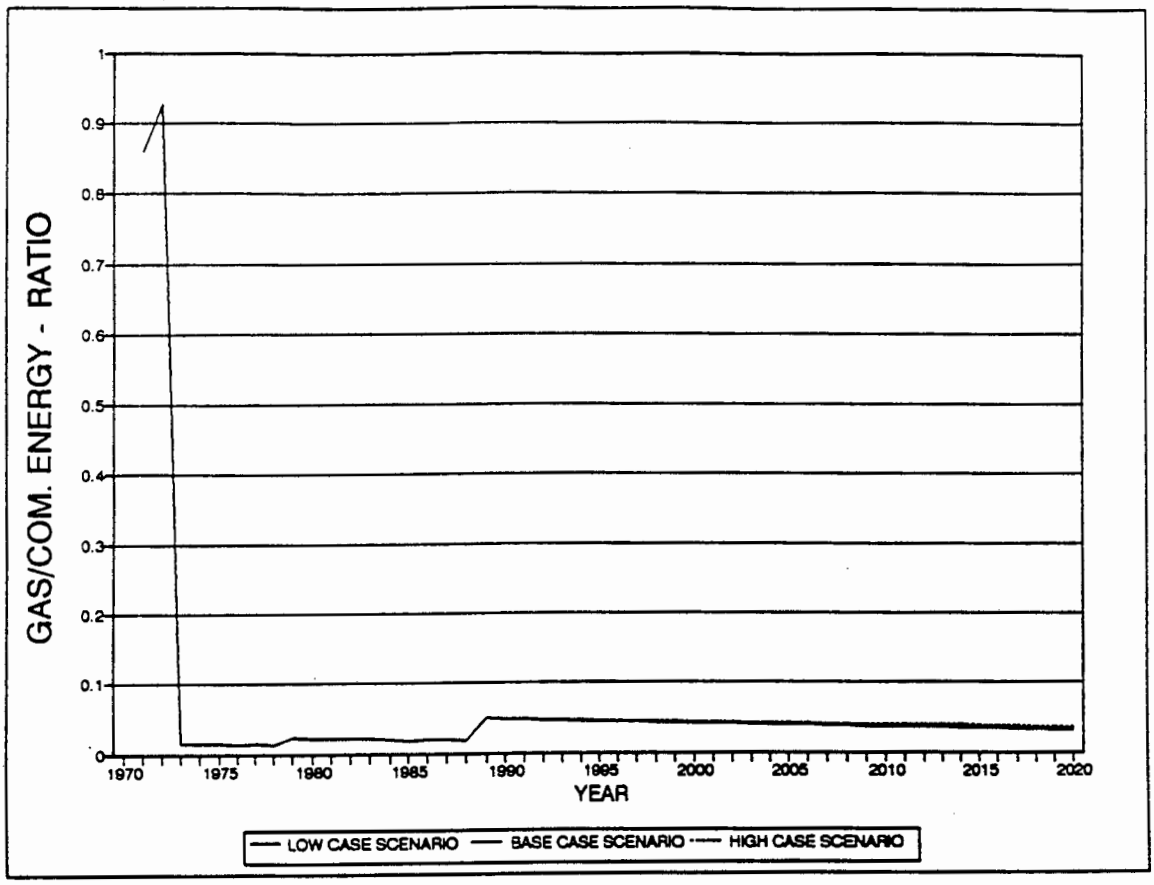


Figure 4.27 Gas as Percentage of Commercial Energy Final Consumption

TABLES

TABLE 3.6 Economic indicators

MILLIONS OF NATIONAL CURRENCY UNLESS INDICATED

YEAR	POPULATION		GROSS DOMESTIC PRODUCT AT MARKET COST							GDP AT MARKET	GDP DEFLATOR	GDP AT 1985 PRICES	GDP/CAPITA CURRENT	GDP/CAPITA REAL	EXCHANGE RATE	GDP IN US$(MILL) CURRENT PRICE	GDP IN US$(MILL) AT 1985 PRICE	GDP PER CAPITA US$/CAPI	GDP PER CAPITA US$(1985)/CAPITA
	MILLIONS	POPULATION GROWTH RATE %	AGRICULTURE	INDUSTRY TOTAL INDUSTRY	MINING QUARRY	MANUFACTURE	ELEC,WTR,GAS	CONSTRUCT	OTHER SERVICES + TAXES	COST		MARKET	CURRENT	1985	ZAIRE PER US$	MARKET PRICE	MARKET PRICE		
1965	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1966	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1967	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1968	18.608	NA	300	400	NA	NA	NA	NA	700	1400	0.8	180275	75	9688	0.5	2800	3615	150	194
1969	19.243	NA	500	1000	NA	NA	NA	NA	1100	2600	0.9	276900	135	14390	0.5	5200	5552	270	289
1970	19.769	2.7	400	1000	NA	NA	NA	NA	1100	2500	0.7	355000	126	17957	0.5	5000	7119	253	360
1971	20.320	2.8	400	1100	NA	NA	NA	NA	1400	2900	0.9	308850	143	15199	0.5	5800	6193	285	305
1972	20.891	2.8	500	1100	NA	NA	NA	NA	1600	3200	0.9	340800	153	16313	0.5	6400	6834	306	327
1973	21.482	2.8	600	1600	NA	NA	NA	NA	1800	4000	1.2	340800	186	15864	0.5	8000	6834	372	318
1974	22.093	2.8	800	2000	NA	NA	NA	NA	2100	4900	1.4	347900	222	15747	0.5	9800	6976	444	316
1975	22.726	2.9	900	1800	NA	NA	NA	NA	2600	5300	1.4	376300	233	16558	0.5	10600	7546	466	332
1976	23.392	2.9	1900	2300	NA	NA	NA	NA	3600	7800	2.3	332280	333	14205	0.79	9873	6663	422	285
1977	24.068	2.9	2700	2700	NA	NA	NA	NA	5400	10800	3.3	328629	449	13654	0.86	12558	6590	522	274
1978	24.760	2.9	3800	3200	NA	NA	NA	NA	6200	13200	4.2	312400	533	12617	0.84	15714	6264	635	253
1979	25.476	2.9	7900	7000	NA	NA	NA	NA	11800	26700	8.5	315950	1048	12402	1.73	15434	6335	606	249
1980	26.225	2.9	11400	13700	NA	7100	NA	NA	16200	41300	12.7	325811	1575	12424	2.8	14750	6533	562	249
1981	27.001	3.0	15100	21200	NA	12200	NA	NA	23500	59800	17.8	335195	2215	12414	4.38	13653	6721	506	249
1982	27.798	3.0	25100	24800	NA	16200	NA	NA	32500	82400	24.6	334309	2964	12026	5.75	14330	6704	516	241
1983	28.625	3.0	47200	43200	NA	25500	NA	NA	54800	145200	42.7	339864	5072	11873	12.89	11265	6815	394	238
1984	29.489	3.0	77400	81700	NA	31200	NA	NA	100700	259800	74.6	348034	8810	11802	36.13	7191	6979	244	237
1985	30.398	3.1	107900	113000	NA	40900	NA	NA	135700	356600	100.0	356600	11731	11731	49.87	7151	7151	235	235
1986	31.346	3.1	165300	135600	NA	50900	NA	NA	194200	495100	133.3	371325	15795	11846	59.63	8303	7446	265	238
1987	32.334	3.2	262200	236800	NA	82500	NA	NA	378400	877400	234.7	373772	27136	11560	112.4	7806	7495	241	232
1988	33.366	3.2	516000	511600	NA	183800	NA	NA	788000	1.82E+06	470.7	385758	54415	11561	187.07	9705	7735	291	232
1989	34.442	3.2	1.09E+06	1.18E+06	NA	379000	NA	NA	1.40E+06	3.66E+06	969.2	378066	1.06E+05	10977	381.45	9607	7581	279	220
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1991	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1992	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

DATA OBTAINED FROM: WORLD BANK TABLES (1989-90, 1991 EDITIONS)

TABLE 3.7 Energy breakdown

YEAR	TOTAL FINAL CONSUMPTION (000s TOE) COMMERCIAL FORMS OF ENERGY COAL	OIL	HYDRO	GAS	ELECT	TOTAL	TRADIT. ENERGY	TOTAL ENERGY	ENERGY FORMS AS % OF TFC COMMERC. ENERGY	TRADITIONAL ENERGY	ENERGY FORMS PER CAPITA (TOE) OIL	ELECTR.	COM. ENERGY	TRAD. ENERGY	TOTAL ENERGY	RATIO COM. ENERGY/ TRAD. ENERGY
1970	95.47	604.26	0	0	239.78	939.5	4882.94	5822.45	16.1	83.9	0.031	0.012	0.048	0.247	0.295	0.19
1971	104.54	680.96	0	0	254.15	1039.6	5019.04	6058.68	17.2	82.8	0.034	0.013	0.051	0.247	0.298	0.21
1972	118.07	731.38	0	0	270.15	1119.6	5160.08	6279.68	17.8	82.2	0.035	0.013	0.054	0.247	0.301	0.22
1973	113.54	700.46	0	0	300.97	1115.0	5306.05	6421.02	17.4	82.6	0.033	0.014	0.052	0.247	0.299	0.21
1974	94.70	757.53	0	0	357.67	1209.9	5456.97	6666.87	18.1	81.9	0.034	0.016	0.055	0.247	0.302	0.22
1975	101.62	798.70	0	0	321.38	1221.7	5613.32	6835.02	17.9	82.1	0.035	0.014	0.054	0.247	0.301	0.22
1976	108.66	767.52	0	0	319.61	1195.8	5777.82	6973.62	17.1	82.9	0.033	0.014	0.051	0.247	0.298	0.21
1977	133.78	687.91	0	0	319.01	1140.7	5944.80	7085.49	16.1	83.9	0.029	0.013	0.047	0.247	0.294	0.19
1978	134.88	654.52	0	0	318.42	1107.8	6115.72	7223.54	15.3	84.7	0.026	0.013	0.045	0.247	0.292	0.18
1979	126.82	634.51	0	0	328.40	1089.7	6292.57	7382.31	14.8	85.2	0.025	0.013	0.043	0.247	0.290	0.17
1980	144.04	691.15	0	0	319.86	1155.1	6477.58	7632.63	15.1	84.9	0.026	0.012	0.044	0.247	0.291	0.18
1981	136.86	720.75	0	0	317.35	1175.0	6669.25	7844.21	15.0	85.0	0.027	0.012	0.044	0.247	0.291	0.18
1982	147.62	638.97	0	0	351.80	1138.4	6866.11	8004.49	14.2	85.8	0.023	0.013	0.041	0.247	0.288	0.17
1983	136.88	678.44	0	0	354.45	1169.8	7070.38	8240.14	14.2	85.8	0.024	0.012	0.041	0.247	0.288	0.17
1984	144.13	793.08	0	0	348.50	1285.7	7283.78	8569.49	15.0	85.0	0.027	0.012	0.044	0.247	0.291	0.18
1985	138.75	763.81	0	0	395.21	1297.8	7508.31	8806.08	14.7	85.3	0.025	0.013	0.043	0.247	0.290	0.17
1986	145.28	640.10	0	0	410.56	1195.9	7742.46	8938.41	13.4	86.6	0.020	0.013	0.038	0.247	0.285	0.15
1987	148.74	799.68	0	0	409.12	1357.5	7986.50	9344.04	14.5	85.5	0.025	0.013	0.042	0.247	0.289	0.17
1988	151.05	844.94	0	0	445.11	1441.1	8241.40	9682.49	14.9	85.1	0.025	0.013	0.043	0.247	0.290	0.17
1989	NA	NA	0	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1990	NA	NA	0	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

DATA OBTAINED FROM: ZAIRE: ISSUES AND OPTIONS IN THE ENERGY SECTOR
ESTIMATIONS

TABLE 3.8 Energy data for graphs

YEAR	TFC COMPONENTS AS % OF COM. ENERGY FIN. CONSUMPTION			TFC COMPONENTS AS % OF TOTAL FINAL CONSUMPTION			COMMERCIAL ENERGY FINAL CONSUMPTION GROWTH RATE			TOTAL FINAL CONSUMPTION GROWTH RATE			ENERGY INTENSITY (kgOE/ZAIRE)		
	COAL	OIL	ELECTRICITY	COAL	OIL	ELECTRICITY	%	3 PTS	5 PTS	%	3 PTS	5 PTS	TRAD. ENERGY	COM. ENERGY	TOTAL ENERGY
1970	10.2	64.3	25.5	1.6	10.4	4.1	NA	NA	NA	NA	NA	NA	1.38E-02	2.65E-03	1.64E-02
1971	10.1	65.5	24.4	1.7	11.2	4.2	10.7	NA	NA	4.1	NA	NA	1.63E-02	3.37E-03	1.96E-02
1972	10.5	65.3	24.1	1.9	11.6	4.3	7.7	6.0	NA	3.6	3.3	NA	1.51E-02	3.29E-03	1.84E-02
1973	10.2	62.8	27.0	1.8	10.9	4.7	-0.4	5.3	5.5	2.3	3.2	3.3	1.56E-02	3.27E-03	1.88E-02
1974	7.8	62.6	29.6	1.4	11.4	5.4	8.5	3.0	2.9	3.8	2.9	2.9	1.57E-02	3.48E-03	1.92E-02
1975	8.3	65.4	26.3	1.5	11.7	4.7	1.0	2.5	0.5	2.5	2.8	2.4	1.49E-02	3.25E-03	1.82E-02
1976	9.1	64.2	26.7	1.6	11.0	4.6	-2.1	-1.9	-0.0	2.0	2.1	2.4	1.74E-02	3.60E-03	2.10E-02
1977	11.7	60.3	28.0	1.9	9.7	4.5	-4.6	-3.2	-2.1	1.6	1.9	2.1	1.81E-02	3.47E-03	2.16E-02
1978	12.2	59.1	28.7	1.9	9.1	4.4	-2.9	-3.0	-1.0	1.9	1.9	2.2	1.96E-02	3.55E-03	2.31E-02
1979	11.6	58.2	30.1	1.7	8.6	4.4	-1.6	0.5	-0.3	2.2	2.5	2.4	1.99E-02	3.45E-03	2.34E-02
1980	12.5	59.8	27.7	1.9	9.1	4.2	6.0	2.0	0.0	3.4	2.8	2.5	1.99E-02	3.55E-03	2.34E-02
1981	11.6	61.3	27.0	1.7	9.2	4.0	1.7	1.5	1.1	2.8	2.7	2.7	1.99E-02	3.51E-03	2.34E-02
1982	13.0	56.1	30.9	1.8	8.0	4.4	-3.1	0.5	3.5	2.0	2.6	3.0	2.05E-02	3.41E-03	2.39E-02
1983	11.7	58.0	30.3	1.7	8.2	4.3	2.8	3.2	2.4	2.9	3.0	2.9	2.08E-02	3.44E-03	2.42E-02
1984	11.2	61.7	27.1	1.7	9.3	4.1	9.9	4.5	0.5	4.0	3.2	2.6	2.09E-02	3.69E-03	2.46E-02
1985	10.7	58.9	30.5	1.6	8.7	4.5	0.9	1.0	3.9	2.8	2.8	3.1	2.11E-02	3.64E-03	2.47E-02
1986	12.1	53.5	34.3	1.6	7.2	4.6	-7.8	2.2	4.5	1.5	2.9	3.3	2.09E-02	3.22E-03	2.41E-02
1987	11.0	58.9	30.1	1.6	8.6	4.4	13.5	3.9	NA	4.5	3.2	NA	2.14E-02	3.63E-03	2.50E-02
1988	10.5	58.6	30.9	1.6	8.7	4.6	6.2	NA	NA	3.6	NA	NA	2.14E-02	3.74E-03	2.51E-02
1989	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 3.9 Oil consumption (000's metric tons)

YEAR	LPG	RESIDUAL	PETROL	AVGAS	KEROSENE & JETFUEL	DIESEL	OTHER	TOTAL	DIES/PET	% PETROL	%DIESEL	OIL TFC GWTH RATE 1 PT	OIL TFC GWTH RATE 3 PTS MA	OIL INTENSITY (kgOE/GDP rel.1985)
1970	1.0	44.0	136.0	28.0	126.0	266.0	0.0	601.0	2.0	22.6	44.3	NA	NA	1.70E-03
1971	2.0	55.0	148.0	23.0	158.0	296.0	0.0	682.0	2.0	21.7	43.4	12.7	NA	2.20E-03
1972	2.0	66.0	160.0	18.0	182.0	309.0	0.0	737.0	1.9	21.7	41.9	7.4	5.3	2.15E-03
1973	2.0	77.0	172.0	13.0	132.0	300.0	0.0	696.0	1.7	24.7	43.1	-4.2	3.8	2.06E-03
1974	1.7	82.7	176.7	12.8	185.3	310.8	-0.0	770.0	1.8	22.9	40.4	8.1	3.1	2.18E-03
1975	1.6	85.7	184.6	10.4	196.0	315.8	-0.1	794.0	1.7	23.2	39.8	5.4	3.2	2.12E-03
1976	1.0	72.1	177.9	11.5	192.8	304.1	-0.0	759.4	1.7	23.4	40.0	-3.9	-2.9	2.31E-03
1977	1.3	76.0	144.1	6.7	169.6	288.1	-0.0	685.8	2.0	21.0	42.0	-10.4	-6.4	2.09E-03
1978	1.1	65.3	123.5	5.4	172.0	284.8	0.0	652.1	2.3	18.9	43.7	-4.9	-6.1	2.10E-03
1979	1.8	65.4	119.1	5.9	176.8	259.6	-0.0	628.6	2.2	18.9	41.3	-3.1	0.3	2.01E-03
1980	0.5	65.2	109.6	6.5	192.0	308.3	0.0	682.1	2.8	16.1	45.2	8.9	3.4	2.12E-03
1981	1.1	75.3	111.0	5.9	188.8	329.3	-0.0	711.4	3.0	15.6	46.3	4.3	0.6	2.15E-03
1982	0.1	75.4	100.0	5.4	163.2	315.0	0.7	659.8	3.2	15.2	47.7	-11.3	-0.3	1.91E-03
1983	0.4	71.9	89.4	5.2	173.1	353.0	0.6	693.6	3.9	12.9	50.9	6.2	3.9	2.00E-03
1984	1.0	178.0	192.0	1.0	91.0	345.0	0.0	808.0	1.8	23.8	42.7	16.9	6.5	2.28E-03
1985	1.0	185.0	175.0	1.0	82.0	340.0	0.0	784.0	1.9	22.3	43.4	-3.7	-1.0	2.14E-03
1986	1.0	164.0	176.0	0.0	69.0	254.0	0.0	664.0	1.4	26.5	38.3	-16.2	1.7	1.72E-03
1987	1.0	205.0	182.0	2.0	96.0	335.0	0.0	821.0	1.8	22.2	40.8	24.9	4.8	2.14E-03
1988	1.0	232.0	185.0	3.0	106.0	338.0	0.0	865.0	1.8	21.4	39.1	5.7	NA	2.19E-03
1989	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

DATA OBTAINED FROM: ZAIRE: ISSUES AND OPTIONS IN THE ENERGY SECTOR
ENERGY STATISTICS YEARBOOKS (1988, 1981)

TABLE 3.10 Crude oil and oil production from refineries

	CRUDE OIL (000s METRIC TONS)				OIL PRODUCT PRODUCTION FROM REFINERIES (000s METRIC TONS)							
YEAR	PRODUCTION	(OFFSHORE)	IMPORTS	EXPORTS	LPG	RESIDUAL	PETROL	AVGAS	KEROSENE & JETFUEL	DIESEL	OTHER	TOTAL
1970	0	0	675	0	1.0	263.0	120.0	0	71.0	179.0	0	634.0
1971	0	0	679	0	1.0	285.0	118.0	0	70.0	177.0	0	651.0
1972	0	0	719	0	1.0	307.0	115.0	0	69.0	175.0	0	667.0
1973	0	0	732	0	2.0	328.0	113.0	0	72.0	174.0	0	689.0
1974	0	0	733	0	2.0	261.0	121.0	0	77.0	166.0	0	627.0
1975	13	13	619	NA	2.0	194.0	128.0	0	81.0	159.0	0	564.0
1976	1291	1291	160	970	2.0	156.0	96.0	0	74.0	119.0	0	447.0
1977	1120	1120	169	1125	1.0	117.0	67.0	0	66.0	80.0	0	331.0
1978	989	989	200	1130	1.0	79.0	33.0	0	59.0	40.0	0	212.0
1979	1077	1077	180	790	1.0	189.0	57.0	0	65.0	94.0	0	406.0
1980	967	946	180	853	0.5	191.3	62.4	0	44.6	94.6	0	393.4
1981	1096	1067	160	790	1.1	112.3	47.8	0	40.1	76.9	-0	278.2
1982	1199	1147	123	1080	0.1	39.2	13.8	0	11.3	17.2	0	81.6
1983	1319	1200	113	800	0.2	13.3	6.9	0	4.9	14.3	-0	39.6
1984	1345	1064	180	1105	0.4	52.4	30.3	0	30.6	59.6	0	173.3
1985	1672	880	185	1537	1.0	95.0	35.0	0	82.0	90.0	0	303.0
1986	1621	828	110	1540	1.0	43.0	51.0	0	30.0	19.0	0	144.0
1987	1561	835	117	1385	1.0	85.0	47.0	0	59.0	95.0	0	287.0
1988	1795	835	115	1530	1.0	105.0	48.0	0	59.0	95.0	0	308.0
1989	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

DATA OBTAINED FROM: ZAIRE: ISSUES AND OPTIONS IN THE ENERGY SECTOR
ENERGY STATISTICS YEARBOOKS (1988, 1985, 1983, 1981)
WORLD ENERGY SUPPLIES (1950-1974; 1973-1978)
ESTIMATIONS

TABLE 3.11 Data for graph

YEAR	GDP GROWTH RATE (Real 1985 PRICES) Z/YEAR	3 PTS MA	5 PTS MA	GDP RATIO AGRICULT/INDUS 1 PT	3 PTS MA	PERCENTAGE CONTRIBUTION TO THE GROSS DOMESTIC PRODUCT AGRI	IND	MINING & QUARRY	MANUF	ELEC, WAT & GAS	CONSTR	OTHER	RATIO AGRI/MANUF	Z CHANGE OF GDP DEFLATOR 1 PT	3 PTS MA	ANNUAL CHANGE OF GDP PER CAPITA CURRENT 1 PT	3 PTS MA	REAL 1 PT	3 PTS MA
1965	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1966	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1967	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1968	NA	NA	NA	0.8	NA	21.4	28.6	NA	NA	NA	NA	50.0	NA	NA	NA	NA	NA	NA	NA
1969	53.6	NA	NA	0.5	0.6	19.2	38.5	NA	NA	NA	NA	42.3	NA	20.9	NA	79.6	NA	48.5	NA
1970	28.2	22.9	NA	0.4	0.4	16.0	40.0	NA	NA	NA	NA	44.0	NA	-25.0	9.7	-6.4	28.7	24.8	19.3
1971	-13.0	8.5	15.8	0.4	0.4	13.8	37.9	NA	NA	NA	NA	48.3	NA	33.3	2.8	12.9	4.6	-15.4	5.6
1972	10.3	-0.9	5.5	0.5	0.4	15.6	34.4	NA	NA	NA	NA	50.0	NA	0.0	19.4	7.3	13.9	7.3	-3.6
1973	0.0	4.1	1.5	0.4	0.4	15.0	40.0	NA	NA	NA	NA	45.0	NA	25.0	15.0	21.6	16.0	-2.8	1.3
1974	2.1	3.4	1.8	0.4	0.4	16.3	40.8	NA	NA	NA	NA	42.9	NA	20.0	15.0	19.1	15.3	-0.7	0.6
1975	8.2	-0.5	-0.5	0.5	0.6	17.0	34.0	NA	NA	NA	NA	49.1	NA	0.0	28.9	5.2	22.4	5.2	-3.3
1976	-11.7	-1.5	-1.5	0.8	0.8	24.4	29.5	NA	NA	NA	NA	46.2	NA	66.7	35.6	43.0	27.6	-14.2	-4.3
1977	-1.1	-5.9	-1.7	1.0	1.0	25.0	25.0	NA	NA	NA	NA	50.0	NA	40.0	45.1	34.6	32.1	-3.9	-8.6
1978	-4.9	-1.6	-2.7	1.2	1.1	28.8	24.2	NA	NA	NA	NA	47.0	NA	28.6	56.2	18.8	50.0	-7.6	-4.4
1979	1.1	-0.2	0.2	1.1	1.0	29.6	26.2	NA	NA	NA	NA	44.2	NA	100.0	59.5	96.6	55.2	-1.7	-3.0
1980	3.1	2.4	0.4	0.8	0.9	27.6	33.2	NA	17.2	NA	NA	39.2	1.6	50.0	63.6	50.3	62.5	0.2	-0.5
1981	2.9	1.9	1.7	0.7	0.9	25.3	35.5	NA	20.4	NA	NA	39.3	1.2	40.7	43.0	40.6	41.6	-0.1	-1.0
1982	-0.3	1.4	2.0	1.0	0.9	30.5	30.1	NA	19.7	NA	NA	39.4	1.5	38.2	50.7	33.8	48.5	-3.1	-1.5
1983	1.7	1.3	1.8	1.1	1.0	32.5	29.8	NA	17.6	NA	NA	37.7	1.9	73.3	62.1	71.1	59.5	-1.3	-1.7
1984	2.4	2.2	2.1	0.9	1.0	29.8	31.4	NA	12.0	NA	NA	38.8	2.5	74.7	60.7	73.7	59.3	-0.6	-0.8
1985	2.5	3.0	2.3	1.0	1.0	30.3	31.7	NA	11.5	NA	NA	38.1	2.6	34.0	47.3	33.2	47.2	-0.6	-0.1
1986	4.1	2.4	2.6	1.2	1.1	33.4	27.4	NA	10.3	NA	NA	39.2	3.2	33.3	47.8	34.6	46.5	1.0	-0.7
1987	0.7	2.7	1.7	1.1	1.1	29.9	27.0	NA	9.4	NA	NA	43.1	3.2	76.1	70.0	71.8	69.0	-2.4	-0.5
1988	3.2	0.6	NA	1.0	1.0	28.4	28.2	NA	10.1	NA	NA	43.4	2.8	100.5	94.2	100.5	89.3	0.0	-2.5
1989	-2.0	NA	NA	0.9	NA	29.6	32.1	NA	10.3	NA	NA	38.3	2.9	105.9	NA	95.5	NA	-5.1	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 3.12 Electricity data: installed capacity (MW)

YEAR	PUBLIC			SELFPRODUCERS					
	HYDRO	THERMAL	TOTAL	HYDRO	THERMAL	TOTAL	TOTAL HYDRO	TOTAL THERMAL	TOTAL INSTALLED
1950	237.8	0.0	238	27.0	5.0	32	265	5	270
1951	237.8	0.0	238	29.0	6.0	35	267	6	273
1952	415.8	0.8	417	32.0	20.0	52	448	21	469
1953	415.8	0.8	417	32.0	21.0	53	448	22	470
1954	491.7	0.8	493	33.0	60.0	93	525	61	586
1955	530.0	2.4	532	34.0	49.0	83	564	51	615
1956	530.0	2.4	532	58.0	60.0	118	588	62	650
1957	543.0	2.4	545	66.0	52.0	118	609	54	663
1958	555.6	5.2	561	61.0	68.0	129	617	73	690
1959	572.8	5.2	578	61.0	45.0	106	634	50	684
1960	572.8	5.7	579	61.0	43.0	104	634	49	683
1961	572.8	5.7	579	61.0	43.0	104	634	49	683
1962	572.8	5.7	579	61.0	43.0	104	634	49	683
1963	572.8	5.7	579	61.0	43.0	104	634	49	683
1964	572.8	5.7	579	61.0	43.0	104	634	49	683
1965	608.8	5.7	615	66.0	43.0	109	675	49	724
1966	608.8	5.7	615	66.0	43.0	109	675	49	724
1967	608.8	5.7	615	64.0	48.0	112	673	54	727
1968	608.8	5.7	615	65.0	48.0	113	674	54	728
1969	608.8	9.8	619	66.0	48.0	114	675	58	733
1970	608.8	11.9	621	80.0	48.0	128	689	60	749
1971	608.8	17.6	626	80.0	48.0	128	689	66	754
1972	975.4	19.8	995	80.0	48.0	128	1055	68	1123
1973	975.4	32.6	1008	80.0	48.0	128	1055	81	1136
1974	981.9	32.6	1014	80.0	48.0	128	1062	81	1142
1975	981.9	45.9	1028	80.0	48.0	128	1062	94	1156
1976	981.9	48.2	1030	80.0	48.0	128	1062	96	1158
1977	1331.4	51.1	1383	80.0	48.0	128	1411	99	1511
1978	1506.4	52.4	1559	80.0	48.0	128	1586	100	1687
1979	1681.4	52.4	1734	80.0	48.0	128	1761	100	1862
1980	1681.4	53.7	1735	80.0	50.0	130	1761	104	1865
1981	2206.4	53.7	2260	80.0	50.0	130	2286	104	2390
1982	2405.9	53.7	2460	80.2	50.0	130	2486	104	2590
1983	2405.9	53.7	2460	80.8	55.1	136	2487	109	2595
1984	2405.9	53.7	2460	80.8	55.1	136	2487	109	2595
1985	2405.9	53.7	2460	80.8	55.1	136	2487	109	2595
1986	2405.9	53.7	2460	80.8	55.1	136	2487	109	2595
1987	2405.9	53.7	2460	80.8	55.1	136	2487	109	2595
1988	2416.0	51.0	2467	80.8	55.1	136	2497	106	2603
1989	2416.0	51.0	2467	80.8	55.1	136	2497	106	2603
1990	2428.9	51.0	2480	80.8	55.1	136	2510	106	2616

DATA OBTAINED FROM: WORLD ENERGY SUPPLIES (1950 - 1974, 1973 - 1978)
ENERGY STATISTICS YEARBOOKS (1981, 1983, 1985, 1988)

TABLE 3.13 Electricity production (GWh)

YEAR	TOTAL HYDRO	TOTAL THERMAL	TOTAL	IMP - EXP	FINAL CONSUMP. (000s TOE)	ELEC TFC GROWTH RATE % P.A.	3 PTS MA	5 PTS MA	ELEC INTENSITY (TOE/GDP rel 1985)	RATIO OF ELEC GWTH BY GDP GWTH 1 PT	3 PTS MA	ELEC/CAP (kWh/CAP)
1950	588	32	620	NA	NA	NA	NA	NA	NA	NA	NA	NA
1951	665	39	704	NA	NA	NA	NA	NA	NA	NA	NA	NA
1952	683	46	729	NA	NA	NA	NA	NA	NA	NA	NA	NA
1953	992	81	1073	NA	NA	NA	NA	NA	NA	NA	NA	NA
1954	1164	128	1292	13	106.9	NA	NA	NA	NA	NA	NA	NA
1955	1330	115	1445	17	119.8	12.0	NA	NA	NA	NA	NA	NA
1956	1639	104	1743	-121	132.3	10.4	10.5	NA	NA	NA	NA	NA
1957	2375	114	2489	-689	144.4	9.2	7.2	7.8	NA	NA	NA	NA
1958	2419	100	2519	-685	147.2	1.9	5.5	5.5	NA	NA	NA	NA
1959	2630	30	2660	-725	155.3	5.5	2.7	3.9	NA	NA	NA	NA
1960	2425	31	2456	-522	156.1	0.5	2.9	3.8	NA	NA	NA	NA
1961	2403	41	2444	-463	160.2	2.6	3.8	2.8	NA	NA	NA	NA
1962	2596	46	2642	-498	173.4	8.2	2.7	2.7	NA	NA	NA	NA
1963	2325	45	2370	-293	168.8	-2.7	3.4	4.2	NA	NA	NA	NA
1964	2336	45	2381	-212	176.7	4.7	3.3	5.1	NA	NA	NA	NA
1965	2573	45	2618	-275	190.7	7.9	6.6	3.3	NA	NA	NA	NA
1966	2789	52	2841	-328	204.4	7.2	4.8	4.7	NA	NA	NA	NA
1967	2452	54	2506	-26	203.0	-0.7	3.6	5.3	NA	NA	NA	NA
1968	2607	57	2664	-74	211.8	4.3	3.9	5.6	1.17E-06	NA	NA	132.0
1969	2847	65	2912	-113	228.7	8.0	7.1	5.4	8.26E-07	0.1	NA	137.9
1970	3152	78	3230	-174	249.5	9.1	7.7	6.7	7.03E-07	0.3	-0.0	146.4
1971	3437	103	3540	-291	264.8	6.1	7.1	8.1	8.57E-07	-0.5	0.1	151.2
1972	3348	125	3473	-44	280.6	6.0	7.8	10.2	8.23E-07	0.6	NA	155.8
1973	3764	80	3844	-26	312.6	11.4	11.9	6.4	9.17E-07	NA	NA	168.8
1974	3850	150	4000	489	369.7	18.3	6.6	5.1	1.06E-06	8.8	NA	194.1
1975	3706	94	3800	251	332.8	-10.0	2.7	3.9	8.85E-07	-1.2	2.5	169.9
1976	4008	80	4088	-33	331.9	-0.3	-3.5	1.6	9.99E-07	0.0	-0.3	164.6
1977	4015	85	4100	-51	331.4	-0.2	-0.2	-1.5	1.01E-06	0.2	0.1	159.7
1978	4100	80	4180	-131	331.0	-0.1	0.9	-0.0	1.06E-06	0.0	1.0	155.1
1979	4200	65	4265	-93	341.3	3.1	0.1	-0.1	1.08E-06	2.7	0.6	155.4
1980	4100	60	4160	-96	332.4	-2.6	-0.1	2.1	1.02E-06	-0.8	0.5	147.0
1981	4102	60	4162	-127	329.9	-0.8	2.5	2.3	9.84E-07	-0.3	-14.0	141.7
1982	4413	153	4566	-97	365.6	10.8	3.6	1.3	1.09E-06	-40.9	-13.6	152.6
1983	4420	138	4558	-59	368.2	0.7	3.3	4.5	1.08E-06	0.4	-13.7	149.2
1984	4425	133	4558	-128	362.3	-1.6	4.2	5.4	1.04E-06	-0.7	1.7	142.5
1985	5027	144	5171	-147	410.8	13.4	5.2	3.2	1.15E-06	5.4	1.9	156.8
1986	5259	147	5406	-184	426.9	3.9	5.7	4.8	1.15E-06	0.9	2.0	158.0
1987	5242	149	5391	-187	425.4	-0.3	4.1	NA	1.14E-06	-0.5	1.0	152.6
1988	5618	144	5762	-109	462.5	8.7	NA	NA	1.20E-06	2.7	NA	160.8
1989	6312	150	6462	NA	NA	NA	NA	NA	NA	NA	NA	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

DATA OBTAINED FROM: WORLD ENERGY SUPPLIES (1950 - 1974, 1973 - 1978)
ENERGY STATISTICS YEARBOOKS (1981, 1983, 1985, 1988)

TABLE 4.27 Demographic data: population (million)

YEAR	ANGOLA	BURUNDI	CAMEROON	C.AF.REP	CONGO	GABON	RWANDA	SUDAN	TANZANIA	UGANDA	ZAIRE	ZAMBIA	REGION POPUL.	POPUL. GROWTH RATE (%/Y) 1 PT	3 PTS MA	5 PTS MA
1965	5.24	NA	NA	NA	NA	NA	NA	NA	11.67	NA	NA	NA	NA	NA	NA	NA
1966	5.32	NA	NA	NA	NA	NA	NA	NA	11.96	NA	NA	NA	NA	NA	NA	NA
1967	5.41	3.22	6.09	1.79	1.120	0.499	3.38	13.08	12.26	8.77	18.222	3.82	77.66	NA	NA	NA
1968	5.50	3.25	6.21	1.82	1.149	0.488	3.48	13.19	12.68	9.12	18.608	3.92	79.41	2.25	NA	NA
1969	5.58	3.30	6.35	1.85	1.178	0.493	3.58	13.51	13.09	9.45	19.243	4.04	81.66	2.84	2.6	NA
1970	5.67	3.35	6.51	1.88	1.208	0.504	3.70	13.86	13.51	9.76	19.769	4.16	83.87	2.71	2.7	2.7
1971	5.71	3.42	6.67	1.90	1.238	0.525	3.82	14.24	13.97	10.04	20.320	4.29	86.14	2.70	2.7	2.8
1972	5.80	3.49	6.84	1.93	1.269	0.550	3.94	14.65	14.44	10.31	20.891	4.42	88.54	2.79	2.8	2.8
1973	5.97	3.57	7.03	1.96	1.302	0.578	4.08	15.08	14.93	10.57	21.482	4.56	91.10	2.90	2.9	2.8
1974	6.11	3.64	7.23	1.99	1.338	0.607	4.22	15.54	15.43	10.84	22.093	4.70	93.73	2.88	2.9	2.9
1975	6.26	3.72	7.44	2.03	1.380	0.637	4.36	16.01	15.94	11.11	22.726	4.85	96.46	2.91	2.9	2.9
1976	6.41	3.80	7.67	2.08	1.424	0.668	4.51	16.51	16.47	11.38	23.392	4.99	99.30	2.94	2.9	2.9
1977	6.57	3.87	7.91	2.14	1.471	0.698	4.66	17.02	17.01	11.67	24.068	5.14	102.23	2.95	3.0	3.0
1978	6.73	3.94	8.17	2.20	1.521	0.728	4.82	17.55	17.57	11.98	24.760	5.30	105.25	2.96	3.0	3.1
1979	6.90	4.02	8.43	2.26	1.574	0.761	4.98	18.10	18.15	12.30	25.476	5.47	108.42	3.01	3.2	3.1
1980	7.72	4.11	8.70	2.32	1.630	0.797	5.14	18.68	18.76	12.64	26.225	5.65	112.37	3.65	3.3	3.2
1981	7.94	4.21	8.98	2.38	1.688	0.835	5.31	19.28	19.39	13.00	27.001	5.84	115.86	3.10	3.3	3.2
1982	8.15	4.32	9.26	2.45	1.748	0.875	5.48	19.89	20.06	13.38	27.798	6.05	119.46	3.11	3.1	3.2
1983	8.36	4.44	9.55	2.51	1.809	0.916	5.65	20.53	20.75	13.79	28.625	6.27	123.21	3.13	3.1	3.1
1984	8.55	4.56	9.86	2.58	1.873	0.957	5.84	21.17	21.48	14.22	29.489	6.51	127.08	3.14	3.2	3.1
1985	8.75	4.70	10.17	2.65	1.938	0.997	6.03	21.82	22.24	14.68	30.398	6.75	131.11	3.17	3.2	3.2
1986	8.96	4.84	10.49	2.72	2.004	1.023	6.23	22.48	23.04	15.16	31.346	7.01	135.29	3.18	3.2	3.2
1987	9.18	4.99	10.83	2.79	2.071	1.050	6.43	23.13	23.86	15.68	32.334	7.28	139.62	3.20	3.2	3.2
1988	9.40	5.14	11.18	2.87	2.139	1.077	6.66	23.78	24.73	16.21	33.366	7.56	144.10	3.21	3.2	NA
1989	9.70	5.30	11.55	2.95	2.208	1.105	6.89	24.42	25.63	16.77	34.442	7.84	148.81	3.27	NA	NA
1990	10.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.12	NA	NA	NA	NA

SOURCES: COUNTRY PROFILE SERIES
THE WORLD BANK ATLAS 1990
WORLD BANK TABLES 1991 EDITION

TABLE 4.28 Economic data: GDP at current market prices (million US$)

YEAR	ANGOLA	BURUNDI	CAMEROON	C.AF.REP	CONGO	GABON	RWANDA	SUDAN	TANZANIA	UGANDA	ZAIRE	ZAMBIA	REGION WITHOUT ANGOLA TOTAL GDP	REGION WITHOUT ANGOLA GDP GROWTH RATE (%/Y) 1 PT	REGION WITHOUT ANGOLA GDP GROWTH RATE (%/Y) 3 PTS MA	REGION WITH ANGOLA TOTAL GDP	REGION WITH ANGOLA GDP GROWTH RATE (%/Y)
1965	NA	NA	NA	NA	NA	NA	NA	NA	860	NA	NA	1001	NA	NA	NA	NA	NA
1966	NA	NA	NA	NA	NA	NA	NA	NA	986	NA	NA	1194	NA	NA	NA	NA	NA
1967	NA	178	933	163	237	271	NA	1531	1028	NA	NA	1348	NA	NA	NA	NA	NA
1968	NA	183	1049	179	252	295	172	1666	1102	1480	2800	1496	10675	NA	NA	NA	NA
1969	NA	190	1159	181	265	318	189	1671	1158	1660	5200	1851	13842	29.7	NA	NA	NA
1970	NA	243	1160	179	274	342	220	2003	1284	1900	5000	1799	14403	4.1	14.4	NA	NA
1971	NA	253	1226	190	320	392	223	2174	1374	2160	5800	1673	15786	9.6	8.3	NA	NA
1972	NA	247	1423	220	410	498	246	2377	1564	2260	6400	1900	17547	11.2	13.3	NA	NA
1973	NA	304	1759	256	542	723	290	2563	1866	2167	8000	2449	20921	19.2	18.5	NA	NA
1974	NA	345	2257	299	586	1546	309	3560	2242	2286	9800	2958	26187	25.2	19.0	NA	NA
1975	NA	421	2753	376	767	2158	568	4317	2581	2500	10600	2475	29516	12.7	15.2	NA	NA
1976	NA	448	3077	448	754	3009	666	5280	2915	2650	9873	2642	31763	7.6	12.5	NA	NA
1977	2445	551	3366	503	765	2809	772	6686	3483	3200	12558	2514	37207	17.1	13.0	39652	NA
1978	2750	610	4410	533	879	2390	873	7587	4171	2574	15714	2813	42555	14.4	12.9	45305	14.3
1979	3323	782	5812	709	1199	3030	1036	7567	4416	2205	15434	3368	45558	7.1	10.3	48881	7.9
1980	3617	920	7499	797	1706	4281	1163	7944	5138	1736	14750	3878	49811	9.3	6.5	53428	9.3
1981	3933	969	8416	695	1994	3863	1321	8893	5927	1591	13653	4006	51327	3.0	3.5	55260	3.4
1982	3746	1013	7764	748	2161	3618	1411	7411	6273	1747	14330	3866	50341	-1.9	-1.8	54088	-2.1
1983	4186	1107	7851	659	2097	3372	1507	7378	6328	2192	11265	3318	47074	-6.5	-4.7	51260	-5.2
1984	4684	1006	7991	638	2194	3515	1588	9082	5813	2626	7191	2724	44368	-5.7	-4.3	49052	-4.3
1985	4779	1171	8148	704	2161	3664	1715	6677	6904	3507	7151	2252	44054	-0.7	1.0	48833	-0.4
1986	4348	1234	10776	990	1849	3468	1944	9228	4883	3893	8303	1664	48231	9.5	4.2	52579	7.7
1987	4953	1137	12455	1073	2298	3396	2158	9962	3409	4354	7806	2078	50125	3.9	6.4	55079	4.8
1988	5411	1094	12667	1118	2220	3234	2328	8954	3137	4899	9705	3616	52972	5.7	7.2	58383	6.0
1989	7720	1062	11083	1105	2269	3439	2169	16348	2865	4713	9607	4704	59363	12.1	NA	67083	14.9
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

SOURCES: WORLD TABLES (1989-90 EDITION)
WORLD DEVELOPMENT REPORT 1991
COUNTRY PROFILE SERIES

TABLE 4.29 Economic data: GDP at 1985 market prices (million 1985 US$)

YEAR	ANGOLA	BURUNDI	CAMEROON	C.AF.REP	CONGO	GABON	RWANDA	SUDAN	TANZANIA	UGANDA	ZAIRE	ZAMBIA	REGION WITHOUT ANGOLA TOTAL GDP	REGION WITHOUT ANGOLA GDP GROWTH RATE (%/Y) 1 PT	REGION WITHOUT ANGOLA GDP GROWTH RATE (%/Y) 3 PTS MA	REGION WITH ANGOLA TOTAL GDP	REGION WITH ANGOLA GDP GROWTH RATE (%/Y)
1965	NA	NA	NA	NA	NA	NA	NA	NA	3550	NA	NA	1783	NA	NA	NA	NA	NA
1966	NA	NA	NA	NA	NA	NA	NA	NA	4030	NA	NA	1709	NA	NA	NA	NA	NA
1967	NA	581	2396	497	526	752	NA	4161	4161	NA	NA	1793	NA	NA	NA	NA	NA
1968	NA	477	2559	508	585	1331	771	4296	4375	3239	3615	1838	23596	NA	NA	NA	NA
1969	NA	396	2661	529	626	1435	869	4142	4399	3549	5552	1755	25914	9.8	NA	NA	NA
1970	NA	502	2738	546	666	1659	920	4455	4733	3644	7119	1900	28880	11.4	7.2	NA	NA
1971	NA	724	2837	550	717	1781	930	4715	4917	3695	6193	1912	28971	0.3	5.9	NA	NA
1972	NA	675	2911	564	781	2217	935	4582	5291	3745	6834	2114	30649	5.8	2.3	NA	NA
1973	NA	729	3062	576	846	2111	967	4275	5592	3801	6834	2102	30895	0.8	4.5	NA	NA
1974	NA	722	3397	611	930	2944	974	4679	5700	3822	6976	2247	33002	6.8	4.4	NA	NA
1975	NA	728	3368	611	1025	3509	1000	5274	5975	3620	7546	2190	34845	5.6	6.0	NA	NA
1976	NA	786	3511	640	1048	4760	1070	6189	6162	3699	6663	2304	36832	5.7	4.1	NA	NA
1977	3945	876	3809	664	936	4163	1123	7159	6160	3562	6590	2202	37245	1.1	2.1	41189	NA
1978	4031	868	4373	680	992	3159	1227	7074	6283	3876	6264	2223	37018	-0.6	-0.5	41049	-0.3
1979	4546	882	4955	663	1111	3177	1348	6350	6432	2888	6335	2156	36297	-1.9	0.9	40843	-0.5
1980	4515	891	5728	632	1319	3254	1486	6392	6618	3111	6533	2209	38173	5.2	2.5	42688	4.5
1981	4675	1011	6466	618	1505	3125	1617	6530	6554	3271	6721	2354	39772	4.2	4.5	44447	4.1
1982	4253	980	6643	664	1897	3209	1644	7331	6536	3497	6704	2284	41388	4.1	3.9	45642	2.7
1983	4656	1048	7155	620	2044	3238	1747	7499	6500	3860	6815	2233	42760	3.3	2.9	47416	3.9
1984	5040	1049	7574	678	2187	3447	1666	7119	6798	3570	6979	2212	43279	1.2	2.1	48319	1.9
1985	4779	1171	8148	704	2161	3664	1715	6677	6904	3507	7151	2252	44054	1.8	2.8	48833	1.1
1986	4093	1215	8807	711	2013	4082	1805	7321	7271	3465	7446	2257	46392	5.3	1.9	50484	3.4
1987	NA	1265	8231	687	2028	3330	1798	7407	7572	3664	7495	2324	45801	-1.3	1.6	NA	NA
1988	NA	1311	7594	698	2039	3333	1800	7267	7970	3886	7735	2453	46087	0.6	0.4	NA	NA
1989	NA	1397	7336	714	2045	3466	1676	7805	8308	4133	7581	2456	46914	1.8	NA	NA	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

DATA OBTAINED BY DIVIDING THE GDP IN LOCAL CURRENCY BY THE CORRESPONDING DEFLATOR AND EXCHANGE RATE IN 1985.

TABLE 4.30 Economic data: GDP per capita at current market prices (US$/capita)

YEAR	ANGOLA	BURUNDI	CAMEROON	C.AF.REP	CONGO	GABON	RWANDA	SUDAN	TANZANIA	UGANDA	ZAIRE	ZAMBIA	REGION WITHOUT ANGOLA GDP PER CAPITA	REGION WITHOUT ANGOLA GROWTH RATE (%/Y) 1 PT	REGION WITHOUT ANGOLA GROWTH RATE (%/Y) 3 PTS MA	REGION WITH ANGOLA GDP PER CAPITA	REGION WITH ANGOLA GDP GROWTH RATE (%/Y)
1965	NA	NA	NA	NA	NA	NA	NA	NA	74	NA	NA	NA	NA	NA	NA	NA	NA
1966	NA	NA	NA	NA	NA	NA	NA	NA	82	NA	NA	NA	NA	NA	NA	NA	NA
1967	NA	55	153	91	211	542	NA	117	84	NA	NA	353	NA	NA	NA	NA	NA
1968	NA	56	169	98	219	605	50	126	87	162	150	381	144	NA	NA	NA	NA
1969	NA	58	182	98	225	646	53	124	88	176	270	458	182	26.0	NA	NA	NA
1970	NA	72	178	95	227	679	60	145	95	195	253	432	184	1.2	11.3	NA	NA
1971	NA	74	184	100	259	746	58	153	98	215	285	390	196	6.6	5.3	NA	NA
1972	NA	71	208	114	323	906	62	162	108	219	306	430	212	8.0	10.2	NA	NA
1973	NA	85	250	131	417	1252	71	170	125	205	372	537	246	15.9	15.2	NA	NA
1974	NA	95	312	150	438	2546	73	229	145	211	444	629	299	21.6	15.7	NA	NA
1975	NA	113	370	185	556	3387	130	270	162	225	466	511	327	9.5	11.9	NA	NA
1976	NA	118	401	215	530	4505	148	320	177	233	422	529	342	4.5	9.2	NA	NA
1977	372	142	426	235	520	4025	166	393	205	274	522	489	389	13.7	9.8	388	NA
1978	409	155	540	243	578	3282	181	432	237	215	635	531	432	11.0	9.6	430	11.0
1979	482	194	689	314	762	3982	208	418	243	179	606	616	449	3.9	7.0	451	4.7
1980	469	224	862	344	1046	5371	226	425	274	137	562	687	476	6.1	3.3	475	5.5
1981	495	230	937	292	1181	4626	249	461	306	122	506	686	476	-0.1	0.4	477	0.3
1982	460	235	838	306	1236	4135	258	373	313	131	516	639	452	-4.9	-4.8	453	-5.1
1983	501	250	822	262	1159	3681	267	359	305	159	394	529	410	-9.4	-7.7	416	-8.1
1984	548	221	811	247	1171	3673	272	429	271	185	244	419	374	-8.7	-7.3	386	-7.2
1985	546	249	802	266	1115	3675	285	306	310	239	235	334	360	-3.8	-2.2	372	-3.5
1986	485	255	1027	364	923	3390	312	411	212	257	265	237	382	6.0	1.0	389	4.3
1987	540	228	1150	384	1110	3234	335	431	143	278	241	285	384	0.7	3.0	394	1.5
1988	576	213	1133	390	1038	3003	350	377	127	302	291	479	393	2.3	3.8	405	2.7
1989	796	200	959	374	1028	3112	315	669	112	281	279	600	427	8.5	NA	451	11.3
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA

TABLE 4.31 Economic data: GDP per capita at real market prices (1985 US$/capita)

YEAR	ANGOLA	BURUNDI	CAMEROON	C.AF.REP	CONGO	GABON	RWANDA	SUDAN	TANZANIA	UGANDA	ZAIRE	ZAMBIA	REGION WITHOUT ANGOLA GDP PER CAPITA	REGION WITHOUT ANGOLA GROWTH RATE (%/Y) 1 PT	REGION WITHOUT ANGOLA GROWTH RATE (%/Y) 3 PTS MA	REGION WITH ANGOLA GDP PER CAPITA	REGION WITH ANGOLA GDP GROWTH RATE (%/Y)
1965	NA	NA	NA	NA	NA	NA	NA	NA	304	NA	NA	NA	NA	NA	NA	NA	NA
1966	NA	NA	NA	NA	NA	NA	NA	NA	337	NA	NA	NA	NA	NA	NA	NA	NA
1967	NA	181	394	277	470	1507	NA	318	339	NA	NA	353	NA	NA	NA	NA	NA
1968	NA	147	412	279	509	2728	222	326	345	355	194	381	319	NA	NA	NA	NA
1969	NA	120	419	286	532	2912	243	307	336	376	289	458	341	13.8	NA	NA	NA
1970	NA	150	421	290	551	3293	249	321	350	373	360	432	369	18.5	8.8	NA	NA
1971	NA	212	425	289	579	3392	244	331	352	368	305	390	360	-5.9	6.4	NA	NA
1972	NA	193	426	293	616	4031	237	313	366	363	327	430	370	6.6	-1.4	NA	NA
1973	NA	204	436	294	650	3653	237	283	375	360	318	537	363	-4.9	3.5	NA	NA
1974	NA	198	470	307	695	4850	231	301	369	353	316	629	377	8.9	3.4	NA	NA
1975	NA	196	453	300	743	5509	229	329	375	326	332	511	386	6.2	7.2	NA	NA
1976	NA	207	458	308	736	7125	237	375	374	325	285	529	397	6.6	2.7	NA	NA
1977	600	226	482	311	636	5964	241	421	362	305	274	489	389	-4.6	-2.3	403	NA
1978	599	220	535	310	652	4339	255	403	358	324	253	531	376	-8.8	-8.4	390	-3.2
1979	659	219	588	294	706	4175	271	351	354	235	249	616	358	-11.7	-5.3	377	-3.4
1980	585	217	658	272	809	4083	289	342	353	246	249	687	365	4.7	-1.5	380	0.8
1981	589	240	720	259	891	3743	305	339	338	252	249	686	369	2.4	3.1	384	1.0
1982	522	227	717	271	1085	3667	300	368	326	261	241	639	372	2.1	1.6	382	-0.4
1983	557	236	749	247	1130	3535	309	365	313	280	238	529	372	0.3	-0.7	385	0.7
1984	589	230	769	263	1167	3602	285	336	316	251	237	419	365	-4.6	-2.5	380	-1.2
1985	546	249	802	266	1115	3675	285	306	310	239	235	334	360	-3.3	-1.1	372	-2.0
1986	457	251	839	262	1005	3990	290	326	316	228	238	237	367	4.6	-3.0	373	0.2
1987	NA	254	760	246	979	3172	279	320	317	234	232	285	351	-10.4	-3.8	NA	NA
1988	NA	255	679	243	953	3095	270	306	322	240	232	479	342	-5.8	-6.4	NA	NA
1989	NA	264	635	242	926	3136	243	320	324	246	220	600	337	-3.2	NA	NA	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA

TABLE 4.32 Coal and peat final consumption (000's TOE)

YEAR	ANGOLA	BURUNDI	CAMEROON	C.AF.REP	CONGO	GABON	RWANDA	SUDAN	TANZANIA	UGANDA	ZAIRE	ZAMBIA	REGION TOTAL	GROWTH RATE (%/Y) 1 PT	GROWTH RATE (%/Y) 3 PTS MA	COAL&PEAT AS PERCENTAGE OF COM.ENERGY	COAL&PEAT AS PERCENTAGE OF TOT.ENERGY
1965	14.3	NA	NA	NA	NA	NA	0	NA	1.2	0	NA	710.2	NA	NA	NA	NA	NA
1966	22.5	NA	NA	NA	NA	NA	0	NA	2.5	0	NA	636.5	NA	NA	NA	NA	NA
1967	14.3	NA	NA	NA	NA	NA	0	NA	1.2	0	NA	847.7	NA	NA	NA	NA	NA
1968	25.9	NA	NA	NA	NA	NA	0	NA	2.5	0	NA	785.7	NA	NA	NA	NA	NA
1969	23.9	NA	NA	NA	NA	NA	0	NA	1.8	0	NA	672.8	NA	NA	NA	NA	NA
1970	12.3	0.0	NA	0	NA	NA	0	NA	2.5	0	95.5	574.5	NA	NA	NA	NA	NA
1971	0.0	0.0	0	0	0	0.0	0	0.0	1.8	0	104.5	496.1	602.4	NA	NA	10.5	1.8
1972	0.0	0.0	0	0	0	0.0	0	0.0	1.8	0	118.1	559.0	678.9	12.7	NA	10.8	2.0
1973	0.0	0.0	0	0	0	0.0	0	0.0	1.2	0	113.5	520.5	635.2	-6.4	-2.4	9.9	1.8
1974	0.0	0.0	0	0	0	0.0	0	0.0	1.2	0	94.7	454.7	550.6	-13.3	-8.4	8.5	1.5
1975	0.0	0.0	0	0	0	0.0	0	0.0	1.3	0	101.6	417.0	519.9	-5.6	-5.1	8.0	1.4
1976	0.0	0.0	0	0	0	0.0	0	0.0	0.6	0	108.7	430.1	539.4	3.7	-0.9	8.3	1.4
1977	0.0	0.0	0	0	0	0.0	0	0.0	0.6	0	133.8	400.1	534.5	-0.9	0.4	8.4	1.4
1978	0.0	0.4	0	0	0	0.0	0	0.0	1.3	0	134.9	389.0	525.6	-1.7	-4.5	7.8	1.3
1979	0.0	0.8	0	0	0	0.0	0	0.0	1.3	0	126.8	339.4	468.3	-10.9	-3.2	7.1	1.2
1980	0.0	1.0	0	0	0	0.0	0	0.7	1.3	0	144.0	335.2	482.2	3.0	-7.2	6.7	1.2
1981	0.0	1.6	0	0	0	0.0	0	0.7	1.3	0	136.9	276.2	416.7	-13.6	-0.9	5.9	1.0
1982	0.0	1.7	0	0	0	0.0	0	0.7	1.3	0	147.6	297.8	449.2	7.8	-4.0	6.3	1.0
1983	0.0	2.2	0	0	0	0.0	0	0.0	5.0	0	136.9	277.4	421.5	-6.2	-0.6	5.7	0.9
1984	0.0	2.2	0	0	0	0.0	0	0.0	6.8	0	144.1	253.5	406.6	-3.5	-2.6	5.4	0.9
1985	0.0	2.4	0	0	0	0.0	0	0.0	10.5	0	138.8	262.6	414.2	1.9	2.1	5.2	0.9
1986	0.0	3.5	0	0	0	0.0	0	0.0	17.2	0	145.3	281.5	447.5	8.0	6.1	5.8	1.0
1987	0.0	3.4	0	0	0	0.0	0	0.0	23.8	0	148.7	309.3	485.3	8.4	8.0	5.9	1.0
1988	0.0	3.4	0	0	0	0.0	0	0.0	35.9	0	151.0	331.6	522.0	7.6	NA	6.1	1.0
1989	NA	3.6	NA	0	NA	NA	0	NA	NA	0	NA	NA	NA	NA	NA	NA	NA
1990	NA	NA	NA	0	NA	NA	0	NA	NA	0	NA	NA	NA	NA	NA	NA	NA

TABLE 4.33 Gas final consumption (000's TOE)

YEAR	ANGOLA	BURUNDI	CAMEROON	C.AF.REP	CONGO	GABON	RWANDA	SUDAN	TANZANIA	UGANDA	ZAIRE	ZAMBIA	REGION TOTAL	GROWTH RATE (%/Y) 1 PT	3 PTS MA	GAS AS PERCENTAGE OF COM.ENERGY	TOT.ENERGY
1965	NA	NA	NA	NA	NA	NA	NA	NA	0	0	NA	0.0	NA	NA	NA	NA	NA
1966	NA	NA	NA	NA	NA	NA	NA	NA	0	0	NA	0.0	NA	NA	NA	NA	NA
1967	NA	NA	NA	NA	NA	NA	NA	NA	0	0	NA	0.0	NA	NA	NA	NA	NA
1968	NA	NA	NA	NA	NA	NA	NA	NA	0	0	NA	0.0	NA	NA	NA	NA	NA
1969	NA	NA	NA	NA	NA	NA	NA	NA	0	0	NA	0.0	NA	NA	NA	NA	NA
1970	NA	0	NA	0	NA	NA	0.9	NA	0	0	0	0.0	NA	NA	NA	NA	NA
1971	0.0	0	0	0	48.5	0.0	0.9	0	0	0	0	0.0	49.4	NA	NA	0.858	0.147
1972	0.0	0	0	0	57.2	0.0	0.9	0	0	0	0	0.0	58.1	17.6	NA	0.926	0.167
1973	0.0	0	0	0	0.0	0.0	0.9	0	0	0	0	0.0	0.9	-98.5	-27.0	0.014	0.002
1974	0.0	0	0	0	0.0	0.0	0.9	0	0	0	0	0.0	0.9	0.0	-32.8	0.014	0.002
1975	0.0	0	0	0	0.0	0.0	0.9	0	0	0	0	0.0	0.9	0.0	0.0	0.014	0.002
1976	0.0	0	0	0	0.0	0.0	0.9	0	0	0	0	0.0	0.9	0.0	0.0	0.013	0.002
1977	0.0	0	0	0	0.0	0.0	0.9	0	0	0	0	0.0	0.9	0.0	0.0	0.014	0.002
1978	0.0	0	0	0	0.0	0.0	0.9	0	0	0	0	0.0	0.9	0.0	21.6	0.013	0.002
1979	0.0	0	0	0	0.0	0.5	1.0	0	0	0	0	0.0	1.5	64.8	22.7	0.022	0.004
1980	0.0	0	0	0	0.0	0.5	1.0	0	0	0	0	0.0	1.5	3.4	21.6	0.021	0.004
1981	0.0	0	0	0	0.0	0.5	1.0	0	0	0	0	0.0	1.5	-3.3	1.2	0.020	0.003
1982	0.0	0	0	0	0.0	0.5	1.0	0	0	0	0	0.0	1.5	3.4	0.0	0.021	0.003
1983	0.0	0	0	0	0.0	0.5	1.0	0	0	0	0	0.0	1.5	0.0	0.0	0.020	0.003
1984	0.0	0	0	0	0.0	0.5	1.0	0	0	0	0	0.0	1.5	-3.3	-1.1	0.019	0.003
1985	0.0	0	0	0	0.0	0.5	1.0	0	0	0	0	0.0	1.5	0.0	-1.1	0.018	0.003
1986	0.0	0	0	0	0.0	0.5	1.0	0	0	0	0	0.0	1.5	0.0	2.3	0.019	0.003
1987	0.0	0	0	0	0.0	0.6	1.0	0	0	0	0	0.0	1.6	6.9	2.3	0.019	0.003
1988	0.0	0	0	0	0.0	0.6	1.0	0	0	0	0	0.0	1.6	0.0	NA	0.018	0.003
1989	NA	0	NA	0	NA	NA	1.4	NA	0	0	0	NA	NA	NA	NA	NA	NA
1990	NA	0	NA	0	NA	NA	0.9	NA	0	0	0	NA	NA	NA	NA	NA	NA

TABLE 4.34 Oil final consumption (000's TOE)

YEAR	ANGOLA	BURUNDI	CAMEROON	C.AF.REP	CONGO	GABON	RWANDA	SUDAN	TANZANIA	UGANDA	ZAIRE	ZAMBIA	REGION TOTAL	GROWTH RATE (%/Y) 1 PT	3 PTS MA	OIL AS PERCENTAGE OF COM.ENERGY	TOT.ENERGY
1965	481.0	NA	NA	NA	NA	NA	NA	NA	366.0	199.3	NA	206.0	NA	NA	NA	NA	NA
1966	623.0	NA	NA	NA	NA	NA	NA	NA	396.0	234.1	NA	195.0	NA	NA	NA	NA	NA
1967	483.0	NA	NA	NA	NA	NA	NA	NA	544.0	253.8	NA	341.0	NA	NA	NA	NA	NA
1968	701.0	NA	NA	NA	NA	NA	NA	NA	428.0	307.3	NA	381.0	NA	NA	NA	NA	NA
1969	732.0	NA	NA	NA	NA	NA	NA	NA	602.0	367.9	NA	432.0	NA	NA	NA	NA	NA
1970	787.0	19.7	NA	68.2	NA	NA	19.5	NA	495.0	440.5	604.3	439.0	NA	NA	NA	NA	NA
1971	524.5	19.7	288.9	62.0	162.9	234.8	19.2	745.7	558.4	401.3	681.0	481.0	4179.3	NA	NA	72.6	12.5
1972	787.8	19.7	309.8	55.9	159.2	250.2	22.4	725.3	581.3	390.7	731.4	525.6	4559.2	9.1	NA	72.7	13.1
1973	691.1	19.7	315.5	56.2	169.7	269.3	24.2	790.4	646.1	352.9	700.5	657.2	4692.7	2.9	4.4	73.4	13.2
1974	640.8	28.0	312.9	62.6	183.0	275.2	23.5	670.9	646.4	365.0	757.5	776.0	4741.8	1.0	1.8	73.3	13.0
1975	578.9	20.8	364.4	35.6	190.1	280.5	30.5	722.3	629.0	348.4	798.7	814.4	4813.6	1.5	1.0	74.2	12.9
1976	519.6	26.6	336.0	40.9	229.5	285.4	40.0	794.4	665.5	296.6	767.5	830.5	4832.5	0.4	-0.3	74.0	12.7
1977	380.4	23.9	496.5	46.0	168.5	328.9	41.2	847.5	636.2	300.1	687.9	740.4	4697.5	-2.8	1.6	73.5	12.1
1978	668.2	29.2	531.2	52.4	221.5	332.7	46.3	839.0	726.7	244.8	654.5	696.3	5042.8	7.4	0.6	74.8	12.6
1979	546.9	30.2	572.9	56.5	208.2	334.7	45.6	896.6	676.1	210.7	634.5	694.5	4907.5	-2.7	5.1	74.6	12.3
1980	630.1	39.6	622.9	57.5	235.3	362.1	48.8	947.8	829.6	254.1	691.2	708.1	5427.1	10.6	2.2	75.9	13.0
1981	656.0	39.3	644.6	55.4	240.3	434.4	54.6	1006.7	663.5	157.0	720.8	691.1	5363.6	-1.2	2.6	75.4	12.6
1982	682.3	43.2	692.6	59.5	273.9	431.5	58.9	1016.6	568.5	159.6	639.0	649.7	5275.3	-1.6	0.6	74.0	12.0
1983	712.9	48.6	760.0	63.3	273.4	425.1	68.5	1091.9	532.8	216.4	678.4	641.5	5512.9	4.5	1.8	74.8	12.1
1984	773.4	45.5	794.7	61.2	248.3	441.7	75.6	1039.5	529.7	215.2	793.1	633.8	5651.6	2.5	4.3	75.3	12.1
1985	883.2	51.2	894.8	54.6	244.8	475.3	83.5	1154.4	523.0	228.3	763.8	634.2	5991.1	6.0	1.8	75.6	12.4
1986	898.2	43.3	895.8	50.8	246.0	433.7	94.7	1211.9	517.7	237.3	640.1	535.2	5804.9	-3.1	3.2	74.9	12.6
1987	974.5	53.4	824.6	83.9	226.6	362.1	105.1	1355.5	602.3	238.0	799.7	563.2	6188.8	6.6	2.9	75.5	13.0
1988	1069.4	54.5	766.6	60.8	204.4	340.8	94.2	1446.1	746.6	285.1	844.9	588.5	6501.9	5.1	NA	75.6	12.8
1989	NA	57.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4.35 Electricity final consumption (000's TOE)

YEAR	ANGOLA	BURUNDI	CAMEROON	C.AF.REP	CONGO	GABON	RWANDA	SUDAN	TANZANIA	UGANDA	ZAIRE	ZAMBIA	REGION TOTAL	GROWTH RATE (%/Y) 1 PT	3 PTS MA	ELECTRICITY AS PERCENTAGE OF COM.ENERGY	TOT.ENERGY
1965	23.2	NA	NA	NA	NA	NA	NA	NA	18.4	31.2	NA	251.6	NA	NA	NA	NA	NA
1966	25.7	NA	NA	NA	NA	NA	NA	NA	21.7	35.5	NA	257.3	NA	NA	NA	NA	NA
1967	28.7	NA	NA	NA	NA	NA	NA	NA	24.3	37.4	NA	278.4	NA	NA	NA	NA	NA
1968	33.5	NA	NA	NA	NA	NA	NA	NA	27.0	40.6	NA	288.8	NA	NA	NA	NA	NA
1969	39.7	NA	NA	NA	NA	NA	NA	NA	30.9	41.6	NA	309.2	NA	NA	NA	NA	NA
1970	47.2	1.9	NA	3.7	NA	NA	5.8	NA	34.1	38.9	239.8	339.1	NA	NA	NA	NA	NA
1971	54.4	2.1	100.6	3.7	7.2	8.3	6.3	30.3	37.6	42.1	254.1	375.9	922.5	NA	NA	16.0	2.8
1972	61.5	2.1	96.4	3.7	8.2	9.7	9.0	32.9	40.4	41.2	270.2	403.5	978.7	6.1	NA	15.6	2.8
1973	72.1	2.1	96.5	4.1	7.9	11.6	9.2	40.3	42.9	37.4	301.0	437.0	1062.1	8.5	8.5	16.6	3.0
1974	75.0	2.1	101.7	4.2	8.1	13.2	9.8	48.2	45.6	37.3	357.7	473.7	1176.5	10.8	5.7	18.2	3.2
1975	61.4	2.3	112.9	4.0	8.7	17.6	10.5	51.4	47.9	35.9	321.4	476.4	1150.4	-2.2	3.0	17.7	3.1
1976	39.0	2.6	114.6	3.9	9.4	22.3	10.9	53.9	48.2	32.8	319.6	499.3	1156.4	0.5	-0.6	17.7	3.0
1977	40.9	2.9	115.4	4.3	10.1	26.5	11.1	56.9	50.5	31.6	319.0	485.5	1154.6	-0.2	0.6	18.1	3.0
1978	43.1	3.1	111.7	4.7	10.3	33.9	12.5	61.2	56.7	31.3	318.4	484.1	1171.0	1.4	1.2	17.4	2.9
1979	47.6	3.5	115.4	4.8	11.0	37.6	14.6	61.8	62.4	22.5	328.4	489.1	1198.6	2.4	2.3	18.2	3.0
1980	50.6	4.0	124.0	4.9	13.5	41.7	15.8	67.9	70.0	22.8	319.9	501.2	1236.3	3.1	4.3	17.3	3.0
1981	52.5	4.4	163.2	4.9	14.7	41.5	14.5	78.3	71.7	27.2	317.3	537.0	1327.3	7.4	5.5	18.7	3.1
1982	57.1	4.7	182.7	5.1	18.8	49.3	11.6	83.7	67.9	27.4	351.8	545.6	1405.7	5.9	5.1	19.7	3.2
1983	56.0	5.7	180.1	5.2	24.4	55.0	12.5	85.7	70.1	30.6	354.4	554.2	1433.9	2.0	2.8	19.5	3.2
1984	53.2	6.3	188.2	5.4	24.2	59.0	12.9	89.9	72.2	30.6	348.5	550.8	1441.2	0.5	2.5	19.2	3.1
1985	51.6	7.5	206.5	5.7	31.2	64.0	14.0	93.7	74.4	29.4	395.2	542.0	1515.2	5.1	1.4	19.1	3.1
1986	55.2	7.4	204.0	6.6	27.4	66.8	13.2	85.4	78.0	28.9	410.6	509.6	1493.1	-1.5	1.9	19.3	3.3
1987	59.6	8.6	204.2	6.7	28.6	63.2	14.1	91.6	81.6	31.3	409.1	523.3	1521.9	1.9	1.4	18.6	3.2
1988	62.1	9.1	204.3	6.3	28.9	63.3	13.9	91.2	95.3	35.4	415.9	553.0	1578.7	3.7	NA	18.3	3.1
1989	NA	8.8	NA	6.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1990	NA	NA	NA	7.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4.36 Commercial energy final consumption (000's TOE)

YEAR	ANGOLA	BURUNDI	CAMEROON	C.AF.REP	CONGO	GABON	RWANDA	SUDAN	TANZANIA	UGANDA	ZAIRE	ZAMBIA	REGION TOTAL	GROWTH RATE (%/Y) 1 PT	3 PTS MA	COM.ENERGY AS % OF TOTAL ENERGY
1965	NA	NA	NA	NA	NA	NA	NA	NA	385.6	230.5	NA	1167.8	NA	NA	NA	NA
1966	NA	NA	NA	NA	NA	NA	NA	NA	420.2	269.6	NA	1088.8	NA	NA	NA	NA
1967	NA	NA	NA	NA	NA	NA	NA	NA	569.5	291.2	NA	1467.1	NA	NA	NA	NA
1968	NA	NA	NA	NA	NA	NA	NA	NA	457.5	347.9	NA	1455.5	NA	NA	NA	NA
1969	NA	NA	NA	NA	NA	NA	NA	NA	634.7	409.5	NA	1414.0	NA	NA	NA	NA
1970	NA	21.6	NA	71.9	NA	NA	26.1	NA	531.6	479.4	939.5	1352.5	NA	NA	NA	NA
1971	578.9	21.8	389.5	65.6	218.6	243.1	26.4	776.0	597.8	443.4	1039.6	1353.0	5753.7	9.1	NA	17.2
1972	849.3	21.8	406.2	59.6	224.6	259.9	32.3	758.2	623.5	431.9	1119.6	1488.1	6274.8	1.8	4.0	18.1
1973	763.2	21.8	412.0	60.3	177.6	280.9	34.3	830.7	690.2	390.3	1115.0	1614.7	6390.9	1.2	1.1	18.0
1974	715.8	30.1	414.6	66.8	191.1	288.4	34.1	719.1	693.2	402.4	1209.9	1704.4	6469.8	0.2	0.7	17.7
1975	640.3	23.0	477.3	39.7	198.8	298.1	41.9	773.7	678.2	384.3	1221.7	1707.8	6484.8	0.7	-0.4	17.3
1976	558.6	29.1	450.6	44.8	238.9	307.7	51.7	848.3	714.3	329.4	1195.8	1759.9	6529.1	-2.2	1.3	17.1
1977	421.3	26.9	611.9	50.3	178.6	355.4	53.1	904.4	687.3	331.6	1140.7	1626.0	6387.5	5.5	0.3	16.5
1978	711.3	32.6	642.9	57.1	231.8	366.6	59.7	900.2	784.7	276.1	1107.8	1569.4	6740.2	-2.4	3.9	16.8
1979	594.5	34.5	688.3	61.3	219.2	372.8	61.1	958.4	739.8	233.3	1089.7	1523.0	6575.8	8.7	1.9	16.4
1980	680.6	44.6	746.9	62.4	248.8	404.3	65.6	1016.4	900.9	276.9	1155.1	1544.5	7147.1	-0.5	2.8	17.2
1981	708.5	45.2	807.8	60.3	255.0	476.4	70.0	1085.7	736.5	184.3	1175.0	1504.3	7109.0	0.3	1.0	16.7
1982	739.4	49.6	875.3	64.7	292.7	481.3	71.5	1101.0	637.7	187.1	1138.4	1493.1	7131.7	3.3	1.8	16.2
1983	768.9	56.5	940.1	68.5	297.8	480.6	82.0	1177.6	607.9	247.0	1169.8	1473.1	7369.8	1.8	3.6	16.2
1984	826.6	54.0	982.9	66.6	272.5	501.2	89.4	1129.4	608.7	245.8	1285.7	1438.1	7500.9	5.6	1.7	16.0
1985	934.9	61.0	1101.3	60.3	276.0	539.8	98.5	1248.1	607.9	257.6	1297.8	1438.8	7922.0	-2.2	3.1	16.4
1986	953.4	54.3	1099.8	57.4	273.4	501.0	108.9	1297.3	612.9	266.2	1195.9	1326.3	7746.9	5.8	2.9	16.9
1987	1034.1	65.4	1028.8	90.6	255.2	425.9	120.1	1447.1	707.7	269.3	1357.5	1395.8	8197.5	5.0	NA	17.2
1988	1131.5	67.0	970.9	67.1	233.3	404.7	109.1	1537.3	877.8	320.5	1411.9	1473.1	8604.2	NA	NA	17.0
1989	NA	69.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4.37 Traditional energy final consumption (000's TOE)

YEAR	ANGOLA	BURUNDI	CAMEROON	C.AF.REP	CONGO	GABON	RWANDA	SUDAN	TANZANIA	UGANDA	ZAIRE	ZAMBIA	REGION TOTAL	GROWTH RATE (%/Y) 1 PT	3 PTS MA	TRAD.ENERGY AS % OF TOTAL ENERGY
1965	NA	NA	NA	NA	NA	NA	NA	NA	NA	3489.0	NA	NA	NA	NA	NA	NA
1966	NA	NA	NA	NA	NA	NA	NA	NA	NA	3561.0	NA	NA	NA	NA	NA	NA
1967	NA	NA	NA	NA	NA	NA	883.0	NA	NA	3623.0	NA	1305.1	NA	NA	NA	NA
1968	NA	NA	NA	NA	NA	NA	907.2	NA	NA	3638.0	NA	1342.0	NA	NA	NA	NA
1969	NA	NA	NA	NA	NA	NA	934.9	NA	NA	3703.0	NA	1381.3	NA	NA	NA	NA
1970	NA	777.2	NA	490.4	NA	NA	964.4	NA	NA	3763.0	4882.9	1422.4	NA	NA	NA	NA
1971	1452.0	793.4	1532.0	496.4	301	60.0	996.2	5729	6080.0	3814.0	5019.0	1466.8	27740.0	NA	NA	82.8
1972	1488.0	810.6	1559.0	503.2	290	61.0	1029.4	5902	6250.0	3864.0	5160.1	1512.7	28429.9	2.5	NA	81.9
1973	1519.0	828.0	1588.0	511.0	294	62.0	1064.1	6075	6445.0	3911.0	5306.1	1559.9	29163.1	2.6	2.7	82.0
1974	1547.0	845.4	1620.0	520.2	297	62.0	1100.1	6264	6760.0	3955.0	5457.0	1608.1	30035.8	3.0	2.8	82.3
1975	1559.0	863.0	1657.0	530.9	304	63.0	1137.4	6455	7087.0	3988.0	5613.3	1657.3	30915.0	2.9	2.7	82.7
1976	1609.0	880.4	1688.0	543.1	314	63.0	1176.1	6507	7300.0	4030.0	5777.8	1707.6	31596.1	2.2	2.5	82.9
1977	1647.0	897.6	1728.0	557.5	311	67.0	1215.7	6665	7519.0	4062.0	5944.8	1758.9	32373.5	2.5	2.5	83.5
1978	1687.0	914.8	1765.0	573.2	315	84.0	1256.7	6879	7764.0	4096.0	6115.7	1812.3	33262.6	2.7	1.9	83.2
1979	1048.8	933.6	1839.0	589.3	321	71.0	1298.7	7022	8000.0	4132.0	6292.6	1869.4	33417.4	0.5	2.1	83.6
1980	1173.4	954.4	1894.0	605.5	332	76.0	1341.3	7228	8250.0	4222.0	6477.6	1931.3	34485.5	3.2	2.1	82.8
1981	1206.9	977.4	1951.0	622.0	344	77.0	1384.9	7424	8512.0	4250.7	6669.2	1998.0	35417.0	2.7	3.4	83.3
1982	1238.8	1002.2	2006.0	638.7	360	77.0	1429.5	7612	9289.0	4376.2	6866.1	2069.1	36964.7	4.4	3.4	83.8
1983	1270.7	1029.2	2058.0	655.6	362	77.0	1475.4	7861	9624.0	4509.7	7070.4	2144.7	38137.7	3.2	3.5	83.8
1984	1299.6	1058.4	2106.0	672.9	379	75.0	1523.2	8023	9975.0	4650.9	7283.8	2225.1	39271.8	3.0	3.0	84.0
1985	1330.0	1089.5	2160.0	690.6	385	75.0	1572.8	8200	10324.0	4800.4	7508.3	2309.5	40445.1	3.0	0.1	83.6
1986	1361.9	1122.2	2214.0	709.1	399	675.0	1624.7	4575	10400.0	4958.6	7742.5	2397.8	38179.8	-5.6	0.2	83.1
1987	1396.4	1156.8	2270.0	728.5	414	691.0	1679.3	4686	10746.2	5125.7	7986.5	2518.7	39399.0	3.2	1.5	82.8
1988	1441.4	1192.5	2327.0	748.8	428	638.0	1737.5	4862	12625.2	5301.0	8241.4	2565.2	42108.0	6.9	NA	83.0
1989	NA	1229.4	NA	770.2	NA	NA	1799.1	NA	NA	5484.4	8507.2	NA	NA	NA	NA	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4.38 Total final consumption (000's TOE)

YEAR	ANGOLA	BURUNDI	CAMEROON	C.AF.REP	CONGO	GABON	RWANDA	SUDAN	TANZANIA	UGANDA	ZAIRE	ZAMBIA	REGION TOTAL	GROWTH RATE (%/Y) 1 PT	3 PTS MA
1965	NA	NA	NA	NA	NA	NA	NA	NA	NA	3719.5	NA	NA	NA	NA	NA
1966	NA	NA	NA	NA	NA	NA	NA	NA	NA	3830.6	NA	NA	NA	NA	NA
1967	NA	NA	NA	NA	NA	NA	NA	NA	NA	3914.2	NA	2772.2	NA	NA	NA
1968	NA	NA	NA	NA	NA	NA	NA	NA	NA	3985.9	NA	2797.5	NA	NA	NA
1969	NA	NA	NA	NA	NA	NA	NA	NA	NA	4112.5	NA	2795.3	NA	NA	NA
1970	NA	798.8	NA	562.3	NA	NA	990.5	NA	NA	4242.4	5822.4	2774.9	NA	NA	NA
1971	2030.9	815.2	1921.5	562.1	519.6	303.1	1022.6	6505.0	6677.8	4257.4	6058.7	2819.8	33493.7	NA	NA
1972	2337.3	832.4	1965.2	562.8	514.6	320.9	1061.7	6660.2	6873.5	4295.9	6279.7	3000.8	34704.8	3.6	NA
1973	2282.2	849.8	2000.0	571.3	471.6	342.9	1098.4	6905.7	7135.2	4301.3	6421.0	3174.6	35553.9	2.4	2.9
1974	2262.8	875.5	2034.6	586.9	488.1	350.4	1134.2	6983.1	7453.2	4357.4	6666.9	3312.5	36505.6	2.7	2.5
1975	2199.3	886.1	2134.3	570.5	502.8	361.1	1179.3	7228.7	7765.2	4372.3	6835.0	3365.1	37399.8	2.4	2.4
1976	2167.6	909.6	2138.6	587.9	552.9	370.7	1227.8	7355.3	8014.3	4359.4	6973.6	3467.5	38125.2	1.9	2.0
1977	2068.3	924.5	2339.9	607.8	489.6	422.4	1268.9	7569.4	8206.3	4393.6	7085.5	3384.9	38761.1	1.7	2.3
1978	2398.3	947.4	2407.9	630.2	546.8	450.6	1316.4	7779.2	8548.7	4372.1	7223.5	3381.7	40002.9	3.2	1.6
1979	1643.3	968.0	2527.3	650.6	540.2	443.8	1359.9	7980.4	8739.8	4365.3	7382.3	3392.4	39993.2	-0.0	2.4
1980	1854.1	999.0	2640.9	668.0	580.8	480.3	1406.9	8244.4	9150.9	4498.9	7632.6	3475.8	41632.6	4.1	2.1
1981	1915.3	1022.6	2758.8	682.3	599.0	553.4	1454.9	8509.7	9248.5	4434.9	7844.2	3502.3	42526.0	2.1	3.3
1982	1978.2	1051.9	2881.3	703.3	652.7	558.3	1500.9	8713.0	9926.7	4563.3	8004.5	3562.2	44096.4	3.7	3.0
1983	2039.6	1085.6	2998.1	724.2	659.8	557.6	1557.5	9038.6	10231.9	4756.6	8240.1	3617.8	45507.4	3.2	3.2
1984	2126.2	1112.3	3088.9	739.5	651.5	576.2	1612.6	9152.4	10583.7	4896.7	8569.5	3663.2	46772.7	2.8	3.1
1985	2264.9	1150.5	3261.3	750.9	661.0	614.8	1671.3	9448.1	10931.9	5058.0	8806.1	3748.3	48367.1	3.4	0.4
1986	2315.4	1176.5	3313.8	766.5	672.4	1176.0	1733.6	5872.3	11012.9	5224.9	8938.4	3724.1	45926.7	-5.0	0.7
1987	2430.5	1222.1	3298.8	819.1	669.2	1116.9	1799.4	6133.1	11453.9	5395.0	9344.0	3914.5	47596.5	3.6	1.7
1988	2572.9	1259.5	3297.9	816.0	661.3	1042.7	1846.5	6399.3	13503.0	5621.5	9653.3	4038.3	50712.1	6.5	NA
1989	NA	1299.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4.39 Total electrical installed capacity (MW)

YEAR	ANGOLA	BURUNDI	CAMEROON	C.AF.REP	CONGO	GABON	RWANDA	SUDAN	TANZANIA	UGANDA	ZAIRE	ZAMBIA	REGION TOTAL	GROWTH RATE (%/Y) 1 PT	3 PTS MA
1965	276	6.0	170	8.02	22	18.0	23	76	76	152	724	260	1810.5	NA	NA
1966	281	6.0	168	8.02	22	22.0	23	91	77	165	724	260	1846.5	2.0	NA
1967	287	6.0	179	8.02	28	16.0	23	92	84	167	727	255	1871.5	1.4	3.6
1968	289	7.0	179	8.74	30	22.0	23	97	97	174	728	359	2013.2	7.6	4.5
1969	296	7.0	179	11.42	31	25.0	23	131	107	174	733	386	2103.0	4.5	7.9
1970	312	7.4	179	11.98	32	40.0	23	117	143	162	749	575	2351.0	11.8	12.6
1971	320	7.4	221	14.20	31	34.0	27	112	149	161	754	1027	2858.0	21.6	16.0
1972	346	7.4	225	14.20	32	37.0	35	114	155	161	1123	1030	3279.8	14.8	14.4
1973	465	7.4	225	14.20	32	40.0	36	195	161	162	1136	1031	3504.6	6.9	7.6
1974	499	7.4	225	14.37	32	40.0	35	195	160	163	1142	1031	3544.2	1.1	5.2
1975	523	6.0	346	16.11	32	101.1	35	242	160	163	1156	1031	3811.0	7.5	3.4
1976	523	7.5	346	30.21	34	106.1	36	243	193	163	1158	1031	3870.9	1.6	6.9
1977	523	7.5	346	30.21	34	162.4	37	249	226	163	1511	1031	4319.6	11.6	11.5
1978	523	7.5	346	29.83	34	167.0	37	260	258	163	1687	1728	5240.1	21.3	13.2
1979	600	7.6	339	29.83	107	167.6	38	297	258	163	1862	1728	5596.8	6.8	9.8
1980	600	8.6	339	31.29	118	209.0	39	302	258	163	1865	1728	5660.9	1.1	5.9
1981	600	9.6	339	30.22	118	219.2	39	312	258	163	2390	1728	6206.1	9.6	7.0
1982	600	16.5	531	30.35	149	221.0	58	323	431	163	2590	1728	6840.6	10.2	9.6
1983	600	16.5	570	35.43	149	228.4	58	368	439	163	2595	2235	7457.8	9.0	6.6
1984	600	18.9	570	35.74	149	239.5	58	390	439	163	2595	2235	7493.6	0.5	3.6
1985	600	18.9	603	35.85	149	251.9	60	450	439	162	2595	2236	7601.2	1.4	1.6
1986	600	37.3	605	36.04	149	251.9	60	450	439	162	2595	2436	7821.8	2.9	1.5
1987	605	37.4	605	35.96	149	251.9	60	450	439	162	2595	2436	7826.7	0.1	1.4
1988	617	38.9	605	34.63	149	251.9	60	450	519	162	2603	2436	7926.4	1.3	NA
1989	NA	39.2	NA	34.69	NA	NA	NA	NA	519	NA	2603	NA	NA	NA	NA
1990	NA	NA	NA	42.72	NA	NA	NA	NA	NA	NA	2616	NA	NA	NA	NA

TABLE 4.40 Hydroelectrical installed capacity (MW)

YEAR	ANGOLA	BURUNDI	CAMEROON	C.AF.REP	CONGO	GABON	RWANDA	SUDAN	TANZANIA	UGANDA	ZAIRE	ZAMBIA	REGION TOTAL	GROWTH RATE (%/Y) 1 PT	3 PTS MA	HYDRO AS % OF TOTAL
1965	213	0.0	152	7.00	15	0.0	21	16	41	122	675	50	1311.8	NA	NA	72.5
1966	215	0.0	152	7.00	15	0.0	21	26	41	135	675	50	1336.8	1.9	NA	72.4
1967	215	0.0	152	7.00	15	0.0	21	27	41	135	673	46	1331.8	-0.4	2.5	71.2
1968	214	0.0	152	7.00	15	0.0	22	27	41	150	674	110	1411.8	6.0	2.2	70.1
1969	211	0.0	152	7.00	15	0.0	22	27	49	150	675	117	1424.8	0.9	7.3	67.8
1970	211	0.4	152	7.00	15	0.0	22	30	49	156	689	306	1637.2	14.9	15.3	69.6
1971	212	0.4	193	8.75	15	0.0	26	27	49	155	689	756	2130.9	30.2	21.3	74.6
1972	227	0.4	197	8.75	15	3.0	34	29	49	155	1055	759	2532.5	18.8	18.9	77.2
1973	343	0.4	197	8.75	15	3.0	35	105	49	156	1055	759	2726.5	7.7	9.5	77.8
1974	368	0.4	197	8.75	15	3.0	34	105	69	156	1062	759	2777.0	1.9	4.7	78.4
1975	368	0.0	263	8.75	15	47.7	34	105	90	156	1062	759	2908.3	4.7	2.8	76.3
1976	368	0.5	263	18.65	17	52.3	34	105	123	156	1062	759	2958.3	1.7	6.6	76.4
1977	368	0.5	263	18.65	17	57.0	35	110	155	156	1411	759	3350.5	13.3	15.0	77.6
1978	368	0.5	263	18.65	17	76.2	34	110	188	156	1586	1538	4355.7	30.0	16.8	83.1
1979	400	0.6	263	18.65	89	76.2	35	147	188	156	1761	1538	4672.8	7.3	12.8	83.5
1980	400	1.6	263	18.65	89	121.8	36	147	188	156	1761	1538	4720.4	1.0	6.5	83.4
1981	400	2.6	263	18.65	89	121.8	36	147	188	156	2286	1538	5246.4	11.1	6.9	84.5
1982	400	9.5	458	18.65	120	121.8	55	148	188	156	2486	1538	5699.0	8.6	10.4	83.3
1983	400	9.5	497	18.65	120	131.4	55	178	259	156	2487	2045	6356.2	11.5	6.8	85.2
1984	400	11.9	497	18.65	120	141.0	55	185	259	156	2487	2045	6375.3	0.3	4.4	85.1
1985	400	11.9	528	18.65	120	163.8	56	225	259	155	2487	2045	6469.1	1.5	1.7	85.1
1986	400	30.3	528	18.65	120	163.8	56	225	259	155	2487	2245	6687.5	3.4	1.6	85.5
1987	400	30.4	528	18.65	120	163.8	56	225	259	155	2487	2245	6687.5	0.0	1.6	85.4
1988	412	31.9	528	18.65	120	163.8	56	225	333	155	2497	2245	6785.2	1.5	NA	85.6
1989	NA	32.2	NA	18.65	NA	NA	NA	NA	NA	NA	2497	NA	NA	NA	NA	NA
1990	NA	NA	NA	18.65	NA	NA	NA	NA	NA	NA	2510	NA	NA	NA	NA	NA

TABLE 4.41 Total production of electricity (GWh)

YEAR	ANGOLA	BURUNDI	CAMEROON	C.AF.REP	CONGO	GABON	RWANDA	SUDAN	TANZANIA	UGANDA	ZAIRE	ZAMBIA	REGION TOTAL	GROWTH RATE (%/Y) 1 PT	3 PTS MA
1965	317.0	1	1100	21	42	42.0	36	174	227	606	2618	645	5829.0	NA	NA
1966	351.0	1	1012	25	46	49.0	48	262	267	706	2841	594	6202.0	6.4	NA
1967	391.0	1	1073	28	50	56.0	58	318	298	746	2506	600	6125.0	-1.2	3.6
1968	457.0	1	1016	35	55	74.0	71	334	329	773	2664	654	6463.0	5.5	5.0
1969	542.0	1	1046	42	65	84.0	79	528	375	773	2912	702	7149.0	10.6	8.8
1970	643.7	1	1170	50	76	97.0	81	392	413	777	3230	949	7879.7	10.2	10.0
1971	742.0	1	1170	50	88	114.0	87	259	509	860	3540	1176	8596.0	9.1	15.1
1972	838.8	1	1133	51	99	134.0	123	300	556	843	3473	3275	10826.8	26.0	14.2
1973	984.3	1	1150	56	96	165.0	126	500	601	834	3844	3275	11632.3	7.4	19.7
1974	1023.8	1	1123	57	99	173.0	132	580	626	826	4000	5973	14613.8	25.6	11.5
1975	838.3	1	1316	55	105	253.0	142	690	653	767	3800	6191	14811.3	1.4	10.6
1976	532.1	1	1336	53	117	327.8	146	805	666	712	4088	6755	15538.9	4.9	3.9
1977	558.2	1	1346	58	118	431.2	149	900	694	728	4100	7319	16402.4	5.6	5.0
1978	588.2	1	1303	64	100	491.2	152	950	757	670	4180	7883	17139.4	4.5	5.4
1979	649.4	1	1347	65	116	524.8	160	995	828	494	4265	8772	18217.2	6.3	5.0
1980	690.3	1	1452	67	148	566.5	163	1000	877	667	4160	9192	18983.8	4.2	5.5
1981	716.5	2	1908	67	165	611.8	163	1000	909	550	4162	9852	20106.3	5.9	5.1
1982	778.6	2	2147	70	200	667.2	137	1010	918	607	4566	10058	21160.8	5.2	3.5
1983	763.8	2	1804	71	233	729.0	156	1010	945	650	4558	10071	20992.8	-0.8	1.9
1984	726.4	2	2230	74	235	795.1	163	1032	975	656	4558	9806	21252.5	1.2	1.9
1985	704.8	6	2413	78	293	861.3	167	1040	1005	639	5171	9993	22371.4	5.3	2.7
1986	753.5	23	2415	90	270	867.0	155	1052	1190	651	5406	9827	22699.0	1.5	0.7
1987	826.0	54	2419	92	281	872.0	170	1055	1395	620	5391	8479	21654.1	-4.6	-0.5
1988	842.0	56	2419	87	292	877.0	172	1061	1377	599	5762	8485	22028.6	1.7	NA
1989	NA	NA	NA	93	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1990	NA	NA	NA	100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4.42 Production of hydroelectricity (GWh)

YEAR	ANGOLA	BURUNDI	CAMEROON	C.AF.REP	CONGO	GABON	RWANDA	SUDAN	TANZANIA	UGANDA	ZAIRE	ZAMBIA	REGION TOTAL	GROWTH RATE (%/Y) 1 PT	GROWTH RATE (%/Y) 3 PTS MA	HYDRO AS % OF TOTAL
1965	270.0	0	1069	21	27	0.0	35	30	178	570	2573	276	5049.0	NA	NA	86.6
1966	300.0	0	976	25	28	0.0	47	80	213	697	2789	245	5400.0	7.0	NA	87.1
1967	333.0	0	1030	28	31	0.0	57	100	234	736	2452	245	5246.0	-2.9	3.1	85.6
1968	386.0	0	979	35	34	0.0	70	105	249	762	2607	294	5521.0	5.2	3.6	85.4
1969	444.0	0	1025	41	38	0.0	78	150	275	761	2847	327	5986.0	8.4	9.5	83.7
1970	543.7	0	1145	47	44	0.0	80	100	305	765	3152	688	6869.7	14.8	10.9	87.2
1971	605.0	0	1139	47	55	0.0	85	90	309	848	3437	909	7524.0	9.5	17.5	87.5
1972	680.3	0	1080	48	66	5.0	121	100	321	832	3348	3050	9651.3	28.3	14.7	89.1
1973	814.1	0	1100	51	50	5.0	123	200	296	823	3764	3027	10253.1	6.2	20.9	88.1
1974	858.1	0	1073	53	54	7.0	130	270	294	815	3850	5736	13140.1	28.2	12.3	89.9
1975	705.1	0	1261	52	58	143.3	139	290	431	757	3706	5940	13482.4	2.6	12.3	91.0
1976	460.7	0	1278	50	65	161.8	143	390	500	703	4008	6550	14309.5	6.1	5.1	92.1
1977	529.4	0	1284	55	68	299.4	146	440	520	718	4015	7160	15234.8	6.5	5.8	92.9
1978	568.1	0	1232	61	55	348.0	149	450	572	660	4100	7770	15965.1	4.8	6.0	93.1
1979	636.4	0	1250	62	60	389.5	152	500	633	487	4200	8662	17031.9	6.7	5.5	93.5
1980	675.3	0	1364	64	80	415.8	155	500	670	659	4100	9192	17875.1	5.0	5.8	94.2
1981	688.1	0	1809	64	90	459.5	155	500	646	543	4102	9852	18908.6	5.8	5.3	94.0
1982	748.4	0	2048	67	176	502.9	134	510	650	598	4413	10012	19859.3	5.0	3.3	93.8
1983	674.3	0	1705	67	231	546.5	153	510	670	641	4420	10036	19653.8	-1.0	1.7	93.6
1984	634.7	0	2120	70	233	612.9	160	512	690	647	4425	9771	19875.6	1.1	1.9	93.5
1985	621.0	4	2319	61	291	667.7	164	515	710	635	5027	9956	20970.6	5.5	2.9	93.7
1986	691.1	21	2321	77	268	672.0	151	517	990	647	5259	9797	21411.4	2.1	0.9	94.3
1987	721.0	52	2325	74	278	675.0	166	516	1274	618	5242	8441	20381.9	-4.8	-0.3	94.1
1988	758.0	54	2325	68	289	676.0	168	517	1250	595	5618	8445	20763.5	1.9	NA	94.3
1989	NA	NA	NA	80	NA	NA	NA	NA	NA	NA	6312	NA	NA	NA	NA	NA
1990	NA	NA	NA	73	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4.43 Commercial energy final consumption per capita (kgOE/capita)

YEAR	ANGOLA	BURUNDI	CAMEROON	C.AF.REP	CONGO	GABON	RWANDA	SUDAN	TANZANIA	UGANDA	ZAIRE	ZAMBIA	REGION TOTAL	GROWTH RATE (%/Y) 1 PT	GROWTH RATE (%/Y) 3 PTS MA
1965	NA	NA	NA	NA	NA	NA	NA	NA	33.0	NA	NA	NA	NA	NA	NA
1966	NA	NA	NA	NA	NA	NA	NA	NA	35.1	NA	NA	NA	NA	NA	NA
1967	NA	NA	NA	NA	NA	NA	NA	NA	46.5	33.2	NA	384.5	NA	NA	NA
1968	NA	NA	NA	NA	NA	NA	NA	NA	36.1	38.2	NA	370.9	NA	NA	NA
1969	NA	NA	NA	NA	NA	NA	NA	NA	48.5	43.4	NA	350.1	NA	NA	NA
1970	NA	6.5	NA	38.2	NA	NA	7.1	NA	39.3	49.1	47.5	325.2	NA	NA	NA
1971	101.4	6.4	58.4	34.5	176.6	463.0	6.9	54.5	42.8	44.2	51.2	315.5	66.8	NA	NA
1972	146.4	6.2	59.4	30.9	177.0	472.5	8.2	51.7	43.2	41.9	53.6	336.4	70.9	6.1	NA
1973	127.8	6.1	58.6	30.8	136.4	486.0	8.4	55.1	46.2	36.9	51.9	354.0	70.1	-1.0	1.2
1974	117.2	8.3	57.4	33.5	142.8	475.1	8.1	46.3	44.9	37.1	54.8	362.5	69.0	-1.6	-1.7
1975	102.3	6.2	64.2	19.5	144.1	468.0	9.6	48.3	42.5	34.6	53.8	352.4	67.2	-2.6	-2.1
1976	87.1	7.7	58.8	21.5	167.8	460.6	11.5	51.4	43.4	28.9	51.1	352.5	65.8	-2.2	-3.3
1977	64.1	6.9	77.4	23.5	121.4	509.2	11.4	53.1	40.4	28.4	47.4	316.2	62.5	-5.0	-1.6
1978	105.7	8.3	78.7	26.0	152.4	503.6	12.4	51.3	44.7	23.1	44.7	296.2	64.0	2.5	-2.6
1979	86.2	8.6	81.6	27.1	139.3	489.9	12.3	52.9	40.8	19.0	42.8	278.6	60.7	-5.3	0.7
1980	88.2	10.8	85.8	26.9	152.6	507.3	12.8	54.4	48.0	21.9	44.0	273.5	63.6	4.9	-1.3
1981	89.2	10.7	90.0	25.3	151.1	570.5	13.2	56.3	38.0	14.2	43.5	257.5	61.4	-3.5	-0.5
1982	90.7	11.5	94.5	26.4	167.4	550.1	13.0	55.3	31.8	14.0	41.0	246.8	59.7	-2.7	-2.0
1983	92.0	12.7	98.4	27.3	164.6	524.7	14.5	57.4	29.3	17.9	40.9	234.9	59.8	0.2	-1.3
1984	96.7	11.8	99.7	25.8	145.5	523.7	15.3	53.4	28.3	17.3	43.6	221.0	59.0	-1.3	0.4
1985	106.8	13.0	108.3	22.8	142.4	541.4	16.3	57.2	27.3	17.5	42.7	213.1	60.4	2.4	-1.4
1986	106.4	11.2	104.8	21.1	136.4	489.7	17.5	57.7	26.6	17.6	38.2	189.2	57.3	-5.2	-0.1
1987	112.6	13.1	95.0	32.5	123.2	405.6	18.7	62.6	29.7	17.2	42.0	191.7	58.7	2.5	-0.3
1988	120.4	13.0	86.8	23.4	109.1	375.8	16.4	64.7	35.5	19.8	42.3	195.0	59.7	1.7	NA
1989	NA	13.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4.44 TFC per capita (kgOE/capita)

YEAR	ANGOLA	BURUNDI	CAMEROON	C.AF.REP	CONGO	GABON	RWANDA	SUDAN	TANZANIA	UGANDA	ZAIRE	ZAMBIA	REGION TOTAL	GROWTH RATE (%/Y) 1 PT	GROWTH RATE (%/Y) 3 PTS MA
1965	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1966	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1967	NA	NA	NA	NA	NA	NA	NA	NA	NA	446.2	NA	726.5	NA	NA	NA
1968	NA	NA	NA	NA	NA	NA	NA	NA	NA	437.2	NA	712.9	NA	NA	NA
1969	NA	NA	NA	NA	NA	NA	NA	NA	NA	435.4	NA	692.1	NA	NA	NA
1970	NA	238.5	NA	299.2	NA	NA	268.1	NA	NA	434.7	294.5	667.2	NA	NA	NA
1971	355.7	238.4	288.2	295.5	419.7	577.3	267.9	456.7	478.1	424.2	298.2	657.5	388.9	NA	NA
1972	403.0	238.2	287.3	291.9	405.5	583.5	269.2	454.6	476.0	416.9	300.6	678.4	392.0	0.8	NA
1973	382.3	238.1	284.6	291.8	362.2	593.3	269.4	457.8	478.0	406.9	298.9	696.0	390.3	-0.4	0.1
1974	370.3	240.3	281.6	294.5	364.8	577.3	269.1	449.4	483.1	402.2	301.8	704.5	389.5	-0.2	-0.4
1975	351.3	238.2	286.9	280.5	364.3	566.9	270.6	451.5	487.1	393.7	300.8	694.4	387.7	-0.5	-0.5
1976	338.2	239.7	278.9	282.5	388.3	554.9	272.5	445.6	486.6	383.0	298.1	694.5	384.0	-1.0	-0.9
1977	314.8	238.9	295.8	284.5	332.8	605.2	272.4	444.8	482.4	376.4	294.4	658.2	379.2	-1.2	-0.7
1978	356.4	240.3	294.8	287.0	359.5	619.0	273.4	443.3	486.6	365.1	291.7	638.2	380.1	0.2	-1.3
1979	238.2	240.6	299.8	288.1	343.2	583.2	273.3	440.8	481.6	355.0	289.8	620.6	368.9	-2.9	-0.8
1980	240.2	242.8	303.5	287.9	356.3	602.6	273.8	441.3	487.9	356.0	291.0	615.5	370.5	0.4	-1.1
1981	241.2	242.7	307.3	286.3	354.9	662.8	274.2	441.4	476.9	341.2	290.5	599.5	367.1	-0.9	0.0
1982	242.7	243.5	311.1	287.4	373.4	638.1	274.0	438.0	494.9	341.0	288.0	588.8	369.1	0.6	-0.1
1983	244.0	244.7	313.8	288.3	364.7	608.7	275.5	440.4	493.0	344.9	287.9	576.9	369.4	0.1	0.1
1984	248.7	243.8	313.4	286.8	347.8	602.1	276.3	432.3	492.7	344.3	290.6	563.0	368.1	-0.4	-0.0
1985	258.8	245.0	320.8	283.8	341.1	616.6	277.3	433.0	491.5	344.5	289.7	555.1	368.9	0.2	-2.7
1986	258.4	243.2	315.9	282.1	335.5	1149.6	278.5	261.3	478.1	344.6	285.2	531.2	339.5	-8.0	-2.4
1987	264.8	245.1	304.6	293.5	323.1	1063.7	279.7	265.2	480.0	344.2	289.0	537.7	340.9	0.4	-1.4
1988	273.7	245.0	294.9	284.4	309.2	968.2	277.4	269.1	546.1	346.8	289.3	534.5	351.9	3.2	NA
1989	NA	245.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4.45 Commercial energy intensity (kgOE/US$(real 1985))

YEAR	ANGOLA	BURUNDI	CAMEROON	C.AF.REP	CONGO	GABON	RWANDA	SUDAN	TANZANIA	UGANDA	ZAIRE	ZAMBIA	REGION WITHOUT ANGOLA	REGION WITH ANGOLA
1965	NA	NA	NA	NA	NA	NA	NA	NA	0.109	NA	NA	0.655	NA	NA
1966	NA	NA	NA	NA	NA	NA	NA	NA	0.104	NA	NA	0.637	NA	NA
1967	NA	NA	NA	NA	NA	NA	NA	NA	0.137	NA	NA	0.818	NA	NA
1968	NA	NA	NA	NA	NA	NA	NA	NA	0.105	0.107	NA	0.792	NA	NA
1969	NA	NA	NA	NA	NA	NA	NA	NA	0.144	0.115	NA	0.806	NA	NA
1970	NA	0.043	NA	0.132	NA	NA	0.028	NA	0.112	0.132	0.132	0.712	NA	NA
1971	NA	0.030	0.137	0.119	0.305	0.137	0.028	0.165	0.122	0.120	0.168	0.707	0.179	NA
1972	NA	0.032	0.140	0.106	0.288	0.117	0.035	0.165	0.118	0.115	0.164	0.704	0.177	NA
1973	NA	0.030	0.135	0.105	0.210	0.133	0.035	0.194	0.123	0.103	0.163	0.768	0.182	NA
1974	NA	0.042	0.122	0.109	0.206	0.098	0.035	0.154	0.122	0.105	0.173	0.759	0.174	NA
1975	NA	0.032	0.142	0.065	0.194	0.085	0.042	0.147	0.114	0.106	0.162	0.780	0.168	NA
1976	NA	0.037	0.128	0.070	0.228	0.065	0.048	0.137	0.116	0.089	0.179	0.764	0.162	NA
1977	0.107	0.031	0.161	0.076	0.191	0.085	0.047	0.126	0.112	0.093	0.173	0.738	0.160	0.155
1978	0.176	0.038	0.147	0.084	0.234	0.116	0.049	0.127	0.125	0.071	0.177	0.706	0.163	0.164
1979	0.131	0.039	0.139	0.092	0.197	0.117	0.045	0.151	0.115	0.081	0.172	0.706	0.165	0.161
1980	0.151	0.050	0.130	0.099	0.189	0.124	0.044	0.159	0.136	0.089	0.177	0.699	0.169	0.167
1981	0.152	0.045	0.125	0.098	0.169	0.152	0.043	0.166	0.112	0.056	0.175	0.639	0.161	0.160
1982	0.174	0.051	0.132	0.097	0.154	0.150	0.043	0.150	0.098	0.053	0.170	0.654	0.154	0.156
1983	0.165	0.054	0.131	0.111	0.146	0.148	0.047	0.157	0.094	0.064	0.172	0.660	0.154	0.155
1984	0.164	0.051	0.130	0.098	0.125	0.145	0.054	0.159	0.090	0.069	0.184	0.650	0.154	0.155
1985	0.196	0.052	0.135	0.086	0.128	0.147	0.057	0.187	0.088	0.073	0.181	0.639	0.159	0.162
1986	0.233	0.045	0.125	0.081	0.136	0.123	0.060	0.177	0.084	0.077	0.161	0.588	0.146	0.153
1987	NA	0.052	0.125	0.132	0.126	0.128	0.067	0.195	0.093	0.074	0.181	0.601	0.156	NA
1988	NA	0.051	0.128	0.096	0.114	0.121	0.061	0.212	0.110	0.082	0.183	0.601	0.162	NA
1989	NA	0.050	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4.46 Total energy intensity (kgOE/US$(real 1985))

YEAR	ANGOLA	BURUNDI	CAMEROON	C.AF.REP	CONGO	GABON	RWANDA	SUDAN	TANZANIA	UGANDA	ZAIRE	ZAMBIA	REGION WITHOUT ANGOLA	REGION WITH ANGOLA
1965	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1966	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1967	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.546	NA	NA
1968	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.231	NA	1.522	NA	NA
1969	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.159	NA	1.593	NA	NA
1970	NA	1.591	NA	1.030	NA	NA	1.077	NA	NA	1.164	0.818	1.461	NA	NA
1971	NA	1.125	0.677	1.021	0.724	0.170	1.100	1.380	1.358	1.152	0.978	1.474	1.086	NA
1972	NA	1.232	0.675	0.998	0.659	0.145	1.136	1.454	1.299	1.147	0.919	1.420	1.056	NA
1973	NA	1.166	0.653	0.991	0.557	0.162	1.136	1.615	1.276	1.132	0.940	1.510	1.077	NA
1974	NA	1.212	0.599	0.961	0.525	0.119	1.165	1.493	1.308	1.140	0.956	1.474	1.038	NA
1975	NA	1.217	0.634	0.934	0.491	0.103	1.180	1.371	1.300	1.208	0.906	1.537	1.010	NA
1976	NA	1.157	0.609	0.918	0.527	0.078	1.148	1.188	1.301	1.178	1.047	1.505	0.976	NA
1977	0.524	1.056	0.614	0.915	0.523	0.101	1.130	1.057	1.332	1.234	1.075	1.537	0.985	0.941
1978	0.595	1.092	0.551	0.927	0.551	0.143	1.073	1.100	1.361	1.128	1.153	1.521	1.016	0.975
1979	0.362	1.097	0.510	0.982	0.486	0.140	1.009	1.257	1.359	1.512	1.165	1.573	1.057	0.979
1980	0.411	1.121	0.461	1.058	0.440	0.148	0.947	1.290	1.383	1.446	1.168	1.574	1.042	0.975
1981	0.410	1.012	0.427	1.104	0.398	0.177	0.900	1.303	1.411	1.356	1.167	1.488	1.021	0.957
1982	0.465	1.073	0.434	1.059	0.344	0.174	0.913	1.189	1.519	1.305	1.194	1.560	1.018	0.966
1983	0.438	1.036	0.419	1.169	0.323	0.172	0.891	1.205	1.574	1.232	1.209	1.620	1.017	0.960
1984	0.422	1.060	0.408	1.091	0.298	0.167	0.968	1.286	1.557	1.371	1.228	1.656	1.032	0.968
1985	0.474	0.982	0.400	1.067	0.306	0.168	0.974	1.415	1.584	1.442	1.232	1.664	1.046	0.990
1986	0.566	0.968	0.376	1.079	0.334	0.288	0.961	0.802	1.515	1.508	1.200	1.650	0.940	0.910
1987	NA	0.966	0.401	1.192	0.330	0.335	1.001	0.828	1.513	1.472	1.247	1.684	0.986	NA
1988	NA	0.961	0.434	1.168	0.324	0.313	1.026	0.881	1.694	1.446	1.248	1.647	1.045	NA
1989	NA	0.930	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4.47 Energy intensity and GDP growth rate scenarios

REGION - ANGOLA

YEAR	ENERGY INTENSITY (kgOE/US$) COAL&PEAT	GAS	OIL	ELECTRIC.	COM.ENE	TOT.ENE.	COMMERCIAL ENERGY INTENSITY REL. TO 1985 (%)	1988 (%)	ENERGY INTENSITY GROWTH RATE (PERCENTAGE) COAL&PEAT	GAS	OIL	ELECTRIC.	COM.ENE
1965	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1966	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1967	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1968	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1969	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1970	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1971	0.021	0.002	0.126	0.030	0.179	1.086	112.6	110.2	NA	NA	NA	NA	NA
1972	0.022	0.002	0.123	0.030	0.177	1.056	111.6	109.2	6.5	11.2	-2.5	-0.1	-0.9
1973	0.021	0.000	0.130	0.032	0.182	1.077	114.8	112.3	-7.2	-98.5	5.3	7.1	2.9
1974	0.017	0.000	0.124	0.033	0.174	1.038	109.9	107.5	-18.9	-6.4	-4.1	4.2	-4.3
1975	0.015	0.000	0.122	0.031	0.168	1.010	105.8	103.4	-10.6	-5.3	-2.2	-6.4	-3.8
1976	0.015	0.000	0.117	0.030	0.162	0.976	102.2	100.0	-1.9	-5.4	-3.7	-2.9	-3.4
1977	0.014	0.000	0.116	0.030	0.160	0.985	101.0	98.8	-2.0	-1.1	-1.0	-1.4	-1.2
1978	0.014	0.000	0.118	0.030	0.163	1.016	102.7	100.4	-1.1	0.6	2.0	1.9	1.7
1979	0.013	0.000	0.120	0.032	0.165	1.057	103.9	101.6	-9.1	68.0	1.7	4.1	1.2
1980	0.013	0.000	0.126	0.031	0.169	1.042	106.8	104.5	-2.1	-1.6	4.6	-2.1	2.8
1981	0.010	0.000	0.118	0.032	0.161	1.021	101.5	99.3	-17.1	-7.2	-5.8	3.2	-5.0
1982	0.011	0.000	0.111	0.033	0.154	1.018	97.4	95.3	3.6	-0.6	-6.2	1.7	-4.0
1983	0.010	0.000	0.112	0.032	0.154	1.017	97.3	95.2	-9.2	-3.2	1.2	-1.1	-0.1
1984	0.009	0.000	0.113	0.032	0.154	1.032	97.2	95.1	-4.7	-4.5	0.4	-0.5	-0.1
1985	0.009	0.000	0.116	0.033	0.159	1.046	100.0	97.8	0.1	-1.8	2.9	3.6	2.8
1986	0.010	0.000	0.106	0.031	0.146	0.940	92.3	90.3	2.6	-5.0	-8.8	-6.7	-7.7
1987	0.011	0.000	0.114	0.032	0.156	0.986	98.6	96.5	9.8	8.3	7.6	3.0	6.8
1988	0.011	0.000	0.118	0.033	0.162	1.045	102.2	100.0	6.9	-0.6	3.5	3.1	3.7
1989	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
AVERAGE GROWTH RATE (%):									-3.2	-3.1	-0.3	0.6	-0.5

	ECONOMIC GROWTH RATE SCENARIOS (PERCENT PER ANNUM) LOW CASE	BASE CASE	HIGH CASE	COM. ENERGY INT. FORECAST (REL.1988)
1989	1.5	2.5	3.0	101.4
1990	1.5	2.5	3.0	101.0
1991	1.5	2.5	3.0	106.2
1992	1.5	2.5	3.0	109.5
1993	1.5	2.5	3.0	110.5
1994	1.5	2.5	3.0	111.4
1995	1.5	2.5	3.5	116.2
1996	1.5	2.5	3.5	122.4
1997	1.6	2.5	3.5	128.1
1998	1.7	2.5	3.5	128.6
1999	1.8	2.7	3.5	128.6
2000	2.0	2.9	3.5	124.3
2001	2.0	3.2	3.5	123.8
2002	2.0	3.2	3.5	124.8
2003	2.0	3.2	3.5	126.7
2004	2.0	3.2	3.5	126.7
2005	2.4	3.2	3.5	127.0
2006	2.5	3.2	3.5	127.0
2007	2.6	3.2	3.5	122.4
2008	2.7	3.2	3.7	119.0
2009	2.8	3.5	4.0	119.0
2010	2.9	3.5	4.3	125.7
2011	3.0	3.5	4.5	130.5
2012	3.0	3.5	4.6	130.5
2013	3.0	3.5	4.7	129.5
2014	3.0	3.5	4.8	126.7
2015	3.0	3.5	4.9	125.2
2016	3.0	3.5	5.0	119.5
2017	3.0	3.5	5.0	113.3
2018	3.0	3.5	5.0	109.5
2019	3.0	3.5	5.0	108.6
2020	3.0	3.5	5.0	107.1

TABLE 4.48 GDP and energy forecast - low case scenario

YEAR	REGION'S GDP (MIL. 1985 US$)	ENERGY CARRIERS - QUANTITIES IN THOUSAND TONS OF OIL EQUIVAL. COAL&PEAT	GAS	OIL	ELECTRIC.	COM.ENE.	TRAD.ENE.	TOT.ENE.	TRAD/TOT. (%)	PERCENTAGE INCREASE OF VARIOUS ENERGY CARRIERS IN THE FINAL DEMAND SECTOR OVER THE BASE YEAR 1988 COAL&PEAT	GAS	OIL	ELECTRIC.	COM.ENE.	TRAD.ENE.	TOT.ENE.
1988	53598	522.0	1.6	6501.9	1578.7	8604.2	42108.0	50712.1	83.0	0	0	0	0	0	0	0
1989	54402	570.2	4.5	6807.2	1709.6	9091.4	42937.5	52028.9	82.5	9	189	5	8	6	2	3
1990	55218	606.4	4.5	6922.4	1802.9	9336.2	43778.9	53115.1	82.4	16	192	6	14	9	4	5
1991	56046	675.9	4.8	7433.5	1996.0	10110.1	44632.1	54742.3	81.5	29	211	14	26	18	6	8
1992	56887	737.6	5.1	7826.9	2164.7	10734.1	45497.2	56231.3	80.9	41	226	20	37	25	8	11
1993	57740	788.5	5.2	8063.3	2299.5	11156.5	46373.9	57530.4	80.6	51	234	24	46	30	10	13
1994	58606	841.7	5.3	8306.6	2440.5	11594.2	47262.4	58856.5	80.3	61	242	28	55	35	12	16
1995	59485	919.7	5.6	8834.8	2655.0	12415.1	48162.4	60577.4	79.5	76	262	36	68	44	14	19
1996	60378	1009.3	6.0	9484.2	2903.7	13403.3	49073.8	62477.1	78.5	93	286	46	84	56	17	23
1997	61344	1100.5	6.4	10126.6	3155.7	14389.1	49996.6	64385.7	77.7	111	311	56	100	67	19	27
1998	62387	1164.1	6.5	10398.2	3323.2	14892.0	50930.6	65822.6	77.4	123	320	60	110	73	21	30
1999	63510	1228.4	6.6	10650.4	3491.5	15376.9	51875.7	67252.6	77.1	135	327	64	121	79	23	33
2000	64780	1270.1	6.5	10589.6	3589.7	15455.8	52831.6	68287.4	77.4	143	321	63	127	80	25	35
2001	66075	1338.4	6.6	10831.8	3767.2	15944.1	53798.2	69742.2	77.1	156	328	67	139	85	28	38
2002	67397	1419.3	6.8	11198.9	3981.1	16606.1	54775.2	71381.3	76.7	172	340	72	152	93	30	41
2003	68745	1510.2	7.1	11657.9	4223.8	17399.0	55762.4	73161.4	76.2	189	355	79	168	102	32	44
2004	70120	1592.0	7.2	11968.4	4437.3	18005.0	56759.6	74764.5	75.9	205	365	84	181	109	35	47
2005	71803	1683.0	7.4	12356.9	4676.7	18724.0	57766.4	76490.4	75.5	222	377	90	196	118	37	51
2006	73598	1776.8	7.6	12743.4	4923.0	19450.7	58782.5	78233.3	75.1	240	389	96	212	126	40	54
2007	75511	1841.8	7.5	12730.6	5080.2	19660.1	59807.6	79467.7	75.3	253	383	96	222	128	42	57
2008	77550	1919.7	7.5	12837.7	5274.4	20039.3	60841.3	80880.6	75.2	268	383	97	234	133	44	59
2009	79721	2027.7	7.7	13278.6	5557.7	20871.7	61883.2	82754.9	74.8	288	396	104	252	143	47	63
2010	82033	2195.0	8.4	14416.4	6018.4	22638.1	62932.9	85571.0	73.5	321	439	122	281	163	49	69
2011	84494	2355.7	8.9	15425.2	6456.8	24246.6	63989.9	88236.5	72.5	351	477	137	309	182	52	74
2012	87029	2483.5	9.2	15973.5	6793.2	25259.4	65053.6	90312.9	72.0	376	494	146	330	194	54	78
2013	89640	2608.4	9.4	16436.2	7118.6	26172.6	66123.5	92296.1	71.6	400	507	153	351	204	57	82
2014	92329	2721.3	9.5	16696.8	7405.2	26832.8	67199.2	94031.9	71.5	421	512	157	369	212	60	85
2015	95099	2851.9	9.7	17124.7	7743.0	27729.2	68279.8	96009.0	71.1	446	523	163	390	222	62	89
2016	97952	2946.8	9.5	17048.6	7969.7	27974.7	69364.8	97339.5	71.3	465	512	162	405	225	65	92
2017	100891	3040.1	9.3	16893.7	8188.9	28132.0	70453.4	98585.5	71.5	482	498	160	419	227	67	94
2018	103917	3160.6	9.2	17017.5	8487.5	28674.8	71545.0	100219.8	71.4	506	495	162	438	233	70	98
2019	107035	3315.6	9.4	17508.3	8887.3	29720.7	72638.6	102359.2	71.0	535	508	169	463	245	73	102
2020	110246	3471.9	9.6	17949.0	9287.9	30718.4	73733.4	104451.8	70.6	565	518	176	488	257	75	106

TABLE 4.49 GDP and energy forecast - base case scenario

YEAR	REGION'S GDP (MIL. 1985 US$)	ENERGY CARRIERS - QUANTITIES IN THOUSAND TONS OF OIL EQUIVAL. COAL&PEAT	GAS	OIL	ELECTRIC.	COM.ENE.	TRAD.ENE.	TOT.ENE.	TRAD/TOT. (%)
1988	53598	522.0	1.6	6501.9	1578.7	8604.2	42108.0	50712.1	83.0
1989	54938	575.5	4.5	6873.8	1725.7	9179.6	42937.5	52117.1	82.4
1990	56311	617.2	4.6	7057.7	1835.7	9515.2	43778.9	53294.1	82.1
1991	57719	693.3	5.0	7651.2	2048.7	10398.2	44632.1	55030.3	81.1
1992	59162	762.0	5.3	8132.3	2238.6	11138.2	45497.2	56635.3	80.3
1993	60641	819.9	5.4	8456.2	2394.6	11676.1	46373.9	58050.1	79.9
1994	62157	880.5	5.6	8791.6	2557.9	12235.7	47262.4	59498.1	79.4
1995	63711	967.8	6.0	9436.6	2800.7	13211.2	48162.4	61373.5	78.5
1996	65304	1068.5	6.5	10223.2	3082.6	14380.8	49073.8	63454.6	77.3
1997	66937	1170.7	7.0	11004.7	3368.3	15550.7	49996.6	65547.3	76.3
1998	68610	1242.6	7.2	11379.0	3560.6	16189.3	50930.6	67120.0	75.9
1999	70462	1316.1	7.3	11746.2	3756.7	16826.4	51875.7	68702.1	75.5
2000	72506	1364.3	7.3	11766.6	3874.6	17012.8	52831.6	69844.4	75.6
2001	74826	1444.7	7.5	12159.9	4088.7	17700.7	53798.2	71498.9	75.2
2002	77220	1539.5	7.8	12701.2	4344.8	18593.4	54775.2	73368.5	74.7
2003	79692	1646.2	8.2	13357.5	4635.2	19647.2	55762.4	75409.6	73.9
2004	82242	1742.6	8.4	13850.6	4892.9	20494.6	56759.6	77254.2	73.5
2005	84873	1845.8	8.7	14391.0	5169.1	21414.5	57766.4	79180.9	73.0
2006	87589	1951.0	9.0	14920.8	5450.0	22330.8	58782.5	81113.4	72.5
2007	90392	2020.4	9.0	14963.0	5620.6	22612.9	59807.6	82420.6	72.6
2008	93285	2103.4	9.0	15133.9	5830.2	23076.5	60841.3	83917.9	72.5
2009	96550	2224.2	9.3	15734.3	6152.2	24120.0	61883.2	86003.2	72.0
2010	99929	2415.7	10.2	17174.1	6685.9	26285.9	62932.9	89218.8	70.5
2011	103426	2598.0	10.9	18453.1	7189.8	28251.9	63989.9	92241.7	69.4
2012	107046	2739.7	11.3	19175.0	7568.2	29494.1	65053.6	94547.7	68.8
2013	110793	2877.1	11.6	19794.7	7931.6	30615.0	66123.5	96738.5	68.4
2014	114671	2998.9	11.8	20165.7	8244.9	31421.3	67199.2	98620.4	68.1
2015	118684	3141.7	12.1	20745.4	8619.4	32518.5	68279.8	100798.3	67.7
2016	122838	3238.6	11.9	20694.7	8852.3	32797.6	69364.8	102162.4	67.9
2017	127138	3331.9	11.7	20540.1	9071.5	32955.2	70453.4	103408.6	68.1
2018	131587	3457.9	11.7	20732.3	9386.7	33588.5	71545.0	105133.5	68.1
2019	136193	3626.2	12.0	21388.9	9826.6	34853.6	72638.6	107492.2	67.6
2020	140960	3794.7	12.2	21982.8	10264.3	36054.1	73733.4	109787.5	67.2

YEAR	PERCENTAGE INCREASE OF VARIOUS ENERGY CARRIERS IN THE FINAL DEMAND SECTOR OVER THE BASE YEAR 1988 COAL&PEAT	GAS	OIL	ELECTRIC.	COM.ENE.	TRAD.ENE.	TOT.ENE.
1988	0	0	0	0	0	0	0
1989	10	191	6	9	7	2	3
1990	18	197	9	16	11	4	5
1991	33	221	18	30	21	6	9
1992	46	239	25	42	29	8	12
1993	57	250	30	52	36	10	14
1994	69	262	35	62	42	12	17
1995	85	287	45	77	54	14	21
1996	105	318	57	95	67	17	25
1997	124	348	69	113	81	19	29
1998	138	361	75	126	88	21	32
1999	152	374	81	138	96	23	35
2000	161	371	81	145	98	25	38
2001	177	385	87	159	106	28	41
2002	195	404	95	175	116	30	45
2003	215	428	105	194	128	32	49
2004	234	445	113	210	138	35	52
2005	254	464	121	227	149	37	56
2006	274	482	129	245	160	40	60
2007	287	479	130	256	163	42	63
2008	303	481	133	269	168	44	65
2009	326	501	142	290	180	47	70
2010	363	557	164	324	206	49	76
2011	398	606	184	355	228	52	82
2012	425	631	195	379	243	54	86
2013	451	651	204	402	256	57	91
2014	475	660	210	422	265	60	94
2015	502	677	219	446	278	62	99
2016	520	668	218	461	281	65	101
2017	538	654	216	475	283	67	104
2018	562	654	219	495	290	70	107
2019	595	673	229	522	305	73	112
2020	627	690	238	550	319	75	116

TABLE 4.50 GDP and energy forecast - high case scenario

YEAR	REGION'S GDP (MIL. 1985 US$)	ENERGY CARRIERS - QUANTITIES IN THOUSAND TONS OF OIL EQUIVAL. COAL&PEAT	GAS	OIL	ELECTRIC.	COM.ENE.	TRAD.ENE.	TOT.ENE.	TRAD/TOT. (%)
1988	53598	522.0	1.6	6501.9	1578.7	8604.2	42108.0	50712.1	83.0
1989	55206	578.2	4.5	6907.2	1733.8	9223.7	42937.5	52161.1	82.3
1990	56862	622.7	4.7	7125.9	1852.2	9605.4	43778.9	53384.3	82.0
1991	58568	702.1	5.0	7761.7	2075.5	10544.3	44632.1	55176.5	80.9
1992	60325	774.5	5.4	8288.4	2276.4	11344.7	45497.2	56841.8	80.0
1993	62135	836.1	5.6	8658.4	2443.6	11943.7	46373.9	58317.6	79.5
1994	63999	900.7	5.8	9043.2	2618.8	12568.4	47262.4	59830.8	79.0
1995	66239	996.7	6.2	9796.6	2887.8	13687.3	48162.4	61849.7	77.9
1996	68557	1107.5	6.8	10711.3	3200.7	15026.3	49073.8	64100.1	76.6
1997	70957	1221.3	7.4	11636.0	3521.1	16385.7	49996.6	66382.3	75.3
1998	73440	1303.5	7.7	12140.2	3744.9	17196.3	50930.6	68126.9	74.8
1999	76011	1386.1	7.9	12620.6	3968.4	17983.0	51875.7	69858.7	74.3
2000	78671	1439.4	7.9	12705.8	4101.9	18255.2	52831.6	71086.7	74.3
2001	81424	1524.8	8.2	13161.3	4331.1	19025.3	53798.2	72823.5	73.9
2002	84274	1625.9	8.5	13780.0	4605.9	20020.3	54775.2	74795.4	73.2
2003	87224	1739.8	9.0	14527.0	4918.3	21194.2	55762.4	76956.6	72.5
2004	90277	1842.5	9.3	15098.1	5194.9	22144.8	56759.6	78904.4	71.9
2005	93436	1952.4	9.6	15723.5	5491.6	23177.1	57766.4	80943.5	71.4
2006	96707	2064.6	10.0	16339.6	5793.5	24207.6	58782.5	82990.1	70.8
2007	100091	2136.9	9.9	16418.0	5972.8	24537.5	59807.6	84345.2	70.9
2008	103795	2226.1	10.0	16667.6	6201.5	25105.2	60841.3	85946.6	70.8
2009	107947	2357.3	10.4	17397.4	6554.7	26319.8	61883.2	88203.1	70.2
2010	112588	2571.8	11.5	19124.9	7158.1	28866.3	62932.9	91799.2	68.6
2011	117655	2780.1	12.4	20728.7	7740.6	31261.9	63989.9	95251.8	67.2
2012	123067	2944.7	13.0	21737.3	8188.4	32883.4	65053.6	97937.0	66.4
2013	128851	3106.6	13.5	22661.7	8625.6	34407.4	66123.5	100530.9	65.8
2014	135036	3251.9	13.9	23327.7	9010.3	35603.8	67199.2	102803.0	65.4
2015	141653	3423.9	14.4	24271.4	9472.9	37182.5	68279.8	105462.3	64.7
2016	148735	3542.2	14.4	24488.9	9770.8	37816.4	69364.8	107181.2	64.7
2017	156172	3654.7	14.3	24573.6	10047.9	38290.6	70453.4	108744.0	64.8
2018	163981	3805.9	14.6	25081.2	10439.4	39341.1	71545.0	110886.0	64.5
2019	172180	4009.4	15.2	26178.2	10985.9	41188.7	72638.6	113827.3	63.8
2020	180789	4213.3	15.7	27213.7	11530.5	42973.3	73733.4	116706.7	63.2

PERCENTAGE INCREASE OF VARIOUS ENERGY CARRIERS IN THE FINAL DEMAND SECTOR OVER THE BASE YEAR 1988 COAL&PEAT	GAS	OIL	ELECTRIC.	COM.ENE.	TRAD.ENE.	TOT.ENE.
0	0	0	0	0	0	0
11	193	6	10	7	2	3
19	200	10	17	12	4	5
35	225	19	31	23	6	9
48	246	27	44	32	8	12
60	259	33	55	39	10	15
73	273	39	66	46	12	18
91	303	51	83	59	14	22
112	339	65	103	75	17	26
134	375	79	123	90	19	31
150	394	87	137	100	21	34
166	411	94	151	109	23	38
176	411	95	160	112	25	40
192	427	102	174	121	28	44
211	450	112	192	133	30	47
233	478	123	212	146	32	52
253	498	132	229	157	35	56
274	520	142	248	169	37	60
296	542	151	267	181	40	64
309	541	153	278	185	42	66
326	546	156	293	192	44	69
352	572	168	315	206	47	74
393	640	194	353	235	49	81
433	703	219	390	263	52	88
464	740	234	419	282	54	93
495	773	249	446	300	57	98
523	795	259	471	314	60	103
556	828	273	500	332	62	108
579	830	277	519	340	65	111
600	826	278	536	345	67	114
629	839	286	561	357	70	119
668	878	303	596	379	73	124
707	913	319	630	399	75	130