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ENERGY PROFILE: ZAIRE

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CONTENTS

1. INTRODUCTION

This report is one in a series covering the energy supply and demand situation in African countries south of the equator. The purpose of the series is to summarize the energy situation, for those trading or intending to trade with those countries, and especially to those in the energy industry. It will eventually form part of an analysis on the scope for regional energy inter-change for sub-equatorial Africa.

For Zaire the available energy statistics are poor and are often contradictory where more than one source is available. One of the most comprehensive studies has been that carried out by the World Bank and shown as Reference 9. The World Bank study was published in 1986 but the main data on which it was based was for the year 1983. Thus in this report the most up-to-date energy data is for 1983 though some of the data, such as the economic indicators, are available up to 1987.

Substantial use has been made of the reports of the World Bank and the permission of the Bank to use the information and to reproduce their maps in this report are gratefully acknowledged.

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2. COUNTRY PROFILE

2.1 Introduction

Zaire was ruled as the Democratic Republic of the Congo from 1885 to 1960. In 1960 it was granted independence and Joseph Kasavubu was appointed president and Patrice Lumumba as Prime Minister. In July 1960 the Force Publique (the army and police) mutinied and the United Nations intervened with troops at the request of the government. The country became split along lines as several seccesionists governments were established with foreign backing. Patrice Lumumba was deposed by the president and later murdered, but his supporters regrouped in the north-east of the country at Stanleyville (now

Kisangani). In Leopoldville (now Kinshasa) General Mobutu (commander of the army), the president, and government disputed control of the country until the election of Cyrille Adoula as Prime Minister. Moise Tshombe took over the mineral rich Shaba Province, with backing from Belgian private interests, and declared independence.

Fighting between United Nations and Tshombe forces continued until June 1963 when Tshombe fled to Europe. Subsequent attempts to take Shaba led to the invasion of Shaba exiles from Angola, and, more recently in 1984, an attack on the town of Moba by Zairean dissidents in Tanzania and anti-government factions in Kivu.

United Nations troops were withdrawn in 1964 and a constitutional deadlock followed which was resolved when in November 1965 General Mobutu seized power in a bloodless coup and assumed the presidency.

Mobutu's presidency has been associated with strict de-colonization which included edicts on dress and style of greeting, and also included wide-spread nationalization of foreign business. The results were economically disastrous and though this step started to be reversed in the 1970's, industry and commerce still live with the results of this nationalization.

In July 1984 President Mobutu was re-elected for a third seven-year period.

2.2 Demography

The population, as given by the 1985 census, is 34,67 Million of whom 36% live in urban areas. The population growth rate estimated by the World Bank is 3% per annum. The population is relatively young with 40% of the population under 14 years of age.

The population is ethnically very diverse with a dozen principal tribes and many smaller tribes. President Mobutu is from one of the smaller tribes in the north-west of the country. Whilst Zairean politics are not run on tribal grounds certain of the tribes, such as the Baluba in Kasai Oriental Province, and the Lunda in Shaba Province have periodically dominated the political scene.

2.3 Economy

During the colonial days Zaire was considered a provider of minerals for industry in Belgium. The mining sector was dominated by Union Miniere du Haut Katanga. With independence came the nationalization of Union Miniere and the creation of the State owned Gecamines to replace it. All foreign owned businesses were also nationalized. At this time a number of large prestigious projects were started by the state, such as the Inga hydroelectric plant, the Maluku metallurgical plant, and the Sozar oil refinery. These projects were an attempt to transform the economy from an agricultural, and single mineral (copper) economy into a modern industrial economy.

Loans to pay for the governments projects were obtained from the developed countries who saw the tremendous mineral wealth of Zaire as sufficient collateral. However, the catastrophic drop in the price of copper, compounded by the lack of fiscal discipline has led to a serious deterioration in the economy, and Zaire is now the ninth poorest country in the world.

Since 1980 there has been a general liberalization of the economy and a return of the nationalized smaller industries to private hands. A further liberalization move was instituted for the 1987-1990 period aimed at the encouragement of private industry, and to decentralize economic activity. World Bank loans have been obtained aimed mainly at the stimulation of the private sector. Public investment during this period is aimed mainly at the transport (39%), mining (35%), electricity (18%), and agricultural (14%) sectors.

Agriculture in Zaire has tremendous potential but has performed badly in the past because of lack of adequate infrastructure, and because of inadequate planning and pricing policies. Crop exports are mainly concentrated on sugar and coffee though various vegetable oils are also produced. Timber is an increasingly important export commodity.

The main export commodity is minerals which account for some 65% of export earnings. The principal minerals are cobalt, copper, diamonds, and zinc. The mining giant is Gecamines which produces all the cobalt, zinc, and coal. In 1990 Gecamines will, with the take-over of Sodzima, become the only producer of copper.

The contribution of the various sectors to GDP in Zaire is given in Table 1.

The GNP of the country has been increasing rapidly during the last twenty years, but this has been associated with a very high inflation rate especially in the mid 1980's. Figure 1 shows the GNP per capita for the period 1967 to 1987 expressed in real terms relative to the 1980 unit of currency. This shows the steady decline until 1985 after which there appears to be the beginning of a reversal in the trend.

The major turning point in the economy came in 1983 when the Government introduced a series of stabilization and reform measures including the devaluation of the Zaire by 78%, the decontrol of prices, the liberalization of exchange rates and trade systems, and tighter control of expenditure.

In 1988 the Government realized that its economic policies were still not having the desired effect and introduced a series of austerity measures. Real growth in GDP is expected to be 3,3% in 1989 compared to 2,7% in 1987 and 2,5% in 1988.

Table 1: Sectorial contribution to GDP in Zaire (1982). (Reference 9)

Sector	US $ Million	Percent
Agriculture	1943	35,7
Mining & Metal Processing	624	11,5
Manufacturing	124	2,3
Construction	328	6,0
Electricity, gas, water	2	0,0
Government services	504	9,3
Non-government services	1740	32,0
	----	----
GDP at factor cost	5265	96,8
Indirect taxes	175	3,2
	----	-----
GDP at market price	5440	100,0

3. ENERGY

3.1 Introduction

Zaire has excellent long-term energy prospects due to the hydro-electric potential of the Zaire River, the second longest river in the world after the Amazon. The river runs north through Shaba to Kisangani before turning to travel south-west to the Atlantic Ocean at Matadi. The potential hydro capacity of the Zaire River is estimated at 100 000 MW.

The country also has oil deposits and some coal. At present there is little commercial energy supply outside the industrial and main urban areas in the Kinshasa and copper belt areas and much of energy in the outlaying areas is based on charcoal and wood.

Per capita secondary energy supply in 1983 was 296 kg of oil equivalent, of which 79% was supplied by fuel-wood and charcoal, 7% by agricultural wastes, 8% by petroleum products, 4% by electricity, and 1% by coal and coke.

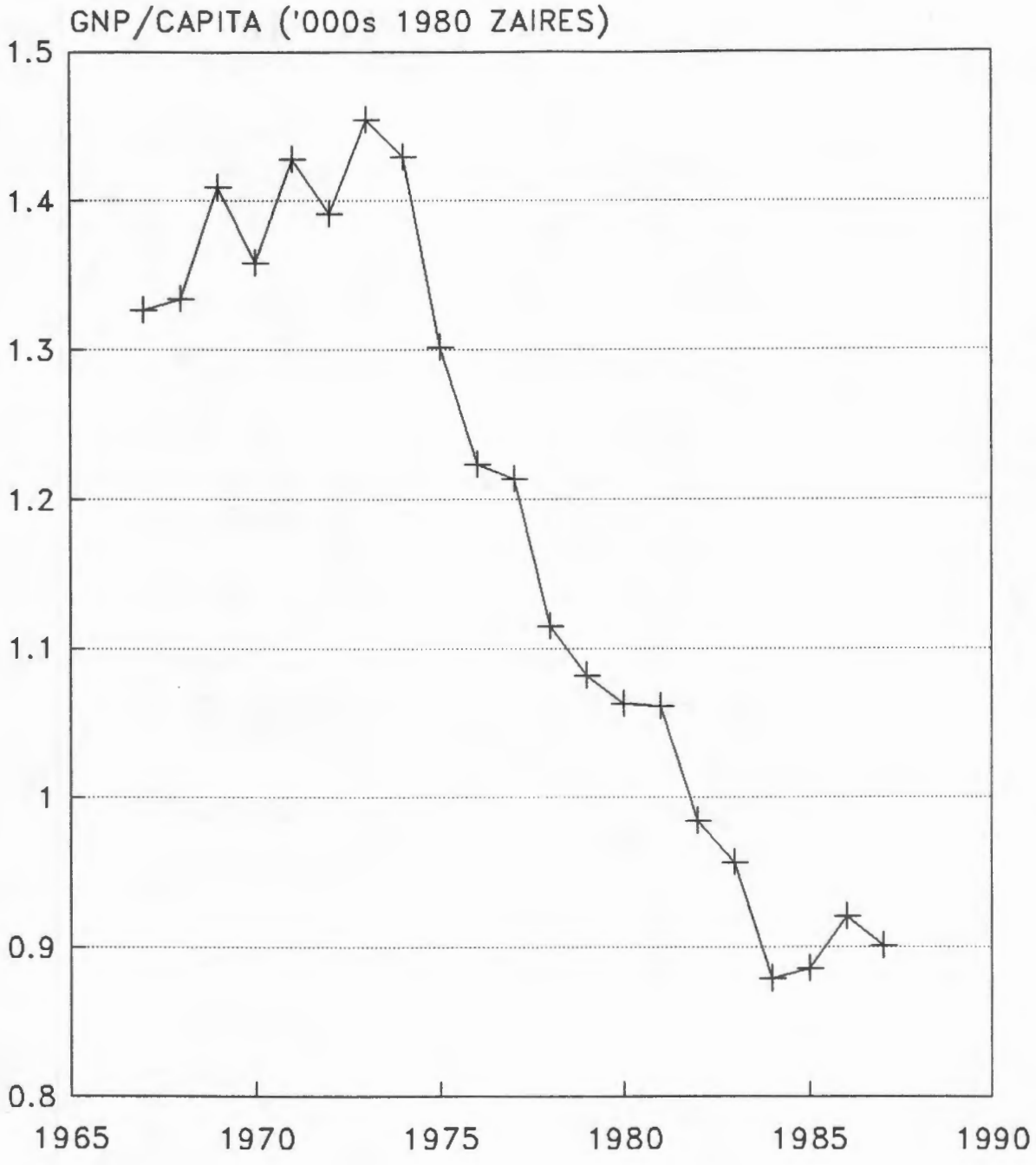
3.2 Energy Institutions

There are a number of public and semi-public agencies which affect the distribution and sale of energy. The main organization overseeing the energy programme for Zaire is the Ministry of Mines and Energy which, through its Energy Department, controls the public and parastatal bodies, and private companies in the petroleum and power industries.

The Ministry of the Environment, Nature Conservation, and Tourism controls one of the main sources of Zaire's energy namely wood.

The Ministry of Finance and Budget, and the Ministry of Economy and Industry is responsible for the pricing of petroleum and electricity prices.

Other agencies involved, or potentially involved in the energy scene are :- the Atomic Energy Commission, Ministry of Agriculture and Rural Development, Ministry of Public Works and Land Management, Ministry of Transport and Communications, Ministry of Education and Scientific Research, and the Prime Ministers Office. These agencies, together with the Executive Council, make the final decisions concerning major energy issues such as pricing and capital expenditure.



ZAIRE 110/FIG1

Figure 1: Gross National Product per capita expressed in terms of constant 1980 Zaires.

One of the problems which has been recognized in the energy scene is the lack of adequate consultation and co-operation between the various ministries. For this reason a National Energy Council was formed in 1981. However, for various reasons, the NEC has not got off the ground and one of the recommendations made by the World Bank in 1986 was that this body should be given power to carry out policy planning and to correct the many problems in the energy field.

In the Petroleum sector the main government agency is the Enterprise Petroliere du Zaire (Petrozaire) which was formed in 1978. It does not have any policy making responsibilities nor does it carry out exploration, which is the duty of the "Petroleum Technical Unit" within the ministry of Mines and Energy.

Also in the Ministry of Mines and Energy is the "Societe Nationale d'Electricite (SNEL)" which is responsible for the generation, transmission, and distribution of electricity.

The other important body in the energy sector is the National Reforestation Service (NRS) which is responsible, through the Ministry of Environment, Nature Conservation, and Tourism, for initiating reforestation programmes in those areas threatened by deforestation. Also, in the same ministry are "Service Permanent d"Inventaire et Amengement Forestier (SPIAF) which carries out an inventory of forest resources and is responsible for forest management, and the "Centre for Adaptation of Wood-Energy Techniques (CATEB) which develops techniques and equipment for wood exploitation and carbonization. These latter two organizations are joint Zaire-Canadian organizations.

4. ENERGY RESOURCES

4.1 Fuelwood

Fuelwood provides most of the total energy consumed in Zaire with consumption estimates varying between 75% and 90% of total energy. The abundance, at present, of wood results in fire-wood still being considered a "free good" in the rural areas. In most rural areas wood is more readily available (only 3,5% of the population has access to electricity) and the use of fire-wood results in a lower capital expenditure than for competing energy resources, and wood is not subject to the same supply constraints as the other fuels.

Zaire is a very heavily forested country, possibly the most forested country in Africa, with a forest cover of 122 million hectare. Forests are classified into three main groups of economic interest :-

a) The Mayumbe forests in Bas-Zaire - 240 000 ha.
b) The dense mountain forests and open forests of the periphery - 21 million ha.
c) The tropical forests of the Central Basin - 101 million ha.

Only a small fraction of the forests are being exploited commercially. However, the peripheral forests are starting to be degraded due to slash-and-burn cultivation. The Mayumbe forests are already heavily depleted due to demand for industrial timber and for wood energy.

Table 2 shows the theoretical energy potential of forests in Zaire on a sustainable basis. However, it must be recognised that the figures quoted are optimistic if the imbalance between areas of surplus capacity and the areas of maximum demand are considered.

Table 2: Theoretical Forest Energy Potential in Zaire (without reforestation) (Ref 9).

Source Forest Notes	Area ha Million	Density m^3/ha	Gross Energy Poten Mtoe *a	Maximum Annual Drawdown t/ha/yr *b	Net Annual Energy Mtoe *c
Central	101,000	300	7800	4,0	83,2
Mayumbe	,24	135	8	2,5	0,2
Peripheral	21,00	100	540	1,5	10.8
TOTAL	122,24		8348	8,0	94,2

Notes

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

Estimates of the potential timber production for energy purpose, on a sustainable basis, show that less than 2% of the forests can be extracted. Practical considerations which limit the ability to exploit fuelwood on a regular basis include the fact that 40% of the Central Basin forests are not fully accessible due to seasonal flooding, and that the most prolific forests are located at large distances from the centres of fuelwood demand.

4.2 Petroleum

The potential oil-bearing areas of Zaire can be divided into three sections - the Tanganyika Graben area on the east of the country, the Central Basin, and the Coastal Basin.

The exploration of the east-most Tanganyika Graben area dates back to the 1920's. The area stretches along the eastern border of Zaire and some shallow wells have yielded small quantities of oil on the boundary between Zaire and Uganda. Recent exploration (1983) in this area has been financed by the World Bank and several oil companies and has been coordinated by Duke University in the USA.

Exploration of the Central Basin in the middle of the country started in 1951 but has not been successful. The Basin extends over 800 000 km^2, most of it covered by dense rain forest. Concessions have been awarded to a number of oil companies the most recent being to a Japanese company. The exploration conducted to date is insufficient to yield any accurate assessment of the potential. Exploration in this region is hampered by the very difficult access to the area, the lack of infrastructure, and the large amount of finance necessary under these conditions.

Exploration offshore of the Coastal Basin in the west of the country started in 1956. Forty oil wells had been sunk by 1983 and led to five operating oil fields and one gas field. On-shore exploration has been going on since 1959 and eighty wells had been sunk to 1983. Four oil fields have been discovered. One of the off-shore fields, Mibale, contains 48% of the recoverable reserves of the Basin. At the moment only the Basin oil fields are producing. The estimated operating cost of these fields is US $ 0,4 per barrel

The original recoverable proven reserves of the Coastal Basin were 127,7 million barrels for the off-shore fields and 101,0 million barrels for the on-shore fields. Of

these amounts cumulative production up to 1983 was 61,9 million barrels for the off-shore fields and 1,5 million barrels in the on-shore fields. The net remaining reserves are therefore as given in Table 3.

Table 3: Oil reserves in the coastal basin (Million barrels) (Ref 9).

	Original Proven	Remaining Proven	Undevel Proven	Possible	Total Remaining
Off-shore	127,7	56,5	9,2	0,6	65,7
On-shore	101,0	99,5			99,5

4.3 Coal

Coal deposits exist in the eastern part of the country at Luena in Shaba Province and at Lukuga north-west of Kalemie in Northern Shaba Province. Total estimated in-situ reserves are 8,6 million tons for Luena, and 78 million tons for Lukuga. The coal is of low quality with an ash content of 20 - 28%. Details of the coal are given in Table 4.

Table 4: Coal quality and reserves

		Luena	Lukuga
Moisture	%	16-21	16-20
Volatile matter	%	32	23-26
Ash content	%	20-25	25-28
Carbon	%	42-46	27-30
Sulphur	%	2-3	2
C.V Net	kJ/kg	16-20	15-18
Reserves - Million tons			
Speculative		20	700
In-situ		8,6	78
Recoverable		4,3	50

Coal production is small with the 1983 production for Luena and Lukuga being 99 400 tons and 11 000 tons respectively. The main consumers are the Gecamines mining complex and the Cimshaba cement works. However the Luena mine does not produce any coking coal and Gecamines has to import coal and coke for metallurgical purposes, mainly from Zambia.

A third deposit is located at Walikale in the north-eastern corner of Lake Kivu but little is known about the quality or quantity of this deposit.

4.4 Hydro-electricity

The Zaire River is the second largest river in the world (after the Amazon). It drains an area of approximately 3,7 million square kilometres and has a length of 4374 km. It has a flow varying from 30 00 to 60 00 cubic metres per second at Kinshasa. The remarkably uniform flow, compared with other rivers, is due to its position straddling the equator and making use of the seasonal variations in different parts of the country. Whilst the river is navigable over much of its length, and, in fact, provides one of the few ways of transporting goods to and from the interior, there are a number of steep drops in certain places providing sites for potential hydro-energy. Of particular interest is the Inga site between Kinshasa and the Atlantic.

It is variously estimated to have a total exploitable energy potential from 53 000 (Water Power and Dam Construction Handbook - 1988) to over 750 000 GWh per year(World Bank estimate -1986). Using the figure of 750 000 GWh and a load factor of 100% this would allow for an installed capacity of 85 000 MW. At a more realistic load factor of 75% this would mean an installed capacity of 100 000 MW. Consideration must however, be given to seasonal variations and the installed capacity would then be less than this figure. Little work has been carried out on the hydro-electric capabilities of this river on the basis of firm supply. The Inga site downstream of Kinshasa is estimated to have a potential of 300 000 GWh. This could allow of an installed capacity of approximately 25 000 MW.

Whatever the correct figure the amount of energy available is far greater than could ever be used by Zaire. The energy statistics for 1985 show that the total electricity consumption for all the countries south of the equator was 146 500 GWh, which is approximately half of the potential at Inga, and only 20% of the total capacity of the river.

Zaire could therefore supply all the electricity required by the sub-continent until well into the next century.

Besides the supply of electricity in large generating units there is also significant scope for the supply of communities far from the grid using micro-hydro schemes.

4.5 Gas

One of the oil fields discovered in the Coastal Basin is a gas producer but has not been put into production.

In Lake Kivu there is an estimated 50 billion Nm^3 of gas dissolved in the waters at a depth of 300 m. This gas contains 25% of methane, 73,5% carbon dioxide, and 1,5% of inert gases. At present some of this gas is being used after washing with surface water to remove some of the carbon dioxide thereby enriching the gas to 72% methane with a calorific value of 19 MJ/m^3.

The gas flow is initiated by supplying a small amount of compressed air at the bottom of the collection pipe. Once the dissolved gas starts flowing it comes out of solution and the gas flow is then self-sustaining.

At present the only producer of Kivu gas is Electrogaz of Rwanda which sells 5 000 m^3 per day to the Gisenyi brewery in Rwanda. Feasibility studies are being carried out on the use of gas in dual-fuel diesel engines for electricity generation, for use in a cement works, and for possible use in road transport.

4.6 Agricultural residues

Many agro-industries in Zaire already use any available residues generated during the processing of cash crops for internal fuel requirements. Some 600 000 tons oil equivalent are already being used in this way. There does not appear to be any major resources which could be used mainly because of transport distances and problems .

4.7 Solar energy

Whilst it has been estimated by the Zaire meteorological service that the average solar insolation is 4,7 kWh/m^2/day there is very little information concerning daily variations or number of sun days. Approximately 250 small photovoltaic systems have been installed mainly for lighting purposes.

4.8 Geothermal energy

Since Zaire adjoins the Rift Fault coming down through Africa it should have some geothermal potential. It was, in fact, the first country in Africa to exploit geothermal energy when, in the 1960's a copper mine in Katanga generated several hundred kW from a hot spring at 60° C. Countries adjoining Zaire, such as Zambia and Uganda have installed some geothermal potential or are carrying out exploration.

5. ENERGY SUPPLY AND DEMAND

5.1 General

The main energy form in Zaire is fuelwood. The estimated contribution of the various energy forms in 1983 is shown in Table 5.

Table 5: Energy supply in 1983 (Ref 9)

Source	Fuelwood	Agr waste	Oil	Elec	Coal	Total
TOE '000	6478	600	662	344	141	8224
%	78,8	7,3	8,0	4,2	1,7	100,0

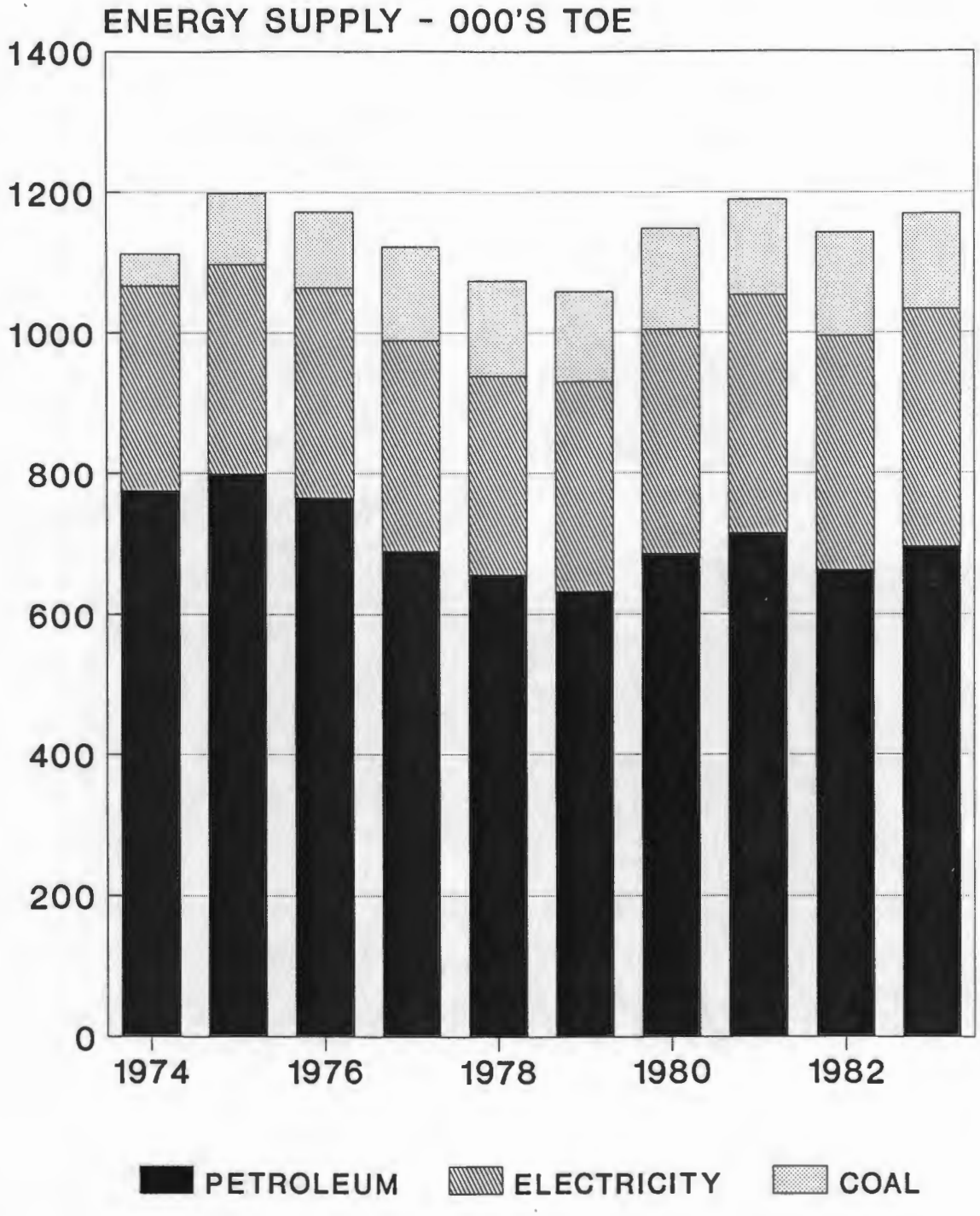


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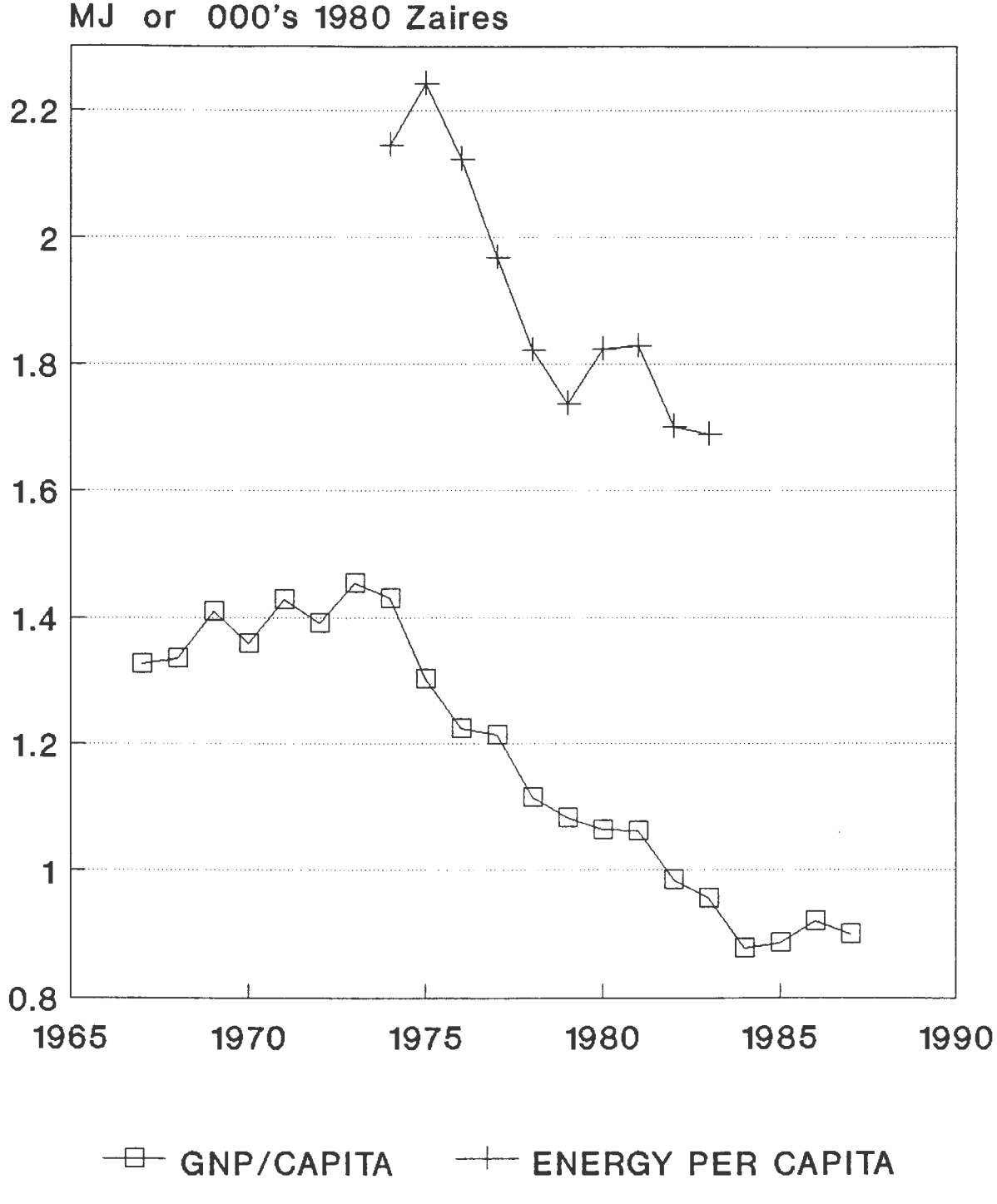
Figure 2: Commercial energy supply in Tons Oil Equivalent for the period 1974 to 1983



ZAIRE 110/FIG3

Figure 3: Energy per capita for the period 1974 to 1983 and GNP per capita for the period 1965 to 1987

Data on the use of energy is only adequately available since 1974 though the electricity statistics go back much further. Figure 2 shows the variation of the consumption of commercial energy during the period 1974 to 1983. The variations during this period have been small. However, this figure masks the effect of population growth and changes in the economy. Figure 3 shows the change with time of energy consumption on a per capita basis. Also shown in the figure is the change in the Gross National Product on a per capita basis. Both curves show similar trends with a decreasing value with time.

5.2 Fuelwood

Fuelwood is used mainly in the domestic sector though small amounts are used for metalworking, brick-making, laundries, drying agricultural products, and for the smoking of food products. Whilst most of the wood is used in its normal form, some is also converted into charcoal.

No long term statistics are available for fuelwood consumption but an estimate has been carried out for 1983 and planning scenarios have been constructed for anticipated demand to the end of the century. Table 6 shows the quantities of fuelwood used in various sectors and also the form in which it is used.

The reason for the heavy reliance on fuelwood is the expense of alternate energy forms and the fact that only 3,5% of households are connected to electricity. The use of fuelwood needs a lower capital investment than electricity, or petroleum products.

Fuelwood is used almost exclusively in the rural areas and is almost always gathered rather than purchased. It is also gathered when required rather than stored. Charcoal is also used for cooking and is more prevalent in dense urban areas such as in Kinshasa. In cities the ratio of charcoal use to fuelwood use is typically 6:4 though in Kinshasa the ratio is 17:3. The ratio of charcoal to fuelwood is a function of the distance from the centre of a city i.e those on the periphery use less charcoal than those in the centre. The average charcoal consumption is 875 kg per household per year, with an estimated 1 kg required to cook a meal.

Table 6: Consumption of fuelwood - 1983 (Cubic metres wood equivalent*) (Ref 9)

Consumer	Form	Quantity '000 m^3	TOE '000
Household			
Rural	Firewood	19 840	5 105
Urban	Firewood	5 224	1 344
	Charcoal	7 836	2 016
Metalwork	Charcoal	100	26
Bricks	Firewood	93	24
Laundries	Firewood	6	1
Smoked food	Firewood	2	1
Agriculture	Firewood	9	2
		33 110	8 520
Subtotals			
Domestic		32 900	8 466
Other		210	54

1 m^3 = 0,75 ton: 1 ton = 0,3431 TOE

Forecast made of fuelwood demand to the turn of the century assume that the amount of fuelwood used in the rural areas will decrease because of the general urban population drift. It is estimated that the urban population will grow at double the country average growth rate. Urban demand is expected to increase by between 3% and 4,8% depending on the assumptions made.

The energy potential values given in Table 2 together with the consumption values in Table 6 show that there is no shortage of fuelwood in the country for the foreseeable future. However, there is already an in-balance between supply and demand in certain parts of the country. Thus Kinshasa which is the most densely populated region in Zaire also has the highest demand for fuelwood. The forests around the city have been largely felled within a radius of 25 km and charcoal and fuelwood are being imported from regions 50 to 100 km from the city. In other

parts of the country the same situation is beginning and the World Bank has recommended that a programme of reforestation should be started. The World Bank also recommends that the government should promote the use of more efficient charcoal stoves which would reduce the consumption of fuelwood. They have also advocated the use of more efficient charcoal kilns.

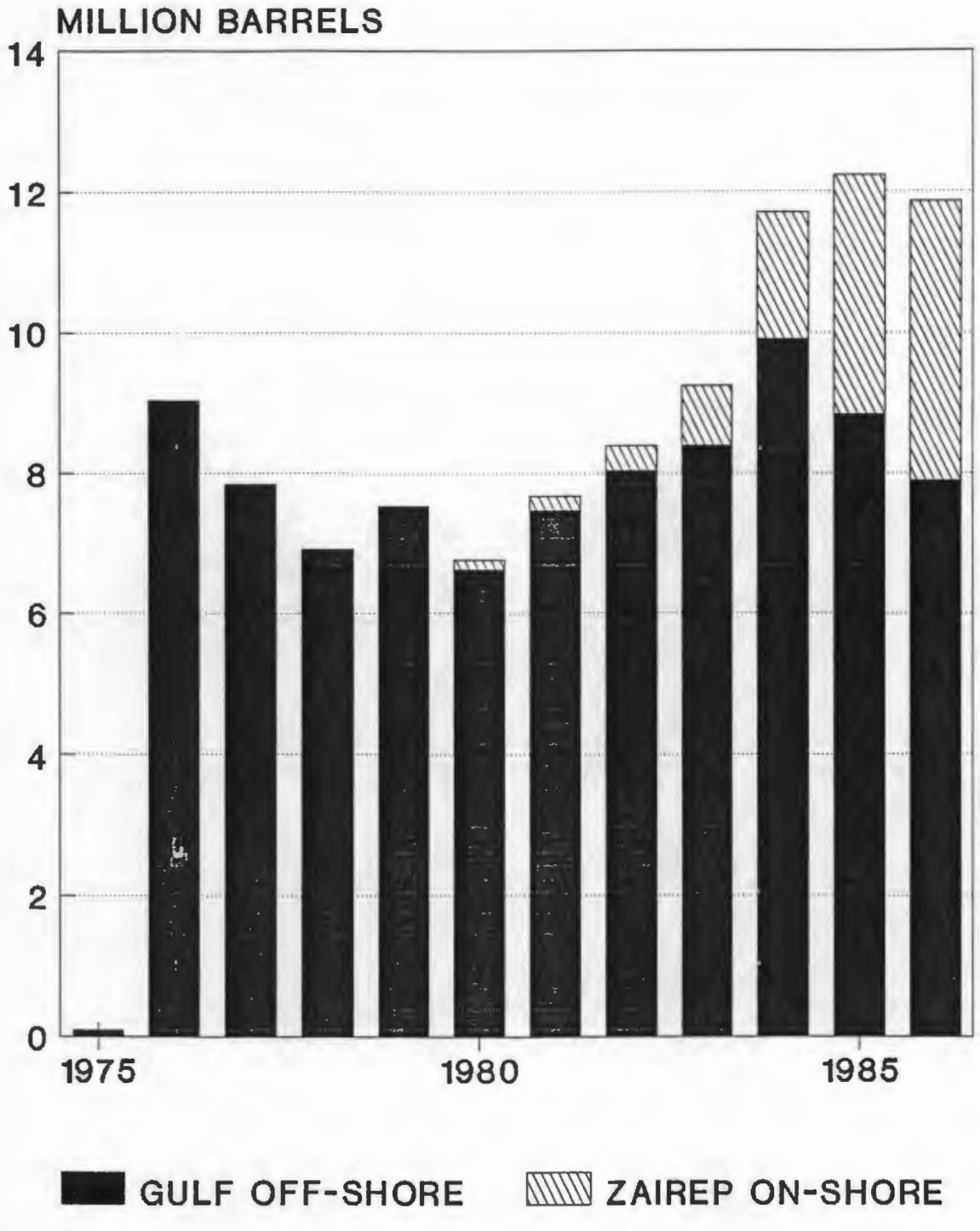
Cost analyses have been carried out on the provision of fuelwood and charcoal from sawmill wastes near Kinshasa. Plans are also being considered for the supply of charcoal to Kinshasa from a fuelwood plantation on the Bateke Plateau, some 150 km from Kinshasa.

It is also evident that unless a large-scale electrification programme can be started there will need to be a programme of using the forest resources of the Central Basin for satisfying the needs of Kinshasa. Consideration is being given to providing electricity to certain industries which use wood but as shown in Table 6 this can only produce a small saving in fuelwood demand.

5.3 Petroleum products

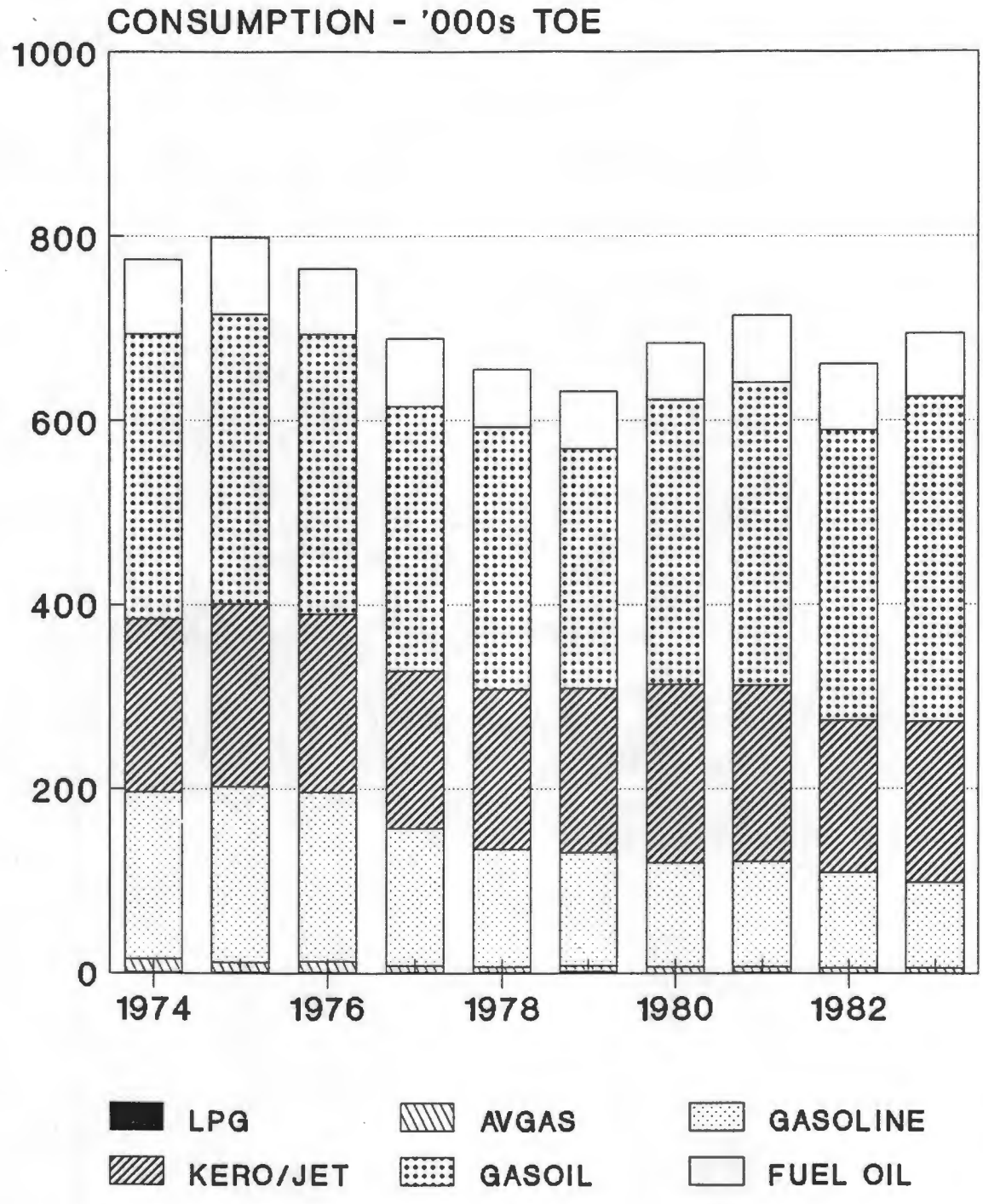
Zaire is an oil producer mainly from its off-shore wells in the Coastal Basin. These off-shore wells have been exploited since 1975 and by 1983 approximately half of the proven recoverable reserves had been used. The on-shore reserves in the Coastal Basin have only been utilized since 1979. Production has been low relative to the recoverable proven reserves and only 1,5% of the reserves have been used. However, the off-shore reserves are considered to be under-estimated and exploration is still being carried out.

The whole of the oil production is exported since it would yield more heavy fuel oil than required for local consumption if it was refined locally . Zaire therefore imports finished products or crude which is lighter than its own, for refining in the SOZIR refinery situated near Moanda. Because of the lack of a deep-water port in Zaire, the imported crude is transshipped to barges at the mouth of the Zaire river. The refinery was commissioned in 1969 and is jointly owned by the Government and AGIP of Italy. It was originally designed for Iranian Light crude but has recently been switched to Nigerian Light crude.



ZAIRE 110/FIG4

Figure 4: Crude production from off-shore and on-shore wells



ZAIRE 110/FIG5

Figure 5: **Demand for petroleum products during the period 1974 to 1983.**

Imported crude comes mainly from Nigeria whilst imported products are imported mainly (96%) from Brazil. Additional finished products come from Kenya by road-tanker for use in the eastern parts of the country, or from Zambia to supply the southern part of the country. Because of the high transport costs by land the products imported by road are some two to three times the price of products in the west of the country.

The production of crude is shown in Figure 4. The production from off-shore wells has reached a plateau whilst that from on-shore wells is increasing. A forecast by Zaire Gulf and Zairep in 1984 showed production peaking in about 1986 and then declining to around 9 million barrels by 1990.

The consumption of petroleum products for the period 1974 to 1983 is shown in Figure 5. This shows a declining consumption from 1975 which is in line with the decline in the economy illustrated in Figure 3. In spite of the general reduction in consumption there is a gradual increase in the use of diesel fuel (gasoil). There is also a significant change in the ratio between diesel and gasoline with the former increasing whilst gasoline use was decreasing.

The distribution of petroleum products is in the hands of 5 oil companies - Fina, Mobil, Texaco, Shell, and the state owned Petrozaire. The largest of these is Fina with Mobil and Texaco of approximately the same size and Shell the smallest of the four private operators. Petrozaire only has some 5% of the total market.

However, there has been a lack of competition in the market since the oil suppliers worked on the basis of a fixed market quota, stipulated for each product. This quota system was abolished in 1985.

5.4 Electricity

Significant electric power generation started in Zaire in 1930 when a 32 MW hydro-plant was commissioned in Shaba Province. Electricity use grew rapidly thereafter until 1958, after which consumption was static until 1964 after which it again began to grow although at a lower rate. Figure 6 shows electricity usage from 1930 to 1983. The consumption rose by 16,6% per annum in the early period and from 1964 it has been growing by 3,2% per annum. The installed capacity over the same period is shown in Figure 7.

Whilst most of Zaire's present electricity generation, and the most significant part of the future potential electricity generation, is based on the Zaire River there are areas which are remote from the river and where alternate electricity generation forms have to be used. At present some 4% of the electricity generation is based on thermal power plant using coal.

Electrical power is supplied by the state-owned Societe Nationale d'Electricite (SNEL) and by various small local producers. The relative amounts supplied by the various producers and from the two resources, hydro and thermal are shown in Table 7.

Table 7: Installed capacity in 1986 by producer and form (MW)

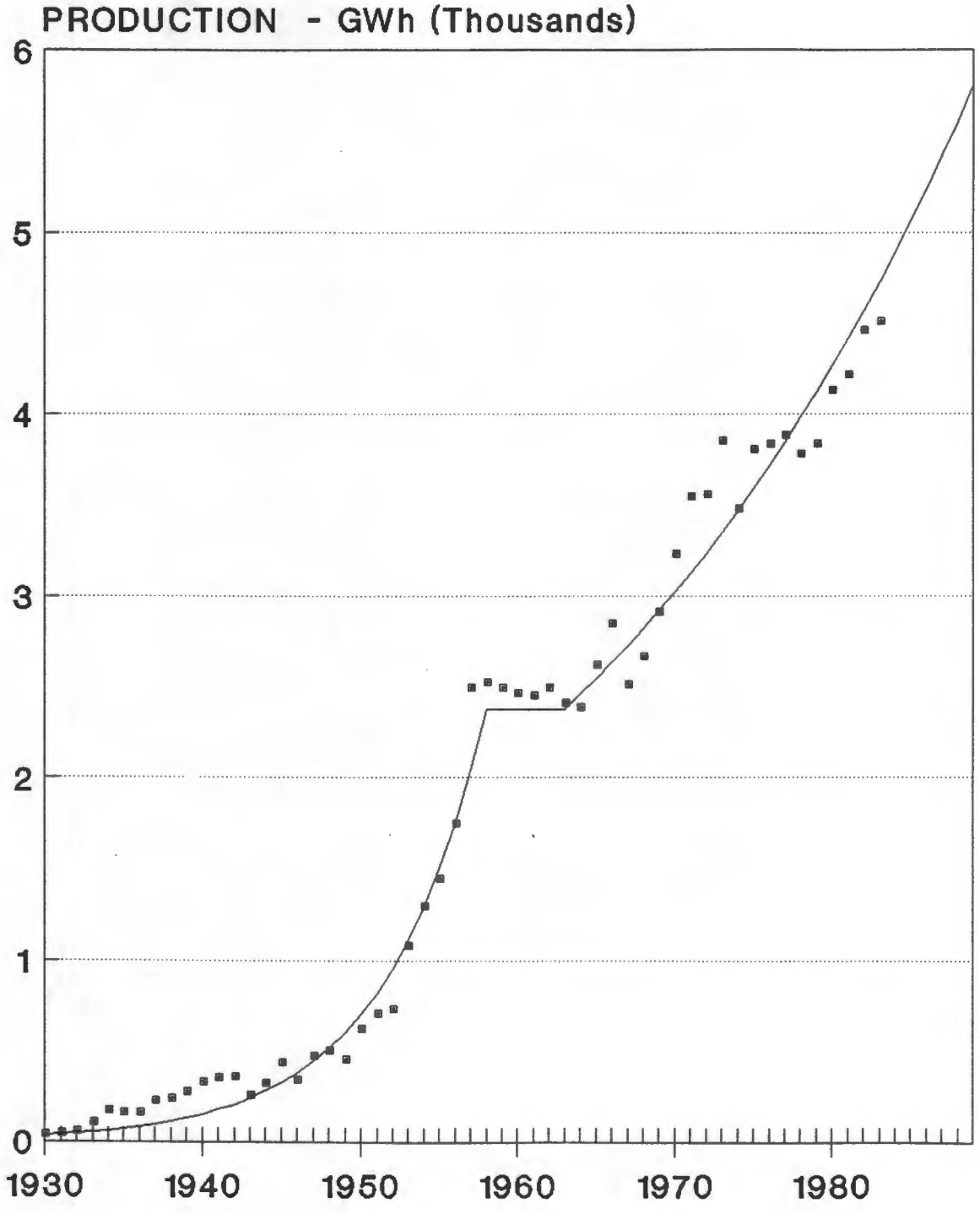
	SNEL	OTHERS
Hydro	2402 MW (93 %)	80 MW (3 %)
Thermal	60 MW (2%)	55 MW (2%)

There are three main distribution areas :-

a) Bas-Zaire system at the western end of the country supplying Kinshasa, Matadi, and other surrounding urban areas. There is also some supply to the Congo.

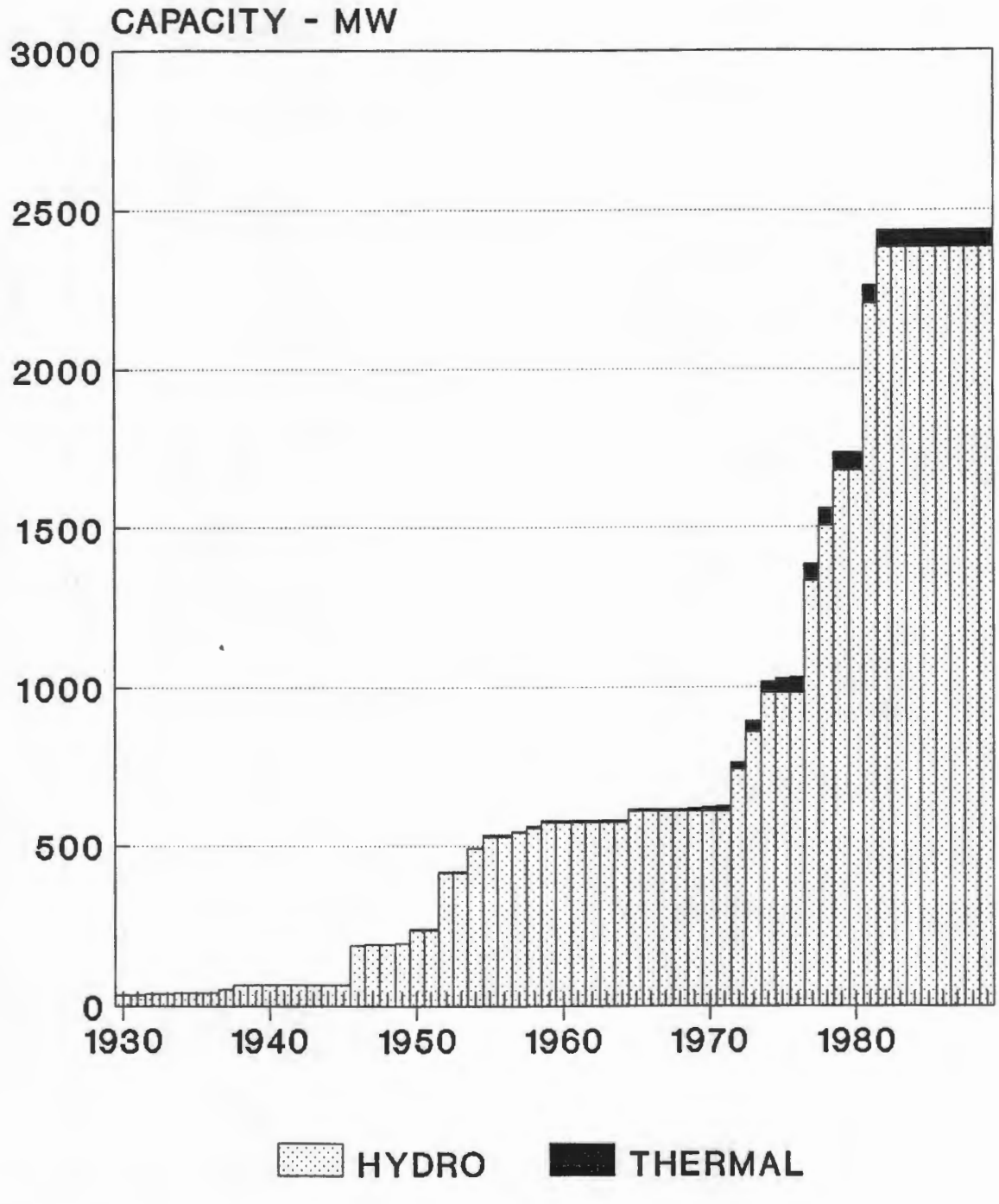
b) Shaba network in the south-eastern part of the country supplying Lubumbashi and other urban areas and with an interconnection with Zambia.

c) Kivu system located in the eastern part supplying local urban areas and inter-connected to Rwanda and Burundi.



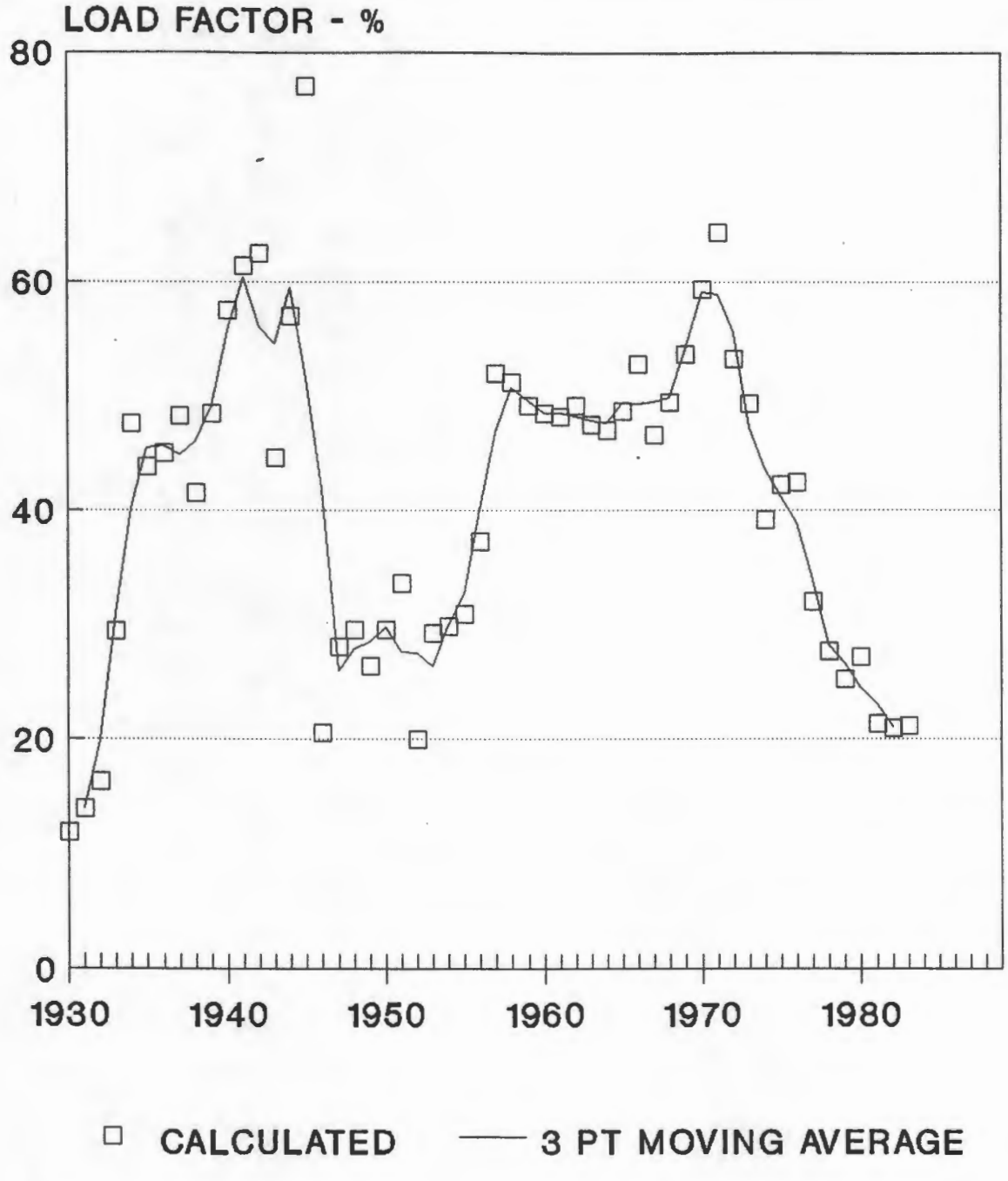
ZAIRE 110/FIG6

Figure 6: Electricity production in Zaire over the period 1930 to 1983



ZAIRE 110/FIG7

Figure 7: **Installed electrical generating capacity over the period 1930 to 1983**



ZAIRE 110/FIG8

Figure 8: Load factor on an assumed Zaire integrated electricity network

The Bas-Zaire and Shaba systems are connected by a 1 700 km Direct-Current link operating at 500 kV between the Inga Power Station and Kolwesi in Shaba Province. This line is currently operated and maintained on SNEL's behalf by Constructeurs Inga-Shaba, a local subsidiary of the international Morrison-Knudsen Company.

The Inga-Kolwesi line was constructed in anticipation of a continuing boom in copper prices on the world market and was rated at 1 120 MW. With the decline in copper prices and the reduced economic activity the terminal equipment was downgraded and the line can only cope with a maximum of 560 MW. During the first years of operation of the line the maximum demand was in the 60-140 MW range.

Because of these factors, and especially because of the high capital cost of the transmission line, the delivered cost of electricity to the Gecamines mines from Inga is US (1984)cents 1,66/kWh, excluding the capital cost of the Inga Power Station. Increased utilization of this line would reduce this cost significantly.

The most important generation capacity on the Zaire electrical system is the Inga II Power Station which consists of eight generating sets, each with a 178 MW capacity giving a total installed capacity of 1 424 MW. Construction started in the early 1970's and was completed in 1982. The cost of the plant was US$ 590/kW in 1984 prices. Because the economic conditions forecast for Zaire did not materialize Inga has always been under-utilized with, for instance, a load factor of 30% in 1984 and an actual output of 1 942 GWh compared with a possible 6 500 GWh.

The operation of Inga II has been badly affected by design and maintenance problems. Because of these it has not been possible to synchronize Inga I and Inga II onto the same system. As a result Kinshasa is fed from the Inga I Power Station whilst Inga II feeds the Inga-Kolwesi D.C. line only. In addition, Inga II Power Station has been forced to operate at conditions of severe cavitation which results in deterioration of the turbine runners.

The down-turn in economy did not only affect Inga's output but had repercussions on all of the installed capacity. Thus SNEL's annual output was 4 700 GWh in 1984 which is approximately 43% of the potential production. As a result of this the load factor on the assumed integrated system has dropped from

a high of 64% in 1971 to 21% in 1983. This is shown in Figure 8. However, this figure hides an imbalance between the various regions. Thus the ratio of peak demand to installed capacity is 0,92 in Shaba province but is 0,27 for Bas-Zaire and Kinshasa. The latter region has 75% of SNEL's installed capacity but produces only 33,8% of electricity.

The sectorial demand picture for Zaire is not available but in 1983 72% was supplied at high voltage, ie to large industry, 12% at medium voltage, ie mainly to small industry though it may include some residential, and 16% was at low voltage.

Table 8: Number of electrical connections as at 1983

	Number of connections	Number of households in region	Connection percentage
Kinshasa	57 386	310 100	18,5
Bandundu	1 570	388 762	0,4
Bas Zaire	9 184	195 751	4,7
Equateur	3 048	325 046	0,9
Haut Zaire	4 715	423 647	1,1
Kasai Occidental	2 395	234 740	1,0
Kasai Oriental	2 212	192 520	1,1
Shaba	18 357	413 505	4,4
Kivu	5 789	515 157	1,1
All regions	104 656	2 999 228	3,5

The domestic consumption of electricity is low due to the small number of consumers connected to the grid. Even in the urban areas the number of customers is small. The Table 8 shows the estimated number and percentages of domestic consumers in the main areas. For the country as a whole the electricity penetration into the domestic market is only 3,5% with most people relying on fuelwood and charcoal. One of the objectives of SNEL has been to increase this

penetration, especially in the more densely populated regions such as in Kinshasa. It has set itself the goal of increasing the domestic connection in Kinshasa from 18,5% in 1983 to 70% by 1991. However, it is unlikely that this target will be reached.

One of the problems of increased penetration into the domestic market will remain the inability of the people to pay for their electricity or even for SNEL to be able to collect the amounts owing. In view of the cost of meters and of the difficulty of reading them one of the plans is to install circuit breakers of a given size, eg 4 amps, and to charge the consumer a fixed charge depending on the circuit breaker setting.

The move to increased electrification appears to be overly optimistic, and also may not be economically attractive from the national point of view. The World Bank has estimated that the long run marginal cost of energy using charcoal is approximately half of that of electricity. Improving the efficiency of charcoal utilization by the use of improved stoves would further widen the gap between charcoal and electricity. The Bank also points out that in areas where charcoal and electricity overlap, such as in Kinshasa, the substitution of charcoal by electricity has been small even where incentives such as free appliances and subsidized energy have been tried.

5.5 Energy substitution

By far the largest proportion of energy demand is in the domestic sector and the main source is fuelwood and charcoal. At present the marginal cost of charcoal is half that of electricity and even with high subsidization of electricity in the domestic sector it is not competitive with charcoal. It is only in the middle and higher income groups where convenience is considered above cost that there is likely to be a significant substitution of charcoal by electricity.

In the transport sector there is little scope for fuel substitution in road vehicles with the introduction of ethanol being one of the options being considered. One of the largest users of petroleum fuels is Gecamines and they are considering the replacement of diesel vehicles in open pit mining by electric traction.

There is also some scope for the replacement of coke in metallurgical furnaces by electricity, and to reduce the use of fossil fuels in industrial boilers by changing

over to electric boilers, and to replace the use of heavy fuel oil in cement works by coal.

6. PRICING

Of the energy sources only firewood and charcoal are not controlled by a price mechanism. The price of petroleum products and electricity is controlled by the government and the World Bank study has indicated that the true cost of energy is not being recovered.

The price of firewood and charcoal varies from market to market and is usually based on volume which makes no allowance for the type (calorific value) of the fuel, and the client sees the value of firewood as being based on the apparent volume. The average price of firewood or charcoal decreases with distance along lesser frequented roads but is approximately constant along major roadways. Transporters appear to charge a fixed price based on volume and irrespective of the distance travelled. All these factors are indicative of an unsophisticated market with little competition from alternative energy sources. Prices do not reflect economic cost though the high mark-ups at each stage, especially of charcoal, result in a higher than economic price being charged. Especially true of this skewed price system is the fact that raw material is considered a "free good" and no allowance is made for reforestation. Whilst the sources of firewood remain good near highly populated regions this factor is not very important but near Kinshasa there is a growing scarcity of firewood and some other pricing mechanism will have to come into being.

Until 1984 the petroleum pricing policy suffered from a number of problems. Firstly, there was an official uniform petroleum price across the country, secondly there was cross-subsidization across products, and lastly there was a lack of any regular price revision. The main concern was the cross-subsidization of diesel fuel by gasoline. Thus diesel fuel was priced at half that of gasoline and the equalization fund charge for gasoline was 35,1 Zaires(1984) whilst the equalization fund for diesel fuel was -19,9 Zaires. Gasoline became a luxury item and at one stage it's retail price was one of the highest in the world. This led to a distortion of the usage pattern with gasoline sales decreasing until the equalization fund recovery on gasoline could not cover the subsidy on diesel.

Since 1985 the government has adopted a system of pricing which is based on central prices at a number of locations with realistic distribution costs. The price of diesel fuel has increased until there is now approximate parity between gasoline and diesel.

In the area of electricity the government has adopted a drive to recruit more low-voltage consumers by SNEL, and has been encouraging foreign investment especially under the ZOFI scheme. This scheme encourages investment in energy-intensive export orientated industry by tax and duty concessions and by the provision of cheap energy. This scheme could have serious repercussions on electricity supply in the longer term. The reason for this is that at present there is a surplus generating capacity which could rapidly decrease if significant growth occurs. Thus any pricing structure which is based on short-run marginal costing considerations could become a financial embarrassment in the longer term. It has been estimated by the World Bank that the short-run marginal cost of electricity from Inga II is US (1984)Cents 0,21/kWh whilst the long-run marginal cost is US (1984)Cents 0,68/kWh.

Electricity tariffs have also resulted in a significant cross-subsidization. Low voltage domestic consumers are the most heavily subsidized energy user in Zaire with the price in 1985 of US cents 1,0/kWh, which is about 12% of the long-term national marginal cost of electricity. In addition, consumers far from the hydro-stations and relying heavily on more expensive thermal power pay the same tariff as any other consumer leading to an under-recovery of costs. The introduction of a realistic tariff is complicated by the fact that some two-thirds of electricity usage is by the state mining company Gecamines and therefore any tariff changes are considered at the top government level since they impinge on the economic viability of the mining operation. The World Bank has suggested that a more equitable tariff which includes provision for debt service should be considered.

7. DISCUSSION

Zaire has large resources of wood and of hydro-power which makes it independent of imported energy with the exception of oil. Whilst it is an exporter of crude oil the amount of production has reached a peak and will decrease with time even though anticipated new finds will extend the life of the oil producers. Because of the inability of the refinery to convert the heavy crude produced into

the correct range of oil products for the country's own use, all the crude is exported and the required products and some light crude are imported. Thus the country may be considered as a net importer of petroleum products.

The country is self sufficient in wood fuel and charcoal which are the main fuels of the domestic sector. Whilst there is no national shortage of wood there are regional shortages caused by the difficult transport problems especially in the rain-forest areas. There are plans therefore for reforestation in areas near the more densely populated urban areas such as Kinshasa.

Whilst the main electricity potential is based on the Zaire River, there is scope for diversified local generation because of the difficulty of access across parts of the country. At present their is an over-supply of generating capacity, mainly in the west of the country and the Inga II Power Station is only operating at half capacity. For technical reasons it has not been possible to synchronize the Inga II system with the western grid and the Inga II station is only used to feed the Inga-Kolwezi D.C. link which supplies Shaba Province.

The main supplier of electricity, SNEL, have plans for increasing penetration into the domestic market, whilst the Government are trying to attract foreign investment for energy intensive export orientated industry. Whilst one of the attractions is cheap electricity, the World Bank is concerned that short-run marginal costing considerations being used to price electricity may, in the longer term, prove to be a financial embarrassment to the country. The Bank has suggested that the present electricity pricing policy does not adequately cover costs.

The hydro-electrical potential of the Zaire River is very large but can only be adequately tapped if the capacity installed is large. There is therefore, scope for the supply of electricity from Zaire to other countries in the sub-continent.

Since 1985 the government has been investigating the role of electricity in the economy and has been considering pricing policy, energy conservation, and energy substitution. These measures will have a long-term effect on the use of energy but the main driving force is the country's economy and energy consumption will follow the economy directly in the medium term.

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9. TABLES

Table A: Energy consumption and economic data

YEAR	OIL	ELECT	COAL	TOTAL COMMER	GNP US $/CAP current	GNP Billion Z current	POPUL million	GDP DEFLAT	ZAIRE/US$	GNP/CAP US$ curr	GNP/CAP US$ ('80)	GNP/CAP ZAIR curr	GNP/CAP ZAIR '80	GNP ZAIRE '80 million	ENER/CAP kJ/CAP	ENER/GNP kJ PER Million Z
	ENERGY CONSUMPTION 000'S TONS OIL EQUIVALENT															
1967	NA	216.03	NA	NA	170	0.87	18.222	3.6	0.3	170	4722	48	1326	24167	NA	NA
1968	NA	229.66	NA	NA	170	1.39	18.608	5.6	0.5	170	3036	75	1334	24821	NA	NA
1969	NA	251.03	NA	NA	180	1.77	19.026	6.6	0.5	180	2727	93	1410	26818	NA	NA
1970	NA	278.45	NA	NA	180	1.72	19.481	6.5	0.5	180	2769	88	1358	26462	NA	NA
1971	NA	305.17	NA	NA	200	1.94	19.976	6.8	0.5	200	2941	97	1428	28529	NA	NA
1972	NA	306.38	NA	NA	200	2.14	20.513	7.5	0.5	200	2667	104	1391	28533	NA	NA
1973	NA	331.72	NA	NA	240	2.73	21.094	8.9	0.5	240	2697	129	1454	30674	NA	NA
1974	775.35	290.92	45.84	1112.11	270	3.26	21.723	10.5	0.5	270	2571	150	1429	31048	2145	1501
1975	799.62	297.23	101.62	1198.47	300	3.44	22.399	11.8	0.5	300	2542	154	1302	29153	2242	1723
1976	765.11	298.03	108.66	1171.80	300	5.26	23.121	18.6	0.8	300	1613	227	1223	28280	2124	1736
1977	689.98	298.69	133.78	1122.45	330	7.39	23.885	25.5	0.9	330	1294	309	1213	28980	1969	1623
1978	655.98	282.79	134.88	1073.65	360	9	24.686	32.7	0.8	360	1101	365	1115	27523	1822	1634
1979	632.47	298.37	126.82	1057.66	410	18.22	25.519	66.0	1.7	410	621	714	1082	27606	1737	1605
1980	685.82	318.54	144.04	1148.40	430	28.04	26.377	100.0	2.8	430	430	1063	1063	28040	1824	1716
1981	714.83	338.06	136.86	1189.75	400	38.9	27.252	134.5	4.4	400	297	1427	1061	28922	1829	1724
1982	662.54	332.39	147.62	1142.55	340	50.03	28.134	180.6	5.8	340	188	1778	985	27702	1702	1728
1983	696.25	336.31	136.88	1169.44	290	94.71	29.013	341.4	12.9	290	85	3264	956	27742	1689	1766
1984	NA	NA	NA	NA	200	146.96	29.877	559.8	36.1	200	36	4919	879	26252	NA	NA
1985	NA	NA	NA	NA	160	197.69	30.712	726.6	49.9	160	22	6437	886	27208	NA	NA
1986	NA	NA	NA	NA	150	307.52	31.672	1055.2	59.6	150	14	9710	920	29143	NA	NA
1987	NA	NA	NA	NA	150	590.85	32.655	2009.1	112.4	150	7	18094	901	29409	NA	NA

Table B: Installed electrical capacity

YEAR	++++++++++ HYDRO CAPACITY - MW ++++++++++					********** THERMAL **********					TOTAL
	BZ & K	SHABA	OTHER	TOTAL	CUMUL	BZ & K	SHABA	OTHER	TOTAL	CUMUL	CUMUL INSTALLED
1930		32		32	32				0	0	32
1931				0	32				0	0	32
1932	6			6	38				0	0	38
1933				0	38				0	0	38
1934	2.2			2.2	40.2				0	0	40.2
1935				0	40.2				0	0	40.2
1936				0	40.2				0	0	40.2
1937		12		12	52.2				0	0	52.2
1938		12		12	64.2				0	0	64.2
1939				0	64.2				0	0	64.2
1940				0	64.2				0	0	64.2
1941				0	64.2				0	0	64.2
1942				0	64.2				0	0	64.2
1943				0	64.2				0	0	64.2
1944				0	64.2				0	0	64.2
1945				0	64.2				0	0	64.2
1946		124		124	188.2				0	0	188.2
1947	2			2	190.2				0	0	190.2
1948	2			2	192.2				0	0	192.2
1949	2		1.6	3.6	195.8				0	0	195.8
1950		42		42	237.8	1.3		0.4	1.7	1.7	239.5
1951				0	237.8				0	1.7	239.5
1952		178		178	415.8		0.8		0.8	2.5	418.3
1953				0	415.8				0	2.5	418.3
1954		75.9		75.9	491.7				0	2.5	494.2
1955	26		12.3	38.3	530	1.6			1.6	4.1	534.1
1956				0	530				0	4.1	534.1
1957	13			13	543				0	4.1	547.1
1958	12.6			12.6	555.6	2.6	0.2		2.8	6.9	562.5
1959		17.2		17.2	572.8				0	6.9	579.7
1960				0	572.8		0.5		0.5	7.4	580.2
1961				0	572.8				0	7.4	580.2
1962				0	572.8				0	7.4	580.2
1963				0	572.8				0	7.4	580.2
1964				0	572.8				0	7.4	580.2
1965	36			36	608.8				0	7.4	616.2
1966				0	608.8				0	7.4	616.2
1967				0	608.8				0	7.4	616.2
1968				0	608.8				0	7.4	616.2
1969				0	608.8			4.2	4.2	11.6	620.4
1970				0	608.8	0.8		1.2	2	13.6	622.4
1971				0	608.8	0.6		5.1	5.7	19.3	628.1
1972	132.6			132.6	741.4	1.2		1	2.2	21.5	762.9
1973	117			117	858.4			12.8	12.8	34.3	892.7
1974	117		6	123	981.4				0	34.3	1015.7
1975				0	981.4			13.4	13.4	47.7	1029.1
1976				0	981.4		0.4	1.9	2.3	50	1031.4
1977	350			350	1331.4			2.9	2.9	52.9	1384.3
1978	175			175	1506.4			1.3	1.3	54.2	1560.6
1979	175			175	1681.4				0	54.2	1735.6
1980				0	1681.4			1.4	1.4	55.6	1737
1981	525			525	2206.4				0	55.6	2262
1982	175			175	2381.4				0	55.6	2437
1983				0	2381.4				0	55.6	2437
1984				0	2381.4				0	55.6	2437
1985				0	2381.4				0	55.6	2437
1986				0	2381.4				0	55.6	2437
1987				0	2381.4				0	55.6	2437
1988				0	2381.4				0	55.6	2437
1989				0	2381.4				0	55.6	2437
1990				0	2381.4				0	55.6	2437
TOTAL	1868.4	493.1	19.9	2381.4		8.1	1.9	45.6	55.6		
% OF TOT	76.7	20.2	0.8	97.7		0.3	0.1	1.9	2.3		

Table C: Electricity consumption

YEAR	MWh	GROWTH %	L.F %
1930	33		
1931	39	18.2	13.9
1932	54	38.5	16.2
1933	98	81.5	29.4
1934	167	70.4	47.4
1935	154	-7.8	43.7
1936	158	2.6	44.9
1937	220	39.2	48.1
1938	233	5.9	41.4
1939	272	16.7	48.4
1940	323	18.8	57.4
1941	345	6.8	61.3
1942	351	1.7	62.4
1943	250	-28.8	44.5
1944	320	28.0	56.9
1945	433	35.3	77.0
1946	337	-22.2	20.4
1947	467	38.6	28.0
1948	497	6.4	29.5
1949	453	-8.9	26.4
1950	620	36.9	29.6
1951	704	13.5	33.6
1952	729	3.6	19.9
1953	1073	47.2	29.3
1954	1292	20.4	29.8
1955	1445	11.8	30.9
1956	1743	20.6	37.3
1957	2489	42.8	51.9
1958	2519	1.2	51.1
1959	2488	-1.3	49.0
1960	2456	-1.3	48.3
1961	2444	-0.5	48.1
1962	2492	2.0	49.0
1963	2407	-3.4	47.4
1964	2381	-1.1	46.8
1965	2618	10.0	48.5
1966	2841	8.5	52.6
1967	2506	-11.8	46.4
1968	2664	6.3	49.4
1969	2912	9.3	53.6
1970	3230	10.9	59.2
1971	3540	9.6	64.3
1972	3554	0.4	53.2
1973	3848	8.3	49.2
1974	3475	-9.7	39.1
1975	3800	9.4	42.2
1976	3828	0.7	42.4
1977	3880	1.4	32.0
1978	3777	-2.7	27.6
1979	3833	1.5	25.2
1980	4126	7.6	27.1
1981	4207	2.0	21.2
1982	4456	5.9	20.9
1983	4502	1.0	21.1

Table D: Oil production

YEAR	PRODUCTION MILLION BARRELS OFF-SHORE	ON-SHORE	TOTAL
1975	0.088	0.000	0.088
1976	9.038	0.000	9.038
1977	7.841	0.000	7.841
1978	6.921	0.000	6.921
1979	7.535	0.003	7.538
1980	6.625	0.146	6.771
1981	7.472	0.196	7.668
1982	8.030	0.364	8.394
1983	8.398	0.836	9.234
1984	9.900	1.800	11.700
1985	8.830	3.400	12.230
1986	7.890	3.970	11.860
1987	0.000	0.000	0.000
1988	0.000	0.000	10.700
1989	0.000	0.000	0.000
1990	0.000	0.000	0.000

Table E: Petroleum product consumption - Thousands Toe

YEAR	LPG	AVGAS	GASOLINE	KER/JET	GASOIL	FUEL OIL
1974	1.80	13.26	181.82	187.52	310.80	80.14
1975	1.69	10.77	189.95	198.35	315.80	83.04
1976	1.06	11.91	183.06	195.11	304.10	69.86
1977	1.38	6.94	148.28	171.64	288.10	73.64
1978	1.16	5.59	127.08	174.06	284.80	63.28
1979	1.91	6.11	122.55	178.92	259.60	63.37
1980	0.53	6.73	112.78	194.30	308.30	63.18
1981	1.16	6.11	114.22	191.07	329.30	72.97
1982	0.11	5.59	103.62	165.16	315.00	73.06
1983	0.42	5.39	91.99	175.18	353.60	69.67

IBRD 18841

ZAIRE
POWER SUBSECTOR

SNEL PRIVATE

Existing Hydropower Plants
Hydro Power Plants Under Construction
Projected Hydropower Plants
Existing Thermal Power Plants
Projected Thermal Power Plants

Transmission Lines:
HVDC Inga-Shaba
220 kV
110-130 kV
50-70 kV
Projected Transmission Lines

Cities Population:
Above 1,000,000 (National Capital)
250,000
100,000
Other Cities

Main Rivers
Rapids
International Boundaries

CENTRAL AFRICAN REP.
SUDAN
UGANDA
RWANDA
BURUNDI
TANZANIA
ZAMBIA
ANGOLA
PEOPLE'S REPUBLIC OF THE CONGO

Zongo
Libenge
Mobayi
Gbado-Lite
Gemena
Karawa
Mongala
Vele
N'zoro
Buta
Lisala
Bumba
Congo
Lopori
Basankusu
Maringa
Mbandaka
Bengamisa
Yangambi
Tshopo
Kisangani
Beni
Kisalala
Butembo
Bunia
Bugiana
Boende
Tshuapa
Mambaya
Inongo
L. Mai-Ndombe
Lukenie
Kasai
Sankuru
Bandundu
Kwilu
Zongo II
KINSHASA
Tshela
Lukula
Inga
Lemba
Boma
Matadi
Sanga
Mbanza-Ngungu
Kenge
Kikwit
Idiofa
Kakobola
Kasanza
Gungu
Mweka
Luebo
Demba
Kananga
Mbuji-Mayi
Tshala
Kabinda
Lubilanji
Kazumba
Katind
Tshimbulo
Tshikapa
Gandajika
Mwene - Ditu
Tshiomba
Kansama
Mani
Kilubi
Kamina
Kilbu
Lubilash
Ruiruru
Nyabiondo
Mokoros
Ruanguba
Gem
Belia
Luiiingu
Ambwe
Kindu
Lutshenvisaru
Kampen
Katana
Bukavu
Ruzuzi I
Ruzuzi II
L. Kivu
Mungombe
Bujumbura
Kasongo
Mangombe
Kongolo
Kyimbi
Kabalo
Kalemie
L. Tanganyika
Lunua
Piana-Mwanga
Mitwab
L. Mweru
Dikolongo
Lubudi
Kalule
N'seke
N'zilo
Kisanga
Kasenga
Kolwezi
Likasi
Kipushi
Lubumbashi
L. Bangweulu

KILOMETERS 0 100 200 300 400 500
MILES 0 100 200 300

JUNE 1985

IBRD 18859

ZAIRE

FORESTRY AND VEGETATION ZONES

- FORESTRY CONCESSIONS
- FLOODED TROPICAL RAIN FOREST
- MOIST EVERGREEN TROPICAL RAIN FOREST
- MOIST SEMI - DECIDUOUS TROPICAL RAIN FOREST
- OPEN FOREST
- DENSE MOUNTAIN FOREST
- MIXED ZONES
- TREE SAVANNA

- CAPITAL
- MAJOR TOWNS
- RIVERS
- INTERNATIONAL BOUNDARIES
- PROVINCE BOUNDARIES

APRIL 1985