ENERGY IN CENTRAL AFRICA: WITH SPECIAL REFERENCE TO ZAIRE

VOLUME II

by

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ENERGY PROFILES:

BURUNDI
CAMEROON
CENTRAL AFRICAN REPUBLIC
CONGO
GABON
RWANDA
SUDAN
UGANDA

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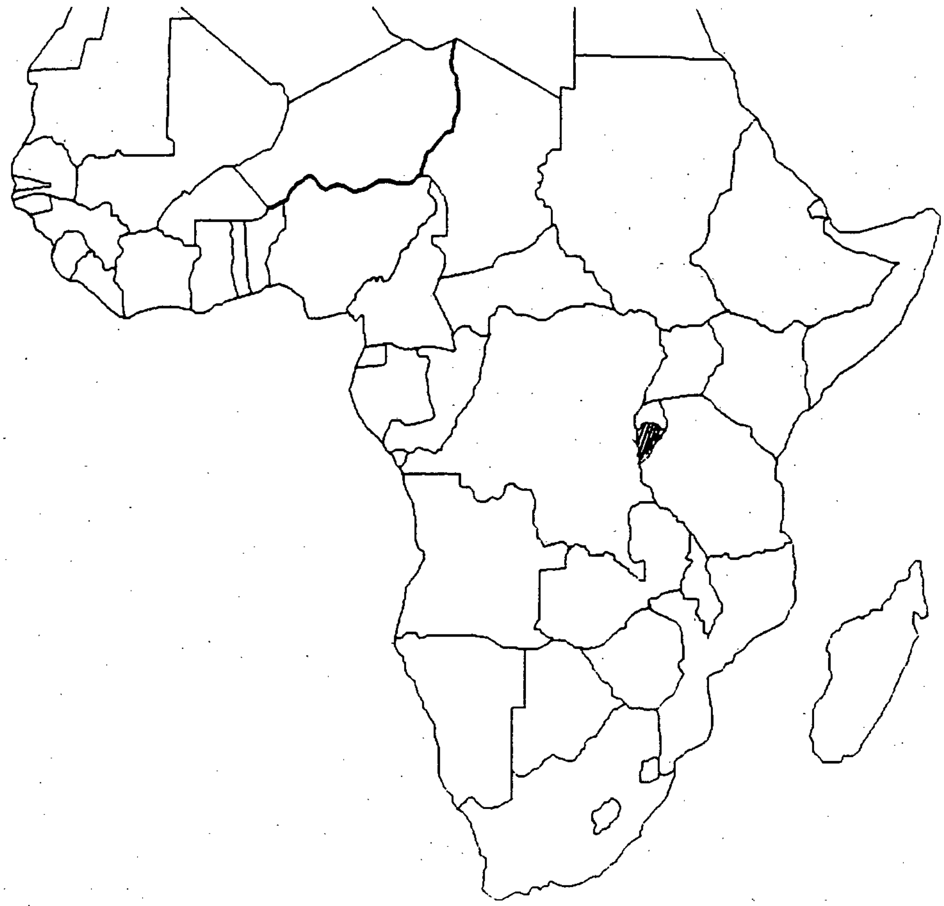
BURUNDI

1. INTRODUCTION



2. COUNTRY PROFILE

2.1 Introduction

Burundi was for a long time a kingdom. It was ruled by a Mwami (king), with a princely class called Ganwa positioned between the King and the people. The aristocracy of the kingdom was drawn from the feudal masters of the land, who consisted of the minority Tutsi ethnic groups. The territory was assigned to Germany by the Berlin Conference of 1885. It was absorbed, together with Rwanda and Tanganyika, by German East Africa in 1899. It was entrusted to Belgium as a League of Nations mandated territory, after the occupation by Belgian troops in 1916, and as a Trust territory under the United Nations in 1946. During the colonial period, the structures under the king remained but were modernized and rendered more efficient in terms of European needs for indirect administration.

Two main political parties emerged on the eve of independence: the Union pour le Progres National (UPRONA), and the Parti Democrate Chretien (PDC). Led by Rwagasore, the eldest son of the ruling king, the first party was a progressive

2.2 Geographical situation and demography

Burundi is a small landlocked country. It is bounded by Rwanda to the north, Tanzania to the east, and Zaire (with which it shares a natural divide formed by the Ruzizi River and Lake Tanganyika) to the west.

Compared to its modest size of 27 834 sq.km, Burundi is heavily populated. Moreover, it has a fast growing population. 1988 estimates give a population of 5 149 million people(1) and a very high population density of 185 persons per sq.km. The population and population growth rates on a yearly basis over the period 1967 to 1988 are shown in Fig. 1. The population is very young, with 45,6% under the age of 15(2). Life expectancy was estimated to be 48,5 years between 1985 and 1990. The literacy levels were 26% among adult females and 43% among adult males in 1985(2). About 92% of the labour force was engaged in agriculture in 1988(3).

The population is composed of three ethnics groups: the Hutu (84% of the population), the Tutsi (15%), and the Twa (1%). The Twa are hunters and descendents of the pygmies, the earlier settlers of the land. The Hutu are Bantus and farmers, while the Tutsi, who belong to the Nilotic family, are herdsmen and warriors. 95% of the population live in rural areas and is concentrated on fertile volcanic soil. In order to reduce the population pressure on the land, efforts are being made to move people to the Ruzizi valley.

2.3 Economy

Burundi is a low income country, with a GDP per capita of about 213 US$ in 1988. Figs 2 and 3 give its GDP and GDP per capita for the period 1967-88. Its economic development is constrained by various factors such as the lack of natural resources, overpopulation, its landlocked position, and the long distance from the sea.

The contribution of different economic sectors to the GDP are shown in Fig. 4. The economy is largely dependent on agriculture which provides more than 50% of GDP (see Fig. 5). The main cash crops are coffee (90% of total export earnings in 1986), tea (4,8%) and cotton (0,1%). Subsistence agriculture and small coffee cultivation are prevalent in rural areas. The sale of hides was the fourth most valuable source of export earnings in 1987(3). According to estimates by the World Bank, agricultural production increased by an annual average rate of 1,7% between 1980 and 1987(3).

The country's geographic position makes oil imports expensive (100 US$/barrel of gasoline in 1988). Oil represents about 15% of total imports and drains 20-30% of foreign exchange earnings. Domestic hydro-resources are relatively abundant, but they are costly to develop. Hydropower development dominates the public energy sector investment programme. Some plants have been built and others are planned. The grid is already connected to Zaire and Rwanda.

The substitution of the expensive petroleum products by alternative domestic sources of energy is a priority. In this regard, the exploitation of viable hydro-resources could help many industries to shift from fuel oil to electrical energy. However, a study has shown that under present electricity pricing, electricity does not constitute a feasible substitute for oil in industry[(4)]. The most significant inter-fuel substitution could come from the vast peat resources found in the country. Used in steam and hot water processes, peat could offer real opportunities for reducing fuel oil use in the industrial sector. It could also be used to meet household needs and reduce the pressure on forest resources.

3.2 Institutions

The Ministry of Energy and Mines controls the energy sector. Its Energy Directorate is responsible for overall policy, co-ordination and planning.

The petroleum sub-sector is under the control of the Ministry of Industry and Trade which supervises oil imports. However, the Ministries of Transport, Finance, and Planning are also involved in the process. Petroleum products are marketed by six private companies.

The exploitation and marketing of peat are the responsibilities of the Office National de la Tourbe (ONATOUR), a parastatal body created in 1977 under the Directorate of Geology and Mines of the Ministry of Energy and Mines. It also develops end-use equipment and utilisation methods.

The wood-fuel sub-sector is supervised by the Ministry of Management, Tourism, and the Environment. Through its Forestry Department, it is responsible for the supply of wood-fuels, forestry development and protection programmes, and efficiency promotion in charcoaling operations. The Ministry of Agriculture and Animal Husbandry is also involved in wood-fuel production when it is integrated with farming.

northwest (42 000 ha), and forests in valleys along water courses and steep gorges. Manmade forests are estimated to cover some 135 000 ha. 60 000 ha of the forest cover are legally protected.

These resources are dwindling very rapidly. As a result of over-population and the high population growth rate, they are severely strained by the expansion of agricultural land and harvesting of trees to meet the growing demand for both food and household energy. The country also has entrenched pastoralist traditions. The overgrazing caused by the increase in the animal population contributes to the pressure on land use. Compared to the 1976-78 figures, the cattle population had a growth of 49% and the sheep and goat population 20% in the ten-year period 1986-88[(2)].

A reforestation programme has been implemented since about 1980 with the assistance of the World Bank, and the co-operation of France, Belgium and Saudi Arabia. Planted forests of at least 1000 ha are located at Mugamba-Bututsi in south-central Burundi, Mumirwa (1000 ha), Gakara (1450 ha), and Vyanda (4900 ha). The World Bank is currently engaged in its second forestry project in the country. Private and communal tree farming is also encouraged. Although relatively successful, tree planting has not kept up with the growth of the population. In addition, the country is small and reforestation schemes are competing for land with food production and with population settlement. The government objective is to increase the forest cover from 7% to 20% of the land area or to some 550 000 ha.

There is no available data on agricultural residues. With the depletion of forest resources and the growing energy demand due to the increase of the population, the common alternative to wood-fuels are crop waste and dung, which are also used as fertilisers. Their increasing use as fuel rather than mulch decreases the soil quality of agricultural land which is already under pressure from the growing population.

4.2 Petroleum, gas and coal

Burundi has no domestic oil, gas or coal resources. With the exception of the Lake Tanganyika region where traces of oil have been found, geological prospects offer only limited encouragement to further exploration for oil. The American company, AMOCO, after positive seismic tests, drilled three exploratory wells offshore in Lake Tanganyika. However, drilling has been suspended following inconclusive results.

Table 1. Proven peat reserves[6] (quantities in thousand metric tons)

	1984	1989
Highland bogs:		
Gitanga	570	550
Gishubi (Matana)	170	131
Kuruyange (Gisozi)	210	173
Kashiru (Ijenda)	10	0
Nyacijima	15	15
Subtotal	**975**	**869**
Lowland bogs:		
Nyamuswaga	2 300	2 300
Akanyaru		
- Byongwe	20 000	19 998
- Ndurumi	14 400	14 400
- Nyavyamo	17 600	17 600
Subtotal	**54 300**	**54 298**
Total	**55 275**	**55 167**

4.5 Biogas and bagasses

Biogas development has received some attention. There are about 140 plants installed in the country, with a capacity ranging from 10 to 150 m^3. Most of them have been built by the project MEN-GTZ (Germany). There are two other projects, the project Sino-Burundais (China) and Project Methane (Belgium), which are promoting the production and the use of biogas. The majority of these plants have been financed by the users and most of them are still in use.

However, the conditions are not ideal for biogas. Although the social system encourages the maintenance of large cattle herds because it is a sign of wealth, the cattle are under-exploited. Dung is difficult to collect as animals are not kept in a resources, which have significantly reduced the country's dependence on electricity imports from Zaire. Peat is extracted on a very small scale. It can, in the long term, provide a substitute for oil and wood in some industrial processes as well as for household needs.

The total final consumption per capita is given in Fig. 14. The consumption of commercial fuel per capita is 13 kgoe, of which 11 kgoe is in form of oil. This highlights the lack of mineral or other base for oil-intensive development in the country. Energy intensity in the economy is shown in Fig. 15. Commercial energy intensity is low, reflecting the high cost of imported oil and the large share of manual agriculture in the economy.

5.2 Fuelwood and other traditional fuels

As can be seen in Figs 10 and 11, traditional fuels (wood, charcoal, and agricultural residues) are the main source of energy in Burundi. This situation is likely to remain so for many years given the country's resources endowment, geographic situation, and socio-economic situation.

Sectorially, the household sector accounts for about 98% of traditional fuel consumption in primary energy terms. The remainder is accounted for by industry and institutions. In primary energy terms, traditional fuels represent 99% of household energy consumption, of which fuelwood represents 73%, charcoal 16%, and agricultural residues 11%(6) . Whilst charcoal represents 16% in primary energy use terms, it represents only 3,5% in final energy use terms. Households in rural areas, which account for about 95% of the total population, consume the bulk of traditional fuels used in the household sector. With the continuing depletion of forest resources, crop residues (coffee and rice husks) are increasingly being used as fuels. However, the supply of agricultural residues is limited and seasonal.

It is estimated that one-fourth of the wood-fuels consumed in Burundi is purchased and the remainder gathered. Traditional fuels markets in rural areas are informal, except for missions, hospitals and rural factories like tea factories. In urban areas the markets are formal. Charcoal is the principal cooking fuel in urban areas, followed by wood. Daily family consumption of charcoal in Bujumbura is 2,5 kg, of which 30% is used for heating water(9). There is a small switch from traditional fuels to commercial fuels for high income level families.

The southern route, which was used for about 8% of oil imports in 1988, has two alternatives. The first alternative runs from Dar-es-Salaam to Kigoma in Tanzania via a 1253 km railroad and from Kigoma to Bujumbura by barge across Lake Tanganyika (175 km). Its use is affected by the lack of adequate railroad capacity and by its low reliability due to managerial and maintenance problems. In the second alternative, oil products are transported by trucks from Dar-es-Salaam to Bujumbura via Manyoni, Singida and Isaka in Tanzania, and sometimes also crossing Rwanda. During the rainy season, some parts of this route are inaccessible. This forces truck drivers to use emergency routes which are longer. A third alternative, by railroad from Dar-es-Salaam to Isaka in Tanzania, and by road transport from Isaka to Burundi, is envisaged for the future. This will become possible once the work on road modernization between the Rwanda frontier and Isaka, where a new terminal for Rwanda is being built, are finished.

Both routes are very expensive. Total transport costs are 107 US$/ton using the first alternative of the southern route and 254 US$/ton for the second alternative. For the northern route, transport costs are 262 US$/ton (including 52 US$ for the pipeline transit) for white products and 188 US$/ton for fuel oil by truck transport. This makes transport cost an important component of final price. Both routes are vulnerable to interruption because of political instability in the region. During a dispute with Kenya, Uganda's president, Idi Amin, ordered a ban on heavy vehicles from neighbouring countries from using Uganda's roads in 1977. In 1978 floods and a shortage of tank-cars possibly related to Tanzanian troops' involvement in Uganda reduced the capacity of the southern route. The civil war in Uganda disrupted road transport in 1984-85. The routes are also dependent on climatic conditions.

Oil storage facilities near the port of Bujumbura hold 12 000 m^3 (78 000 barrels), equivalent to about three months' consumption in 1981. To minimize any serious interruption in supply, the government has built additional oil storage capacities of 20 000 m^3 which have never been used since being commissioned in 1988 due to stock financing problems. The optimum volume of buffer stocks to be held has to be assessed carefully, the cost of maintaining the stockpile being compared to the possible cost of air freight.

5.4 Electricity

Public power supply is in the hands of the Régie de Production et de Distribution d'Eau et d'Electricité (REGIDESO) and the Direction Générale de l'Hydraulique et des Energies Rurales (DGHER). REGIDESO supplies power to urban centres, while

The Bujumbura network has been expanding radially. It includes the provinces of Bujumbura, Cibitoke, Kayanza, and Ngozi, and the localities of Tora and Mugamba in the provinces of Bururi and Gisozi, and Mwaro and Kibumbu in the province of Muramvya[6]. This network is supplied by the Rwegura station through a 110 kV transmission line, the Mugere plant through a 35 kV line of 25 km, and by the Ruzizi I and Ruzizi II dams on the Zaire-Rwanda border. Bujumbura is linked to Ruzizi I and Ruzizi II through a 70 kV transmission line of 110 km and a 110 kV transmission line respectively. The thermal power plant in Bujumbura has a nominal capacity of 7,4 MW. However, its actual output is only about 3 MW.

The Gitega network is mainly served by the Ruvyironza power station and an old thermal power station. The town of Gitega, which has experienced a rapid increase in its economic activities over the last few years, has experienced electricity shortages. The interconnection between Bujumbura and Gitega via Muramvya through a 110 kV transmission line was scheduled for completion in 1991. This interconnection was expected to free the Gitega network from electricity shortages.

The isolated systems are being regrouped into two separate subsystems in the south and the north-east. The first will interconnect Nyanza Lac, Rumonge, Makamba, Rutana, Gihofi and Bururi with the Nyemanga hydro-electric power plant (1,4 MW) through 30 kV transmission lines. The second will connect Cankunzo, Muyinga, Karuzi and Kirundo with the micro-hydro-electric plants of Murore (24 kW), Kayenzi (800 kW), Buhiga (240 kW), and Marangara (240 kW), also through 30 kV transmission lines[6].

The grid is interconnected to Zaire and Rwanda through the Ruzizi I and Ruzizi II schemes. The 28,2 MW Ruzizi I (with an estimated annual production of 148 GWh) is the property of the Zairean government and is operated by its electricity corporation SNEL. The Zairean government also owns the transmission line between Ruzizi II and Bujumbura and it also owns a substation in Bujumbura. The 2 x 13,3 MW Ruzizi II, located downstream from the Ruzizi I dam, is a joint project of the three CEPGL countries. Each of them has rights to one-third of the electricity produced. This station, operated by SINELAC, came on stream in 1989, with an annual output estimated at 140 GWh. A third unit is expected to be installed around 1995. According to recent studies, the available energy can be increased to 197 GWh with two units and 223 GWh with three units[6].

Table 3 shows the domestic hydro-electric schemes which are under consideration. The most important of them is probably the Kagunuzi multi-purpose project, for which a feasibility study already exists. Two scenarios, based on the independent or joint use of the Kagunuzi and Kaburantwa Rivers, are under the consideration. The first scenario (independent use) will lead to the development of the Masango, Rushila, Kagu 10 and Kagu 06 sites on the Kagunuzi River (using the waters released through the Rwegura power plants), and Kabu 16 and Kabu 23 on the Kaburantwa River.

The second scenario (joint use) envisages the replacement of the Kabu 23, Kabu 16, Kagu 10 and Kagu 6 projects by the Kagunuzi C, plus siphoning of the Kaburantwa River with the addition of either Kagunuzi A or Kagunuzi D. In fact, the Kagunuzi C power station is to have a big reservoir to be used for irrigation purpose in the Imbo Valley. In a second phase, the waters of the Kagunuzi would be diverted through a tunnel to the reservoir. They would be used for the extension of the Kagunuzi power plant (the Kagunuzi D power project) if there is a need for additional water for irrigation. Otherwise, an independent power plant (the Kagunuzi A project) will have to use them.

Future regional schemes include the Ruzizi III and Rusumu Falls schemes. The feasibility study for Ruzizi III, started in 1989 under the sponsorship of the Energie des Pays de Grands Lacs (EGL), was expected to be completed in mid-1991. The KBO members have been considering a generation station project at the Rusumu Falls, 2 kilometres downstream of the confluence of the Kagera and Ruvuvu Rivers on the border Rwanda-Tanzania. Feasibility studies, including flow control and water storage, were completed in 1987. In principle, an agreement has been reached with Rwanda to compensate that country for the flooding of its territory, but the project is not being pursued actively by the interested parties[6]. The plant would have an installed capacity of between 60 and 100 MW and a unit cost of 1,9 millions of 1987 US$/kW)[5].

Table 4. Annual peat production and consumption(6)

Year	Production (tons)	Sales (tons)
1977	42	42
1978	1 301	1 301
1979	2 703	2 703
1980	3 534	3 534
1981	6 435	5 570
1982	10 899	6 072
1983	13 293	7 852
1984	14 065	7 634
1985	10 261	8 237
1986	13 590	12 203
1987	17 530	12 000
1988	12 089	12 000
1989	14 212	12 500

Peat production and marketing are in the hands of Onatour. It has been receiving technical assistance from the Irish Peat Development Authority and the Canadian International Development Agency through the company Cartier-Moneco. The CIDA has been involved in carbonized peat briquette research. In 1988 the USAID ended its 8-year technical assistance for marketing and institutional development.

Peat is used by institutions (army, hospitals, prisons, schools) for cooking, and in small industries (bakers, brickmakers, textile plants, milk and tea processing factories) for heating processes. In the early 1980's the army accounted for 80% of peat consumption. The household sector has been reluctant to accept peat. On the one hand, peat is expensive and requires higher investment (for stoves and chimneys) than wood-fuels, and on the other hand it produces a bad smell, has a high smoke output, and has a high ash content. The use of peat in large industries could lead to the major development of peat production and help reduce the consumption of electricity and costly imported oil products. A projected nickel plant general tariff is 16 BuF/kWh for consumers using less than 375 kWh/month and 19 BuF/kWh those consuming more than 375 kWh per month. This last category of consumers had a tariff increase of 27% in April 1990. This is the initial step in the adjustment of their tariff to the long-run marginal cost estimated at 22,5 BuF/kWh (0,141 US$/kWh).

After negotiations, the cost of electricity imported from Zaire was raised from 1,83 BuF/kWh in 1980 to about 4 BuF/kWh in the 1990's.

6.3 Peat

The present retail price of peat is 8 BuF/kg (0,05 US$/kg) in Bujumbura. Extraction costs and transport to Bujumbura represent about 25% and 37,5% of the selling price respectively. The retail price in places close to the bogs is 5,5 BuF/kg (0,034 US$/kg). The price could drop to 6,4 BuF/kg (0,04 US$/kg) in Bujumbura if the production per year were increased to 20 000 tons.

6.4 Firewood and charcoal

Fuel-wood prices are free-market orientated but remain below the economic cost. Cost recovery is hindered by the fear of illegal cutting and marketing of forest products, and by the lack of an effective monitoring system. Wood-cutting in government and communal plantations is theoretically regulated by either a permit fee or a communal tax. The communal tax is levied when products cross the border between two prefectures. The stumpage fee set up by the government is 415 BuF/stere (2,59 US$/stere) of standing wood coming from public plantations.

The price of a sack of about 45 kg of charcoal is 750 BuF (4,69 US$) in Bujumbura and about 350 BuF (2,19 US$) at some road points around the production sites. The difference is due to transport, tax, and a high distribution margin. The community tax is about 50 BuF (0,313 US$) per bag of charcoal.

7. DISCUSSION

Wood is the main source of energy in the country. Forest resources cannot provide a sustainable supply. In the long term, reforestation programmes will be constrained

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TABLE A. ECONOMIC INDICATORS

CURRENCY: BURUNDI FRANC

MILLIONS OF NATIONAL CURRENCY UNLESS INDICATED

YEAR	POPUL. MILLIONS	POPUL. GROWTH RATE (%)	GROSS DOMESTIC PRODUCT AT MARKET COST: AGRICULTURE	INDUSTRY: TOTAL INDUSTRY	INDUSTRY: MINING QUARRY	INDUSTRY: MANUFACTURE	INDUSTRY: ELEC, WTR AND GAS	INDUSTRY: CONSTRUCTION	OTHER SERVICES + TAXES	TOTAL	GDP DEFLATOR	GDP AT 1985 PRICES MARKET	GDP/CAPITA CURRENT	GDP/CAPITA REAL 1985	EXCHANGE RATE BuF PER US$	GDP IN US$(MILL) CURRENT PRICE MARKET	GDP IN US$(MILL) AT 1985 PRICE MARKET	GDP PER CAPITA US$/CAP	GDP PER CAPITA US$(1985)/CAPITA
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	3.22	NA	NA	NA	NA	NA	NA	NA	NA	15600	22.2	70175	4849	21814	87.5	178	581	55	181
1968	3.25	0.9	NA	NA	NA	NA	NA	NA	NA	16030	27.8	57579	4938	17738	87.5	183	477	56	147
1969	3.30	1.5	NA	NA	NA	NA	NA	NA	NA	16640	34.8	47851	5050	14522	87.5	190	396	58	120
1970	3.35	1.7	13880	2000	NA	1430	NA	NA	5360	21240	35.1	60598	6340	18089	87.5	243	502	72	150
1971	3.42	2.1	14330	2160	NA	1620	NA	NA	5630	22120	25.3	87434	6468	25566	87.5	253	724	74	212
1972	3.49	2.2	13120	2330	NA	1770	NA	NA	6150	21600	26.5	81525	6182	23333	87.5	247	675	71	193
1973	3.57	2.1	15420	2830	NA	2270	NA	NA	6110	24360	27.7	87971	6825	24649	80.0	304	729	85	204
1974	3.64	2.1	16590	3300	NA	2580	NA	NA	7300	27190	31.2	87184	7462	23925	78.8	345	722	95	198
1975	3.72	2.1	20320	4170	NA	2840	NA	NA	8660	33150	37.7	87888	8911	23626	78.8	421	728	113	196
1976	3.80	2.0	23000	4540	NA	3160	NA	NA	11140	38680	40.8	94910	10192	25009	86.3	448	786	118	207
1977	3.87	1.9	27390	6000	NA	3880	NA	NA	16190	49580	46.9	105673	12815	27313	90.0	551	876	142	226
1978	3.94	1.9	29640	7860	NA	4530	NA	NA	17420	54920	52.4	104733	13928	26562	90.0	610	868	155	220
1979	4.02	2.1	37910	10360	NA	6550	NA	NA	22150	70420	66.1	106463	17500	26457	90.0	782	882	194	219
1980	4.11	2.2	47870	9700	NA	5700	NA	NA	25230	82800	77.0	107531	20126	26138	90.0	920	891	224	217
1981	4.21	2.4	50390	11070	NA	6400	NA	NA	25740	87200	71.5	121990	20698	28956	90.0	969	1011	230	240
1982	4.32	2.5	48080	12960	NA	7500	NA	NA	30160	91200	77.1	118299	21111	27384	90.0	1013	980	235	227
1983	4.44	2.7	53830	14580	NA	8410	NA	NA	34480	102890	81.3	126517	23194	28521	93.0	1107	1048	250	236
1984	4.56	2.8	64590	14870	NA	9260	NA	NA	40990	120450	95.1	126624	26403	27756	119.7	1006	1049	221	230
1985	4.70	2.9	77660	16410	NA	10170	NA	5599	47280	141350	100.0	141350	30100	30100	120.7	1171	1171	249	249
1986	4.84	3.0	72060	16640	NA	10790	NA	4942	52140	140840	96.0	146641	29117	30316	114.2	1234	1215	255	251
1987	4.99	3.1	71490	18590	NA	11910	NA	5691	50400	140480	92.0	152702	28175	30626	123.6	1137	1265	228	254
1988	5.14	3.1	75090	20070	NA	12900	NA	NA	58420	153580	97.1	158238	29879	30786	140.4	1094	1311	213	255
1989	5.30	3.1	NA	NA	NA	NA	NA	NA	NA	168550	100.0	168550	31808	31808	158.7	1062	1397	200	264
1990	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 C. ENERGY DATA FOR GRAPHS

YEAR	COMMERCIAL ENERGY COMPONENTS AS % OF COM. ENERGY FINAL CONS.			COMMERCIAL ENERGY COMPONENTS AS % OF TOTAL FINAL CONSUMPTION			COM. ENERGY FINAL CONSUMPTION GROWTH RATE			TOTAL FINAL CONSUMPTION GROWTH RATE		
	PEAT	OIL	ELECT	PEAT	OIL	ELECT	1 PT	3 PTS M.A.	5 PTS M.A.	1 PT	3 PT M.A.	5 PTS M.A.
1970	0.0	91.2	8.8	0.0	2.5	0.2	NA	NA	NA	NA	NA	NA
1971	0.0	90.5	9.5	0.0	2.4	0.3	0.8	NA	NA	2.1	NA	NA
1972	0.0	90.5	9.5	0.0	2.4	0.2	-0.2	0.2	NA	2.1	2.1	NA
1973	0.1	90.4	9.5	0.0	2.3	0.2	0.1	12.8	3.1	2.1	2.4	2.1
1974	0.0	93.1	6.9	0.0	3.2	0.2	38.4	5.0	8.2	3.0	2.1	2.2
1975	0.1	90.0	9.9	0.0	2.3	0.3	-23.5	13.8	6.7	1.2	2.3	2.1
1976	0.0	91.2	8.8	0.0	2.9	0.3	26.4	-1.6	11.0	2.7	1.8	2.2
1977	0.0	89.0	10.9	0.0	2.6	0.3	-7.9	13.4	4.4	1.6	2.3	2.0
1978	1.1	89.4	9.5	0.0	3.1	0.3	21.6	6.4	15.0	2.5	2.1	2.4
1979	2.2	87.7	10.1	0.1	3.1	0.4	5.5	18.8	10.0	2.2	2.6	2.4
1980	2.3	88.8	9.0	0.1	4.0	0.4	29.4	12.1	13.5	3.2	2.6	2.6
1981	3.5	86.8	9.7	0.2	3.8	0.4	1.5	13.5	12.0	2.4	2.8	2.8
1982	3.5	87.0	9.5	0.2	4.1	0.4	9.8	8.3	10.0	2.9	2.8	2.8
1983	4.0	86.0	10.1	0.2	4.5	0.5	13.8	6.4	6.7	3.2	2.8	2.9
1984	4.0	84.3	11.7	0.2	4.1	0.6	-4.5	7.5	4.2	2.5	3.0	2.9
1985	3.9	83.9	12.2	0.2	4.5	0.6	13.1	-0.8	6.4	3.4	2.7	3.1
1986	6.4	79.9	13.7	0.3	3.7	0.6	-11.1	7.5	4.1	2.4	3.2	3.1
1987	5.2	81.6	13.1	0.3	4.4	0.7	20.5	3.9	5.8	3.9	3.1	3.2
1988	5.1	81.3	13.5	0.3	4.3	0.7	2.5	9.0	NA	3.1	3.4	NA
1989	5.1	82.2	12.6	0.3	4.4	0.7	4.0	NA	NA	3.0	NA	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE E. OIL PRODUCT CONSUMPTION (000's METRIC TONS)

YEAR	LPG	RESIDUAL	PETROL	JET FUELS	KEROSENE	DIESEL	OTHER	TOTAL	DIESEL/ PETROL	% PETROL	% DIESEL	OIL TFC GROWTH RATE %/ YEAR	OIL TFC GROWTH RATE 3 PTS M.A.
1970	0.0	1.0	8.0	3.0	3.0	4.0	0.0	19.0	0.5	42.1	21.1	NA	NA
1971	0.0	1.0	8.0	3.0	3.0	4.0	0.0	19.0	0.5	42.1	21.1	0.0	NA
1972	0.0	1.0	9.0	1.0	3.0	5.0	0.0	19.0	0.6	47.4	26.3	−0.2	−0.1
1973	0.0	1.0	9.0	1.0	3.0	5.0	0.0	19.0	0.6	47.4	26.3	0.0	14.1
1974	0.0	2.0	12.4	2.0	2.4	8.0	0.2	27.0	0.6	45.9	29.6	42.5	5.5
1975	0.0	1.0	9.3	2.0	1.6	6.0	0.1	20.0	0.6	46.5	30.0	−26.0	14.8
1976	0.0	1.0	11.7	3.0	1.6	8.0	0.2	25.5	0.7	45.9	31.4	28.0	−2.7
1977	0.0	1.0	11.9	1.0	1.0	8.0	0.1	23.0	0.7	51.7	34.8	−10.0	13.4
1978	0.0	1.0	14.0	1.0	1.2	10.0	0.8	28.0	0.7	50.0	35.7	22.0	5.2
1979	0.0	3.0	12.6	1.0	1.0	11.0	0.6	29.2	0.9	43.2	37.7	3.5	18.8
1980	0.0	3.0	16.6	4.0	0.9	13.0	0.5	38.0	0.8	43.7	34.2	30.9	11.2
1981	0.0	3.6	14.8	3.8	1.5	14.3	0.1	38.1	1.0	38.8	37.5	−0.8	13.4
1982	0.0	4.3	15.4	4.3	1.6	16.2	0.1	41.9	1.1	36.8	38.7	10.0	7.2
1983	0.0	4.6	15.5	4.7	2.2	19.9	0.2	47.1	1.3	32.9	42.3	12.5	5.4
1984	0.0	5.6	15.3	4.8	2.4	15.9	0.2	44.2	1.0	34.6	36.0	−6.3	6.3
1985	0.0	6.3	16.1	4.4	2.2	20.8	−0.0	49.8	1.3	32.3	41.8	12.6	−3.0
1986	0.0	5.7	16.4	2.5	1.5	16.2	−0.1	42.2	1.0	38.9	38.4	−15.4	6.8
1987	0.0	7.5	17.7	3.7	2.1	20.8	0.1	51.9	1.2	34.1	40.1	23.1	3.3
1988	0.2	7.6	19.4	4.8	1.6	19.3	−0.0	52.9	1.0	36.7	36.5	2.1	10.1
1989	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.2	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

DATA OBTAINED : YEARBOOK OF WORLD ENERGY STATISTICS (1981)
BURUNDI: ISSUES AND OPTIONS IN THE ENERGY SECTOR (JUNE 1982)
BURUNDI: ISSUES AND OPTIONS IN THE ENERGY SECTOR (JANUARY 1992)

TABLE G. ELECTRICITY DATA CONSUMPTION OF ELECTRICITY (GWh)

YEAR	LV CONS.	MV CONS.	REGIDESO	DGHER	OTHER	TOTAL
1980	19.8	21.5	41.3	0.0	5.0	46.3
1981	21.7	24.0	45.7	0.0	5.1	50.8
1982	23.5	26.0	49.5	0.1	5.3	54.9
1983	27.5	32.9	60.4	0.1	5.4	65.9
1984	29.0	38.3	67.3	0.2	5.5	73.0
1985	47.9	32.5	80.4	0.4	5.7	86.5
1986	46.4	33.5	79.9	0.6	5.8	86.3
1987	36.9	56.3	93.2	0.7	5.8	99.7
1988	40.2	58.2	98.4	0.8	6.1	105.3
1989	43.5	50.3	93.8	0.9	7.5	102.2

DATA OBTAINED FROM: 'BURUNDI: ISSUES AND OPTIONS IN THE ENERGY SECTOR' (JANUARY 1992)

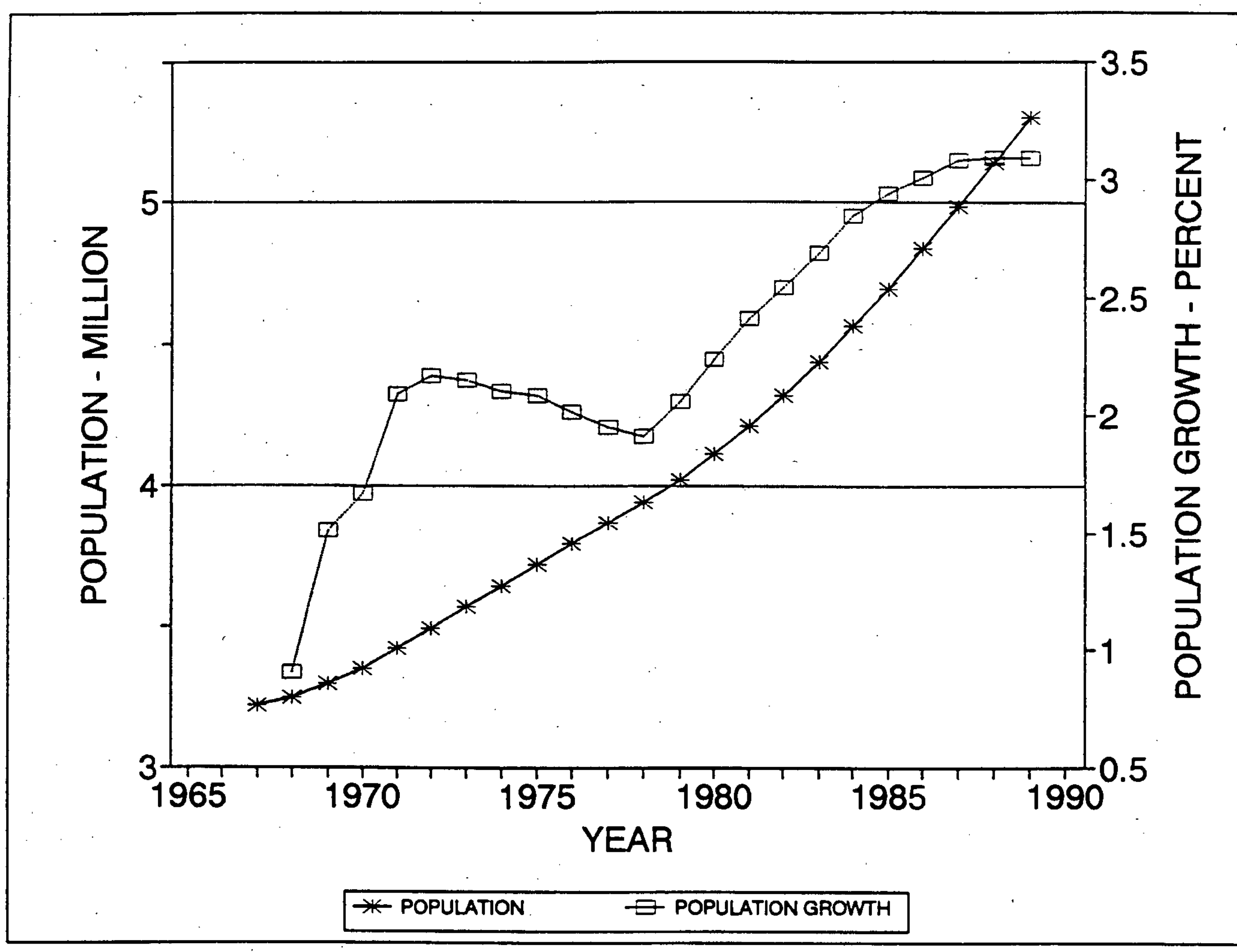


Figure 1. Population and population growth

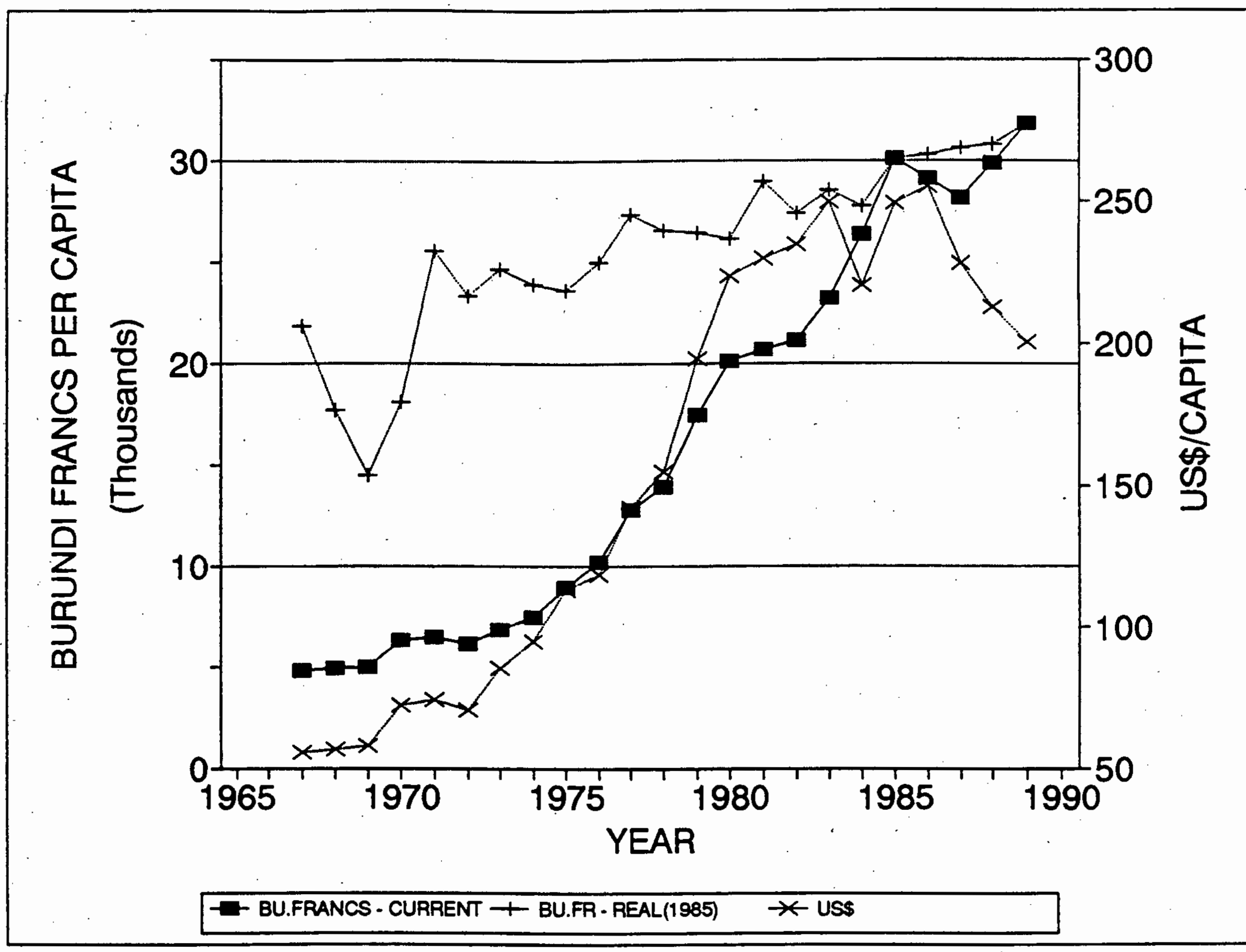


Figure 3. GDP per capita

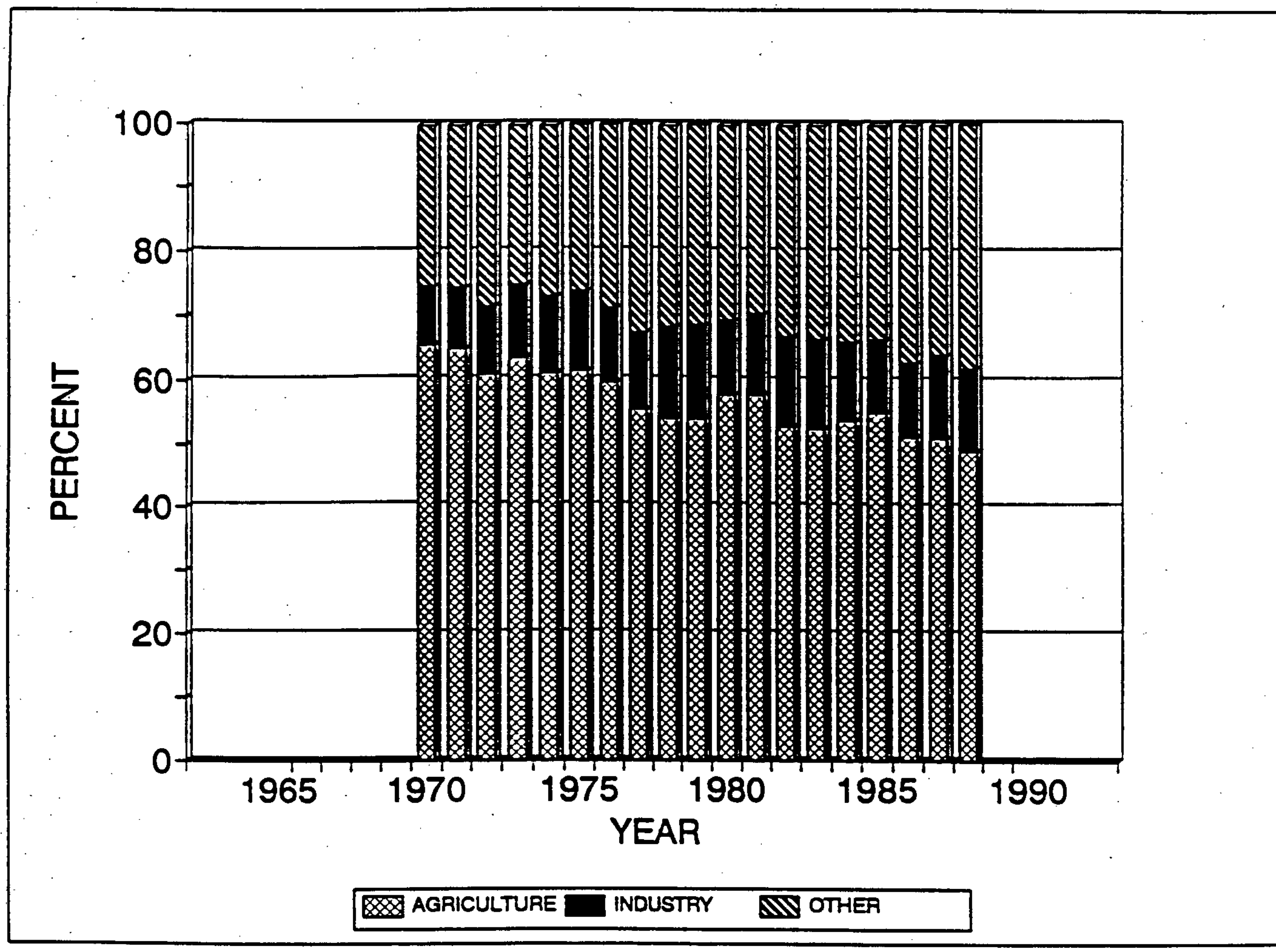


Figure 5. GDP components as percentage of total

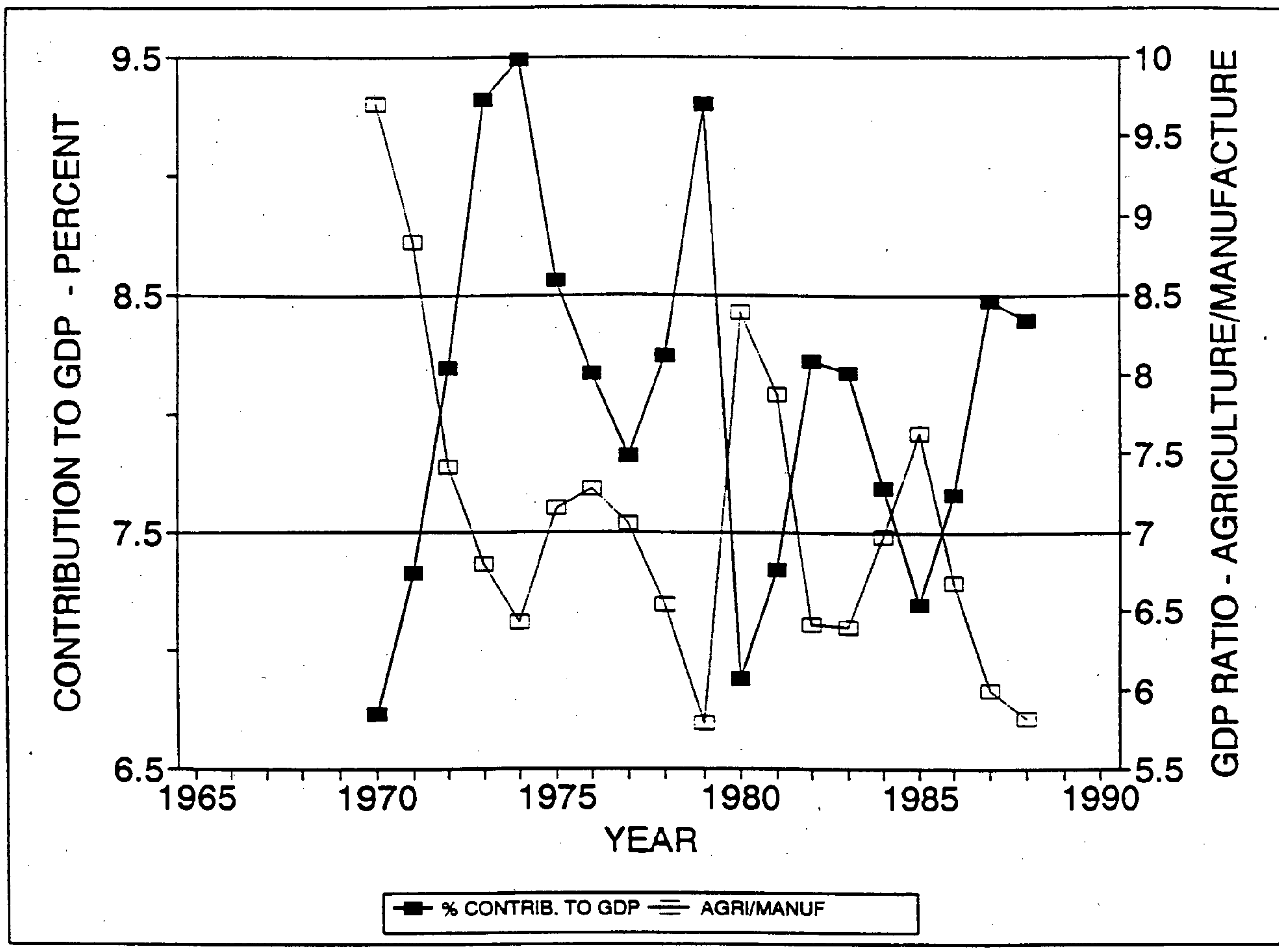


Figure 7. Manufacture: percentage contribution to GDP and GDP ratio

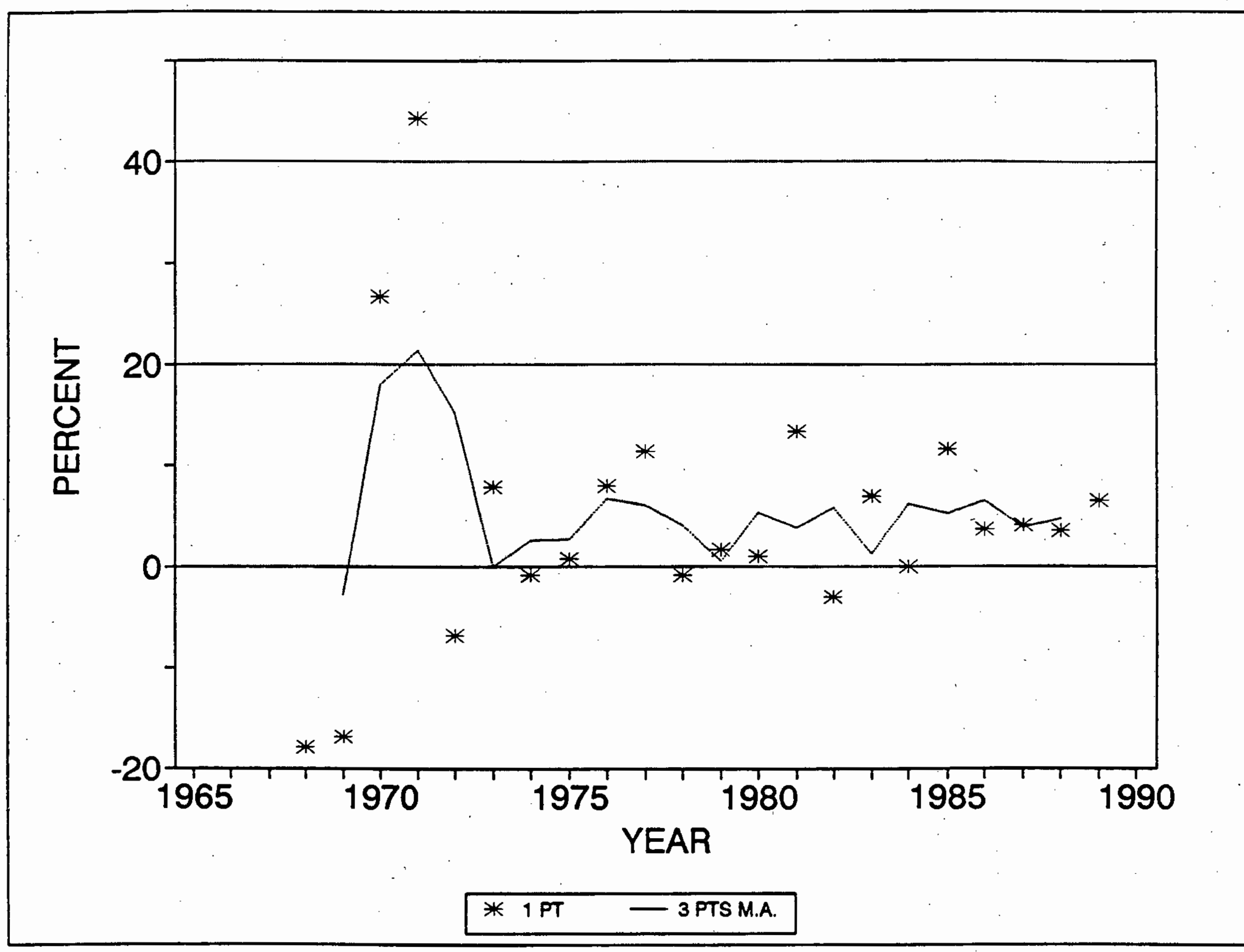


Figure 9. GDP per capita growth rate: percentage/year (Real 1985)

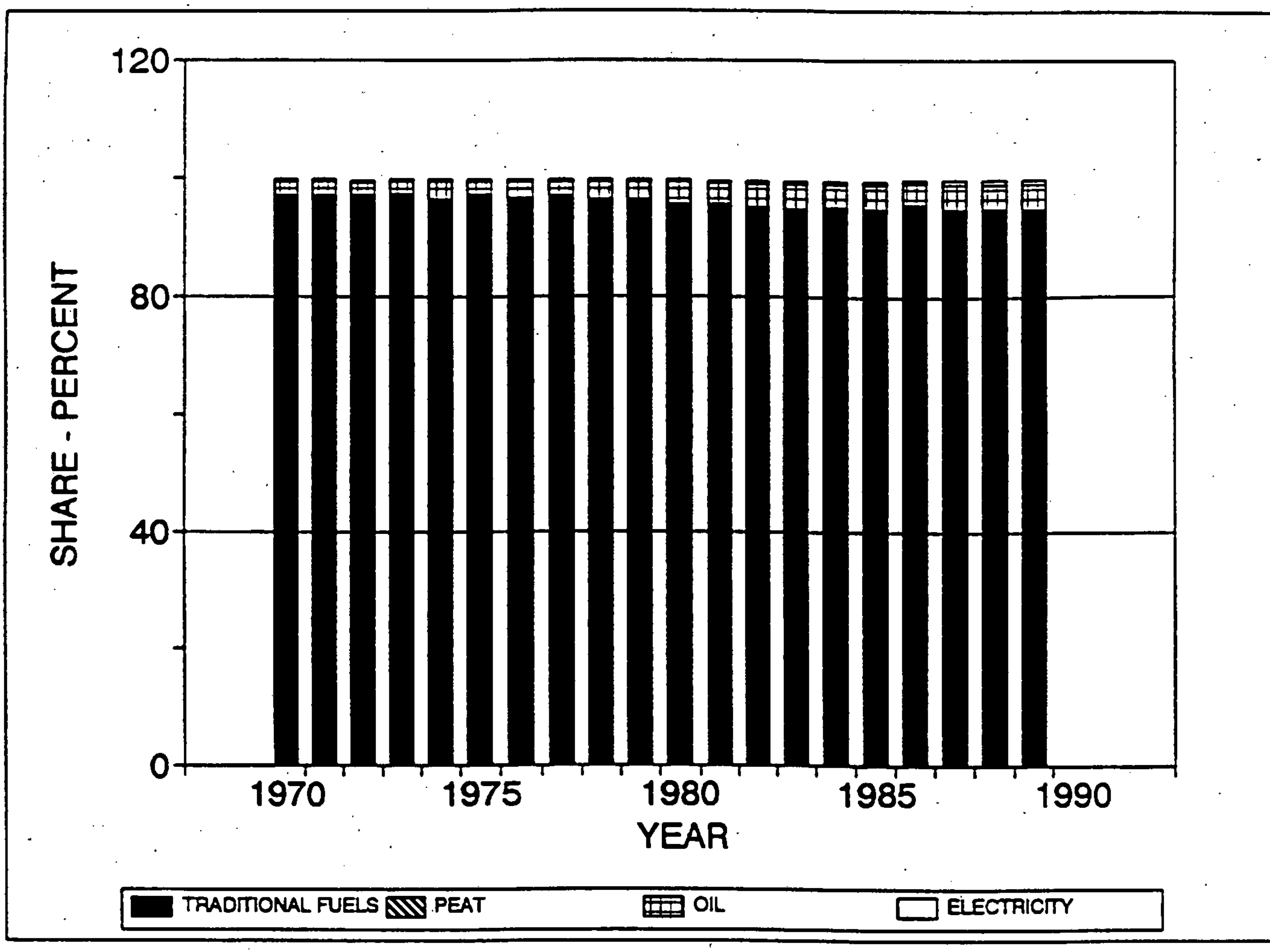


Figure 11. Total final consumption: percentage shares of components

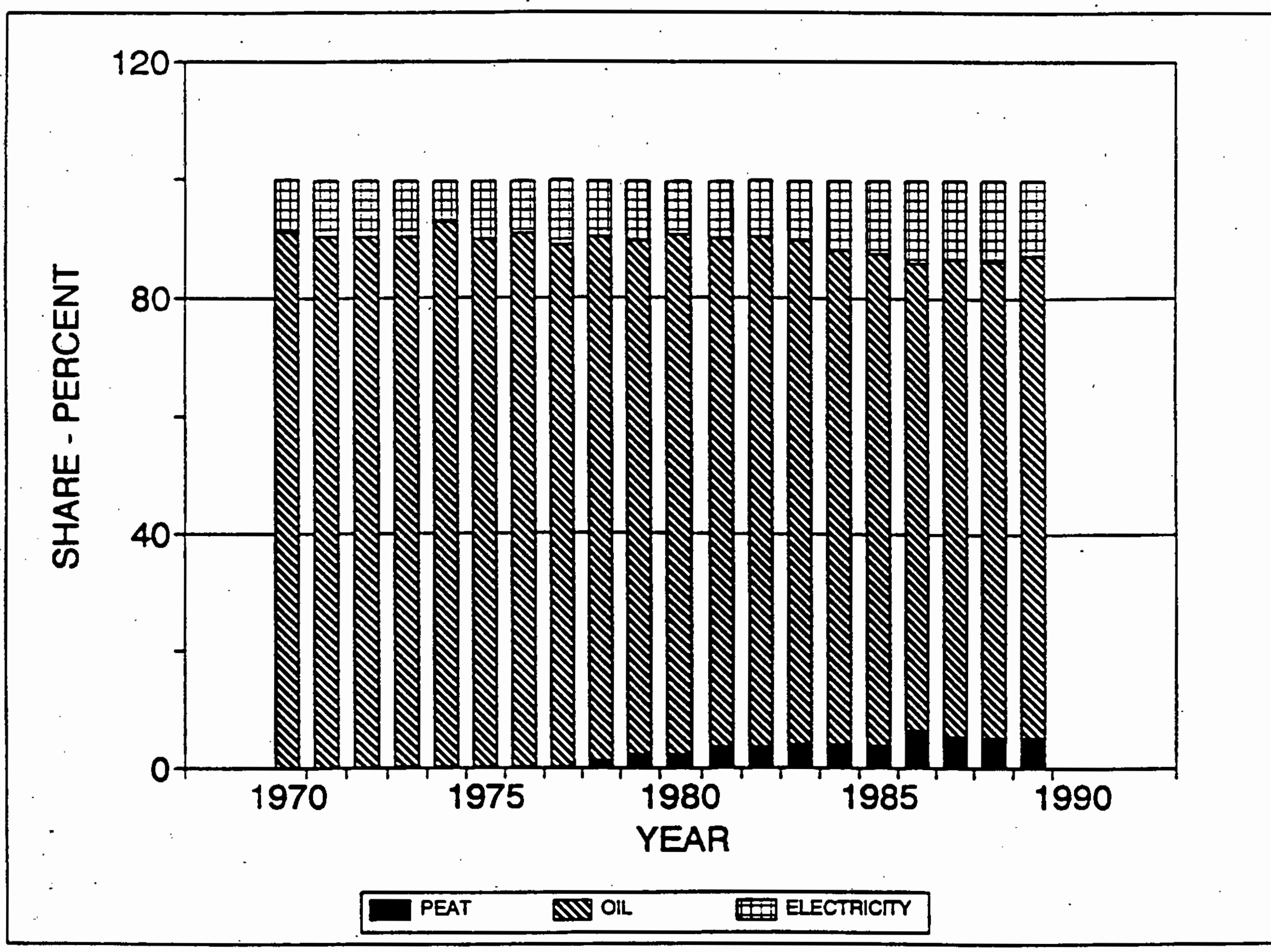


Figure 13. Commercial energy final consumption: percentage shares of components

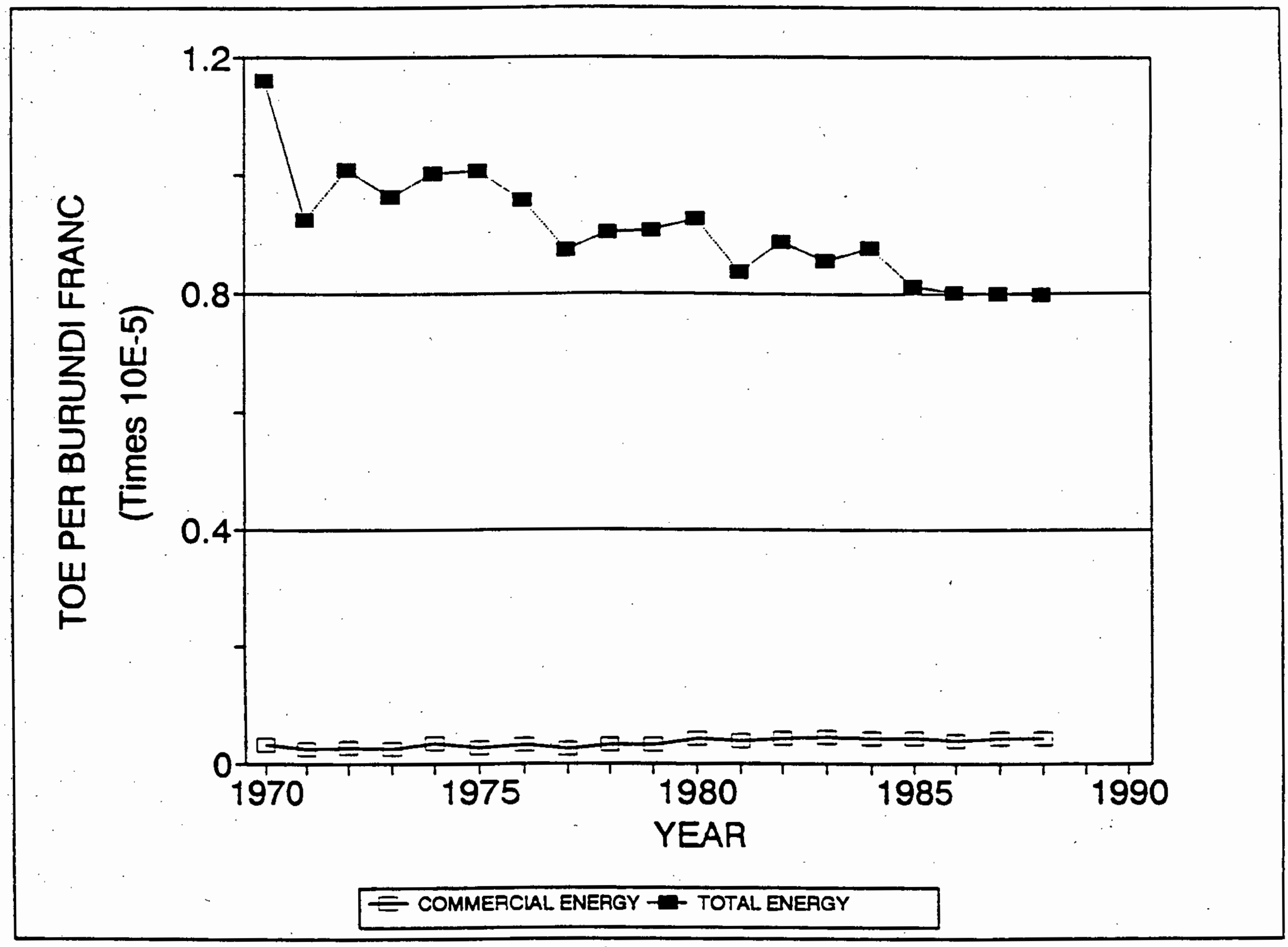


Figure 15. Energy intensity: final consumption / GDP (Real 1985)

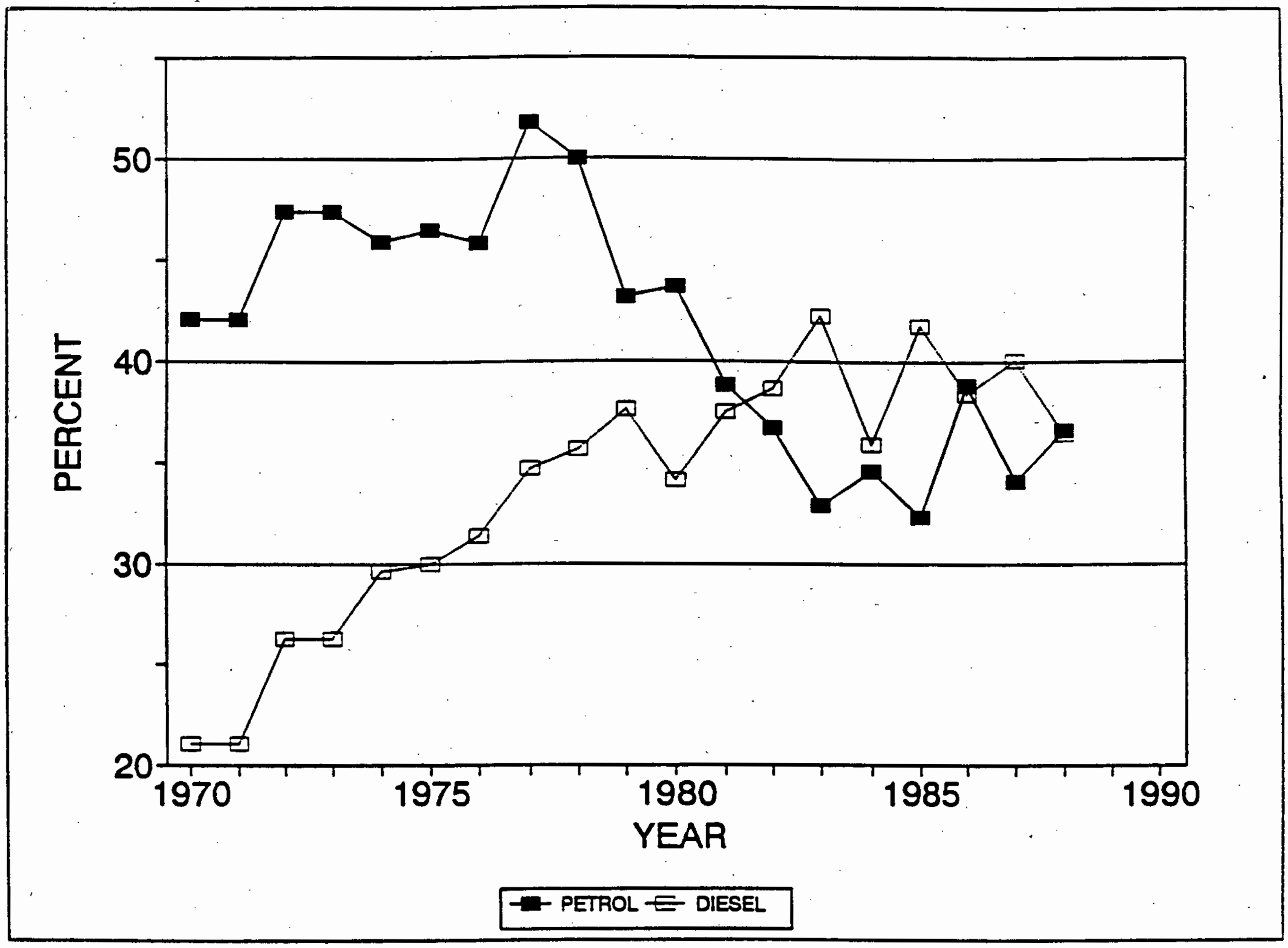


Figure 17. Petrol and diesel as percentage of oil consumption

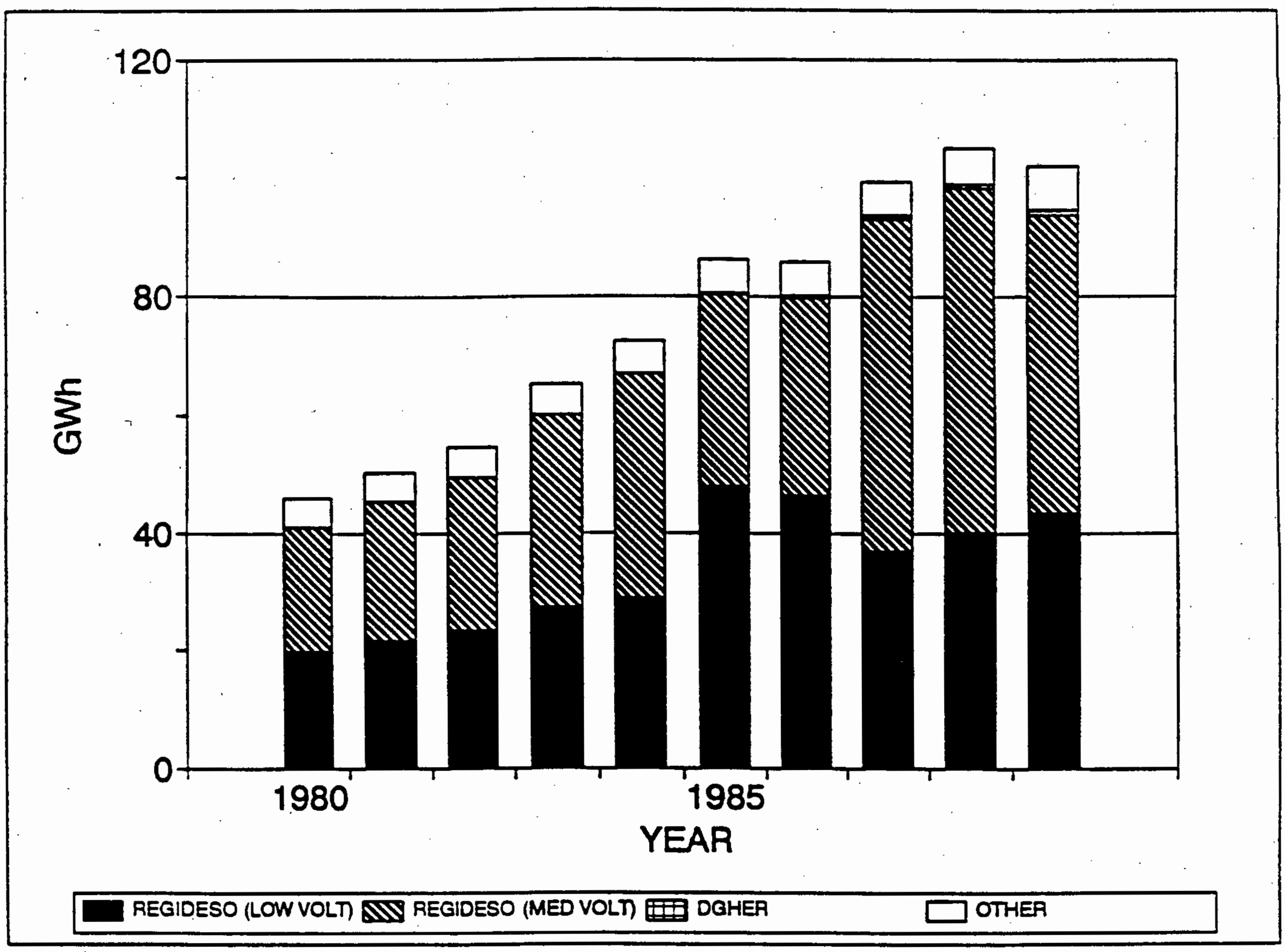
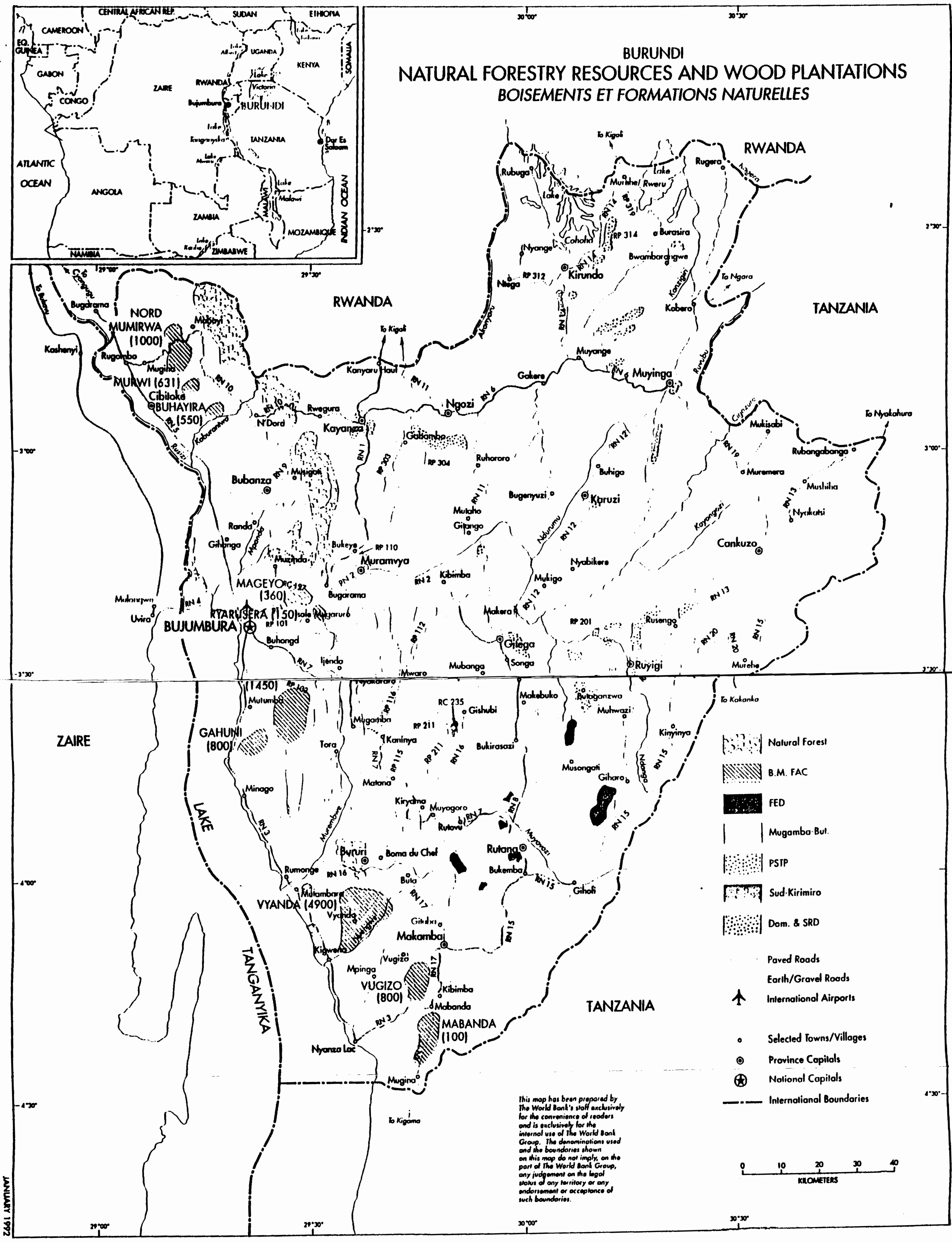


Figure 19. Shares of suppliers in electricity consumed


BURUNDI
NATURAL FORESTRY RESOURCES AND WOOD PLANTATIONS
BOISEMENTS ET FORMATIONS NATURELLES
RWANDA
TANZANIA
ZAIRE
LAKE TANGANYIKA
NORD MUMIRWA (1000)
MURWI (631)
BUHAYIRA (550)
MAGEYO (360)
RYARUSERA (150)
(1450)
GAHUNI (800)
VYANDA (4900)
VUGIZO (800)
MABANDA (100)
BUJUMBURA
Cibitoke
Bubanza
Kayanza
Ngozi
Kirundo
Muyinga
Muramvya
Gitega
Karuzi
Cankuzo
Ruyigi
Bururi
Makamba
Rutana
Natural Forest
B.M. FAC
FED
Mugamba-But.
PSTP
Sud-Kirimiro
Dom. & SRD
Paved Roads
Earth/Gravel Roads
International Airports
Selected Towns/Villages
Province Capitals
National Capitals
International Boundaries
0 10 20 30 40
KILOMETERS
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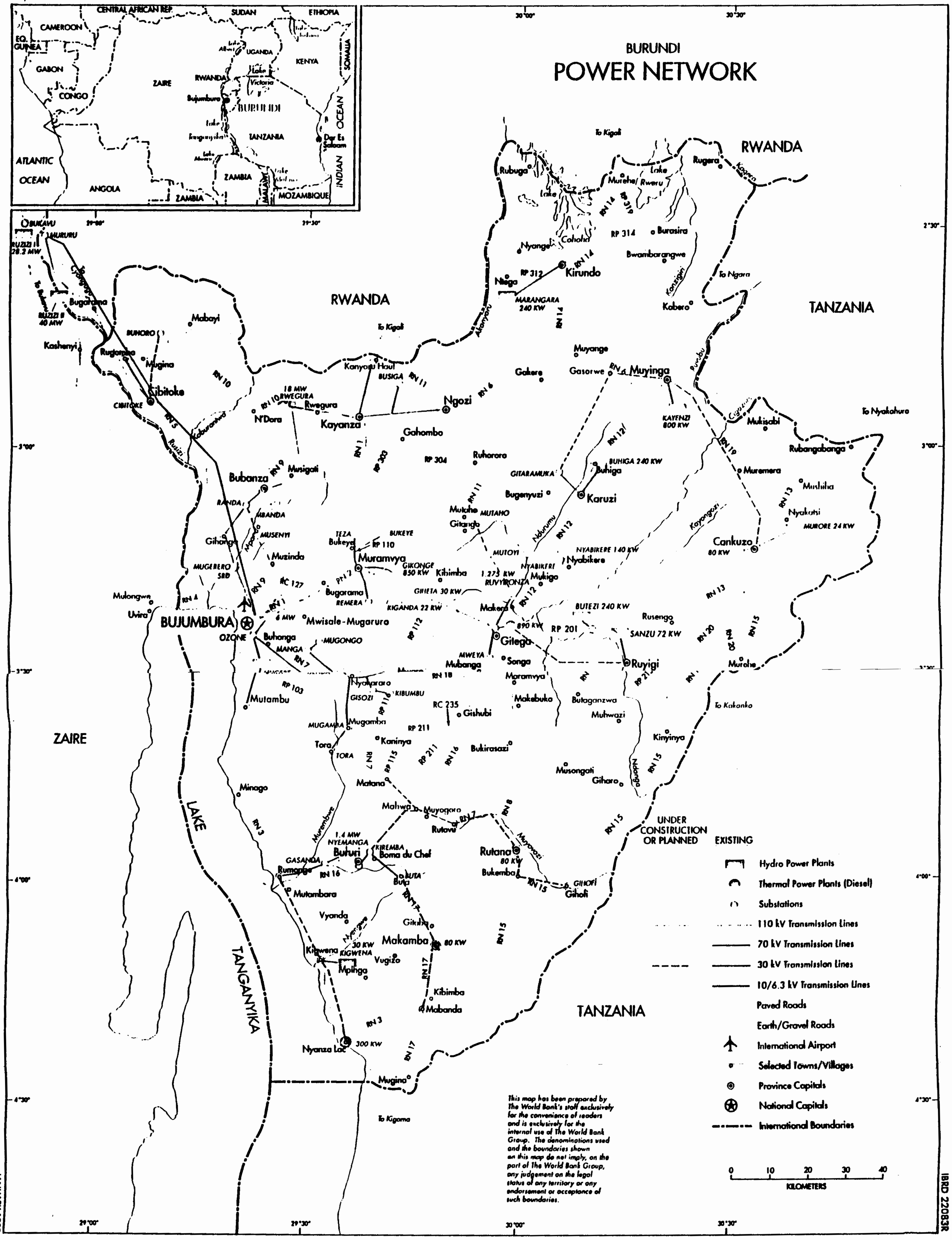
JANUARY 1992
IBRD 22084R
CENTRAL AFRICAN REP.
SUDAN
ETHIOPIA
CAMEROON
EQ. GUINEA
GABON
CONGO
UGANDA
KENYA
SOMALIA
ZAIRE
RWANDA
BURUNDI
TANZANIA
ATLANTIC OCEAN
ANGOLA
ZAMBIA
MOZAMBIQUE
INDIAN OCEAN
ZIMBABWE
NAMIBIA



BURUNDI
POWER NETWORK
RWANDA
TANZANIA
ZAIRE
LAKE TANGANYIKA
BUJUMBURA
Ngozi
Kayanza
Kirundo
Muyinga
Karuzi
Cankuzo
Gitega
Ruyigi
Muramvya
Bubanza
Cibitoke
Bururi
Rutana
Makamba
Nyanza Lac
RUZIZI I 28.2 MW
RUZIZI II 40 MW
18 MW RWEGURA
MARANGARA 240 KW
KAYENZI 800 KW
BUHIGA 240 KW
NYABIKERE 140 KW
MUROR E 24 KW
GIKONGE 850 KW
GIHETA 30 KW
KIGANDA 22 KW
BUTEZI 240 KW
SANZU 72 KW
890 KW
1.4 MW NYEMANGA
30 KW KIGWENA
300 KW
80 KW
UNDER CONSTRUCTION OR PLANNED
EXISTING
Hydro Power Plants
Thermal Power Plants (Diesel)
Substations
110 kV Transmission Lines
70 kV Transmission Lines
30 kV Transmission Lines
10/6.3 kV Transmission Lines
Paved Roads
Earth/Gravel Roads
International Airport
Selected Towns/Villages
Province Capitals
National Capitals
International Boundaries
0 10 20 30 40
KILOMETERS
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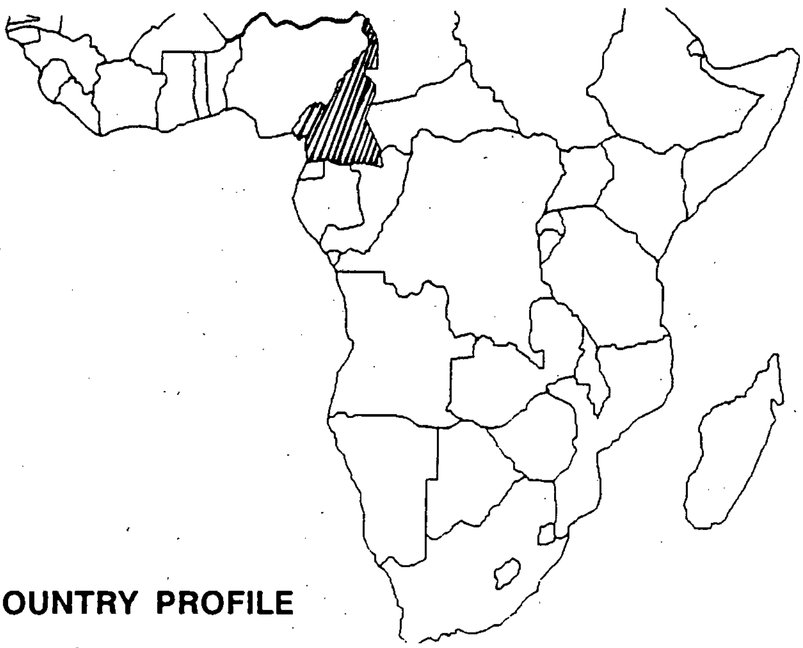
JANUARY 1992
IBRD 22083R

CAMEROON

1. INTRODUCTION



2. COUNTRY PROFILE

2.1 Introduction

All of Cameroon, or Kamerum as it was called at that time, became a German protectorate in 1884. For 30 years the Germans laid the groundwork of a modern economic infrastructure: roads, railways, ports and plantations. The protectorate came to an end in 1916 when a joint military operation involving French, British, and Belgian troops invaded it and deposed the German governor. The territory was subsequently divided between the French and the British, with the larger eastern sector (four-fifths of the land) allocated to France. The remainder of the territory, the western sector, went to the British and became known as the British Cameroons. These two sectors consisted of two long, non-contiguous areas along the eastern Nigerian border, the Northern Cameroons and the Southern Cameroons. The division was recognised by the League of Nations and the mandates were converted into UN trust territories in 1946.

Development programmes implemented by the French in their territory resulted in significant increases in export commodities (timber, cocoa, palm oil, etc.) and the extension of the road and harbour facilities. While Southern Cameroons enjoyed a basic infrastructure left by the Germans and a relatively well educated population, Northern Cameroons did not receive enough attention to enable economic growth. Linked to Nigeria by an administrative union, it was left outside the mainstream of the Nigerian development[1].

The French Cameroon was granted full internal autonomy on 1 January 1959. It achieved its complete independence exactly one year later as the Republic of Cameroon, with Ahidjo as President. Under the auspices of the United Nations, separate plebiscites were held in the two parts of the British Trusteeship. The Northern Cameroons, joined to Northern Nigeria in another administrative union, decided to unite with Nigeria. It became the Saradauna province of Northern Nigeria on 1 June 1961. The Southern Cameroons opted in favour of joining the Republic of Cameroon. This was implemented on 1 October 1961 with the formation of the Federal Republic of Cameroon in which Southern Cameroons became the western state. Ahidjo and Foncha, former Premiers of the Southern Cameroons, assumed respectively the presidency and the vice-presidency of the federation.

After the federation, the two states (East Cameroon and West Cameroon) moved politically, economically and socially towards increasing integration. The two main parties, the East's Union Camerounaise (UC) and the West's Kamerun National Democratic Party (KNDP), and four minor parties merged in 1966 into a single national party, the Union Nationale Camerounaise (UNC). Following a national referendum held on 21 May 1972, Cameroon became a unitary republic on 2 June 1972, known as the United Republic of Cameroon, renamed in January 1984 the Republic of Cameroon. The federal system brought a growing dissatisfaction among the anglophone population. In November 1982, after 22 years in power, President Ahidjo resigned, handing over his responsibilities to the Prime Minister, Paul Biya(1).

2.2 Geographical situation and demography

Cameroon covers a triangular-shaped area of 475 442 sq.km in West-Central Africa. Located halfway between Algiers and Cape Town and halfway between Dakar and Dar-es-Salaam, it has a fairly central position within the African continent(1). It is bounded to the north-east by Nigeria; to the east by Chad, with Lake Chad at its northern tip, and the Central African Republic; to the south by Congo, Gabon and Equatorial Guinea; and to the west by the Atlantic Ocean which gives it 258 km of coastline along the Gulf of Guinea.

The population, as given by World Bank estimates, was 11,2 million in 1988(2). Annual population and population growth figures over the period 1967-1988 are given in Fig. 1. Population density is 20 per sq.km nationwide, rising to 55 per sq.km in arable areas. More than half the population is concentrated in less than 10% of the land. The highest concentration is found in the area extending from Douala to the Wouri River estuary northward into the Bamenda Highlands (with population densities of up to 300 per sq km), in the capital city of Yaoundé and in the Mandara Hills region between Garoua and Moroua[3]. 65% of the population lives in rural areas. The population is very young, with 41,4% under the age of 15; life expectancy was 52,9 years, and the literacy level 68% among adult males and 55% among adult females in 1985[4].

The ethnic composition of the population is diverse; there are about 200 ethnic groups. There are three major contrasts in the social geography of the country. Firstly, the country is divided by the 'Bantu line, the northern limit of the Bantu people. Southwards of that line, the population consists of the Semi-Bantu such as the Bamileke; and south of them are the Bantu and some groups of pygmies, in the Southern forests. In the north are found the Hamitic Fulani, the Arab Choas and Sudanese Negroes groups.

Secondly, in the south and west, which is inhabited by cultivating people, the population is Christian, while the north is Muslim or animist, with pastoral and sedentary people. Furthermore, the south, which received the bulk of the development programmes and modern economic infrastructure during the colonial rule, is more developed than the rest of the country. The towns of Douala and Yaounde, found in the south, account for 45% and 10% respectively of the industrial units of the country.

Thirdly, the country comprises two zones with different colonial heritages. Over one-fifth of the population is English-speaking, while the remainder is French-speaking. Officially, the country is bilingual.

In 1984 the economically active population constituted 66,7% of the total population and 37,8% of these were women. The total labour force, which has a growth rate of 2,8%, is distributed among agriculture (83%), industry (7%) and service (10%).

2.3 Economy

Cameroon is a middle income country among developing countries, with a GDP per capita averaging 1133 US$ in 1988. Figures 2 and 3 give the GDP and the GDP per capita respectively for the period 1967-88. The economy is based on a wide range of agricultural and petroleum products. The country is self-sufficient in food. A twenty-year plan, which has guided the development of the country, consists of a series of five-year plans set up in the early 1960's.

Industry is an important sector of the economy, accounting for 28,6% of GDP in 1988. The share of industry, as well as those of other sectors in the overall GDP generation for previous years, are given in Fig. 4. The industrial sector is dominated by mining operations. Petroleum products are the main exports commodities. Oil mining operations are followed by the exploitation of very large deposits of limestone found near Garoua which serve as feedstocks for the local cement industry. Other mineral deposits have been found, but they have not yet been exploited. They consist of natural gas at Kriba, bauxite at Minim-Martap and Ngaoundal, iron ore near Kriba and uranium reserves.

Manufacture is essentially engaged in the processing or assembly of raw material and imported components. Its contribution to GDP for the period 1967-88 is given in Fig. 5. The increase in the manufacturing share of GDP is ascribed to the special emphasis put on the subsector during the fourth five-year plan (1976-81). In fact, in order to get manufacturing more integrated into the economic structure and increase its linkage effects, new industrial units have been set up. A petroleum refinery, a local rubber-based tyre factory, and an integrated pulp and paper mill (commissioned in 1981 but closed in 1982 due to financial losses) were built. In addition, cement production was expanded and aluminum production capacity increased. Alucam's aluminum plant located at Edea is the largest industry outside the Douala and Yaounde areas. It processes bauxite from Guinea as local resources have not yet been exploited.

Figure 6 gives the GDP ratio of agriculture/industry. Agriculture was the major sector of the economy before the exploitation of petroleum. Agricultural products consist of 10 major food crops and 7 major industrial and export crops. About 40 to 45% of output consists of subsistence crops, but cash export crops are increasing their share in the market. Primary agricultural and forest products provide about one-half of total export earnings, with coffee and cocoa accounting for one-quarter[(1)]. In order to encourage the development of agriculture, the government has been using oil revenue to keep producers' prices constant, giving incentives to grow coffee and cocoa, and subsidizing fertilizers and pesticides.

Apart from palm oil and rubber, agricultural production is almost entirely in the hands of small-scale family units. However, in the former Western state, the initially German-developed plantation sector has remained dominant. Pastoral activities are important on the Adamaoua plateau and are in the hands of traditional herders such as the Fulani. The main constraints to their development are the incidence of the tsetse fly and traditional practices of grazing and breeding.

The economy of the country has undergone a small structural change since 1976, with the exploitation of oil resources. Oil revenue has protected the country from the fluctuation in export crops earnings. Figures 7 and 8 give the growth rates of GDP and GDP per capita in real terms. They reached their maximum levels around 1980 (when oil products became the main export commodity), before decreasing with the fall in world oil prices and the drought that affected agricultural output. Oil production reached its maximum output in 1985 and began to decline the following year. Moreover there was a steep fall in international prices for petroleum in 1986. Consequently, these growth rates started decreasing significantly.

As a result of the combined effect of the sustained weakness of world oil prices and the oil output decline which started in 1986, the economy contracted and the economic growth rate continued its downwards trend, reaching negative values. The government used oil revenue accumulated in the past in order to cushion the impact. When the fund became exhausted in 1989 an economic crisis started. With support loans from the World Bank, the African Development Bank and France, the government introduced austerity measures and economic restructuring programmes(1).

3. ENERGY: GENERAL

3.1 Introduction

Like many other African countries, energy supply consists of traditional fuels (mainly fuelwood), oil and electricity. Traditional fuels are dominant. In 1988 traditional fuels accounted for 70,6% of the total final consumption, while oil products and electricity represented 23,2% and 6,2% respectively. Figure 9 gives the quantity shares of these commercial fuels.

There is no foreseeable shortage of woodfuels as resources are plentiful, especially in the southern part of the country where there are dense tropical forests. Hydro resources are also considerable. As an oil-producing country, Cameroon refines part of its crude to meets its needs, helping to save foreign exchange.

3.2 Energy institutions

The Ministry of Mines, Water and Energy oversees the energy scene.

Many companies are involved in the oil sector, reflecting the importance of this sector in the economy of the country. Among them are Gulf, Shell, Mobil, Occidental and, Cities Services, all of which are engaged in offshore oil prospection and exploration. One of the most important companies involved in the exploitation and the exploration of petroleum resources is the Société ELF de Recherches et d'Exploitation des Pétroles du Cameroon (ELF-SEREPCA). The distribution of oil products is in the hands of oil marketing companies, which include the Société Nationale des Hydrocarbures (SNH) and the Société Shell du Cameroon.

In the fuelwood sector the State-owned Centre National de Developpement des Forêts (CENADEFOR) is responsible for the development and protection of forests.

In the power subsector the Société Nationale d'Electricité du Cameroun (SONEL) is responsible for the generation and distribution of electricity.

4. ENERGY RESOURCES

4.1 Fuelwood

Forest resources are abundant. About 20,23 million ha or 43% of the land area is covered by dense forests, of which 2,8 million ha are forest reserves and another 2,8 million ha have been licensed for exploitation(3). It is the southern part of the country which is best endowed with forest resources because of favourable climatic conditions. From south to north, the forests are successively dense rain forest, Guinea savannah, Sudan savannah, and thorn steppe.

Under its agricultural diversification programmes, the government has encouraged the extension of farms for export crops: palm oil, rubber, cocoa, cotton, and coffee. As a result a large part of the forest cover has been destroyed. Log-cutting is also contributing to the deterioration of forest cover. The land area under active forestry development is less than 500 000 ha(1).

4.2 Petroleum and gas

Oil deposits were discovered in 1973 off Rio del Rey. They were followed later by other discoveries near the Nigerian border, in the Wouri estuary and off Kriba. Figure 9 gives oil output on a yearly basis over the period 1978-88. Production started in 1977 and increased significantly in the following years. With the coming on-stream of new fields at Moudi and Lokele in 1984, it reached a maximum output of 9,16 million tons[1] in 1985. However, since 1986 there has been a decline. This trend is expected to continue as long as no discoveries and development take place. In 1988 the remaining oil resources were estimated at 57,2 million tons. Natural gas was discovered off Kriba and proven reserves amount to 119 billion m^3[3].

4.3 Hydro-electricity

Hydro-electricity resources are important. They decrease from the south (the annual rainfall in the south-west is over 5000 mm) to the north where the annual rainfall near Lake Chad is only 610 mm. The potential of all sites that might be developed regardless of economic or other considerations is 23 000 MW (100 000 GWh) per year. The potential that can be developed at costs competitive with other sources and that has no unacceptable social or environmental impacts is estimated at 8000 MW. The installed capacity in 1990 was 583 MW[5].

5. ENERGY SUPPLY AND DEMAND

5.1 General

The main energy form in Cameroon is traditional fuels. Figures 10 and 11 give the contribution of various forms of energy with respect to the total final consumption on a yearly basis over the period 1971-88.

Oil and electricity contributions to the commercial energy final consumption are shown in Figs 12 and 13. The transport sector is the main energy consumer of commercial energy and is followed by the industrial and residential sectors. This is shown in Fig. 14 which gives the sectorial distribution of the commercial energy final consumption for the period 1971-88.

As can be seen from Fig. 15, in 1988 the total energy per capita was 295 kgoe, of which 208 kgoe came from traditional fuels. Oil and electricity accounted for 69 kgoe and 18 kgoe respectively.

Figure 16 gives the energy intensity, defined as energy per unit of GDP. As the sectorial breakdown for traditional fuels is not known, it is not possible to obtain the share used in GDP generating activities. It is assumed that the bulk of traditional fuels is used for household purposes. The true value of energy intensity is somewhere between the total energy and commercial energy lines. The gap between the two has been decreasing as a result of the reduction of the traditional fuels' share in the total final consumption and increasing income from oil.

Figure 17 shows the commercial energy intensity by sector. In agriculture it is almost zero because of the large use of manpower in this sector. It is very low for the overall economy (see Fig. 16) as a result of the high income from oil. For the same reason, the energy intensity has been declining since 1978. A CFA franc generated by industry requires far less commercial energy than by the other sectors together except agriculture. The most energy-intensive industries in the country are the oil companies (for oil) and the aluminum company, Alucam (for electricity). As the contribution of transport (the largest oil-user sector) to GDP cannot be estimated, it is difficult to calculate its energy intensity.

The growth rates of GDP and the different energy carriers are shown in Fig. 18. As oil makes up the bulk of commercial energy, their growth rates are similar. Electricity growth patterns are related to those of GDP.

5.2 Fuelwood and other traditional energy

The share of traditional fuels in the total final consumption over the period 1971-88, as given **by** the International Energy Agency, can be seen in Figs 10 and 11.

Like other countries in the humid and semi-humid West African region, Cameroon will not have national fuelwood supply problems. However, large cities such as Yaounde are grappling with supply difficulties[6].

The expansion of agricultural land to grow both cash crops and food, log-cutting and fuelwood collection are all leading to deforestation.

5.3 Petroleum products

The consumption of oil products in the country is shown in Fig. 19. All petroleum product needs were met by imports prior to the oil discoveries. Following the exploitation of the country's oil resources, a refinery was built at Cap Limboh and began production in 1981.

Domestic crude oil is processed to meet local demand. Crude oil exports and consumption are given in Fig. 20. It is estimated that more than half of the refinery output is surplus and must be exported[7]. Excess oil products are generally exported to industrial countries at a considerable loss.

The oil products consumed consist largely of diesel and petrol, as shown in Fig. 21. Figure 22 shows the sectorial breakdown of oil final consumption over the period 1971-88. Transport is the largest oil consumer and is followed by the residential sector and industry respectively. The oil industry is one of the most oil-intensive users.

The Kriba natural gas resources have not yet been exploited. Plans to build a LNG plant costing 2000 million US$ were suspended following the downturn in world demand and more modest revised estimates in these areas. In 1986 feasibility studies were carried out for a 250 million US$ project using the gas reserves[1].

The refinery is operated by the Société Nationale de Raffinage (SONARA),in which the State owns a 66% share. Among the oil marketing companies are Shell and the Société Nationale des Hydrocarbures (SNH) which is a State corporation. The storage facilities are handled by the Société Camerounaise des Dépôts Pétroliers (SCDP). In 1982 the SNH obtained a 20% interest in all petroleum-producing companies.

5.4 Electricity

Power generation is obtained mainly from hydro-electricity. In 1988 Cameroon had an installed capacity of 605 MW, of which 77 MW were thermal. Production totalled 2395 GWh, with 70 GWh thermally generated. Figures 23 and 24 show the installed capacity and production of electricity respectively for the period 1965-88. The primary consumption of electricity, as given by the United Nations' 1988 Statistics Yearbook, was 225 kWh per capita in 1988.

The supply system is served by three hydro-electric plants located successively at Edea, Song Loulon and Lagdo. These three dams account for 87% of Cameroon's power generation[1]. The Edea complex, near the mouth of the Sanaga river and 50 km south-east of Douala, has an installed capacity of 263 MW. The 288 MW Song-Loulou station was commissioned in 1983 and expansion of its capacity to 384 MW was scheduled for 1990. Built with Chinese assistance, the Lagdo dam has a capacity of 72 MW, but its operation is being hindered by years of drought.

The supply system consists of two main networks. The first network links Yaounde, Edea, Douala and the western sector and is served by the Edea and Song-Loulon plants. The second network, covering the north of the country, is based on the Lagdo plant. The transmission is done through 225 and 90 kV lines, while the distribution is done through 55, 33, 30, 15 and 10 kV lines. The grid is not interconnected with other countries.

Sectorially, industry has been and is still the main user of electricity. Its percentage share in the electricity final consumption was above 80% until 1980. However, it decreased significantly with the coming on stream of other plants (Song-Loulon and Lagdo). The aluminum refining industry, Alucam, located at Edea, accounts for more than half of the total system load. The complete breakdown of electricity final consumption is given in Fig. 25.

Public power supply is in the hands of the Société Nationale d'Electricité (SONEL). At its foundation in 1974 it took over three previous electricity corporations. The company is jointly owned by the State (93,1% share) and the Caisse Centrale de Coopération Economique of France.

The government has been planning to build another plant at the Nachtigal Falls on the Sanaga River, with an installed capacity of 200 MW. The project's studies were completed in 1988.

6. PRICING

In 1987 the price of one kWh of electricity was 17,43 USc for residential and commercial users (up to 400 kWh/month); 10,86 USc for small industries (up to 2000 kWh/month); and 6,25 USc for large industries (up to 100 000 kWh/month). The average revenue for SONEL was 14,14 USc/kWh[(8)].

7. DISCUSSION

Cameroon is endowed with significant energy resources: oil, forests and hydro resources.

Oil production is in a decline, causing negative effects on the economy. The refinery output exceeds the domestic market, resulting in the export of large quantities of oil products to industrialised countries at uneconomic rates. Options to rationalize the refinery and serve other countries, such as the Central African Republic which has no oil resources, would be beneficial.

Forests and hydro resources are more important in the south than in the north which is desert. Woodfuels are and will remain for a long time the most important source of energy in the country. Hydro resources are not fully exploited. Plans to increase power generating capacity are envisaged.

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TABLES

TABLE A. ECONOMIC INDICATORS

CURRENCY: CFA FRANCS

MILLIONS OF NATIONAL CURRENCY UNLESS INDICATED

YEAR	POPUL. (MILLIONS)	POPUL. GROWTH RATE (%)	GROSS DOMESTIC PRODUCT AT MARKET COST: AGRICULTURE	INDUSTRY: TOTAL INDUSTRY	INDUSTRY: MINING QUARRY	INDUSTRY: MANUFACTURE	INDUSTRY: ELEC,WTR,GAS	INDUSTRY: CONSTRUCT	OTHER SERVICES + TAXES	TOTAL	GDP DEFLATOR	GDP AT 1985 MARKET PRICES	GDP/CAPITA CURRENT	GDP/CAPITA REAL 1985	EXCHANGE RATE CFA FRANCS PER US$	GDP IN US$(MILL) CURRENT MARKET PRICE	GDP IN US$(MILL) AT 1985 MARKET PRICE	GDP PER CAPITA US$/CAPITA	GDP PER CAPITA US$(1985)/CAPITA
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	6.09	NA	71700	46300	NA	22500	NA	NA	112300	230300	20.4	1128922	37829	185434	246.9	933	2396	153	394
1968	6.21	2.0	81600	50500	NA	24000	NA	NA	126900	259000	21.5	1205773	41727	194260	246.9	1049	2559	169	412
1969	6.35	2.3	87900	55600	NA	28100	NA	NA	142600	286100	22.8	1253452	45041	197332	246.9	1159	2661	182	419
1970	6.51	2.4	99800	59300	NA	32600	NA	NA	159100	318200	24.7	1289964	48909	198273	274.3	1160	2738	178	421
1971	6.67	2.5	105600	65500	NA	35200	NA	NA	169500	340600	25.5	1336410	51087	200452	277.7	1226	2837	184	425
1972	6.84	2.6	120700	71200	NA	39200	NA	NA	185700	377600	27.5	1371432	55197	200472	265.4	1423	2911	208	426
1973	7.03	2.7	130500	78900	NA	43400	NA	NA	214400	423800	29.4	1442692	60310	205307	241.0	1759	3062	250	436
1974	7.23	2.8	153400	92800	NA	51000	NA	NA	273100	519300	32.4	1600492	71865	221491	230.1	2257	3397	312	470
1975	7.44	2.9	178300	111700	NA	63000	NA	NA	322300	612300	38.6	1586783	82309	213306	222.4	2753	3358	370	453
1976	7.67	3.1	191200	131300	NA	73000	NA	NA	370000	692500	41.9	1654211	90322	215757	225.1	3077	3511	401	458
1977	7.91	3.2	280600	153400	NA	74700	NA	NA	400000	834000	46.5	1794753	105436	226897	247.8	3366	3809	426	482
1978	8.17	3.2	329900	167900	NA	86700	NA	NA	554400	1052200	51.1	2060119	128836	252249	238.6	4410	4373	540	535
1979	8.43	3.2	388100	259900	NA	101900	NA	NA	611100	1259100	53.9	2334233	149342	276863	216.7	5812	4955	689	588
1980	8.70	3.2	437000	406000	NA	124100	NA	NA	725900	1568900	58.1	2698618	180313	310150	209.2	7499	5728	862	658
1981	8.98	3.2	527400	617900	NA	173700	NA	NA	834700	1980000	65.0	3046394	220539	339318	235.3	8416	6466	937	720
1982	9.26	3.2	633900	810400	NA	247000	NA	NA	859100	2303400	73.6	3129933	248694	337933	296.7	7764	6643	838	717
1983	9.55	3.2	656000	1085900	NA	290900	NA	NA	1042600	2784500	82.6	3371074	291449	352844	354.7	7851	7155	822	749
1984	9.86	3.2	758700	1333400	NA	358500	NA	NA	1180500	3272600	91.7	3568449	332075	362095	409.5	7991	7574	811	769
1985	10.17	3.2	790400	1317400	NA	422500	NA	NA	1731100	3838900	100.0	3838900	377621	377621	471.1	8148	8148	802	802
1986	10.49	3.2	907900	1373100	NA	536600	NA	NA	1885000	4166000	100.4	4149013	397102	395483	386.6	10776	8807	1027	839
1987	10.83	3.2	976000	1137000	NA	522800	NA	NA	1856000	3969000	102.4	3877713	366482	358053	318.7	12455	8231	1150	760
1988	11.18	3.3	954000	1055000	NA	498200	NA	NA	1686000	3695000	103.3	3577815	330383	319905	291.7	12667	7594	1133	679
1989	11.55	3.3	939000	945000	NA	456200	NA	NA	1611000	3495000	101.1	3456088	302493	299125	315.4	11083	7336	959	635
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

DATA OBTAINED FROM: WORLD TABLES (1989-90 EDITION)

TABLE B. 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 COM. ENERGY	TRAD. ENERGY	ENERGY FORMS PER CAPITA (TOE/CAPITA) OIL	ELECTRIC.	COM. ENERGY	TRAD. ENERGY	TOTAL ENERGY	RATIO COM. ENERGY/ TRAD. ENERGY	FINAL CONSUMPTION OF OIL IN OIL REFINERIES 000s TOE	% OF OIL TFC
1970	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1971	0	288.9	0	0	100.6	389.5	1532.0	1921.5	20.3	79.7	0.043	0.015	0.058	0.230	0.288	0.254	0	0.0
1972	0	309.8	0	0	96.4	406.2	1559.0	1965.2	20.7	79.3	0.045	0.014	0.059	0.228	0.287	0.261	0	0.0
1973	0	315.5	0	0	96.5	412.0	1588.0	2000.0	20.6	79.4	0.045	0.014	0.059	0.226	0.285	0.259	0	0.0
1974	0	312.9	0	0	101.7	414.6	1620.0	2034.6	20.4	79.6	0.043	0.014	0.057	0.224	0.282	0.256	0	0.0
1975	0	364.4	0	0	112.9	477.3	1657.0	2134.3	22.4	77.6	0.049	0.015	0.064	0.223	0.287	0.288	0	0.0
1976	0	336.0	0	0	114.6	450.6	1688.0	2138.6	21.1	78.9	0.044	0.015	0.059	0.220	0.279	0.267	0	0.0
1977	0	496.5	0	0	115.4	611.9	1728.0	2339.9	26.2	73.8	0.063	0.015	0.077	0.218	0.296	0.354	0	0.0
1978	0	531.2	0	0	111.7	642.9	1765.0	2407.9	26.7	73.3	0.065	0.014	0.079	0.216	0.295	0.364	0	0.0
1979	0	572.9	0	0	115.4	688.3	1839.0	2527.3	27.2	72.8	0.068	0.014	0.082	0.218	0.300	0.374	0	0.0
1980	0	622.9	0	0	124.0	746.9	1894.0	2640.9	28.3	71.7	0.072	0.014	0.086	0.218	0.304	0.394	72.9	11.7
1981	0	644.6	0	0	163.2	807.8	1951.0	2758.8	29.3	70.7	0.072	0.018	0.090	0.217	0.307	0.414	100.5	15.6
1982	0	692.6	0	0	182.7	875.3	2006.0	2881.3	30.4	69.6	0.075	0.020	0.095	0.217	0.311	0.436	72.1	10.4
1983	0	760.0	0	0	180.1	940.1	2058.0	2998.1	31.4	68.6	0.080	0.019	0.098	0.215	0.314	0.457	75.9	10.0
1984	0	794.7	0	0	188.2	982.9	2106.0	3088.9	31.8	68.2	0.081	0.019	0.100	0.214	0.313	0.467	97.2	12.2
1985	0	894.8	0	0	206.5	1101.3	2160.0	3261.3	33.8	66.2	0.088	0.020	0.108	0.212	0.321	0.510	140.2	15.7
1986	0	895.8	0	0	204.0	1099.8	2214.0	3313.8	33.2	66.8	0.085	0.019	0.105	0.211	0.316	0.497	127.3	14.2
1987	0	824.6	0	0	204.2	1028.8	2270.0	3298.8	31.2	68.8	0.076	0.019	0.095	0.210	0.305	0.453	100.6	12.2
1988	0	766.6	0	0	204.3	970.9	2327.0	3297.9	29.4	70.6	0.069	0.018	0.087	0.208	0.295	0.417	89.5	11.7
1989	NA	NA	NA	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	ERR	ERR	ERR	NA	NA	NA

DATA OBTAINED FROM: IEA WORLD ENERGY STATISTICS AND BALANCES (1971-1988)

TABLE C. SECTORIAL DISTRIBUTION OF TOTAL FINAL CONSUMPTION (000'S TOE)

YEAR	COAL		OIL						ELECTRICITY						TOTAL					
	IND	TOTAL	IND	TRANS	AGRI	RESID	OTHER	TOTAL	IND	TRANS	AGRI	RESID	OTHER	TOTAL	IND	TRANS	AGRI	RESID	OTHER	TOTAL
1970	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1971	0	0	25.0	245.0	0.0	19.0	-0.1	288.9	89.0	0.0	0.0	3.8	7.8	100.6	114.0	245.0	0.0	22.8	7.7	389.5
1972	0	0	25.0	273.2	0.0	11.7	-0.1	309.8	84.2	0.0	0.0	4.3	7.9	96.4	109.2	273.2	0.0	16.0	7.8	406.2
1973	0	0	22.1	278.6	0.0	14.8	-0.0	315.5	83.8	0.0	0.0	4.7	8.0	96.5	105.9	278.6	0.0	19.5	8.0	412.0
1974	0	0	22.1	260.3	0.0	19.0	11.5	312.9	88.8	0.0	0.0	4.6	8.3	101.7	110.9	260.3	0.0	23.6	19.8	414.6
1975	0	0	30.7	282.1	0.0	42.0	9.6	364.4	99.0	0.0	0.0	4.6	9.3	112.9	129.7	282.1	0.0	46.6	18.9	477.3
1976	0	0	19.2	263.4	0.0	38.9	14.5	336.0	100.6	0.0	0.0	4.7	9.3	114.6	119.8	263.4	0.0	43.6	23.8	450.6
1977	0	0	31.7	386.1	0.0	54.7	24.0	496.5	102.3	0.0	0.0	4.7	8.4	115.4	134.0	386.1	0.0	59.4	32.4	611.9
1978	0	0	49.9	405.2	0.0	57.8	18.3	531.2	99.1	0.0	0.0	4.3	8.3	111.7	149.0	405.2	0.0	62.1	26.6	642.9
1979	0	0	45.1	431.1	0.0	74.6	22.1	572.9	100.6	0.0	0.0	4.7	10.1	115.4	145.7	431.1	0.0	79.3	32.2	688.3
1980	0	0	50.9	458.2	0.0	84.0	29.8	622.9	103.2	0.0	0.9	0.9	19.0	124.0	154.1	458.2	0.9	84.9	48.8	746.9
1981	0	0	63.4	453.2	0.0	91.5	36.5	644.6	81.6	0.0	0.9	0.9	79.8	163.2	145.0	453.2	0.9	92.4	116.3	807.8
1982	0	0	61.4	503.6	0.0	95.9	31.7	692.6	98.9	0.0	1.0	0.9	81.9	182.7	160.3	503.6	1.0	96.8	113.6	875.3
1983	0	0	54.7	575.7	0.0	96.0	33.6	760.0	103.6	0.0	1.0	0.9	74.6	180.1	158.3	575.7	1.0	96.9	108.2	940.1
1984	0	0	57.6	587.3	0.0	105.6	44.2	794.7	107.5	0.0	1.0	0.9	78.8	188.2	165.1	587.3	1.0	106.5	123.0	982.9
1985	0	0	65.3	639.3	0.0	128.9	61.3	894.8	107.1	0.0	1.0	0.9	97.5	206.5	172.4	639.3	1.0	129.8	158.8	1101.3
1986	0	0	65.3	669.2	0.0	133.5	27.8	895.8	107.2	0.0	1.0	0.9	94.9	204.0	172.5	669.2	1.0	134.4	122.7	1099.8
1987	0	0	53.8	614.4	0.0	132.4	24.0	824.8	107.1	0.0	1.0	0.9	95.2	204.2	160.9	614.4	1.0	133.3	119.2	1028.8
1988	0	0	57.6	544.1	0.0	140.9	24.0	766.6	107.1	0.0	1.0	0.9	95.3	204.3	164.7	544.1	1.0	141.8	119.3	970.9
1989	NA	NA	NA	NA	NA	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	NA	NA	NA

TABLE D. SECTORIAL DISTRIBUTION OF TOTAL FINAL CONSUMPTION AS A PERCENTAGE OF TOTAL

YEAR	COAL		OIL						ELECTRICITY						TOTAL					
	IND	TOTAL	IND	TRANS	AGRI	RESID	OTHER	TOTAL	IND	TRANS	AGRI	RESID	OTHER	TOTAL	IND	TRANS	AGRI	RESID	OTHER	TOTAL
1970	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1971	0	0	8.7	84.8	0.0	6.6	-0.0	100	88.5	0.0	0.0	3.8	7.8	100	29.3	62.9	0.0	5.9	2.0	100
1972	0	0	8.1	88.2	0.0	3.8	-0.0	100	87.3	0.0	0.0	4.5	8.2	100	26.9	67.3	0.0	3.9	1.9	100
1973	0	0	7.0	88.3	0.0	4.7	-0.0	100	86.8	0.0	0.0	4.9	8.3	100	25.7	67.6	0.0	4.7	1.9	100
1974	0	0	7.1	83.2	0.0	6.1	3.7	100	87.3	0.0	0.0	4.5	8.2	100	26.7	62.8	0.0	5.7	4.8	100
1975	0	0	8.4	77.4	0.0	11.5	2.6	100	87.7	0.0	0.0	4.1	8.2	100	27.2	59.1	0.0	9.8	4.0	100
1976	0	0	5.7	78.4	0.0	11.6	4.3	100	87.8	0.0	0.0	4.1	8.1	100	26.6	58.5	0.0	9.7	5.3	100
1977	0	0	6.4	77.8	0.0	11.0	4.8	100	88.6	0.0	0.0	4.1	7.3	100	21.9	63.1	0.0	9.7	5.3	100
1978	0	0	9.4	76.3	0.0	10.9	3.4	100	88.7	0.0	0.0	3.8	7.4	100	23.2	63.0	0.0	9.7	4.1	100
1979	0	0	7.9	75.2	0.0	13.0	3.9	100	87.2	0.0	0.0	4.1	8.8	100	21.2	62.6	0.0	11.5	4.7	100
1980	0	0	8.2	73.6	0.0	13.5	4.8	100	83.2	0.0	0.7	0.7	15.3	100	20.6	61.3	0.1	11.4	6.5	100
1981	0	0	9.8	70.3	0.0	14.2	5.7	100	50.0	0.0	0.6	0.6	48.9	100	17.9	56.1	0.1	11.4	14.4	100
1982	0	0	8.9	72.7	0.0	13.8	4.6	100	54.1	0.0	0.5	0.5	44.8	100	18.3	57.5	0.1	11.1	13.0	100
1983	0	0	7.2	75.8	0.0	12.6	4.4	100	57.5	0.0	0.6	0.5	41.4	100	16.8	61.2	0.1	10.3	11.5	100
1984	0	0	7.2	73.9	0.0	13.3	5.6	100	57.1	0.0	0.5	0.5	41.9	100	16.8	59.8	0.1	10.8	12.5	100
1985	0	0	7.3	71.4	0.0	14.4	6.9	100	51.9	0.0	0.5	0.4	47.2	100	15.7	58.0	0.1	11.8	14.4	100
1986	0	0	7.3	74.7	0.0	14.9	3.1	100	52.5	0.0	0.5	0.4	46.5	100	15.7	60.8	0.1	12.2	11.2	100
1987	0	0	6.5	74.5	0.0	16.1	2.9	100	52.4	0.0	0.5	0.4	46.6	100	15.6	59.7	0.1	13.0	11.6	100
1988	0	0	7.5	71.0	0.0	18.4	3.1	100	52.4	0.0	0.5	0.4	46.6	100	17.0	56.0	0.1	14.6	12.3	100
1989	NA	NA	NA	NA	NA	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	NA	NA	NA

TABLE E. ENERGY DATA FOR GRAPHS

YEAR	TFC COMPONENTS AS % OF COMMERCIAL ENERGY FIN. CONS.			TFC COMPONENTS AS % OF TOTAL FINAL CONSUMPTION			COMMERCIAL ENERGY FIN. CONSUMPTION GROWTH RATE			TOTAL FINAL CONSUMPTION GROWTH RATE			ENERGY INTENSITY (TOE/CFA FRANC) COMMERCIAL ENERGY INTENSITY				TFC
	COAL	OIL	ELECTRICITY	COAL	OIL	ELECTRICITY	%	3PTS M.A.	5 PTS M.A.	%	3 PTS M.A.	5 PTS M.A.	TOTAL	INDUSTRY	AGRICULT	OTHER	INTENSITY
1970	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1971	0	74.2	25.8	0	15.0	5.2	NA	NA	NA	NA	NA	NA	2.9E-07	4.4E-03	0.0E+00	4.1E-03	1.4E-06
1972	0	76.3	23.7	0	15.8	4.9	4.3	NA	NA	2.3	NA	NA	3.0E-07	4.2E-03	0.0E+00	4.4E-03	1.4E-06
1973	0	76.6	23.4	0	15.8	4.8	1.4	2.1	NA	1.8	1.9	NA	2.9E-07	3.9E-03	0.0E+00	4.2E-03	1.4E-06
1974	0	75.5	24.5	0	15.4	5.0	0.6	5.7	3.2	1.7	2.8	1.8	2.6E-07	3.9E-03	0.0E+00	3.6E-03	1.3E-06
1975	0	76.3	23.7	0	17.1	5.3	15.1	3.4	9.5	4.9	2.3	3.0	3.0E-07	4.5E-03	0.0E+00	4.2E-03	1.3E-06
1976	0	74.6	25.4	0	15.7	5.4	-5.6	15.1	10.2	0.2	4.8	3.2	2.7E-07	3.8E-03	0.0E+00	3.7E-03	1.3E-06
1977	0	81.1	18.9	0	21.2	4.9	35.8	11.8	11.5	9.4	4.2	3.7	3.4E-07	4.1E-03	0.0E+00	5.6E-03	1.3E-06
1978	0	82.6	17.4	0	22.1	4.6	5.1	16.0	10.2	2.9	5.8	3.7	3.1E-07	4.5E-03	0.0E+00	4.6E-03	1.2E-06
1979	0	83.2	16.8	0	22.7	4.6	7.1	6.9	12.9	5.0	4.1	4.4	2.9E-07	3.0E-03	0.0E+00	4.8E-03	1.1E-06
1980	0	83.4	16.6	0	23.6	4.7	8.5	7.9	7.4	4.5	4.6	3.5	2.8E-07	2.2E-03	1.2E-05	4.7E-03	9.8E-07
1981	0	79.8	20.2	0	23.4	5.9	8.2	8.3	7.9	4.5	4.5	3.7	2.7E-07	1.5E-03	1.1E-05	5.2E-03	9.1E-07
1982	0	79.1	20.9	0	24.0	6.3	8.4	8.0	7.4	4.4	4.3	3.4	2.8E-07	1.5E-03	1.2E-05	6.1E-03	9.2E-07
1983	0	80.8	19.2	0	25.3	6.0	7.4	6.8	8.1	4.1	3.8	3.6	2.8E-07	1.2E-03	1.3E-05	6.2E-03	8.9E-07
1984	0	80.9	19.1	0	25.7	6.1	4.6	8.0	6.4	3.0	4.2	3.1	2.8E-07	1.1E-03	1.2E-05	6.3E-03	8.7E-07
1985	0	81.2	18.8	0	27.4	6.3	12.0	5.5	3.5	5.6	3.4	2.3	2.9E-07	1.3E-03	1.3E-05	5.4E-03	8.5E-07
1986	0	81.5	18.5	0	27.0	6.2	-0.1	1.8	0.9	1.6	2.2	1.6	2.7E-07	1.3E-03	1.1E-05	4.9E-03	8.0E-07
1987	0	80.2	19.8	0	25.0	6.2	-6.5	-4.1	NA	-0.5	0.4	NA	2.7E-07	1.4E-03	1.0E-05	4.8E-03	8.5E-07
1988	0	79.0	21.0	0	23.2	6.2	-5.6	NA	NA	-0.0	NA	NA	2.7E-07	1.6E-03	1.1E-05	4.9E-03	9.2E-07
1989	NA	NA	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 F. ELECTRICITY DATA INSTALLED CAPACITY (MEGAWATTS)

YEAR	PUBLIC HYDRO	THERMAL	TOTAL	SELFPRODUCERS HYDRO	THERMAL	TOTAL	TOTAL HYDRO	TOTAL THERMA	TOTAL INSTALLED
1950	0	2	2	0	0	0	0	2	2
1951	0	3	3	0	0	0	0	3	3
1952	0	6	6	0	0	0	0	6	6
1953	16	7	23	0	0	0	16	7	23
1954	16	7	23	1	0	1	17	7	24
1955	23	7	30	1	0	1	24	7	31
1956	20	8	28	2	0	2	22	8	30
1957	13	7	20	52	0	52	65	7	72
1958	7	8	15	145	0	145	152	8	160
1959	10	5	15	142	3	145	152	8	160
1960	10	5	15	142	3	145	152	8	160
1961	10	5	15	142	3	145	152	8	160
1962	10	5	15	142	3	145	152	8	160
1963	10	5	15	142	5	147	152	10	162
1964	10	5	15	142	8	150	152	13	165
1965	12	5	17	140	13	153	152	18	170
1966	12	5	17	140	11	151	152	16	168
1967	12	5	17	140	22	162	152	27	179
1968	12	5	17	140	22	162	152	27	179
1969	12	5	17	140	22	162	152	27	179
1970	0	27	27	152	0	152	152	27	179
1971	0	28	28	193	0	193	193	28	221
1972	0	28	28	197	0	197	197	28	225
1973	0	28	28	197	0	197	197	28	225
1974	0	28	28	197	0	197	197	28	225
1975	0	83	83	263	0	263	263	83	346
1976	0	83	83	263	0	263	263	83	346
1977	0	83	83	263	0	263	263	83	346
1978	0	83	83	263	0	263	263	83	346
1979	0	76	76	263	0	263	263	76	339
1980	0	76	76	263	0	263	263	76	339
1981	0	76	76	263	0	263	263	76	339
1982	0	73	73	458	0	458	458	73	531
1983	0	73	73	497	0	497	497	73	570
1984	0	73	73	497	0	497	497	73	570
1985	0	73	73	528	2	530	528	75	603
1986	0	75	75	528	2	530	528	77	605
1987	0	75	75	528	2	530	528	77	605
1988	0	75	75	528	2	530	528	77	605
1989	NA	NA	NA	NA	NA	NA	NA	NA	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE G. OIL PRODUCT CONSUMPTION

YEAR	LPG	RESID	PETROL	AVGAS	KEROSE	DIESEL	OTHER	TOTAL	DIESEL/ PETROL	% PETROL	% DIESEL	OIL TFC GROWTH RAFTE 1 PT	3 PTS MA
1970	2	20	88	3	10	76	3	202	0.86	43.56	37.62	NA	NA
1971	2	20	93	3	11	102	4	235	1.10	39.57	43.40	NA	NA
1972	2	20	91	3	11	96	2	225	1.05	40.44	42.67	7.2	NA
1973	2	23	101	3	12	115	5	261	1.14	38.70	44.06	1.8	2.8
1974	2	28	89	2	25	120	2	268	1.35	33.21	44.78	-0.8	5.8
1975	2	32	109	2	36	142	1	324	1.30	33.64	43.83	16.5	2.6
1976	2	38	119	2	41	162	6	370	1.36	32.16	43.78	-7.8	18.8
1977	3	44	130	2	46	183	10	418	1.41	31.10	43.78	47.8	15.7
1978	4	52	142	2	51	204	9	464	1.44	30.60	43.97	7.0	20.9
1979	5	55	167	2	54	224	8	515	1.34	32.43	43.50	7.9	7.9
1980	18	260	320	10	180	395	10	1193	1.23	26.82	33.11	8.7	6.7
1981	20	940	516	13	298	630	10	2427	1.22	21.26	25.96	3.5	6.6
1982	18	917	428	0	365	649	10	2387	1.52	17.93	27.19	7.4	6.9
1983	18	984	429	0	468	611	10	2520	1.42	17.02	24.25	9.7	7.2
1984	20	1006	648	0	510	651	10	2845	1.00	22.78	22.88	4.6	9.0
1985	18	602	413	2	297	450	28	1810	1.09	22.82	24.86	12.6	5.8
1986	19	659	408	3	301	455	31	1876	1.12	21.75	24.25	0.1	1.6
1987	17	617	400	5	286	435	45	1805	1.09	22.16	24.10	-7.9	-5.0
1988	18	597	394	4	288	425	25	1751	1.08	22.50	24.27	-7.0	NA
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

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

TABLE H. GDP DATA FOR GRAPHS

YEAR	GDP GROWTH RATE (REAL 1985 PRICES) %/YEAR	3PT MA	5PT MA	GDP RATIO AGRICUL/INDUSTRY 1 PT	3 PT M.A.	PERCENTAGE CONTRIBUTION TO GROSS NATIONAL PRODUCT AGRI	IND	MINE QUARRY	MANU	ELEC,WTR GAS	CONSTR	OTHER	AGRI/MANU	% CHANGE OF GDP DEFLATOR 1 PT	3PT MA	ANNUAL CHANGE OF GDP PER CAPITA CURRENT %	3 PT M.A.	REAL %	3 PT M.A.
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	1.5	NA	31.1	20.1	NA	9.8	NA	NA	48.8	3.2	NA	NA	NA	NA	NA	NA
1968	6.8	NA	NA	1.6	1.6	31.5	19.5	NA	9.3	NA	NA	49.0	3.4	5.3	NA	10.3	NA	4.8	NA
1969	4.0	4.6	NA	1.6	1.6	30.7	19.4	NA	9.8	NA	NA	49.8	3.1	6.3	6.5	7.9	8.9	1.6	2.3
1970	2.9	3.5	4.0	1.7	1.6	31.4	18.6	NA	10.2	NA	NA	50.0	3.1	8.1	5.9	8.6	7.0	0.5	1.1
1971	3.6	3.0	3.7	1.6	1.7	31.0	19.2	NA	10.3	NA	NA	49.8	3.0	3.3	6.5	4.5	7.0	1.1	0.5
1972	2.6	3.8	5.1	1.7	1.7	32.0	18.9	NA	10.4	NA	NA	49.2	3.1	8.0	6.0	8.0	7.3	0.0	1.2
1973	5.2	6.3	4.3	1.7	1.7	30.8	18.6	NA	10.2	NA	NA	50.6	3.0	6.7	8.4	9.3	12.2	2.4	3.4
1974	10.9	5.1	4.4	1.7	1.6	29.5	17.9	NA	9.8	NA	NA	52.6	3.0	10.5	12.0	19.2	14.3	7.9	2.2
1975	-0.9	4.8	5.6	1.6	1.6	29.1	18.2	NA	10.3	NA	NA	52.6	2.8	18.9	12.6	14.5	14.5	-3.7	1.8
1976	4.2	4.0	7.5	1.5	1.6	27.6	19.0	NA	10.5	NA	NA	53.4	2.6	8.5	12.8	9.7	13.7	1.1	0.9
1977	8.5	9.2	8.0	1.8	1.8	33.6	18.4	NA	9.0	NA	NA	48.0	3.8	11.0	9.8	16.7	16.2	5.2	5.8
1978	14.8	12.2	11.3	2.0	1.8	31.4	16.0	NA	8.2	NA	NA	52.7	3.8	9.9	8.8	22.2	18.3	11.2	8.7
1979	13.3	14.6	13.0	1.5	1.5	30.8	20.6	NA	8.1	NA	NA	48.5	3.8	5.6	7.8	15.9	19.6	9.8	11.0
1980	15.6	13.9	11.9	1.1	1.1	27.9	25.9	NA	7.9	NA	NA	46.3	3.5	7.8	8.4	20.7	19.7	12.0	10.4
1981	12.9	10.4	10.4	0.9	0.9	26.6	31.2	NA	8.8	NA	NA	42.2	3.0	11.8	10.9	22.3	18.6	9.4	7.0
1982	2.7	7.8	9.0	0.8	0.7	27.5	35.2	NA	10.7	NA	NA	37.3	2.6	13.2	12.4	12.8	17.4	-0.4	4.5
1983	7.7	5.4	7.4	0.6	0.7	23.6	39.0	NA	10.4	NA	NA	37.4	2.3	12.2	12.2	17.2	14.6	4.4	2.2
1984	5.9	7.0	6.4	0.6	0.6	23.2	40.7	NA	11.0	NA	NA	36.1	2.1	11.0	10.8	13.9	14.9	2.6	3.8
1985	7.6	7.2	4.5	0.6	0.6	20.6	34.3	NA	11.0	NA	NA	45.1	1.9	9.0	6.8	13.7	10.9	4.3	3.9
1986	8.1	3.0	1.4	0.7	0.7	21.8	33.0	NA	12.9	NA	NA	45.2	1.7	0.4	3.8	5.2	3.7	4.7	-0.1
1987	-6.5	-2.1	-0.4	0.9	0.8	24.6	28.6	NA	13.2	NA	NA	46.8	1.9	1.9	1.1	-7.7	-4.1	-9.5	-5.1
1988	-7.7	-5.9	NA	0.9	0.9	25.8	28.6	NA	13.5	NA	NA	45.6	1.9	0.9	0.3	-9.9	-8.7	-10.7	-8.9
1989	-3.4	NA	NA	1.0	NA	26.9	27.0	NA	13.1	NA	NA	46.1	2.1	-2.1	NA	-8.4	NA	-6.5	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE I. CRUDE OIL (000'S TONS)

YEAR	PRODUCTION	OFF SHORE	EXPORT	IMPORTS	CONSUMPTION
1970	NA	NA	NA	NA	NA
1971	NA	NA	NA	NA	NA
1972	NA	NA	NA	NA	NA
1973	NA	NA	NA	NA	NA
1974	NA	NA	NA	NA	NA
1975	NA	NA	NA	NA	NA
1976	NA	NA	NA	NA	NA
1977	NA	NA	NA	NA	NA
1978	505	505	247	0	0
1979	2004	2004	1822	0	0
1980	2700	2700	1612	0	840
1981	4000	4000	1434	0	2385
1982	5331	5331	1872	0	3120
1983	5689	5689	1950	0	3078
1984	6475	6475	2975	0	3250
1985	9170	8975	6663	0	2190
1986	8976	7970	6631	0	2210
1987	8348	8102	6196	0	2150
1988	8480	7970	6570	0	2010
1989	NA	NA	NA	NA	NA
1990	NA	NA	NA	NA	NA

DATA OBTAINED FROM: YEARBOOK OF WORLD ENERGY STATISTICS (1981)
ENERGY STATISTICS YEARBOOKS (1983, 1985, 1988)

TABLE J. ELECTRICITY DATA / ELECTRICITY PRODUCTION (GWhs)

YEAR	PUBLIC HYDRO	THERMAL	TOTAL	SELFPRODUCERS HYDRO	THERMAL	TOTAL	TOTAL HYDRO	TOTAL THERMAL	TOTAL	(000s TOE)	ELEC. TFC GROWTH RATE % P.A.	3 PTS MA	5 PTS MA	ELEC. INTENSITY TOE/GDP REL 1985	RATIO ELEC GWTH/GDP GWTH 1 PT	3 PT M.A.	ELEC/CA kWh/CA
1965	0	31	31	1069	0	1069	1069	31	1100	94.8	NA	NA	NA	NA	NA	NA	NA
1966	0	36	36	976	0	976	976	36	1012	87.2	NA	NA	NA	NA	NA	NA	NA
1967	0	43	43	1030	0	1030	1030	43	1073	92.5	NA	NA	NA	NA	NA	NA	NA
1968	0	37	37	979	0	979	979	37	1016	87.6	NA	NA	NA	NA	NA	NA	NA
1969	0	21	21	1025	0	1025	1025	21	1046	90.2	NA	NA	NA	NA	NA	NA	NA
1970	0	25	25	1145	0	1145	1145	25	1170	100.9	NA	NA	NA	NA	NA	NA	NA
1971	0	31	31	1139	0	1139	1139	31	1170	100.9	NA	NA	NA	7.53E-08	NA	NA	175
1972	0	53	53	1080	0	1080	1080	53	1133	97.7	-4.2	NA	NA	7.03E-08	-1.6	NA	163
1973	0	50	50	1100	0	1100	1100	50	1150	99.1	0.1	0.4	NA	6.69E-08	0.0	-0.4	159
1974	0	50	50	1073	0	1073	1073	50	1123	96.8	5.4	5.5	2.8	6.35E-08	0.5	-4.1	163
1975	0	55	55	1261	0	1261	1261	55	1316	113.4	11.0	6.0	3.7	7.12E-08	-12.9	-4.0	176
1976	1	58	59	1277	0	1277	1278	58	1336	115.2	1.5	4.4	3.1	6.93E-08	0.4	-4.1	173
1977	0	62	62	1284	0	1284	1284	62	1346	116.0	0.7	-0.3	2.7	6.43E-08	0.1	0.1	169
1978	0	71	71	1232	0	1232	1232	71	1303	112.3	-3.2	0.3	2.0	5.42E-08	-0.2	0.0	159
1979	0	97	97	1250	0	1250	1250	97	1347	116.1	3.3	2.5	8.0	4.94E-08	0.2	0.2	159
1980	0	88	88	1364	0	1364	1364	88	1452	125.2	7.5	14.1	10.2	4.59E-08	0.5	1.1	165
1981	0	99	99	1809	0	1809	1809	99	1908	164.5	31.6	17.0	10.6	5.36E-08	2.5	2.4	211
1982	0	99	99	2048	0	2048	2048	99	2147	185.1	11.9	14.0	10.8	5.84E-08	4.4	2.2	229
1983	0	99	99	1705	0	1705	1705	99	1804	155.5	-1.4	5.0	11.3	5.34E-08	-0.2	1.6	219
1984	0	110	110	2120	0	2120	2120	110	2230	192.2	4.5	4.3	4.7	5.27E-08	0.8	0.6	222
1985	0	94	94	2319	0	2319	2319	94	2413	208.0	9.7	4.3	2.3	5.38E-08	1.3	0.6	236
1986	0	94	94	2321	0	2321	2321	94	2415	208.2	-1.2	2.9	2.6	4.92E-08	-0.1	0.4	226
1987	0	94	94	2325	0	2325	2325	94	2419	208.5	0.1	-0.4	NA	5.27E-08	-0.0	-0.1	219
1988	0	94	94	2325	0	2325	2325	94	2419	208.5	0.0	NA	NA	5.71E-08	-0.0	NA	212
1989	NA	NA	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

DATA OBTAINED FROM: AFRICAN STATISTICAL YEARBOOK (1976), PART 4, CENTRAL AFRICA
WORLD ENERGY SUPPLIES (1973-1978)
YEARBOOK OF WORLD ENERGY STATISTICS (1981)
ENERGY STATISTICS YEARBOOKS (1983, 1985, 1988)

TABLE K. ENERGY COEFFICIENT: RATIO OF ENERGY GROWTH AND GDP GROWTH

YEAR	OIL	ELECTR	COM.ENERGY	TFC
1970	NA	NA	NA	NA
1971	NA	NA	NA	NA
1972	NA	NA	NA	NA
1973	0.4	0.1	0.3	0.3
1974	1.1	1.1	1.1	0.5
1975	0.5	1.2	0.7	0.5
1976	4.7	1.1	3.8	1.2
1977	1.7	-0.0	1.3	0.5
1978	1.7	0.0	1.3	0.5
1979	0.5	0.2	0.5	0.3
1980	0.5	1.0	0.6	0.3
1981	0.6	1.6	0.8	0.4
1982	0.9	1.8	1.0	0.6
1983	1.3	0.9	1.2	0.7
1984	1.3	0.6	1.1	0.6
1985	0.8	0.6	0.8	0.5
1986	0.5	0.9	0.6	0.7
1987	2.4	0.2	2.0	-0.2
1988	NA	NA	NA	NA
1989	NA	NA	NA	NA
1990	NA	NA	NA	NA

FIGURES

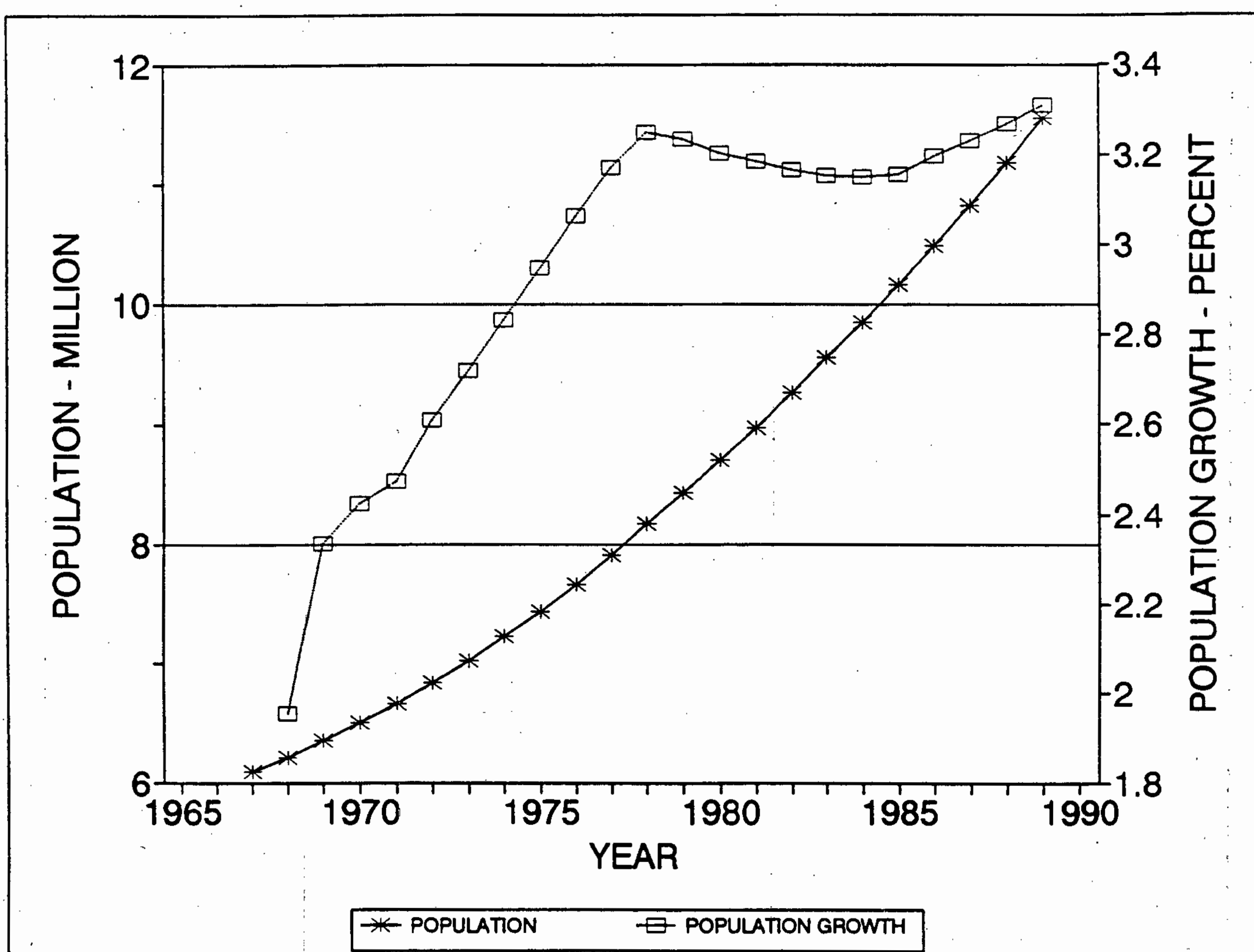


Figure 1. Population and population growth

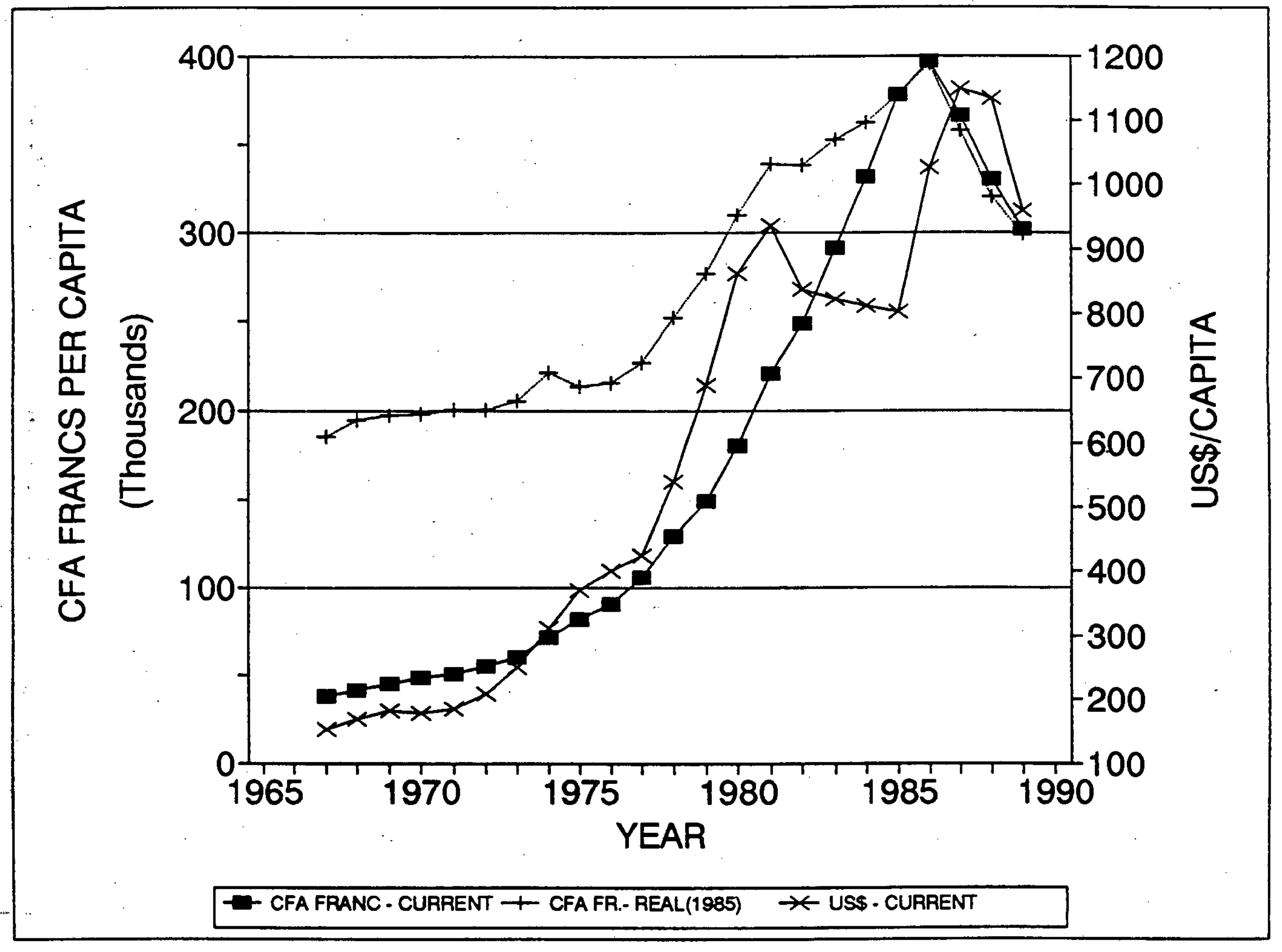


Figure 2. GDP per capita

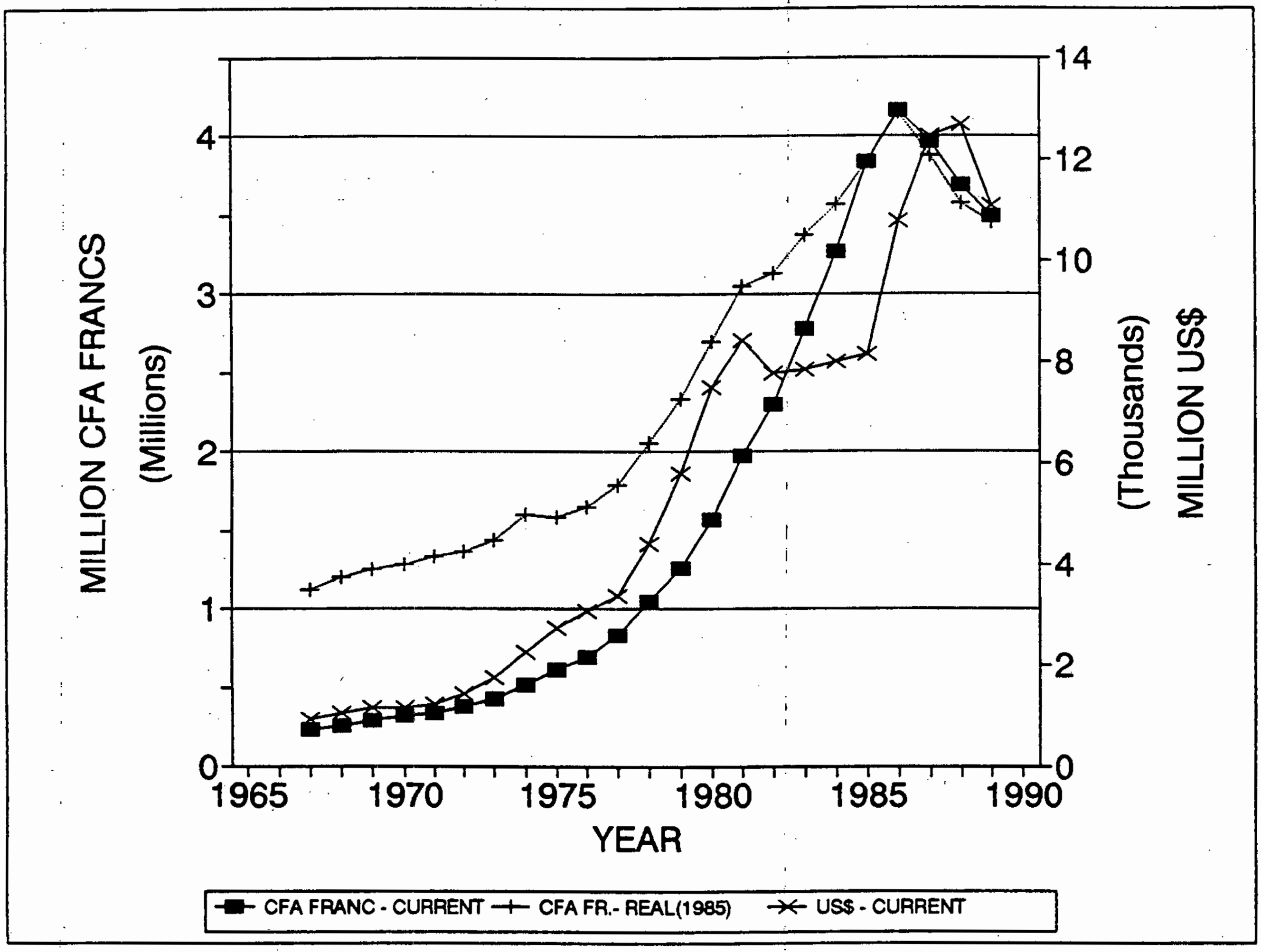


Figure 3. Gross domestic product (market)

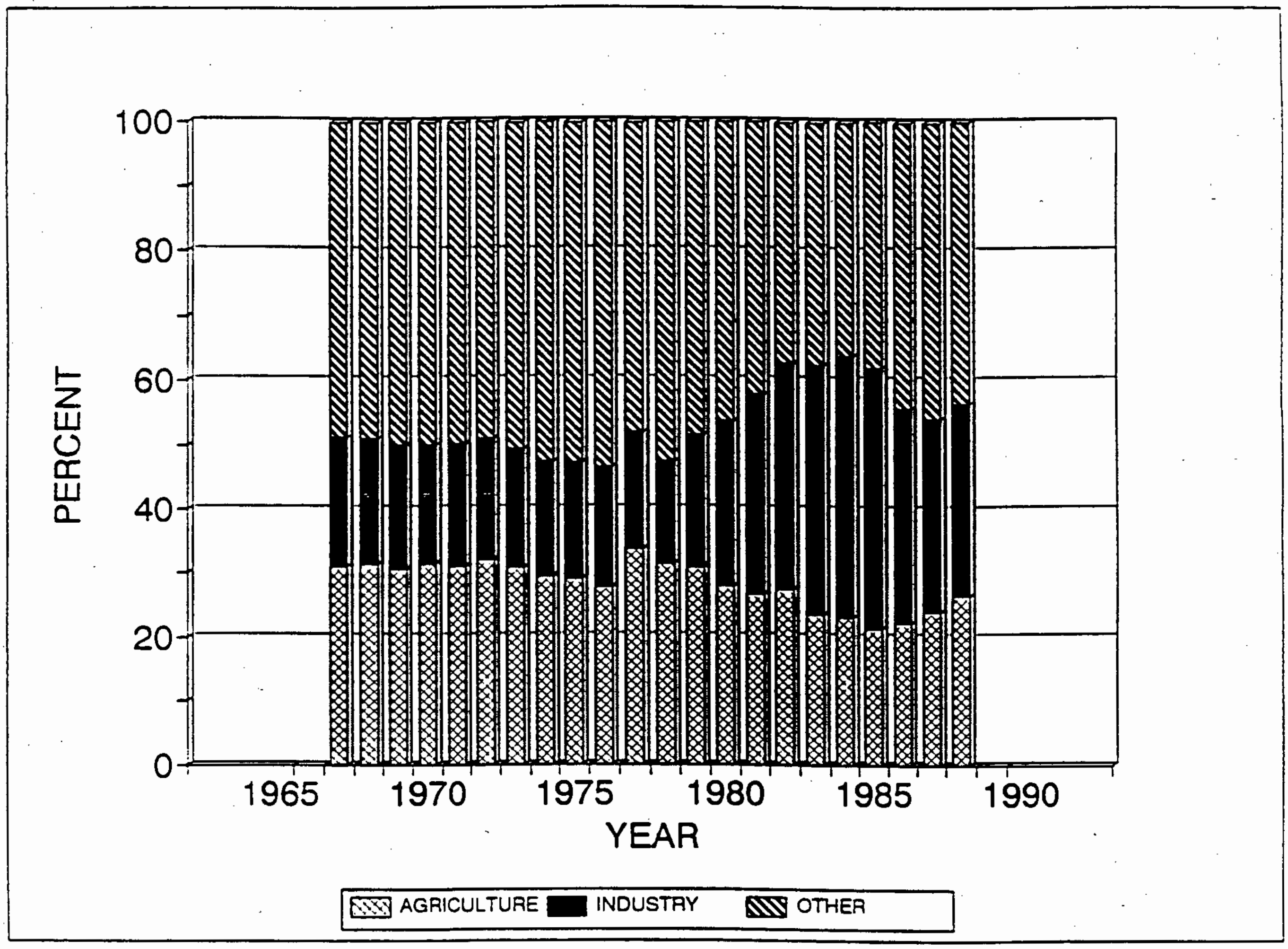


Figure 4. GDP components as percentage of total

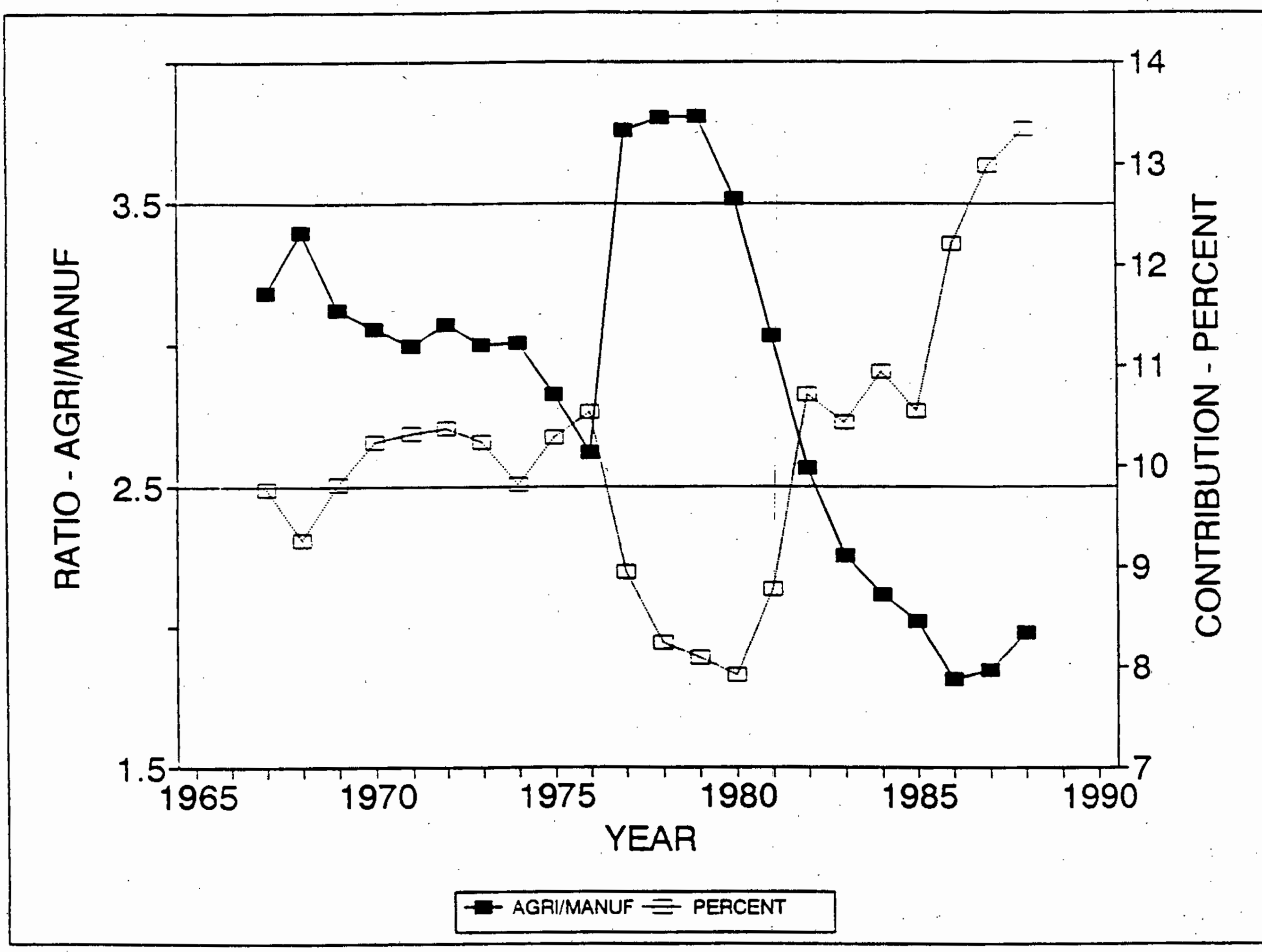


Figure 5. GDP ratio: Agriculture / Manufacture

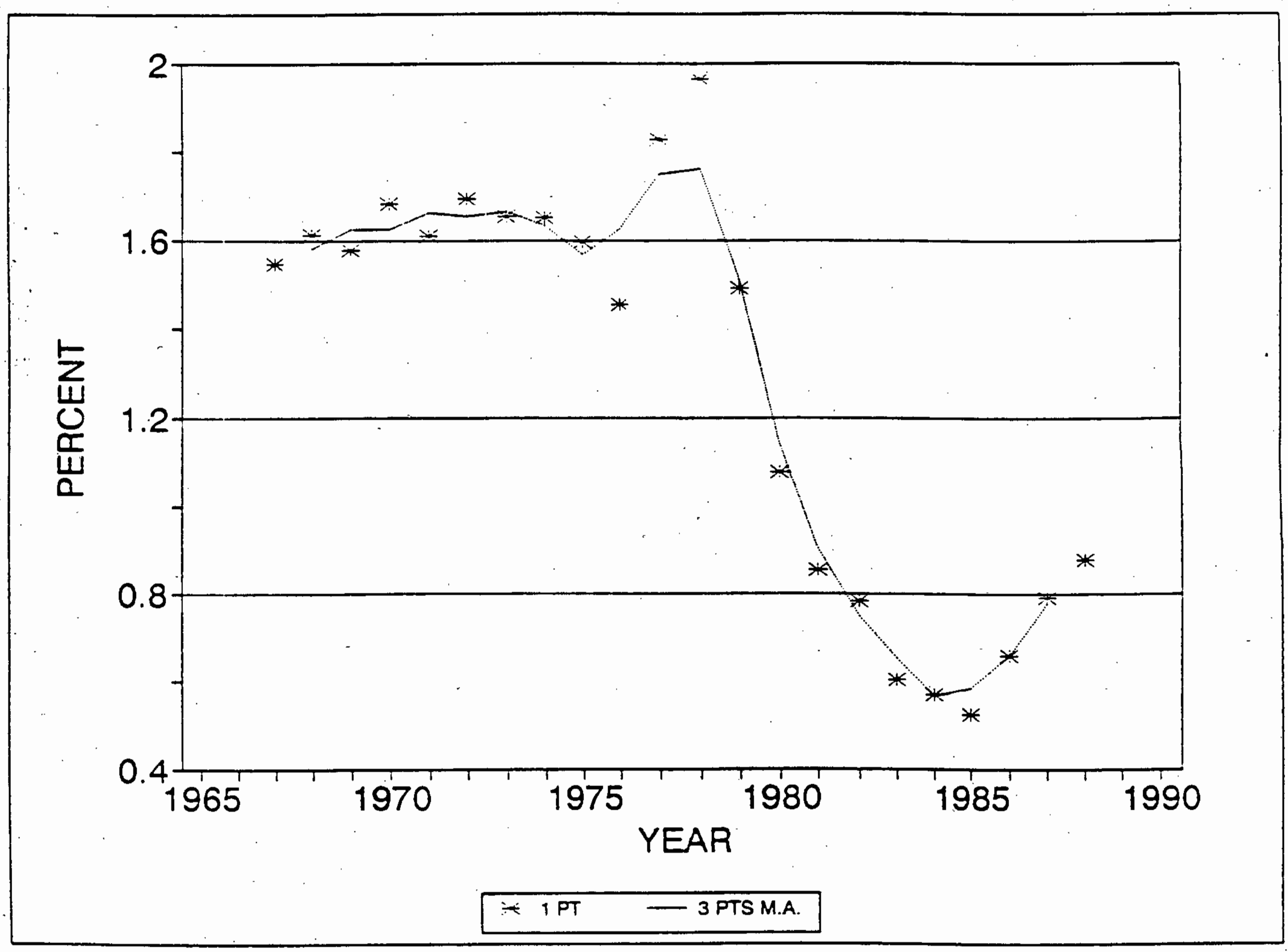


Figure 6. GDP ratio: Agriculture / Industry

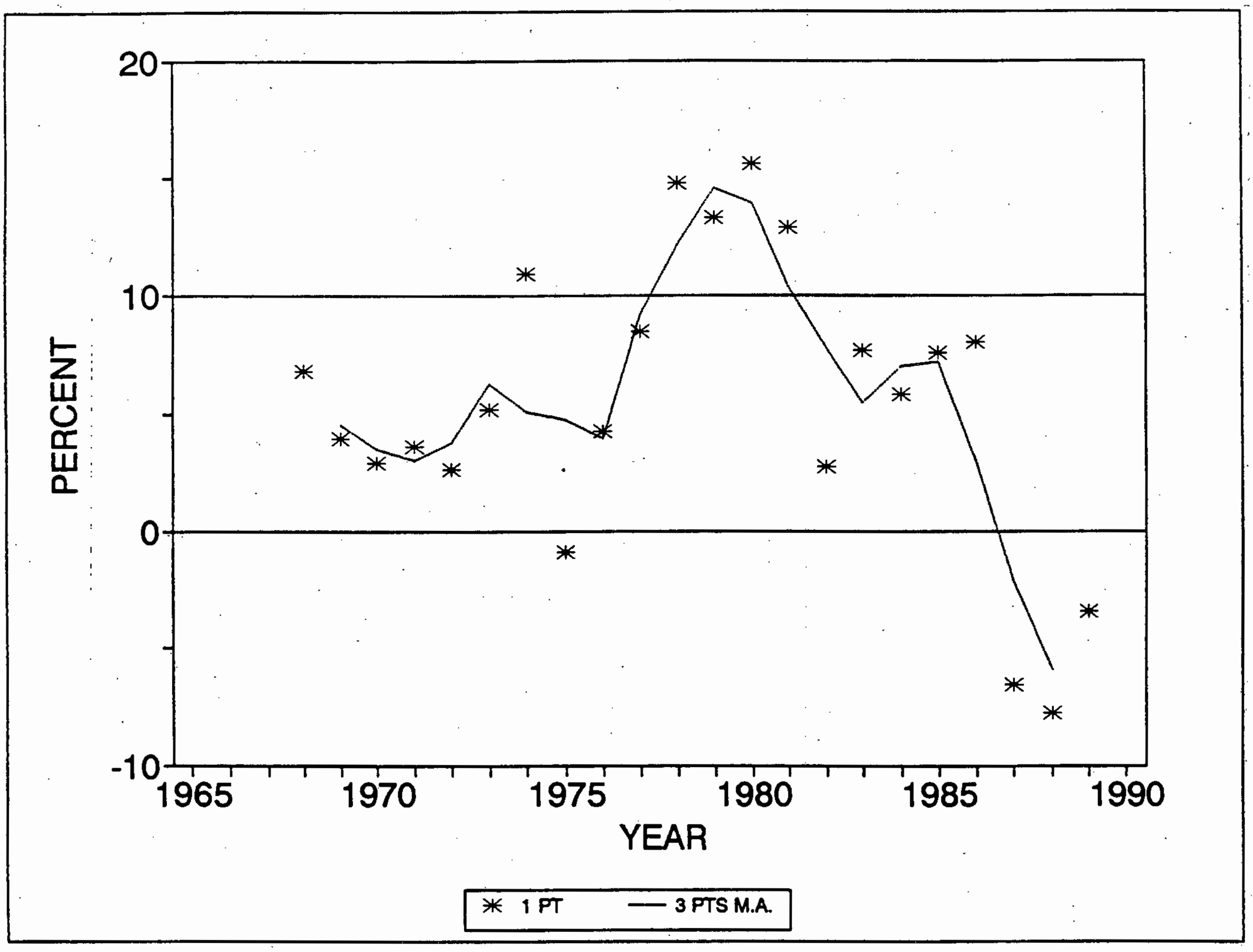


Figure 7. Gross domestic product growth rate: percentage per year (Real 1985)

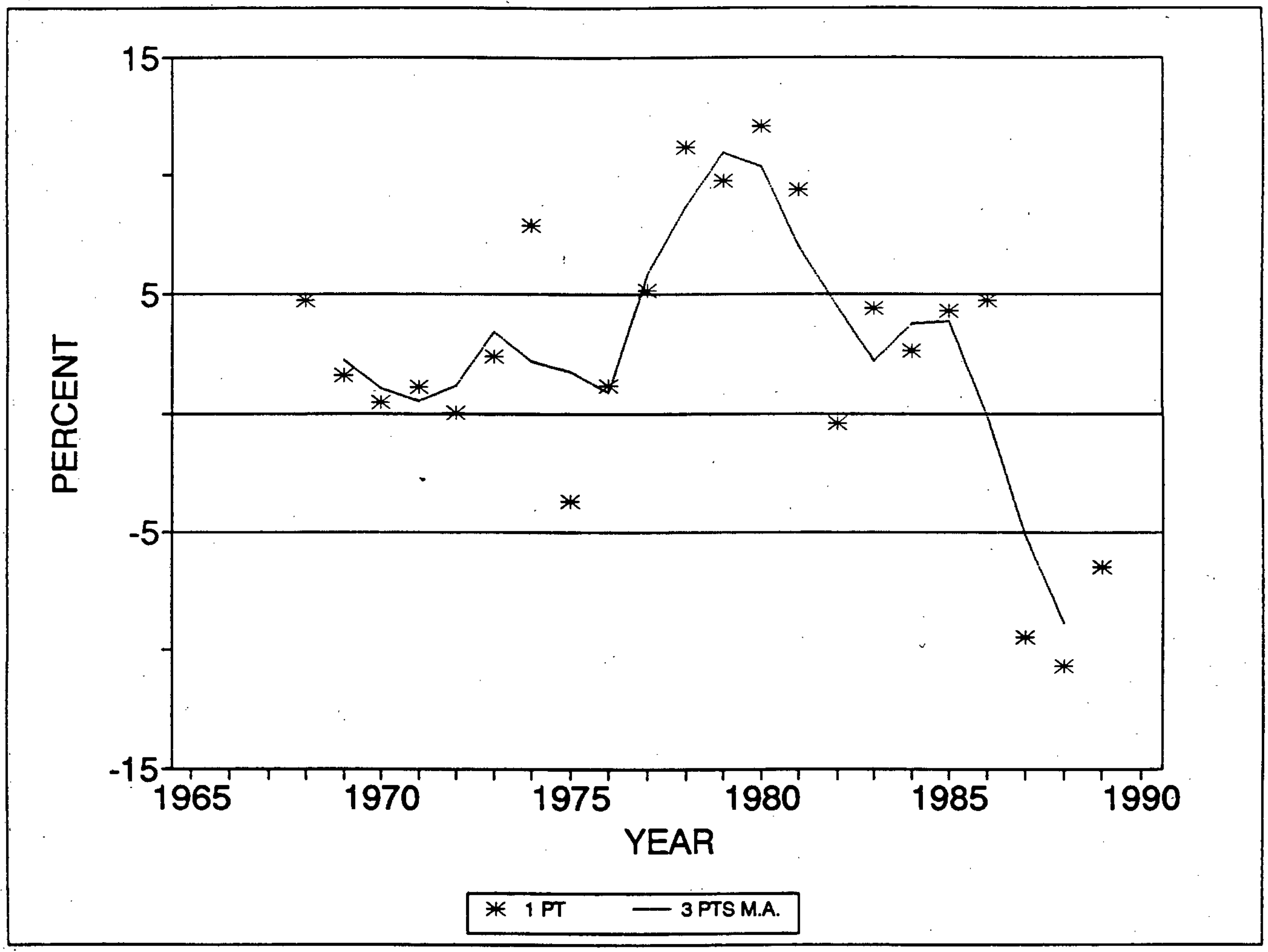


Figure 8. GDP per capita growth rate: percentage / year (Real 1985)

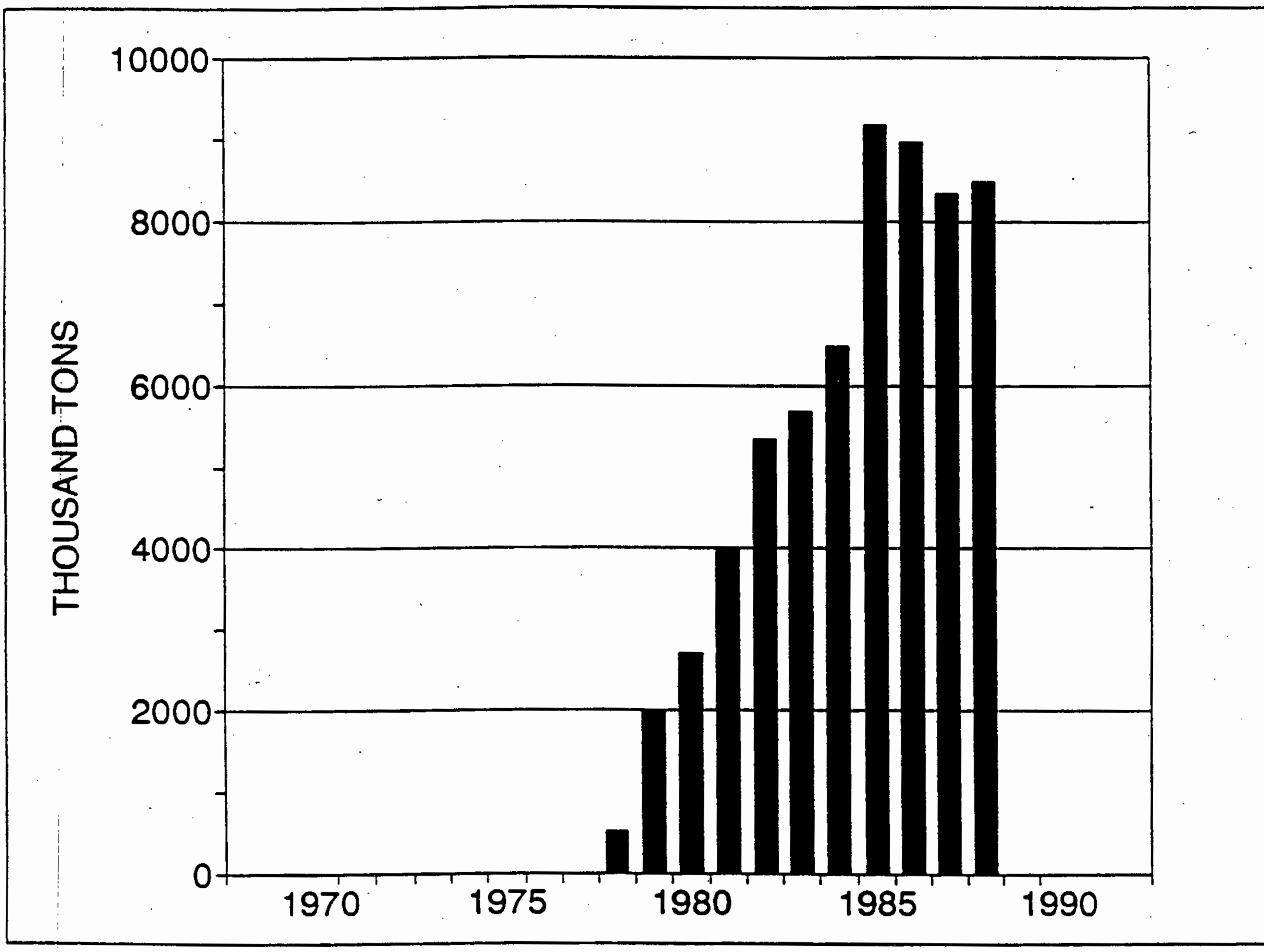


Figure 9. Crude oil production

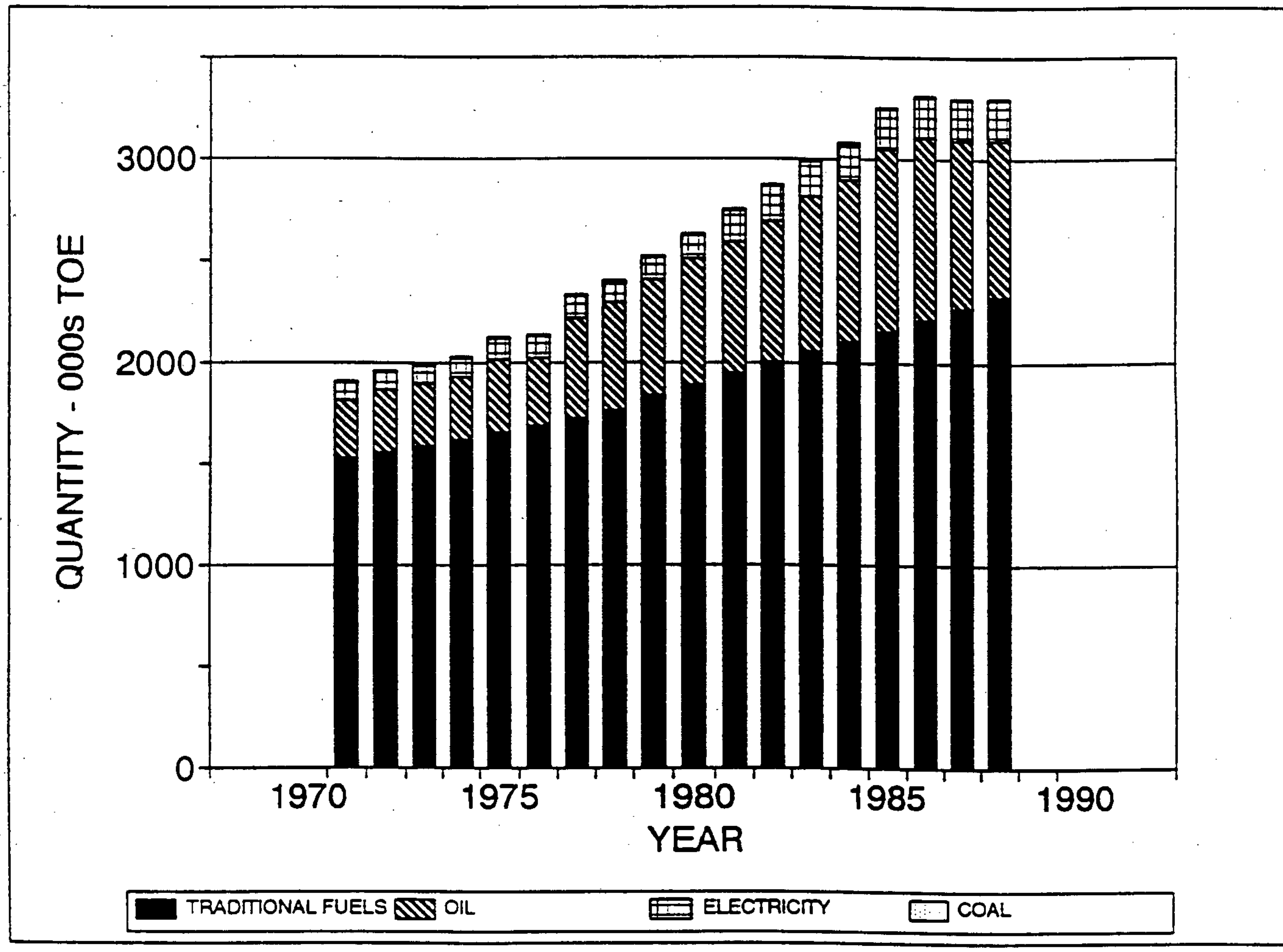


Figure 10. Total final consumption: quantity shares of components

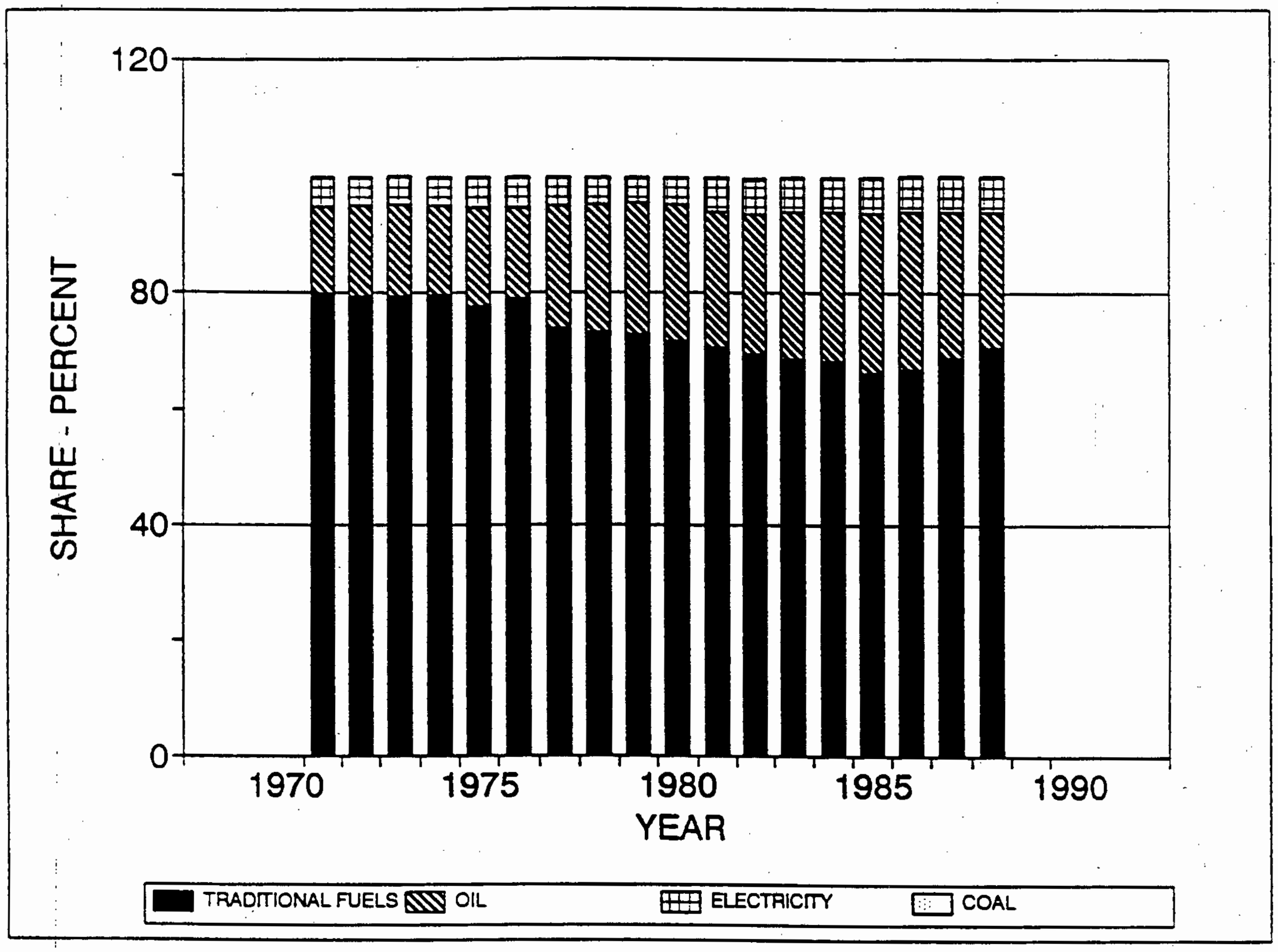


Figure 11. Total final consumption: percentage shares of components

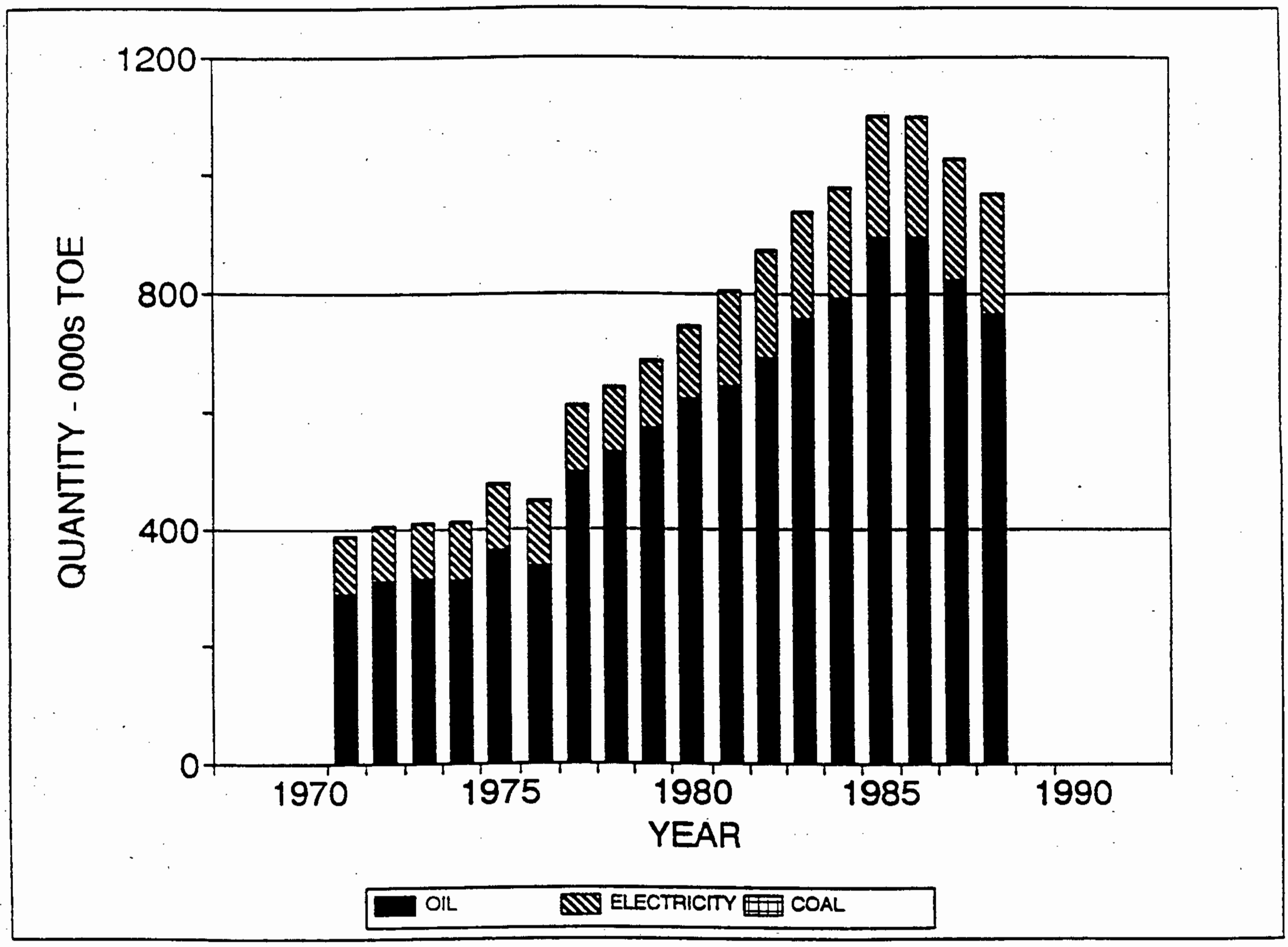


Figure 12. Commercial energy final consumption: quantity shares of components

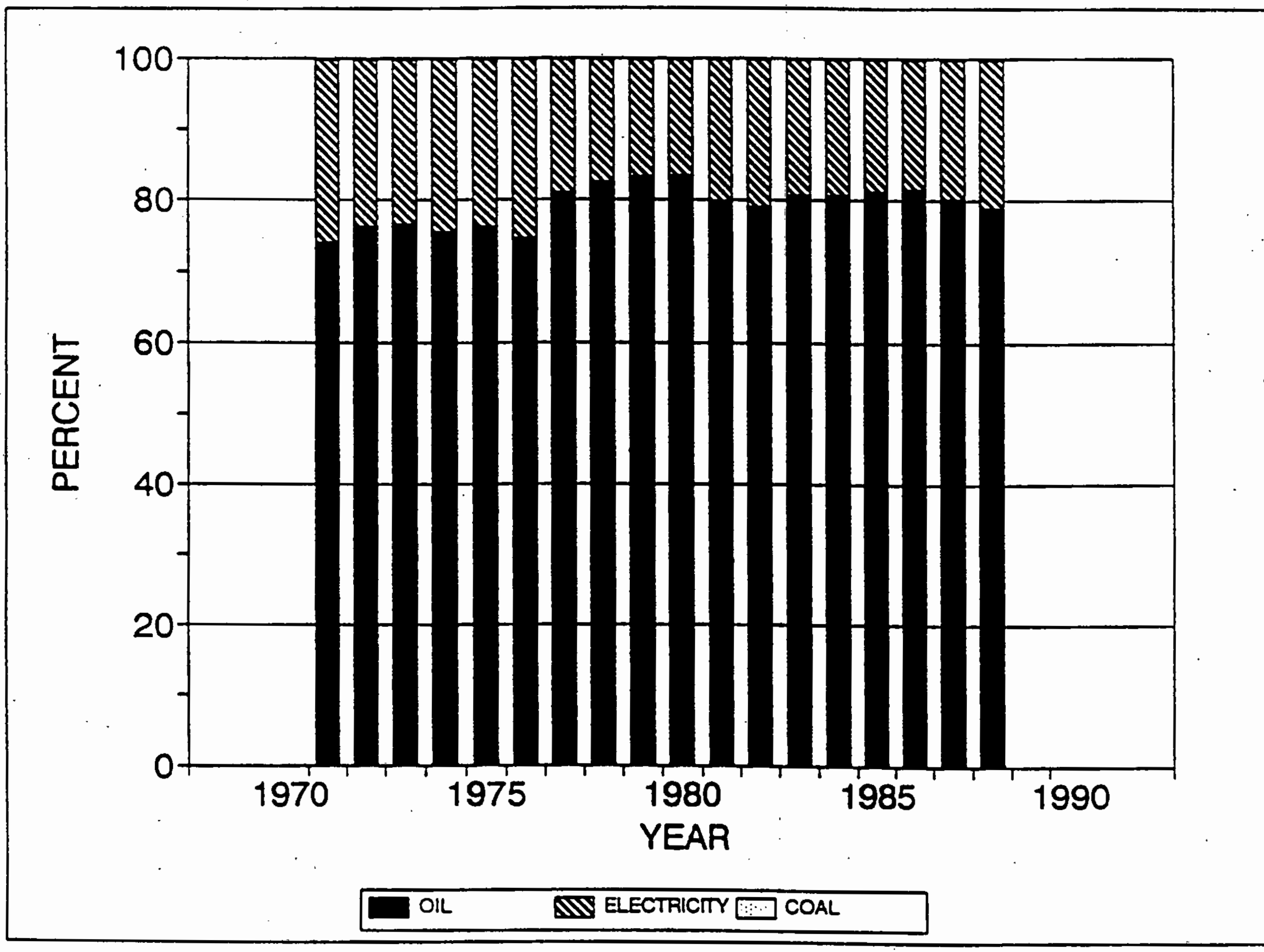


Figure 13. Commercial energy final consumption: percentage shares of components

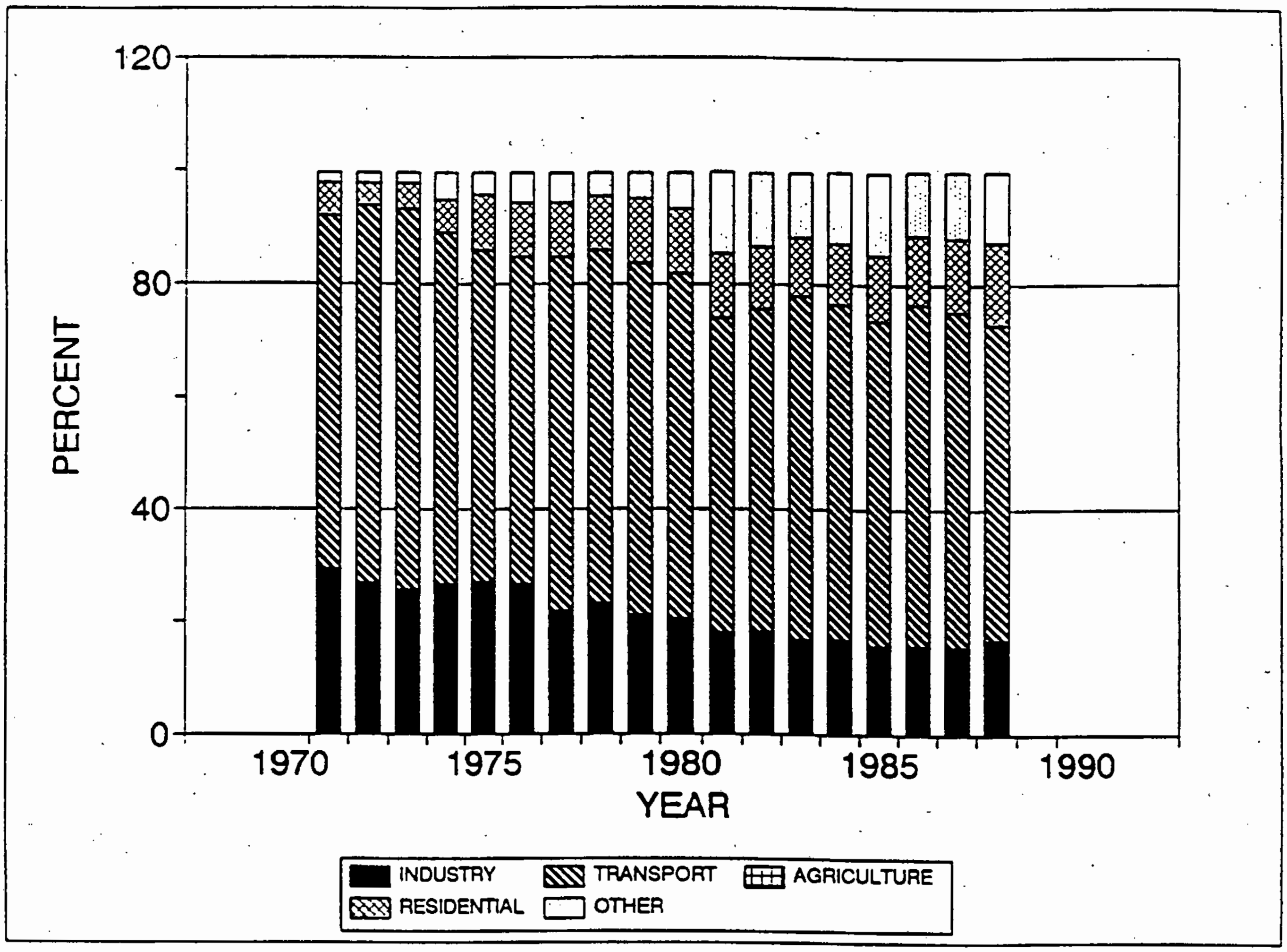


Figure 14. Commercial energy final consumption: Sectorial breakdown (%)

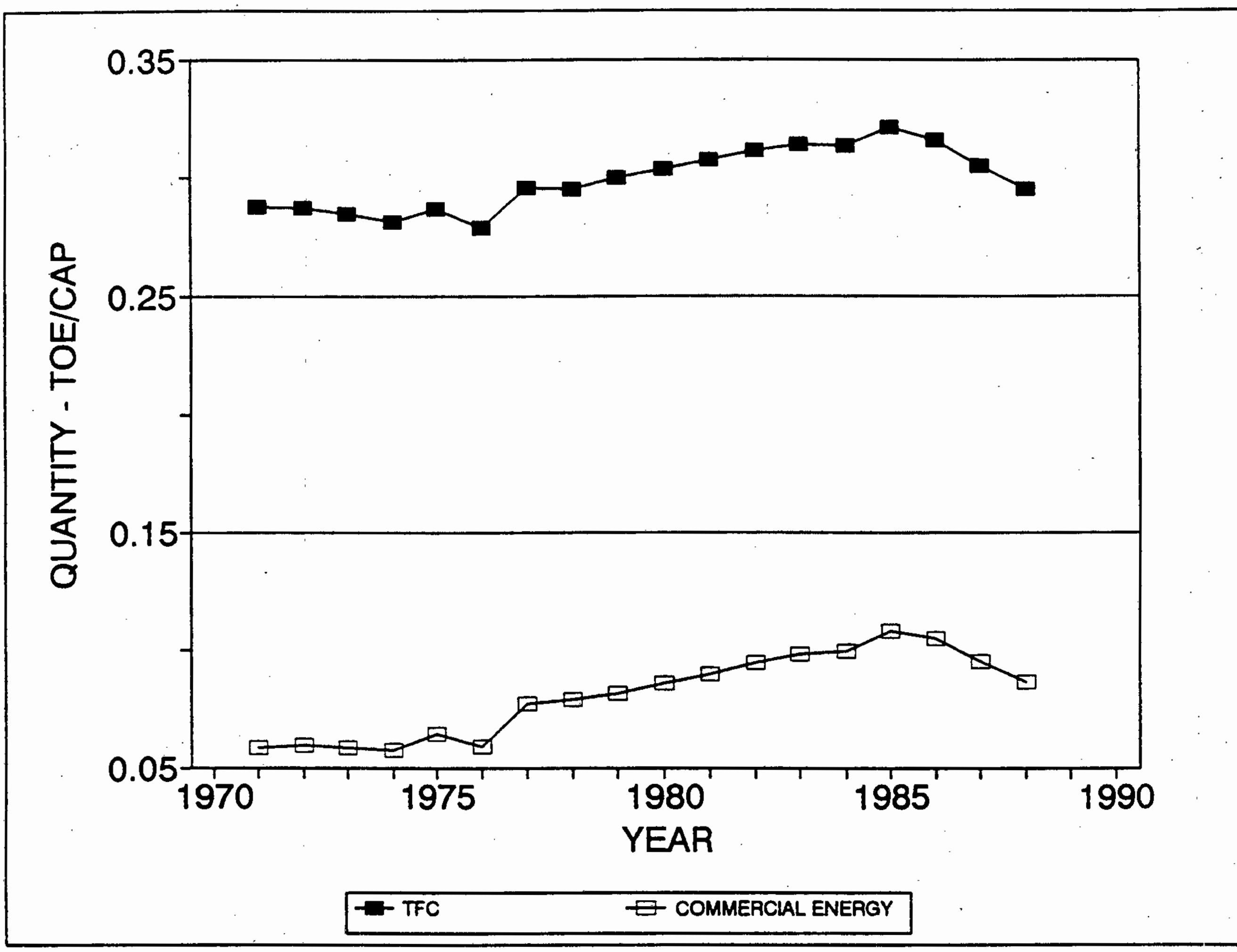


Figure 15. Energy final consumption per capita

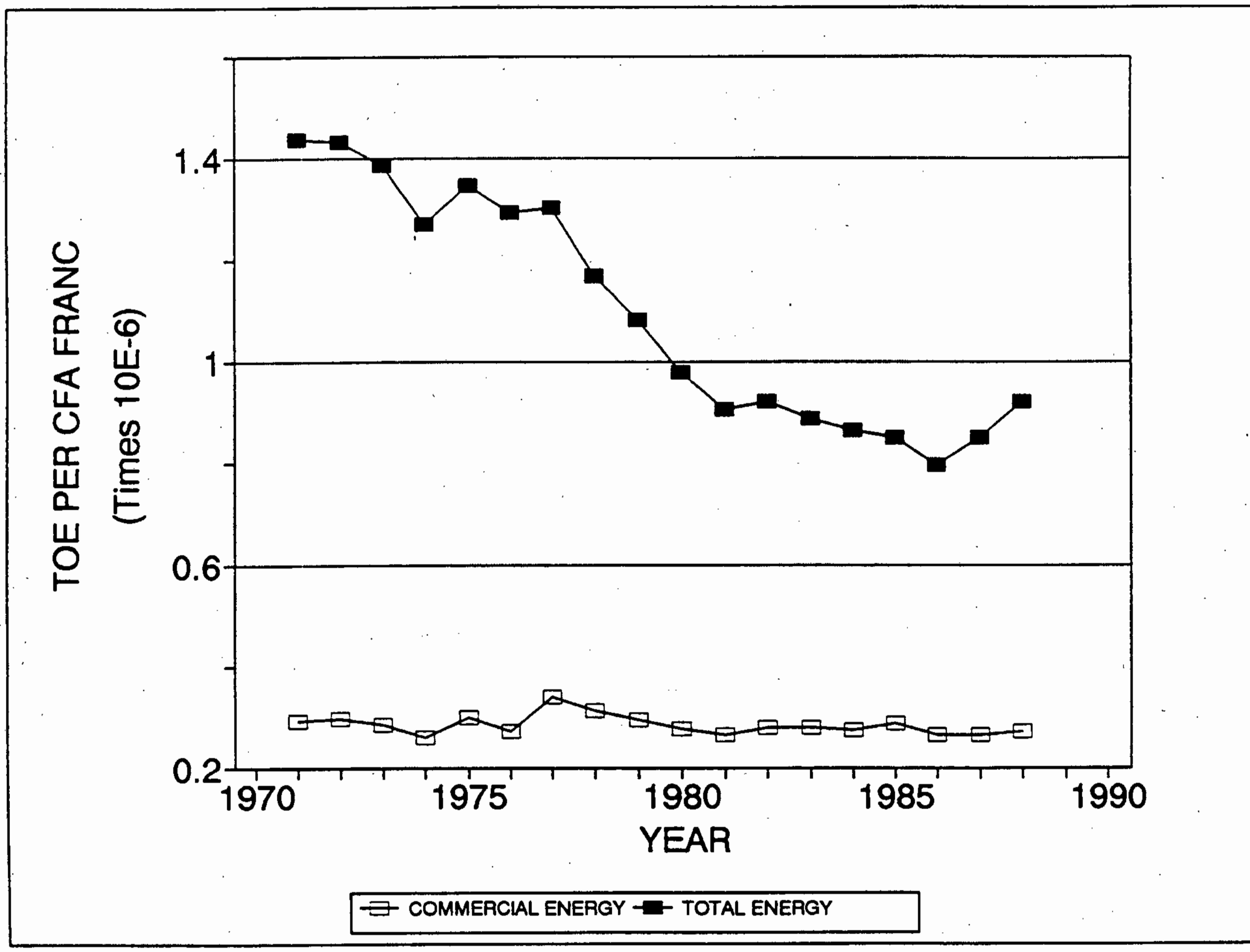


Figure 16. Energy intensity: final consumption / GDP (Real 1985)

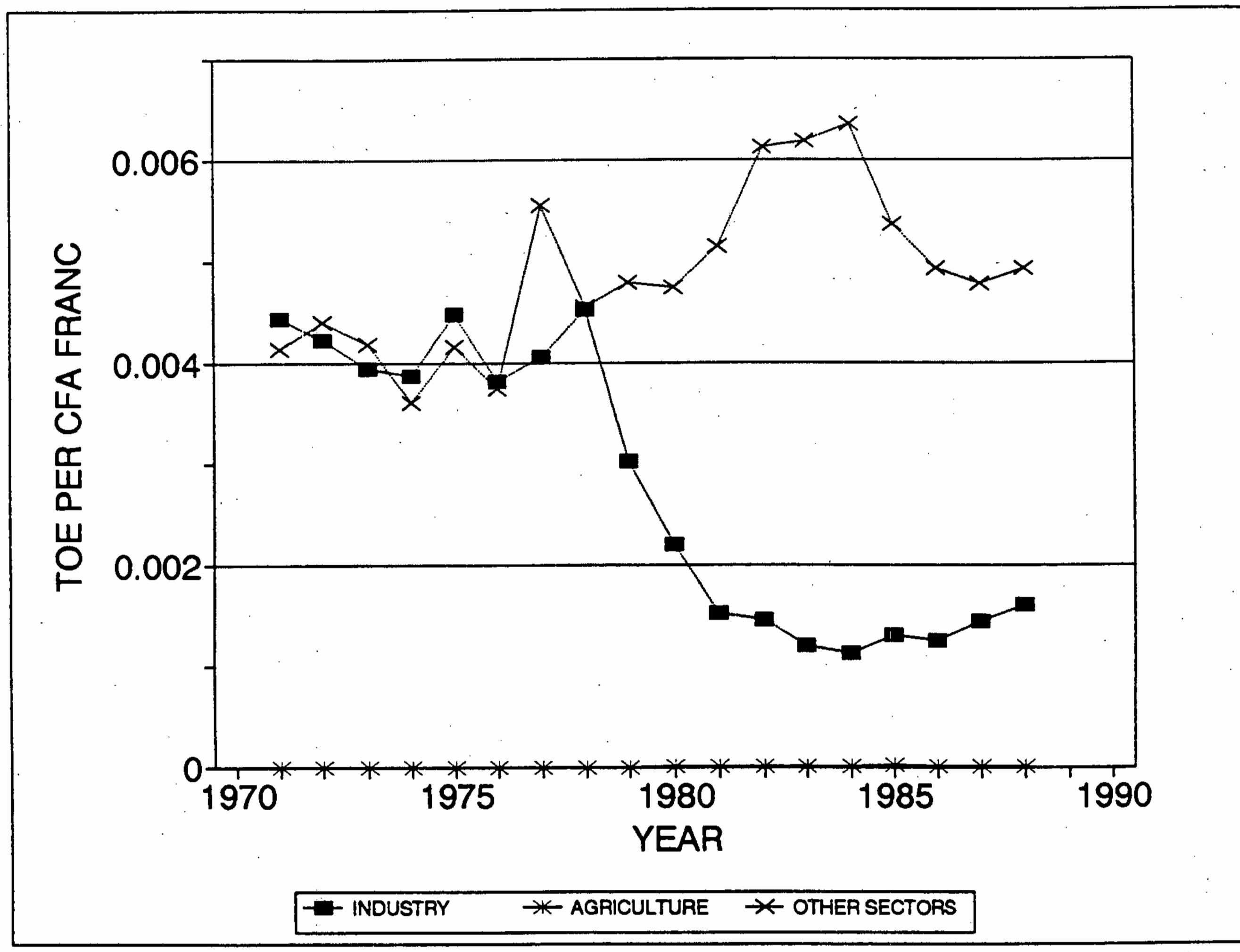


Figure 17. Commercial energy intensity: commercial energy final consumption / GDP (Real 1985)

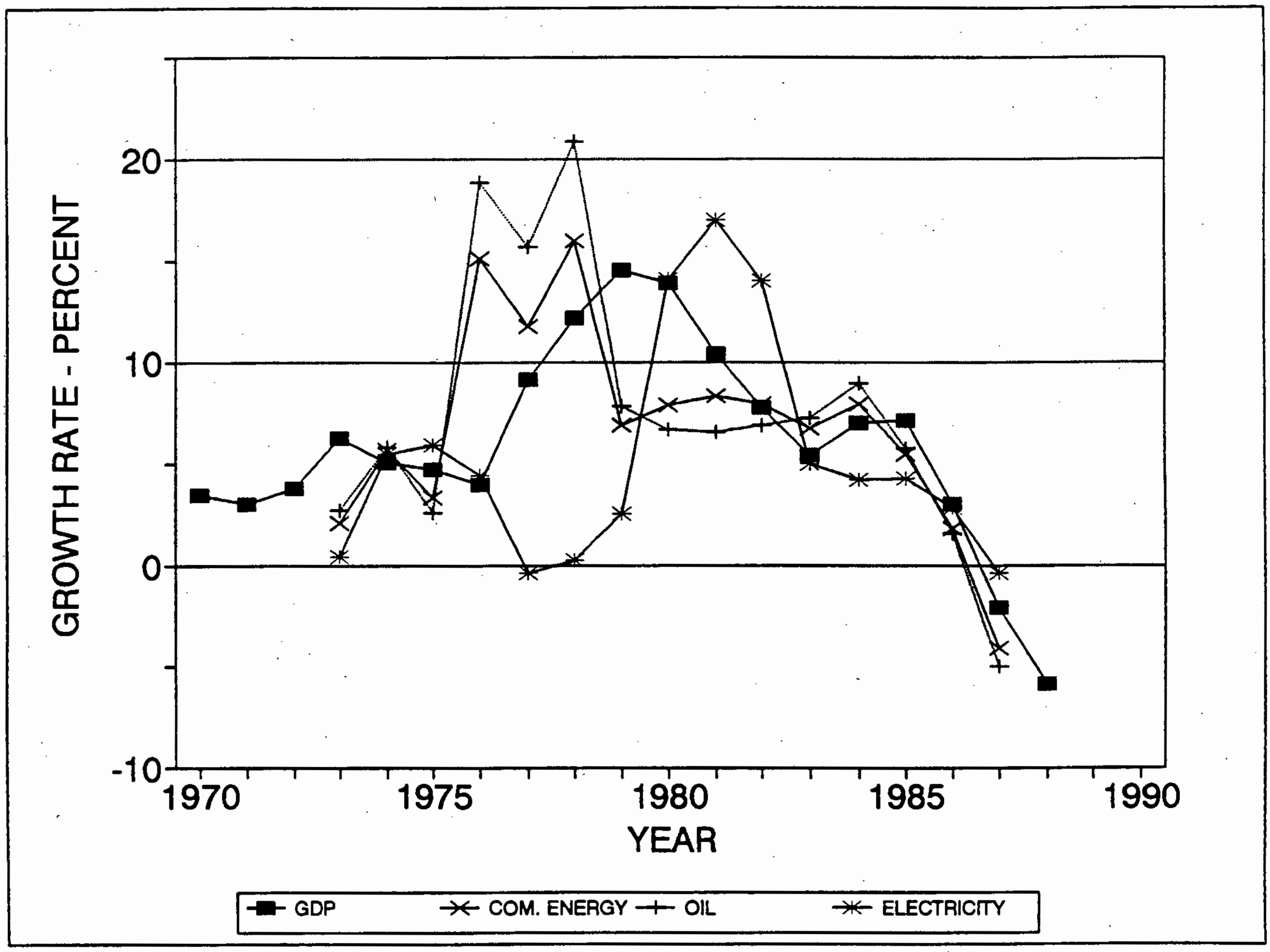


Figure 18. Growth rates (3 pts M.A.)

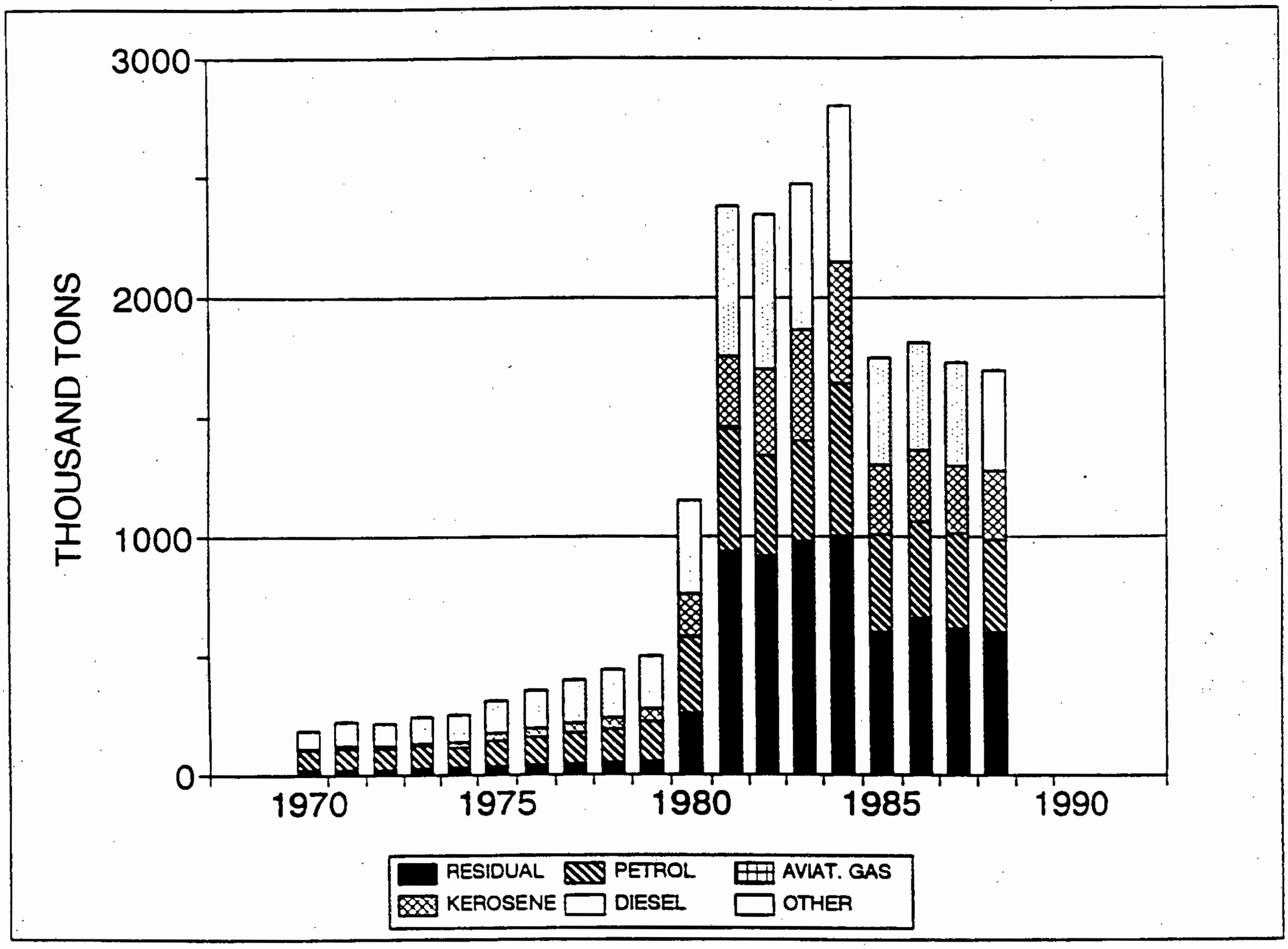


Figure 19. Oil products consumption by type

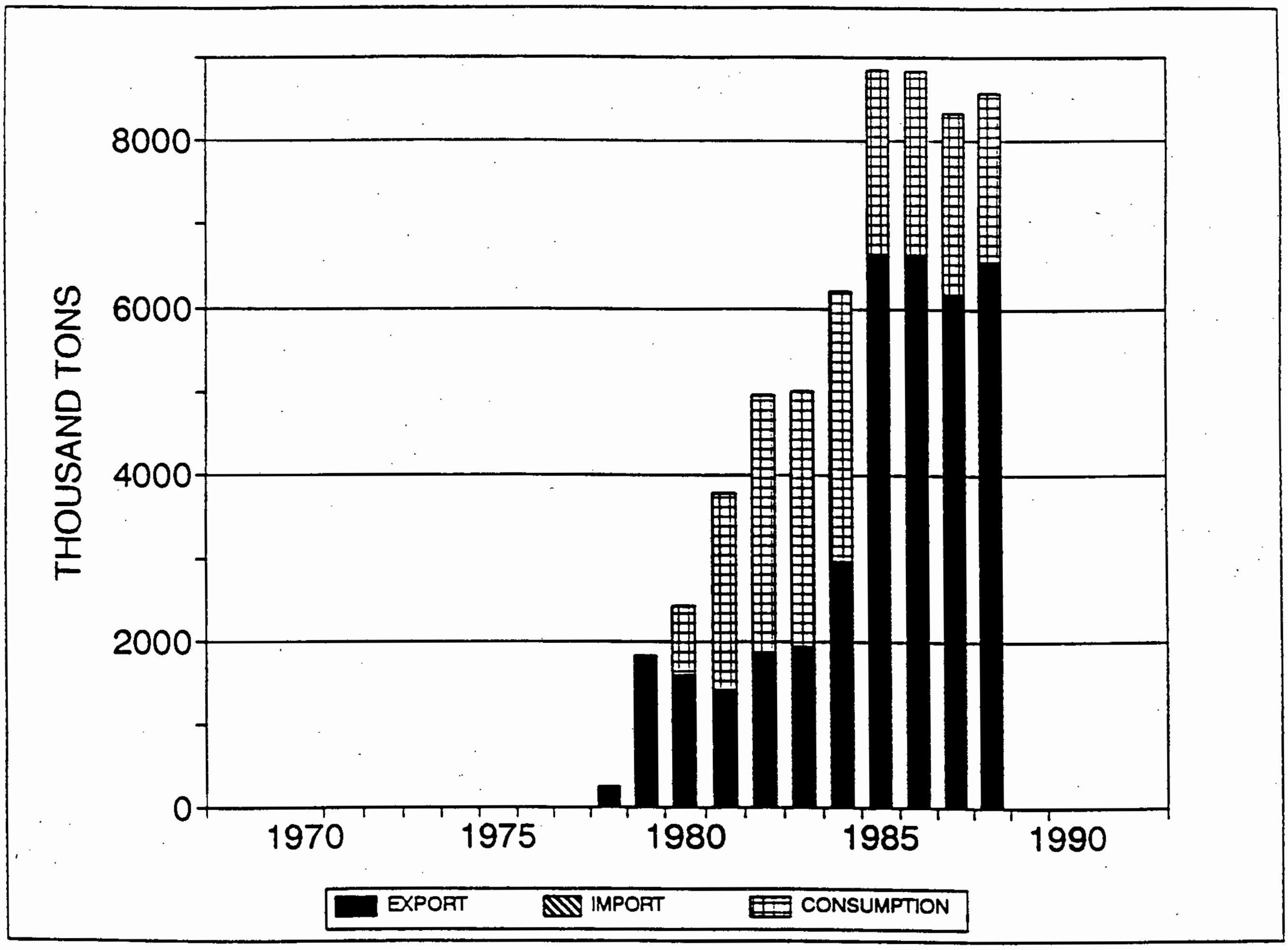


Figure 20. Crude oil: export and consumption

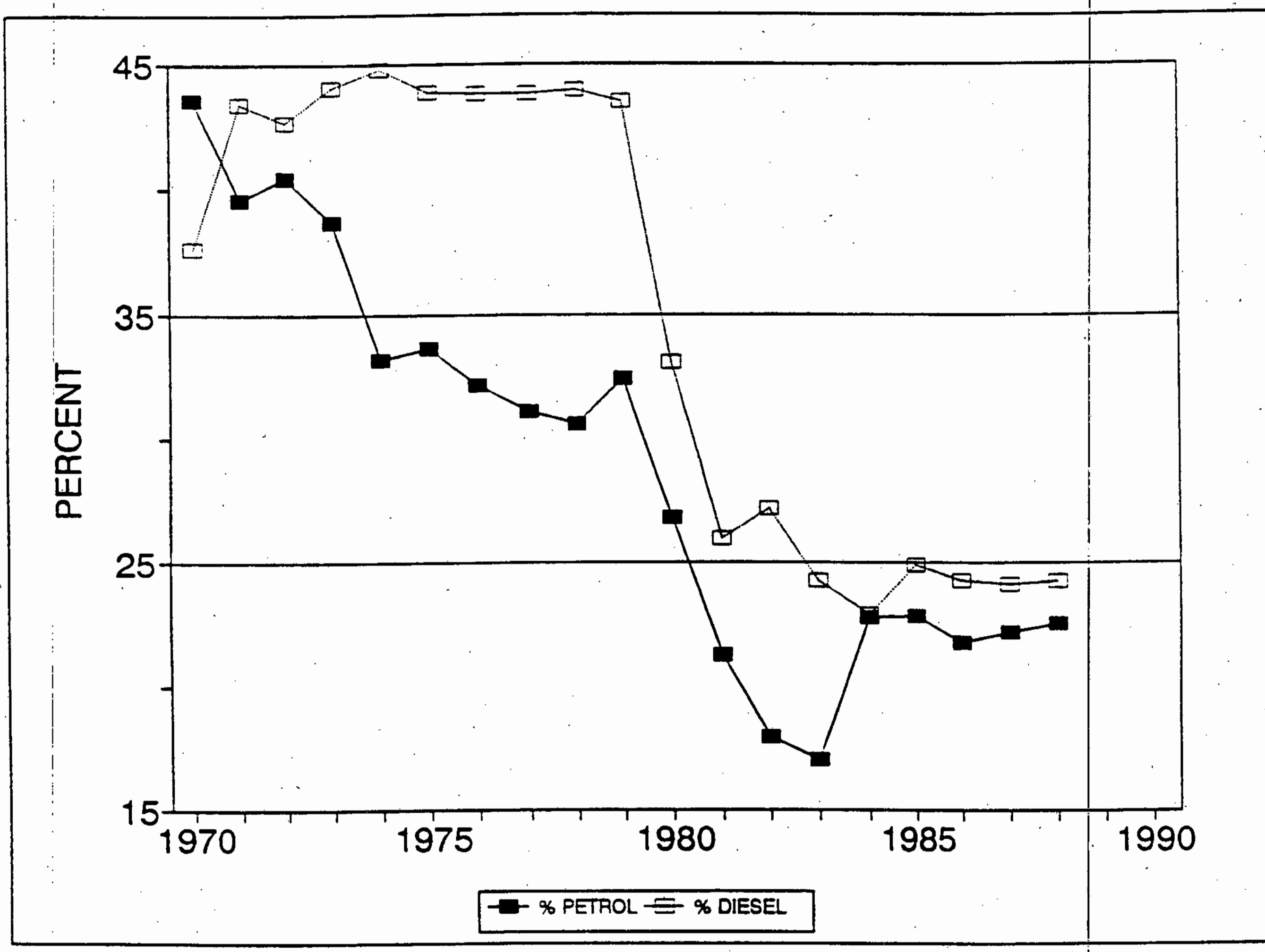


Figure 21. Petrol and diesel as a percent of oil consumption

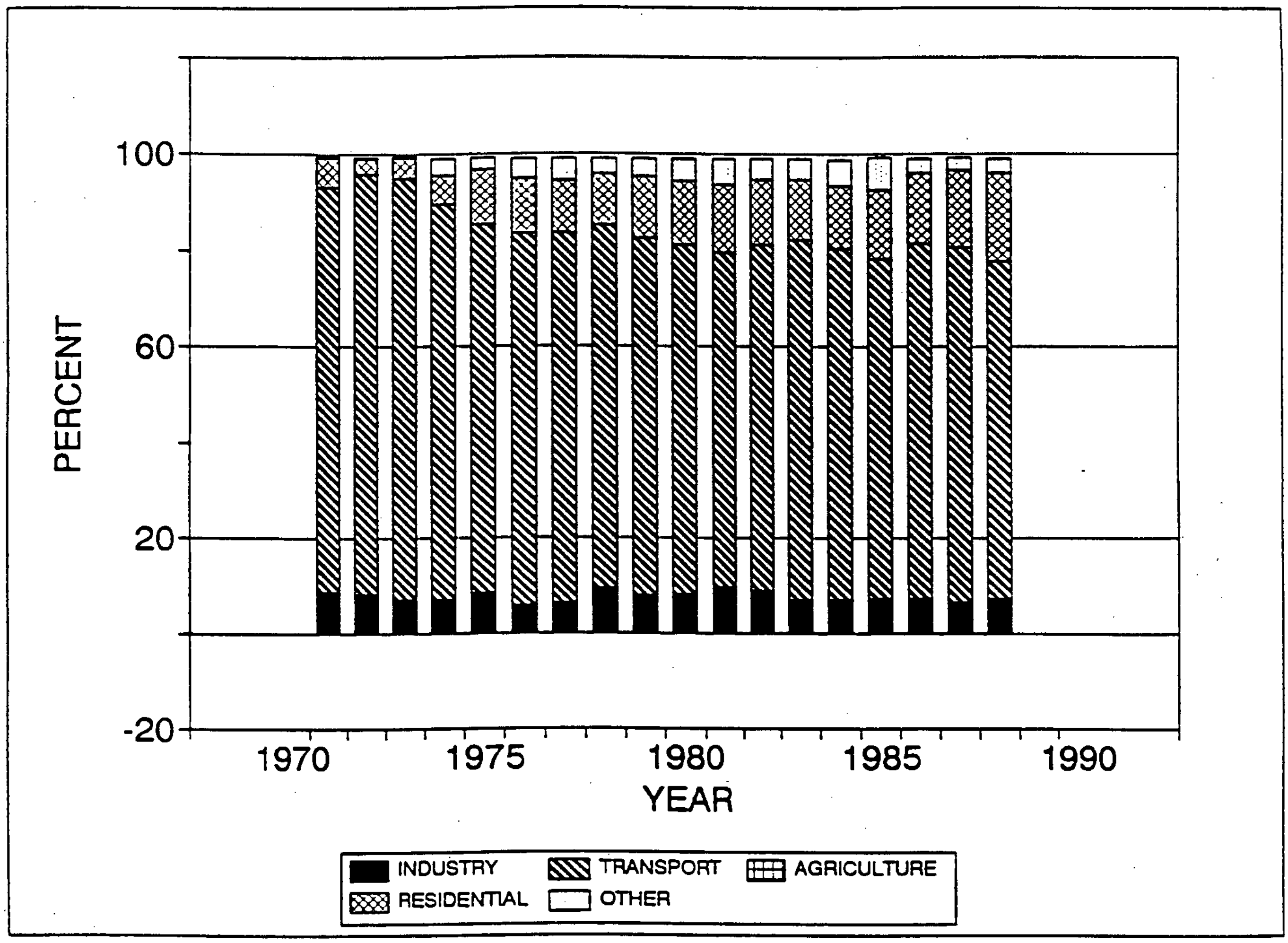


Figure 22. Oil final consumption: sectorial breakdown (%)

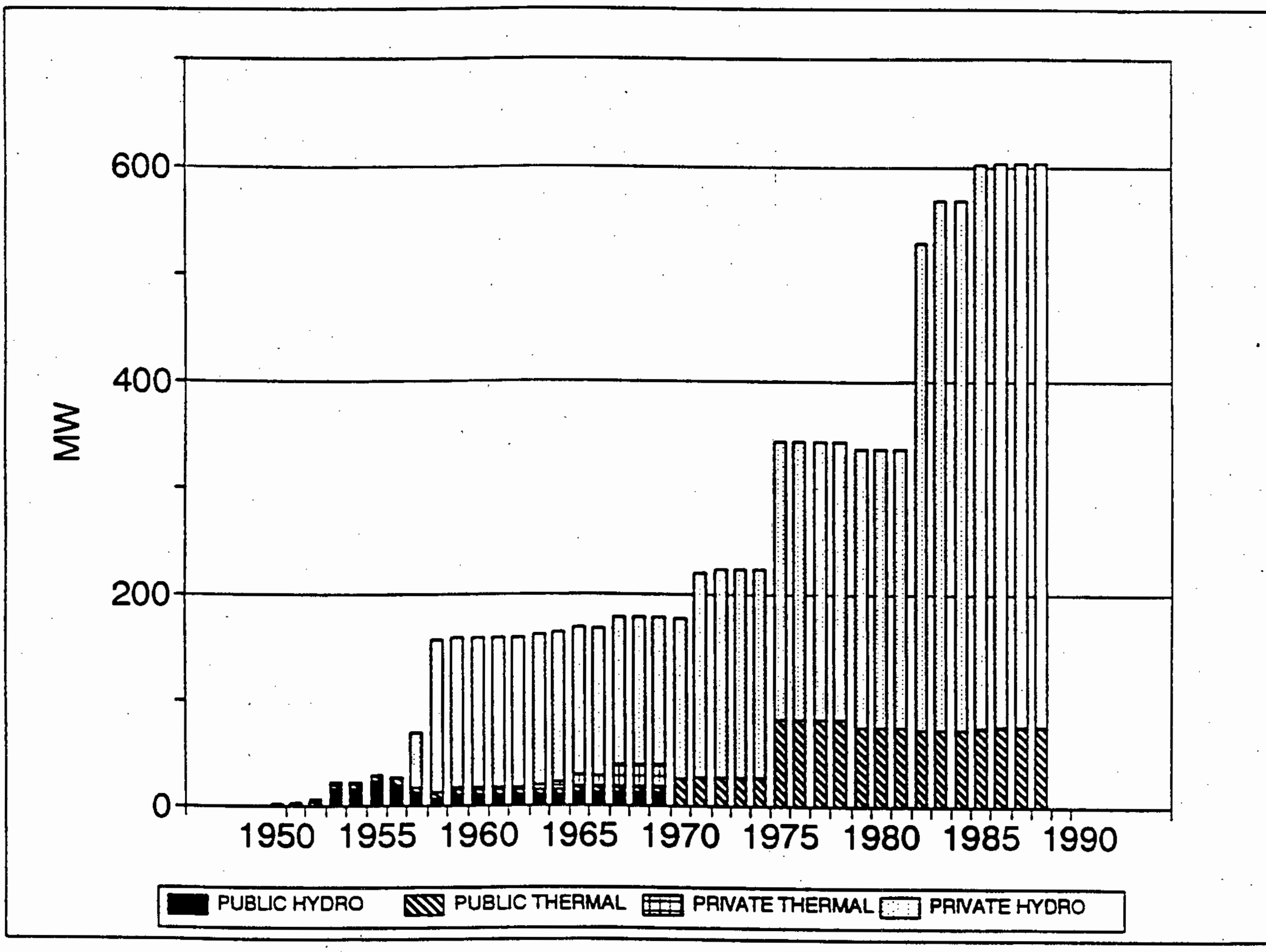


Figure 23. Electrical installed capacity

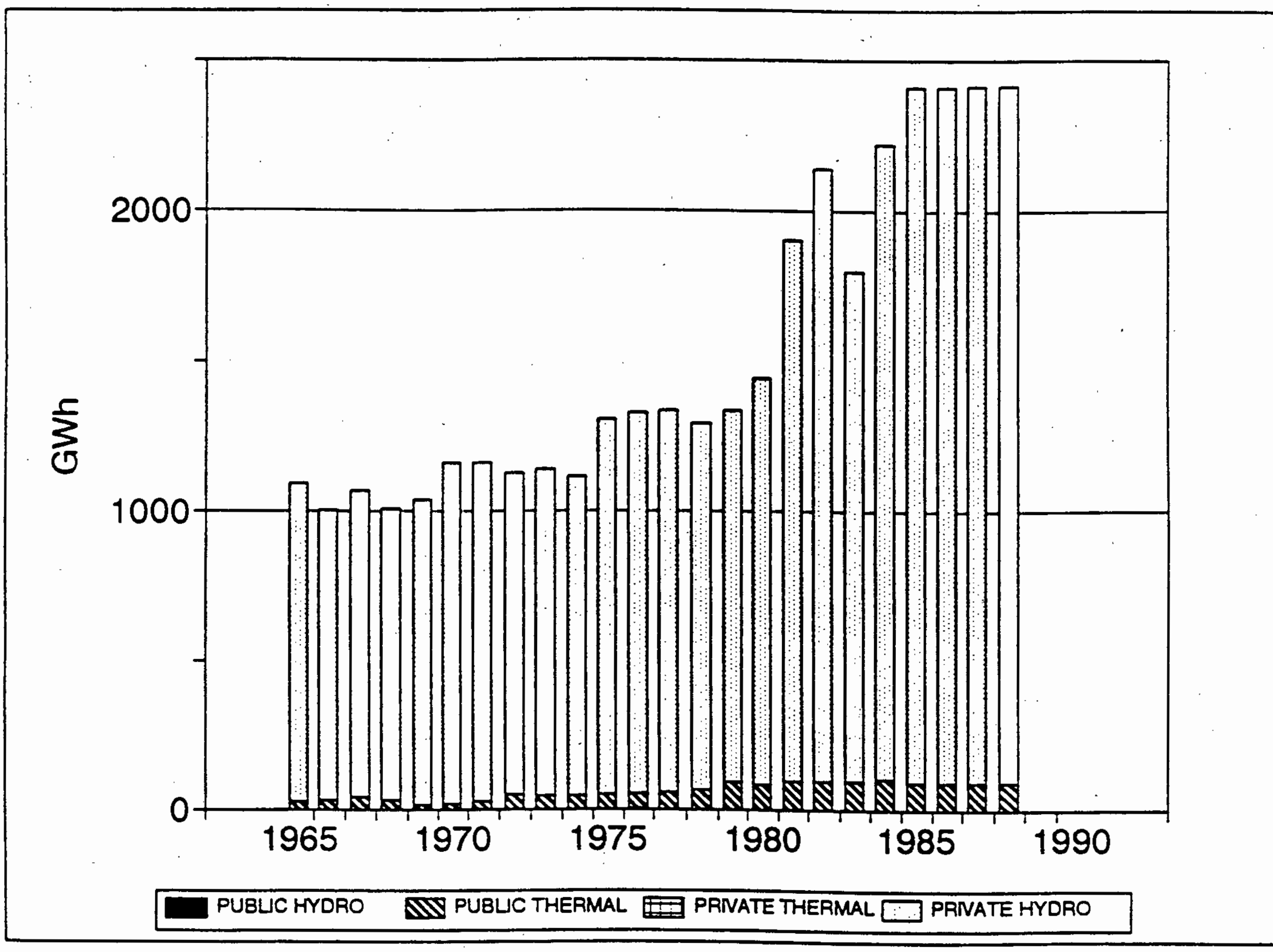


Figure 24. Electricity production

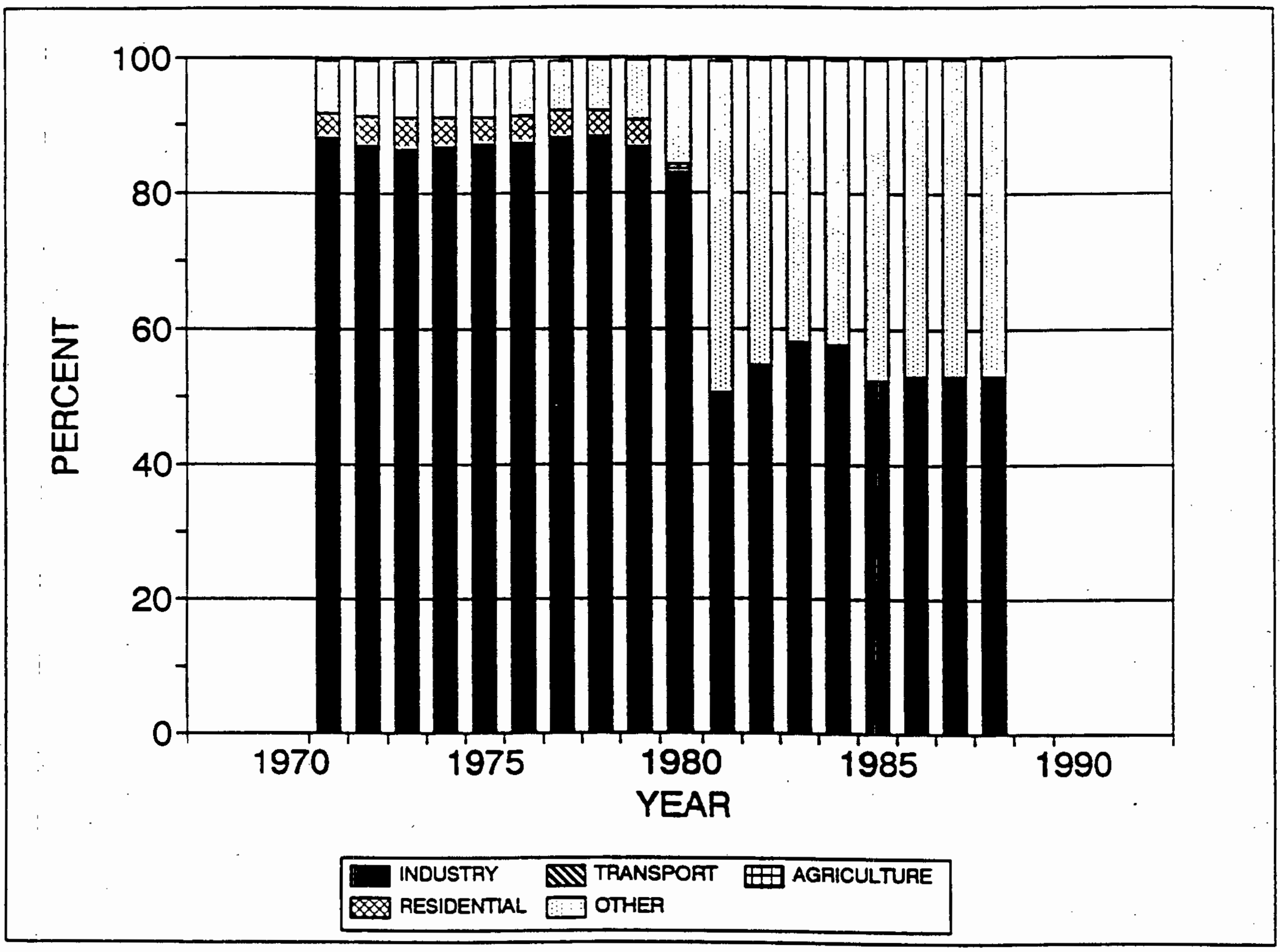
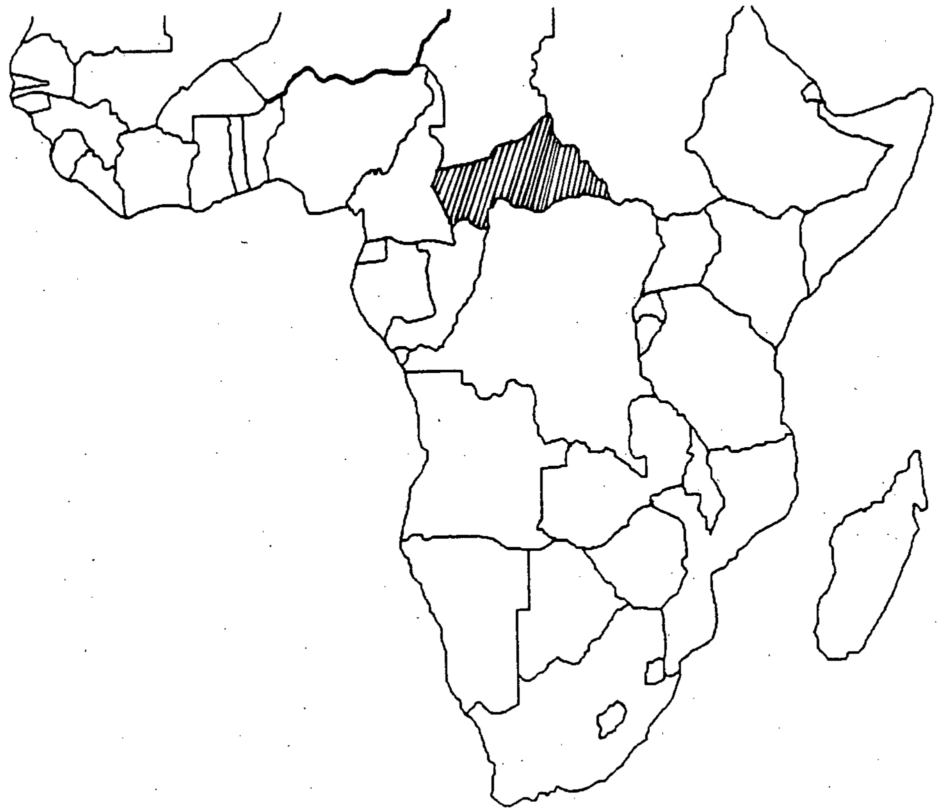


Figure 25. Electricity final consumption: sectorial breakdown (%)

CENTRAL AFRICAN REPUBLIC

1. INTRODUCTION



2. COUNTRY PROFILE

2.1 Introduction

Seriously ravaged by three centuries of slavery trade and a bone of contention between rival Europeans powers, the territory finally became a French colony known as Ubangui-Chari. It was considered a province of French Congo from 1901, and as a province of French Equatorial Africa from 1908.

The country obtained internal self-government in December 1958, with Boganda as Prime Minister. As the first Ubanguian priest, he founded, following World War II, the Mouvement de l'Evolution Sociale de l'Afrique Noire (MESAN). Panafricanist-minded, he advocated the creation of a confederation of French Equatorial Africa, Belgian Congo, Angola, Rwanda and Burundi into a State called the United States of Latin Africa[1] or Central African Republic. He died (disappeared) prematurely on 29 March 1959.

Backed by MESAN and foreign interests, Mr Dacko became, at the time of independence on 13 April 1960, president of the country which was renamed the Central African Republic. He directed the country towards a single-party system.

He was deposed on 31 December 1965 by his cousin and Chief of Staff, Col. Bokassa, who installed a dictatorship. He declared himself President for life in 1972, and Marshall of the Republic two years later. He finally declared himself Emperor Bokassa I on 4 December 1976. The coronation ceremony, copied from that of Napoleon I and held in December 1977, cost the country one-fourth of the total annual foreign exchange earnings.

As a result of growing public discontent and the killing of students, a bloodless coup was carried out with the support of French troops when the emperor was visiting Libya. Mr Dacko was reinstated to power on 20 September 1979 and the country subsequently reverted back to being a republic. Following internal problems and with the loss of French support after the coming to power of Mr Mitterand's socialist government, Dacko surrendered power to army commander, Gen. Kolingba, on 1 September 1981. A Military Committee for National Recovery (CMNR), including the entire military hierarchy, formed the government. In a move towards the return to constitutional rule, the CMNR was dissolved on 21 September 1985 and a new Cabinet dominated by civilians was appointed. A referendum installing a new constitution and a one-party State, the Rassemblement Democratique Centrafricain (RDC), was approved in November 1986(2).

2.2 Geographical situation and demography

The Central African Republic is a landlocked country, covering a total land area of 622 984 sq km situated north of the Ubangui River. It shares its borders with five neighbours: Zaire, Congo, Cameroon, Chad and Sudan.

The population, according to figures given by the World Bank, was 2,8 million in 1988(3), which gives an average population density of 4,4 persons per sq km nationwide. Figure 1 shows the population and population growth for the period 1967-88.

The population is young, with 40,2% under 15 years of age. Average life expectancy was 45 years for the period 1985-90. In 1985 the literacy level was 53% among adult males and 29% among adult females(4).

The population, almost exclusively made up of Ubanguian languages speakers, is divided into over 80 ethnic groups. The three major groups are the Banda with 32%(5) of the total population, the Baya-Mandjia with 29%, and the Mbaka with 7%.

The population is concentrated in the western part of the country, while large areas in the east are virtually uninhabited[2]. The urban component of the population in the mid-1980s was estimated at 45,6%. Agricultural activities occupy 83,3% of the economically active population (about 649 000 persons). The remainder of the work-force is engaged in manufacture and construction (4%), commerce (4,1%), mining (1%) and other services (7,1%)[5].

2.3 Economy

As can be seen from Fig. 2, agriculture is the mainstay of the economy, contributing 40% of GDP in 1988. Despite its large fraction of the labour force, land under cultivation represents only 2% of the total land area and food production has not kept up with population growth. In recent years one-fifth of the total food requirements has been met by imports, representing one-tenth of import spending[2]. The main cash crops are coffee and cotton. Rubber, palm oil and timber are also produced. However, as a result of the lack of suitable transport facilities, forestry exploitation is limited. Animal husbandry development is hampered by the prevalence of the tsetse fly.

The industrial sector is relatively small, as reflected by the GDP ratio agriculture:industry shown in Fig. 3. Its contribution to GDP was 13% in 1988, with manufacturing alone accounting for 7,8%. The most important manufacturing activities are related to textile and leather. They are followed by the processing of cotton seed, groundnuts and other primary products, and some light manufacture. Mining operations are limited mainly to commercial diamond exploitation from the alluvial deposits in the south-west near Berberati and in the north-east near Bria. The local cutting and polishing industry is being developed. Deposits of gold are also being exploited. Uranium deposits have been discovered at Bakouma but have not yet been exploited.

Despite its relatively broad resource base, the economy has suffered from poor development planning and inadequate management during successive regimes. The economic performances are linked to the fluctuations in volume and international prices of export commodities. In addition, structural problems, such as the weakness of the transport infrastructure and the landlocked position which impose a complete dependence on other countries for almost all imports including oil, are a serious constraint to a sound economic development.

Figures 4 and 5 show the overall GDP and the GDP per capita respectively for the period 1967-88. Their growth rates in real terms are shown in Figs 6 and 7 respectively. The first five years of independence saw a marked deterioration of the economy, with a significant decline of cotton output and an increase in government expenditure. Measures taken by the new government of President Bokassa resulted in the revival of agriculture and a significant growth in GDP. However a period of stagnation and decline began in 1970. Unfavorable climatic conditions resulted in the decline in output of major export crops. Problems with the diamond industries, corruption, maladministration, large-scale spending for the imperial coronation, etc. exacerbated the situation. This explains the precipitous decline of the GDP growth rate after 1976. This downward trend continued during Mr Dacko's second term until the military coup of President Kolingba. With the help of austerity measures, he revitalized the economy, as reflected in the growth of GDP after 1980. However in 1985, drought brought a new decline, and in mid-1987 the government started implementing a 3-year structural readjustment programme supported by the IMF and the World Bank(2).

The Central African Republic is a member of the Union Douanière et Economique de l'Afrique Centrale (UDEAC) and the Communauté Economique des Etats de l'Afrique Centrale (CEEAC).

3. ENERGY: GENERAL

3.1 Introduction

The Central African Republic has large forest resources which provide the bulk of energy consumed in the country. The economy is very dependent on imported refined petroleum products, which has a serious effect on foreign exchange. Hydropower potential is significant but remains largely untapped. However, the government is committed to expand the exploitation of hydro resources and to reduce the dependence on oil-fired thermal plants.

3.2 Energy institutions

The energy sector as a whole is controlled by the Ministry of Energy, Mines, Geology and Water Resources.

In the petroleum sector, the State-owned Total Centrafricaine de Gestion (TOCAGES) is responsible for the storage, retailing and transport of petroleum products.

The Energie Centrafricaine (ENERCA), a State corporation, is responsible for the generation and distribution of electric power.

In the forestry subsector, the Office National des Forets (ONF), under the Ministry of Water, Forests, Wildlife, Fisheries and Tourism, is concerned with reforestation and the development of forest resources.

4. ENERGY RESOURCES

4.1 Fuelwood

Forest resources are large. There are about 3,5 million ha of tropical rain forest, situated in the south-western corner of the country where the annual rainfall is high. In addition, the country has 32,3 million ha of open forest(4).

Forestry exploitation is hampered by transportation difficulties. Of the total forest land area, only 10% is accessible by the river transport system. As a result of prolonged exploitation and pressure for agricultural and pastoral use, its output has been declining.

There is no forestry conservation policy. However, the World Bank is trying to fill the gap and is initiating a 15 million US$ programme intended to control the environment by the management of timber resources and the development of processing capacity(2).

4.2 Hydro-electricity

Thanks to its numerous rivers, the Central African Republic has a large hydro-electric potential. Technically exploitable capacity from potential sites is now estimated at 1200 MW(6). Little of this capacity has yet been harnessed.

4.3 Other sources

The country has no known petroleum or gas resources. High grade uranium deposits, have been found near Bakouma, 480 km east of the capital Bangui. They are estimated at between 10 000 and 16 000 tons[2]. A joint venture called the Société de l'Uranium Centrafricain (URCA), which includes the government, the French Atomic Energy and Alusuisse, was formed in 1977. However, following the fall of world prices, the scheme, expected to be operational in the 1980s with a yearly output of 800 tons, did not materialize.

5. ENERGY SUPPLY AND DEMAND

5.1 General

The forms of energy consumed in the country are traditional fuels, mainly fuelwood, petroleum products, and electricity. The supply is overwhelmingly dominated by traditional fuels. Due to the lack of accurate data, it has been assumed that the annual final consumption of traditional fuels per capita is 0,9 m^3fuelwood equivalent. Using this assumption, traditional fuels accounted for about 92% of the total final consumption in 1988. Figures 8 and 9 give the estimated quantity and percentage shares of the various energy carriers for the period 1970-88.

Oil is the main commercial fuel, accounting for 90% of the commercial energy supply (final consumption). It is widely used in transport, in industry and for electricity generation. The contributions of both oil and electricity to the estimated final consumption of commercial energy can be seen in Figures 10 and 11.

The total final consumption is given on a per capita basis in Fig. 12. Oil and electricity consumptions have been estimated at 0,021 and 0,002 TOE per capita respectively in 1988. Traditional fuels consumption has been assumed to be 0,261 TOE per capita.

The energy intensity, defined as the final energy consumption for a unit of GDP, is shown in Fig. 13. One can see the wide gap between the total energy intensity and the commercial energy intensity graphs, due to the large use of traditional fuels. As the actual amount of traditional fuels used in GDP generating sectors is not known, it is difficult to estimate values for the graphs. These two graphs ignore the large amount of human energy used in agriculture, the largest sector of the economy.

The growth rates of different energy carriers and that of GDP are shown for the period 1970-88 in Fig. 14. Since 1977 electricity has closely followed the trend of GDP. It reflects the large efforts undertaken to electrify the interior of the country and to develop local hydro-resources. Oil growth rates have been influenced by the vagaries of world prices and the state of the economy. Of particular interest is the low growth for 1974 due to the oil crisis, and the declining growth for the period 1977-80 due to the decline of the economy during the imperial period. Oil growth declined during the period 1983-85 due to economic problems related to the drought, but grew in 1986 following the fall in the world prices. Overall, total commercial energy, whose main contribution comes from oil, follows the same trends.

5.2 Traditional fuels

As shown in Figs 8 and 9, traditional fuels, mainly fuelwood, constitute the bulk of energy consumed in the Central African Republic. The country is believed to have an adequate supply for many years to come. On one hand the resources are abundant (see 4.1) and tree growth is good as a result of abundant rainfall. On the other hand the population size is modest. However the concentration of population to the west, timber cutting, and the extension of agricultural and pastoral land are all putting pressure on local resources.

5.3 Petroleum products

The country has no known oil resources or refinery activities. All petroleum requirements are met by imports of refined products.

Figure 15 shows the consumption of petroleum products on a yearly basis as given by the United Nations Energy Statistics Year-books. Petrol and diesel are the major products consumed in the country and their percentage contribution to oil consumption is shown in Fig. 16.

Foreign exchange problems make it difficult to import the increasing amounts of petroleum products required. Moreover, the increasingly unreliable transportation links and the landlocked position of the country on one hand make oil imports costly and on the other isolate the country from foreign suppliers and markets. The oil import route is about 1815 km long. It runs from the port of Pointe-Noire on the

Atlantic coast to Brazzaville in the Congo by railway, and from Brazzaville to Bangui on the Congo River and its tributary, the Ubangui. The shortages of oil products were very acute in 1979/80.

The Total Centrafricaine de Gestion (TOCAGES), a State corporation, transports, stores and retails petroleum products.

5.4 Electricity

Figures 17 and 18 give the installed capacity and electricity production respectively for the period 1959-88.

Electricity production and distribution is almost exclusively in the hands of the State-owned Energie Centrafricaine (ENERCA) which in 1962 took over the former Société Equatoriale d'Energie Electrique (SEEE). It supplies power to the capital Bangui and about 13 commercial centres. ENERCA had a total staff of 509 persons in 1990.

ENERCA's assets at present are two hydroelectric power stations, Boali I and Boali II, and some thermal plants (about 14). These two hydroelectric stations are powered by two dams constructed at the M'Bali Falls located 90 km from the capital Bangui on the M'Bali River. In order to improve the control of river flow, a regulating dam was inaugurated in 1991. The regional distribution of the installed capacity, electricity production, electricity sales and transmission lines in 1990 are to be found in Table 1.

As can be seen from Table 1, the main load centre is the capital, Bangui. In 1990 it was supplied by the two hydropower stations, the 8,75 MW (4 x 1,75 MW) Boali I and the 9,90 MW (2 x 4,95 MW) Boali II, and thermal plants with an installed capacity of 18,24 MW. In 1990 the Bangui system, which includes the city of Boali where the two hydroelectric plants are located, accounted for 86,4% of the total installed capacity and 98,47 GWh or 98,5% of electricity production in the country. Outside the Bangui system, 13 provincial centres had access to electricity and accounted altogether for an installed capacity of 5,83 MW. The electrification of these provincial centres was started in 1986.

Table 1. Some characteristics of ENERCA's load system in 1990[6]

	Bangui	Provincial Centre	Total System
Installed capacity:			
Thermal (MW)	18,24	5,83	24,07
Hydro (MW)	18,65	--	18,65
Total (MW)	36,89	5,83	42,72
Share of thermal	49,4%	100%	56,3%
Electricity production:			
Thermal (GWh)	25,39	1,48	26,87
Hydro (GWh)	73,08	--	73,08
Total (GWh)	98,47	1,48	99,95
Share of thermal	25,8%	100%	26,9%
Aux. consum. (GWh)	1,47	--	--
Distr. losses (GWh)	4,45	--	--
Unbilled cons. (GWh)	28,22	--	--
ENERCA's sales (GWh)	64,33	0,77	65
Transportation & distribution lines (km):			
HV (63 and 110 KV)	172	--	172
MV	133,01	26,69	159,70
LV	211,92	78,7	290,62

In 1990 thermal plants accounted for more than half of the total installed capacity (56,3%) and 26,9% of electricity production. About 6545 tons of diesel, costing 1774 million CFA Francs (about 5,9 million US$), were required to fuel them. The country has problems importing these costly oil products (see 5.3) and this is the reason that the present electricity policy puts a special emphasis on reducing the share of thermally generated power in the total production to help reduce oil consumption[6]. In this regard there are plans to build four small hydroelectric power stations and to expand one of the Boali stations, raising its generating capacity by 10 MW[1].

Work started in 1987 on the Mobayi Mbongo power plant and it was completed in 1989. The 3 x 3,5 MW plant on the Ubangui River is a joint project with Zaire. It supplies power to the remote towns of Mobayi Mbanga in the Central African Republic and Gbadolite in Zaire.

In 1987 ENERCA's electricity sales were shared among residential (35%), commercial (15%), and industrial (50%)[7]. Of the total amount of 64,33 GWh sold in Bangui in 1990, 29 GWh were used by low voltage consumers and the remainder by medium voltage consumers. There were about 9000 low voltage consumers in Bangui in 1985. Low voltage users consume all the electricity sold in provincial centres[6].

6. PRICING

Electricity tariffs in effect were approved by a decree of the Minister of Energy, Mines, Geology and Water Resources on 6 February 1989.

The pricing structure for low voltage consumers has a minimum monthly payment of 65,68 CFAF (21,89 USc) and increasing incremental rates for energy charge. The energy charge per kWh is 70,93 CFAF (23,64 USc) for the first 65 units and 76,61 CFAF (25,54 USc) for the next 129 units.

For medium voltage consumers, the electricity price has two components: a monthly demand charge of 2390,37 CFAF (7,97 US$) per kW subscribed, and an energy charge. The energy charge is divided into three subcomponents: an active power daily charge of 36,78 CFAF/kWh (12,26 USc), an active power nightly charge of 26,42 CFAF/kWh (8,81 USc), and a reactive charge of 36,68 CFAF (12,23 USc). There is also a penalty charge of 22,74 CFAF/kW (7,58 USc) for those going over the subscribed demand.

In 1990 the sales price per kWh in Bangui was 45,12 CFAF (15,04 USc) for MV users and 61,16 CFAF (20,39 USc) for LV consumers. It was 122,88 CFAF (40,96 USc) for LV users in provincial centres. The average sales price in the system was 53,18 CFAF/kWh (17,73 USc) in 1990.

7. DISCUSSION

The Central African Republic has important mineral resources and economic development programmes can be fuelled by the country's significant energy resources (extensive forests and large hydroelectric potential) which are underexploited.

Increasing power generation in order to meet growing demand is a priority in the electricity sector. This is reflected in increasing incremental rates in the electricity pricing structure. However, this pricing structure is too complex and needs to be simplified. Hydropower schemes are being given consideration as they can help to reduce the consumption of costly oil products in thermal generation.

Buying petroleum products from the Congo, Cameroon and Gabon should be considered if it is economically profitable.

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TABLES

TABLE A. ECONOMIC INDICATORS

COUNTRY: CENTRAL AFRICAN REPUBLIC
CURRENCY: CFA FRANCS

MILLIONS OF NATIONAL CURRENCY UNLESS INDICATED

YEAR	POPUL MILLIONS	POPUL GROWTH RATE (%)	GROSS DOMESTIC PRODUCT AT MARKET COST: AGRICULTURE	INDUSTRY: TOTAL INDUSTRY	INDUSTRY: MINING QUARRY	INDUSTRY: MANUFACTURE	INDUSTRY: ELEC,WT & GAS	INDUSTRY: CONSTRUCTION	OTHER SERVICE + TAXES	TOTAL	GDP DEFLATOR	GDP AT 1985 PRICES MARKET	GDP/CAPITA CURRENT	GDP/CAPITA REAL 1985	EXCHANG RATE MS PER US$	GDP IN US$(MILL) CURREN PRICES MARKET	GDP IN US$(MILL) AT 1985 PRICES MARKET	GDP PER CAPITA US$/CAP	GDP PER CAPITA US$(1985)/CAPITA
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	1.79	NA	14900	9100	NA	2100	NA	NA	16300	40300	18.1	223269	22501	124681	246.9	163	497	91	277
1968	1.82	1.7	16100	11300	NA	2300	NA	NA	16900	44300	19.4	228233	24314	125265	246.9	179	508	98	279
1969	1.85	1.6	16500	12100	NA	2300	NA	NA	18300	46900	19.7	237478	25338	128297	259.7	181	529	98	286
1970	1.88	1.5	16600	12200	NA	3200	NA	NA	20900	49700	20.3	245170	26450	130479	277.7	179	546	95	290
1971	1.90	1.2	18400	13300	NA	3300	NA	NA	21000	52700	21.3	247225	27708	129982	277.1	190	550	100	289
1972	1.93	1.4	19900	14100	NA	3800	NA	NA	21600	55600	21.9	253377	28838	131420	252.2	220	564	114	293
1973	1.96	1.6	20600	14100	NA	4100	NA	NA	22400	57100	22.0	258980	29162	132267	222.7	256	576	131	294
1974	1.99	1.8	26500	15100	NA	5200	NA	NA	30400	72000	26.2	274518	36126	137741	240.5	299	611	150	307
1975	2.03	2.1	28500	17300	NA	5700	NA	NA	34800	80600	29.4	274499	39626	134955	214.3	376	611	185	300
1976	2.08	2.3	40600	20500	NA	6200	NA	NA	45900	107000	37.2	287638	51416	138221	239.0	448	640	215	308
1977	2.14	2.6	46800	22900	NA	7600	NA	NA	53800	123500	41.4	298458	57818	139728	245.7	503	664	235	311
1978	2.20	2.8	51300	28800	NA	10800	NA	NA	56200	136300	44.6	305478	62067	139107	255.6	533	680	243	310
1979	2.26	2.8	55800	32200	NA	11800	NA	NA	62900	150900	50.7	297755	66829	131867	212.7	709	663	314	294
1980	2.32	2.7	63400	31800	NA	11400	NA	NA	73200	168400	59.4	283730	72586	122298	211.3	797	632	344	272
1981	2.38	2.7	70500	33600	NA	13200	NA	NA	84700	188800	68.0	277545	79228	116469	271.7	695	618	292	259
1982	2.45	2.7	96600	30350	NA	17900	NA	NA	118950	245900	82.4	298259	100490	121888	328.6	748	664	306	271
1983	2.51	2.7	95800	34830	NA	20600	NA	NA	120370	251000	90.2	278340	99920	110804	381.1	659	620	262	247
1984	2.56	2.6	109270	39000	NA	21700	NA	NA	130430	278700	91.5	304470	108107	118103	437.0	638	678	247	263
1985	2.65	2.6	117300	40300	NA	21520	NA	NA	158600	316200	100.0	316200	119501	119501	449.3	704	704	266	266
1986	2.72	2.7	132100	38900	NA	20510	NA	NA	171900	342900	107.4	319217	126205	117489	346.3	990	711	364	262
1987	2.79	2.7	127000	42100	NA	23800	NA	NA	153400	322500	104.5	308633	115550	110581	300.5	1073	687	384	246
1988	2.87	2.8	134000	43800	NA	26000	NA	NA	155300	333100	106.2	313757	116103	109361	297.9	1116	698	390	243
1989	2.95	2.9	141000	51100	NA	33000	NA	NA	160400	352500	109.9	320668	119451	108664	319.0	1105	714	374	242
1990	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 B. ENERGY BREAKDOWN

YEAR	TOTAL FINAL CONSUMPTION (000s TOE) COMMERCIAL FORMS OF ENERGY CO	OIL	HYD	GA	ELECT	TOTAL	TRAD ENERG	TOTAL ENERGY	ENERGY FORMS AS % OF TFC COM. ENERG	TRAD. ENERGY	ENERGY FORMS PER CAPITA (TOE/CAP) OIL	ELECT	COM. ENERG	TRAD. ENERGY	TOTAL ENERG	RATIO COM.ENERGY/ TRAD.ENERGY	ENERGY INTENSITY (TOE/GDP real 1985) TRAD. ENERGY	COM. ENERG	TOTAL ENERGY
1970	0	68.2	0	0	3.7	71.9	490.4	562.3	12.8	87.2	0.036	0.002	0.038	0.261	0.299	0.147	2.0E-06	2.9E-07	2.3E-06
1971	0	62.0	0	0	3.7	65.8	496.4	562.1	11.7	88.3	0.033	0.002	0.035	0.261	0.296	0.132	2.0E-06	2.7E-07	2.3E-06
1972	0	55.9	0	0	3.7	59.6	503.2	562.8	10.6	89.4	0.029	0.002	0.031	0.261	0.292	0.118	2.0E-06	2.4E-07	2.2E-06
1973	0	56.2	0	0	4.1	60.3	511.0	571.3	10.5	89.5	0.029	0.002	0.031	0.261	0.292	0.118	2.0E-06	2.3E-07	2.2E-06
1974	0	62.6	0	0	4.2	66.8	520.2	586.9	11.4	88.6	0.031	0.002	0.033	0.261	0.294	0.128	1.9E-06	2.4E-07	2.1E-06
1975	0	35.6	0	0	4.0	39.7	530.9	570.5	7.0	93.0	0.018	0.002	0.020	0.261	0.281	0.075	1.9E-06	1.4E-07	2.1E-06
1976	0	40.9	0	0	3.9	44.8	543.1	587.9	7.6	92.4	0.020	0.002	0.022	0.261	0.283	0.082	1.9E-06	1.6E-07	2.0E-06
1977	0	46.0	0	0	4.3	50.3	557.5	607.8	8.3	91.7	0.022	0.002	0.024	0.261	0.285	0.090	1.9E-06	1.7E-07	2.0E-06
1978	0	52.4	0	0	4.7	57.1	573.2	630.2	9.1	90.9	0.024	0.002	0.026	0.261	0.287	0.100	1.9E-06	1.9E-07	2.1E-06
1979	0	56.5	0	0	4.8	61.3	589.3	650.6	9.4	90.6	0.025	0.002	0.027	0.261	0.288	0.104	2.0E-06	2.1E-07	2.2E-06
1980	0	57.5	0	0	4.9	62.4	605.5	668.0	9.3	90.7	0.025	0.002	0.027	0.261	0.288	0.103	2.1E-06	2.2E-07	2.4E-06
1981	0	55.4	0	0	4.9	60.3	622.0	682.3	8.8	91.2	0.023	0.002	0.025	0.261	0.288	0.097	2.2E-06	2.2E-07	2.5E-06
1982	0	59.5	0	0	5.1	64.7	638.7	703.3	9.2	90.8	0.024	0.002	0.026	0.261	0.287	0.101	2.1E-06	2.2E-07	2.4E-06
1983	0	63.3	0	0	5.2	68.5	655.6	724.2	9.5	90.5	0.025	0.002	0.027	0.261	0.288	0.105	2.4E-06	2.5E-07	2.6E-06
1984	0	61.2	0	0	5.4	66.6	672.9	739.5	9.0	91.0	0.024	0.002	0.026	0.261	0.287	0.099	2.2E-06	2.2E-07	2.4E-06
1985	0	54.6	0	0	5.7	60.3	690.6	750.9	8.0	92.0	0.021	0.002	0.023	0.261	0.284	0.087	2.2E-06	1.9E-07	2.4E-06
1986	0	50.8	0	0	6.6	57.4	709.1	766.5	7.5	92.5	0.019	0.002	0.021	0.261	0.282	0.081	2.2E-06	1.8E-07	2.4E-06
1987	0	83.9	0	0	6.7	90.6	728.5	819.1	11.1	88.9	0.030	0.002	0.032	0.261	0.293	0.124	2.4E-06	2.9E-07	2.7E-06
1988	0	60.8	0	0	6.3	67.1	748.8	816.0	8.2	91.8	0.021	0.002	0.023	0.261	0.284	0.090	2.4E-06	2.1E-07	2.6E-06
1989	0	NA	0	0	6.8	NA	770.2	NA	NA	NA	NA	0.002	NA	0.261	NA	NA	2.4E-06	NA	NA
1990	0	NA	0	0	7.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

THESE DATA ARE ESTIMATED WITH FOLLOWING ASSUMPTIONS:
15% OF APPARENT CONSUMPTION OF ELECTRICITY IS LOST
(STATION'S USES, TRANSMISSIONS AND DISTRIBUTION LOSSES)
THERMAL GENERATION EFFICIENCY IS 30%
PER CAPITA TRADITIONAL FUELS USE IS 0.9 CUBIC METRES FUELWOOD EQUIVALENT
1 CUBIC METRES OF FUELWOOD = 0.29 TOE

TABLE C. ENERGY DATA FOR GRAPHS

YEAR	COMMERCIAL ENERGY COMPONENTS AS % OF COM. ENERGY FINAL CONS.			COMMERCIAL ENERGY COMPONENTS AS % OF TOTAL FINAL CONSUMPTION			COM. ENERGY FINAL CONSUMPTION GROWTH RATE			TOTAL FINAL CONSUMPTION GROWTH RATE		
	COAL	OIL	ELECT	COAL	OIL	ELECT	1 PT	3 PTS MA	5 PTS MA	1 PT	3 PTS MA	5 PTS MA
1970	0	94.9	5.1	0	12.1	0.7	NA	NA	NA	NA	NA	NA
1971	0	94.4	5.6	0	11.0	0.7	-8.7	NA	NA	-0.0	NA	NA
1972	0	93.7	6.3	0	9.9	0.7	-9.2	-5.6	NA	0.1	0.5	NA
1973	0	93.2	6.8	0	9.8	0.7	1.1	0.9	-9.3	1.5	1.5	0.3
1974	0	93.7	6.3	0	10.7	0.7	10.8	-9.6	-5.0	2.7	0.5	0.9
1975	0	89.8	10.2	0	6.2	0.7	-40.6	-5.6	-0.7	-2.8	1.0	1.6
1976	0	91.3	8.7	0	7.0	0.7	12.9	-5.1	1.8	3.0	1.2	2.0
1977	0	91.5	8.5	0	7.6	0.7	12.3	12.9	1.1	3.4	3.4	2.1
1978	0	91.8	8.2	0	8.3	0.7	13.5	11.1	9.6	3.7	3.4	3.2
1979	0	92.2	7.8	0	8.7	0.7	7.4	7.6	6.3	3.2	3.2	3.0
1980	0	92.1	7.9	0	8.6	0.7	1.9	2.0	5.3	2.7	2.7	3.0
1981	0	91.9	8.1	0	8.1	0.7	-3.4	1.9	3.8	2.1	2.6	2.8
1982	0	92.1	7.9	0	8.5	0.7	7.2	3.3	1.8	3.1	2.7	2.6
1983	0	92.4	7.6	0	8.7	0.7	6.0	3.5	-0.5	3.0	2.7	2.4
1984	0	91.9	8.1	0	8.3	0.7	-2.8	-2.1	-0.8	2.1	2.2	2.4
1985	0	90.5	9.5	0	7.3	0.8	-9.5	-5.7	9.4	1.5	1.9	3.1
1986	0	88.6	11.4	0	6.6	0.9	-4.8	14.5	3.0	2.1	3.5	2.4
1987	0	92.6	7.4	0	10.2	0.8	57.9	9.1	NA	6.9	2.9	NA
1988	0	90.6	9.4	0	7.5	0.8	-25.9	NA	NA	-0.4	NA	NA
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

TABLE D. ELECTRICITY DATA INSTALLED CAPACITY (MEGAWATTS)

YEAR	PUBLIC HYDRO	THERMA	TOTAL	SELFPRODUCERS HYDR	THERM	TOTAL	TOTAL HYDRO	TOTAL THERMAL	TOTAL INSTALLED
1959	3.50	1.02	4.52	0	0	0	3.50	1.02	4.52
1960	3.50	1.02	4.52	0	0	0	3.50	1.02	4.52
1961	3.50	1.02	4.52	0	0	0	3.50	1.02	4.52
1962	5.25	1.02	6.27	0	0	0	5.25	1.02	6.27
1963	7.00	1.02	8.02	0	0	0	7.00	1.02	8.02
1964	7.00	1.02	8.02	0	0	0	7.00	1.02	8.02
1965	7.00	1.02	8.02	0	0	0	7.00	1.02	8.02
1966	7.00	1.02	8.02	0	0	0	7.00	1.02	8.02
1967	7.00	1.02	8.02	0	0	0	7.00	1.02	8.02
1968	7.00	1.74	8.74	0	0	0	7.00	1.74	8.74
1969	7.00	4.42	11.42	0	0	0	7.00	4.42	11.42
1970	7.00	4.98	11.98	0	0	0	7.00	4.98	11.98
1971	8.75	5.45	14.20	0	0	0	8.75	5.45	14.20
1972	8.75	5.45	14.20	0	0	0	8.75	5.45	14.20
1973	8.75	5.45	14.20	0	0	0	8.75	5.45	14.20
1974	8.75	5.62	14.37	0	0	0	8.75	5.62	14.37
1975	8.75	7.36	16.11	0	0	0	8.75	7.36	16.11
1976	18.65	11.56	30.21	0	0	0	18.65	11.56	30.21
1977	18.65	11.56	30.21	0	0	0	18.65	11.56	30.21
1978	18.65	11.18	29.83	0	0	0	18.65	11.18	29.83
1979	18.65	11.18	29.83	0	0	0	18.65	11.18	29.83
1980	18.65	12.64	31.29	0	0	0	18.65	12.64	31.29
1981	18.65	11.57	30.22	0	0	0	18.65	11.57	30.22
1982	18.65	11.70	30.35	0	0	0	18.65	11.70	30.35
1983	18.65	16.78	35.43	0	0	0	18.65	16.78	35.43
1984	18.65	17.09	35.74	0	0	0	18.65	17.09	35.74
1985	18.65	17.20	35.85	0	0	0	18.65	17.20	35.85
1986	18.65	17.39	36.04	0	0	0	18.65	17.39	36.04
1987	18.65	17.31	35.96	0	0	0	18.65	17.31	35.96
1988	18.65	15.98	34.63	0	0	0	18.65	15.98	34.63
1989	18.65	16.04	34.69	0	0	0	18.65	16.04	34.69
1990	18.65	24.07	42.72	0	0	0	18.65	24.07	42.72

DATA OBTAINED FROM: ENERGIE CENTRAFRICAINE (ENERCA)

TABLE E. OIL PRODUCT CONSUMPTION (000's METRIC TONS)

YEAR	LPG	RESIDUAL	PETROL	AVGAS	KEROSE	DIESEL	OTHER	TOTAL	DIES/PET	%PETROL	%DIESEL	%	3 PTS M.A.	(TOE/GDP Real 1985)
1970	0	3	21	0	15	24	3	66	1.14	31.8	36.4	NA	NA	2.78E-07
1971	0	3	21	0	13	20	3	60	0.95	35.0	33.3	-9.1	NA	2.51E-07
1972	0	3	27	0	5	17	2	54	0.63	50.0	31.5	-9.9	-6.2	2.2E-07
1973	0	4	24	1	3	21	2	55	0.88	43.6	38.2	0.5	0.7	2.17E-07
1974	0	4	24	0	2	30	1	61	1.25	39.3	49.2	11.4	-10.4	2.28E-07
1975	0	4	13	0	0	14	4	35	1.08	37.1	40.0	-43.0	-5.6	1.3E-07
1976	0	4	15	0	1	16	4	40	1.07	37.5	40.0	14.7	-5.2	1.42E-07
1977	0	5	17	0	2	18	3	45	1.06	37.8	40.0	12.6	13.7	1.54E-07
1978	0	5	19	0	2	20	5	51	1.05	37.3	39.2	13.8	11.4	1.71E-07
1979	0	6	20	0	2	21	6	55	1.05	36.4	38.2	7.9	7.8	1.9E-07
1980	0	6	22	0	3	22	3	56	1.00	39.3	39.3	1.8	2.0	2.03E-07
1981	0	6	21	0	3	21	3	54	1.00	38.9	38.9	-3.7	1.9	2E-07
1982	0	7	22	0	3	23	3	58	1.05	37.9	39.7	7.4	3.4	2E-07
1983	0	8	23	0	3	26	2	62	1.13	37.1	41.9	6.4	3.5	2.27E-07
1984	0	8	22	0	3	25	2	60	1.14	36.7	41.7	-3.3	-2.6	2.01E-07
1985	0	2	15	0	6	29	5	57	1.93	26.3	50.9	-10.8	-7.0	1.73E-07
1986	0	3	15	1	3	25	5	52	1.67	28.8	48.1	-6.9	15.8	1.59E-07
1987	0	2	19	0	18	32	14	85	1.68	22.4	37.6	65.0	10.2	2.72E-07
1988	0	2	14	0	19	19	9	63	1.36	22.2	30.2	-27.5	NA	1.94E-07
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: WORLD ENERGY SUPPLIES (1950-1974)
YEARBOOK OF WORLD ENERGY STATISTICS (1981)
ENERGY STATISTICS YEARBOOKS (1983, 1985, 1988)
ESTIMATIONS

TABLE F. GDP DATA FOR GRAPHS

YEAR	GDP GROWTH RATE (REAL 1985 PRICES) %/YEAR	3PT MA	5PT MA	GDP RATIO: AGRICULTURE/INDUSTRY 1 PT	3 PTS M.A.	PERCENTAGE CONTRIBUTION TO THE GROSS DOMESTIC PRODUCT AGRI	IND	MINE QUARRY	MAN	ELEC,WTR GAS	CONS	OTHER	GDP RATIO: AGRI/MANU.	PERCENTAGE CHANGE OF GDP DEFLATOR 1 PT	3PT MA	ANNUAL CHANGE OF GDP PER CAPITA CURRENT 1 PT	3PTS 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	1.6	NA	37.0	22.6	NA	5.2	NA	NA	40.4	7.1	NA	NA	NA	NA	NA	NA
1968	2.2	NA	NA	1.4	1.5	36.3	25.5	NA	5.2	NA	NA	38.1	7.0	7.5	NA	8.1	NA	0.5	NA
1969	4.1	3.2	NA	1.4	1.4	35.2	25.8	NA	4.9	NA	NA	39.0	7.2	1.7	4.0	4.2	5.6	2.4	1.5
1970	3.2	2.7	2.6	1.4	1.4	33.4	24.5	NA	6.4	NA	NA	42.1	5.2	2.6	3.2	4.4	4.5	1.7	1.2
1971	0.8	2.2	2.8	1.4	1.4	34.9	25.2	NA	6.3	NA	NA	39.8	5.6	5.2	3.6	4.8	4.4	-0.4	0.8
1972	2.5	1.8	3.0	1.4	1.4	35.8	25.4	NA	6.8	NA	NA	38.8	5.2	2.9	2.9	4.1	3.3	1.1	0.5
1973	2.2	3.6	2.3	1.5	1.5	36.1	24.7	NA	7.2	NA	NA	39.2	5.0	0.5	7.5	1.1	9.7	0.6	2.0
1974	6.0	2.7	3.1	1.8	1.6	36.8	21.0	NA	7.2	NA	NA	42.2	5.1	19.0	10.5	23.9	11.6	4.1	0.9
1975	-0.0	3.6	3.4	1.6	1.8	35.4	21.5	NA	7.1	NA	NA	43.2	5.0	12.0	19.2	9.7	21.1	-2.0	1.5
1976	4.8	2.8	3.4	2.0	1.9	37.9	19.2	NA	5.8	NA	NA	42.9	6.5	26.7	16.6	29.8	17.3	2.4	0.5
1977	3.8	3.6	1.7	2.0	1.9	37.9	18.5	NA	6.2	NA	NA	43.6	6.2	11.2	15.3	12.4	16.5	1.1	1.0
1978	2.4	1.2	0.7	1.8	1.9	37.8	21.1	NA	7.9	NA	NA	41.2	4.8	7.8	10.9	7.3	9.2	-0.4	-1.5
1979	-2.5	-1.6	-0.7	1.7	1.8	37.0	21.3	NA	7.8	NA	NA	41.7	4.7	13.6	12.8	7.7	7.9	-5.2	-4.3
1980	-4.7	-3.1	0.1	2.0	1.9	37.6	18.9	NA	6.8	NA	NA	43.5	5.6	17.1	15.1	6.6	8.5	-7.3	-5.7
1981	-2.2	0.2	-1.7	2.1	2.4	37.3	17.8	NA	7.0	NA	NA	44.9	5.3	14.6	17.6	9.2	14.9	-4.8	-2.5
1982	7.5	-0.5	0.7	3.2	2.7	39.3	12.3	NA	7.3	NA	NA	48.4	5.4	21.2	15.1	26.8	11.8	4.7	-3.1
1983	-6.7	3.4	2.4	2.8	2.9	38.2	13.9	NA	8.2	NA	NA	48.0	4.7	9.4	10.7	-0.6	11.5	-9.1	0.7
1984	9.4	2.2	3.0	2.8	2.8	39.2	14.0	NA	7.8	NA	NA	46.8	5.0	1.5	6.7	8.2	6.1	6.6	-0.4
1985	3.9	4.7	0.8	2.9	3.0	37.1	12.7	NA	6.8	NA	NA	50.2	5.5	9.2	6.1	10.5	8.1	1.2	2.0
1986	1.0	0.5	2.5	3.4	3.1	38.5	11.3	NA	6.0	NA	NA	50.1	6.4	7.4	4.6	5.6	2.6	-1.7	-2.1
1987	-3.3	-0.2	1.1	3.0	3.2	39.4	13.1	NA	7.4	NA	NA	47.8	5.3	-2.7	2.1	-8.4	-0.8	-5.9	-2.9
1988	1.7	0.2	NA	3.1	2.9	40.2	13.1	NA	7.8	NA	NA	48.6	5.2	1.8	0.8	0.5	-1.7	-1.1	-2.5
1989	2.2	NA	NA	2.8	NA	40.0	14.5	NA	9.4	NA	NA	45.5	4.3	3.5	1.7	2.9	NA	-0.6	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE G. ELECTRICITY PRODUCTION (GWh)

YEAR	PUBLIC HYDRO	THERMAL	TOTAL	SELF PRODUCERS HYDRO	THERMAL	TOTAL	TOTAL HYDRO	TOTAL THERMAL	TOTAL	ELEC TFC GROWTH RATE 1 PT	3 PT MA	5 PT MA	ELEC INTENSITY TOE/GDP	RATIO: ELEC GWTH/ GDP GROWTH 1 PT	3 PT MA	ELEC/CAP (KWh/CAP)
1959	8	0	8	0	0	0	8	0	8	NA	NA	NA	NA	NA	NA	NA
1960	8	0	8	0	0	0	8	0	8	NA	NA	NA	NA	NA	NA	NA
1961	9	0	9	0	0	0	9	0	9	NA	NA	NA	NA	NA	NA	NA
1962	12	0	12	0	0	0	12	0	12	NA	NA	NA	NA	NA	NA	NA
1963	17	0	17	0	0	0	17	0	17	NA	NA	NA	NA	NA	NA	NA
1964	20	0	20	0	0	0	20	0	20	NA	NA	NA	NA	NA	NA	NA
1965	21	0	21	0	0	0	21	0	21	NA	NA	NA	NA	NA	NA	NA
1966	25	0	25	0	0	0	25	0	25	NA	NA	NA	NA	NA	NA	NA
1967	28	0	28	0	0	0	28	0	28	NA	NA	NA	NA	NA	NA	NA
1968	35	0	35	0	0	0	35	0	35	NA	NA	NA	NA	NA	NA	NA
1969	41	1	42	0	0	0	41	1	42	NA	NA	NA	NA	NA	NA	NA
1970	47	3	50	0	0	0	47	3	50	NA	NA	NA	1.49E-08	NA	NA	22.6
1971	47	3	50	0	0	0	47	3	50	0.0	NA	NA	1.48E-08	0.0	NA	22.3
1972	48	3	51	0	0	0	48	3	51	2.0	3.9	NA	1.47E-08	0.8	1.7	22.5
1973	51	5	56	0	0	0	51	5	56	9.8	4.5	2.0	1.58E-08	4.4	1.8	24.3
1974	53	4	57	0	0	0	53	4	57	1.8	2.7	1.3	1.52E-08	0.3	170.6	24.3
1975	52	3	55	0	0	0	52	3	55	-3.5	-1.8	2.8	1.47E-08	507.1	168.9	23.0
1976	50	3	53	0	0	0	50	3	53	-3.6	0.8	2.9	1.35E-08	-0.8	169.6	21.6
1977	55	3	58	0	0	0	55	3	58	9.4	5.4	2.8	1.42E-08	2.5	2.0	23.1
1978	61	3	64	0	0	0	61	3	64	10.3	7.1	4.2	1.54E-08	4.4	2.1	24.8
1979	62	3	65	0	0	0	62	3	65	1.6	5.0	4.9	1.6E-08	-0.6	1.0	24.5
1980	64	3	67	0	0	0	64	3	67	3.1	1.5	3.9	1.73E-08	-0.7	-0.4	24.5
1981	64	3	67	0	0	0	64	3	67	0.0	2.5	2.1	1.77E-08	0.0	-0.0	23.9
1982	67	3	70	0	0	0	67	3	70	4.5	2.0	2.7	1.72E-08	0.6	0.1	24.3
1983	67	4	71	0	0	0	67	4	71	1.4	3.4	3.2	1.87E-08	-0.2	0.3	24.0
1984	70	4	74	0	0	0	70	4	74	4.3	3.8	6.1	1.78E-08	0.5	0.6	24.4
1985	61	17	78	0	0	0	61	17	78	5.8	6.1	5.7	1.82E-08	1.5	5.7	25.2
1986	77	12	90	0	0	0	77	12	90	14.3	7.6	4.2	2.06E-08	15.0	5.2	28.0
1987	74	18	92	0	0	0	74	18	92	2.8	3.7	4.9	2.19E-08	-0.8	3.5	28.0
1988	68	18	87	0	0	0	68	18	87	-6.0	1.5	5.2	2.02E-08	-3.6	-0.3	25.6
1989	80	13	93	0	0	0	80	13	93	7.8	3.0	2.4	2.13E-08	3.5	NA	26.9
1990	73	27	100	0	0	0	73	27	100	7.1	5.0	1.8	NA	NA	NA	NA

DATA OBTAINED FROM: WORLD ENERGY SUPPLIES (1950-1974)
WORLD ENERGY SUPPLIES (1973-1978)
YEARBOOK OF WORLD ENERGY STATISTICS (1981)
ENERGY STATISTICS YEARBOOKS (1983, 1985)
ENERGIE CENTRAFRICAINE (ENERCA)

FIGURES

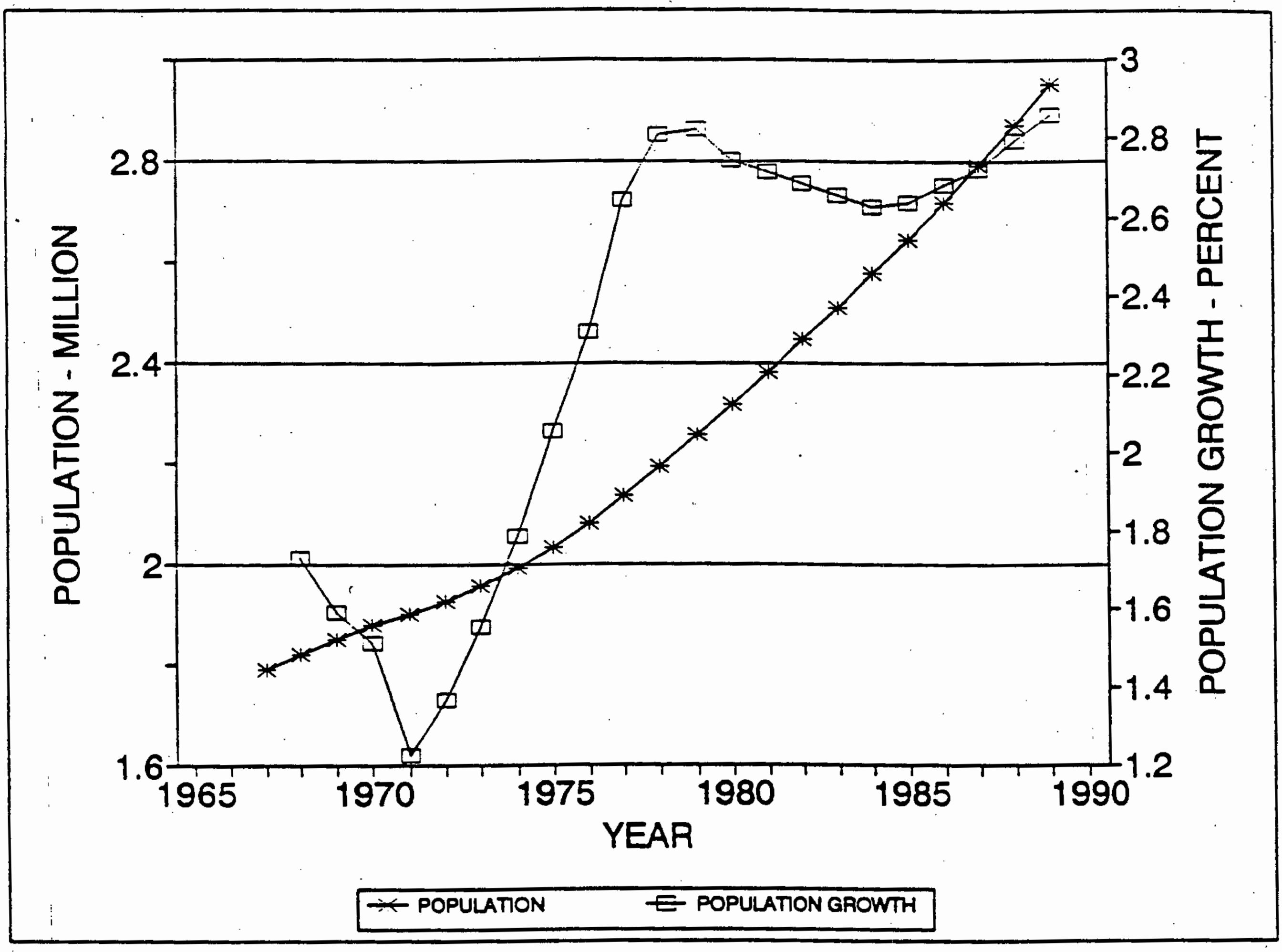


Figure 1. Population and population growth

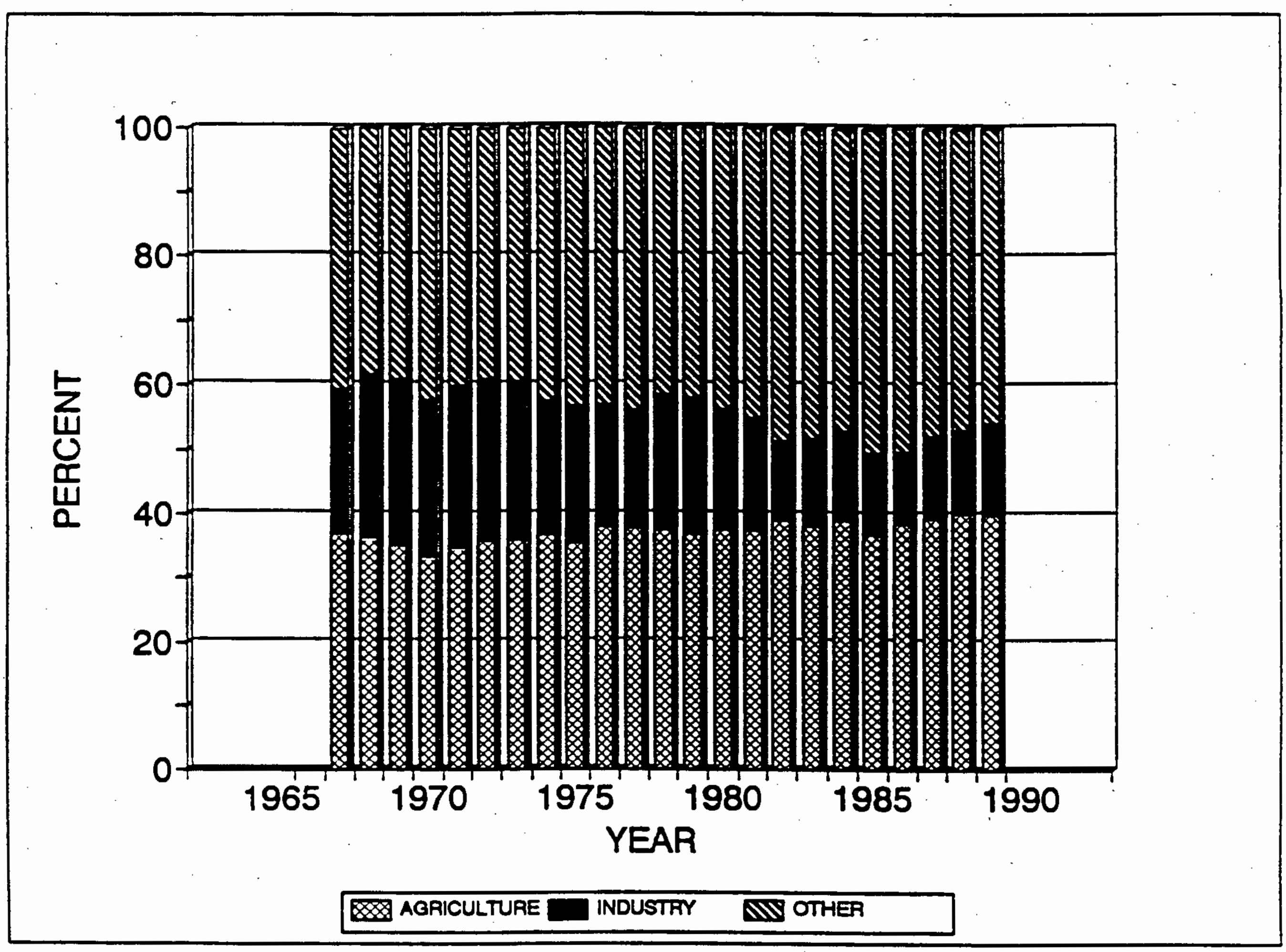


Figure 2. GDP components as percentage of total

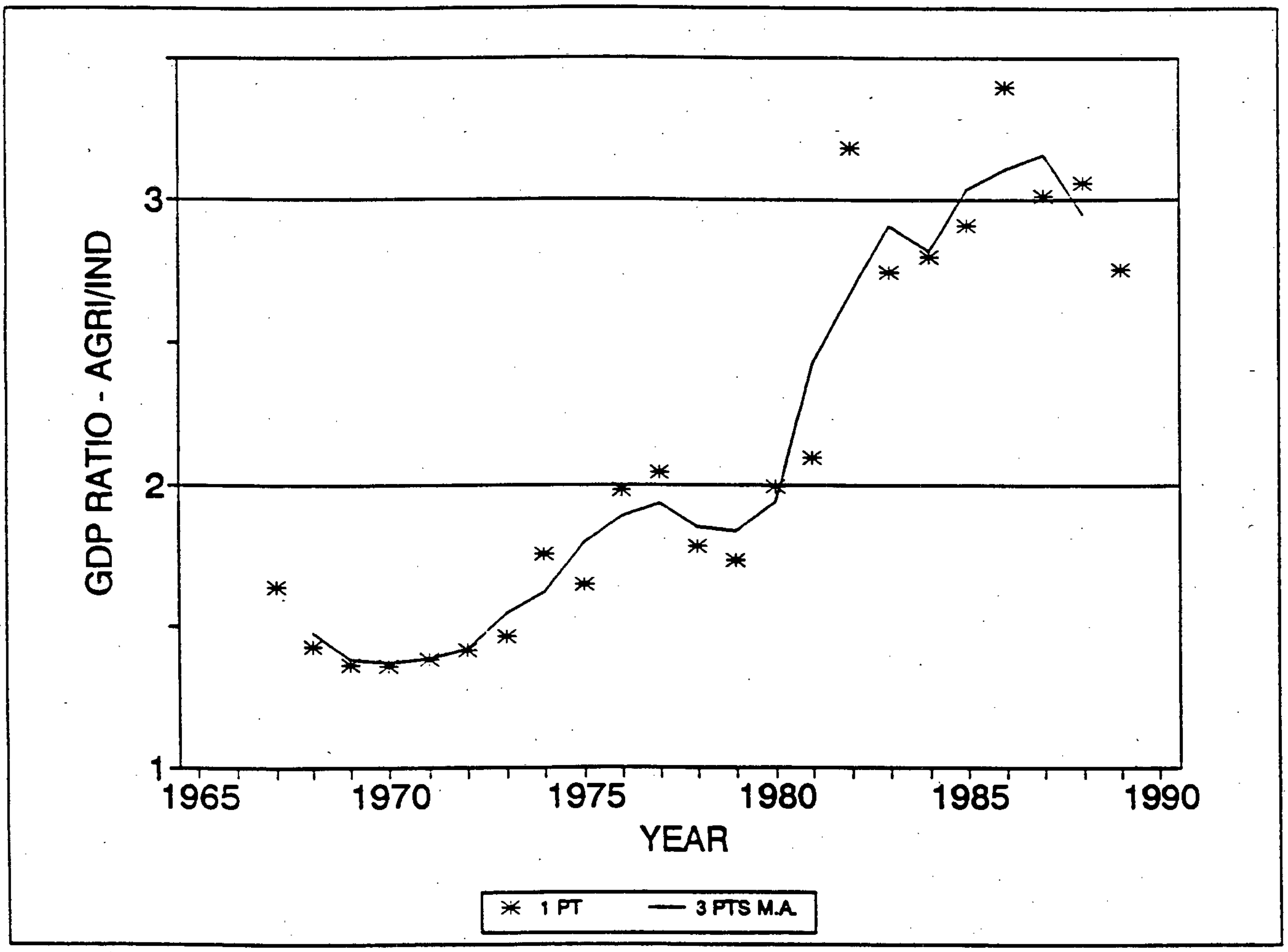


Figure 3. GDP ratio: Agriculture / Industry

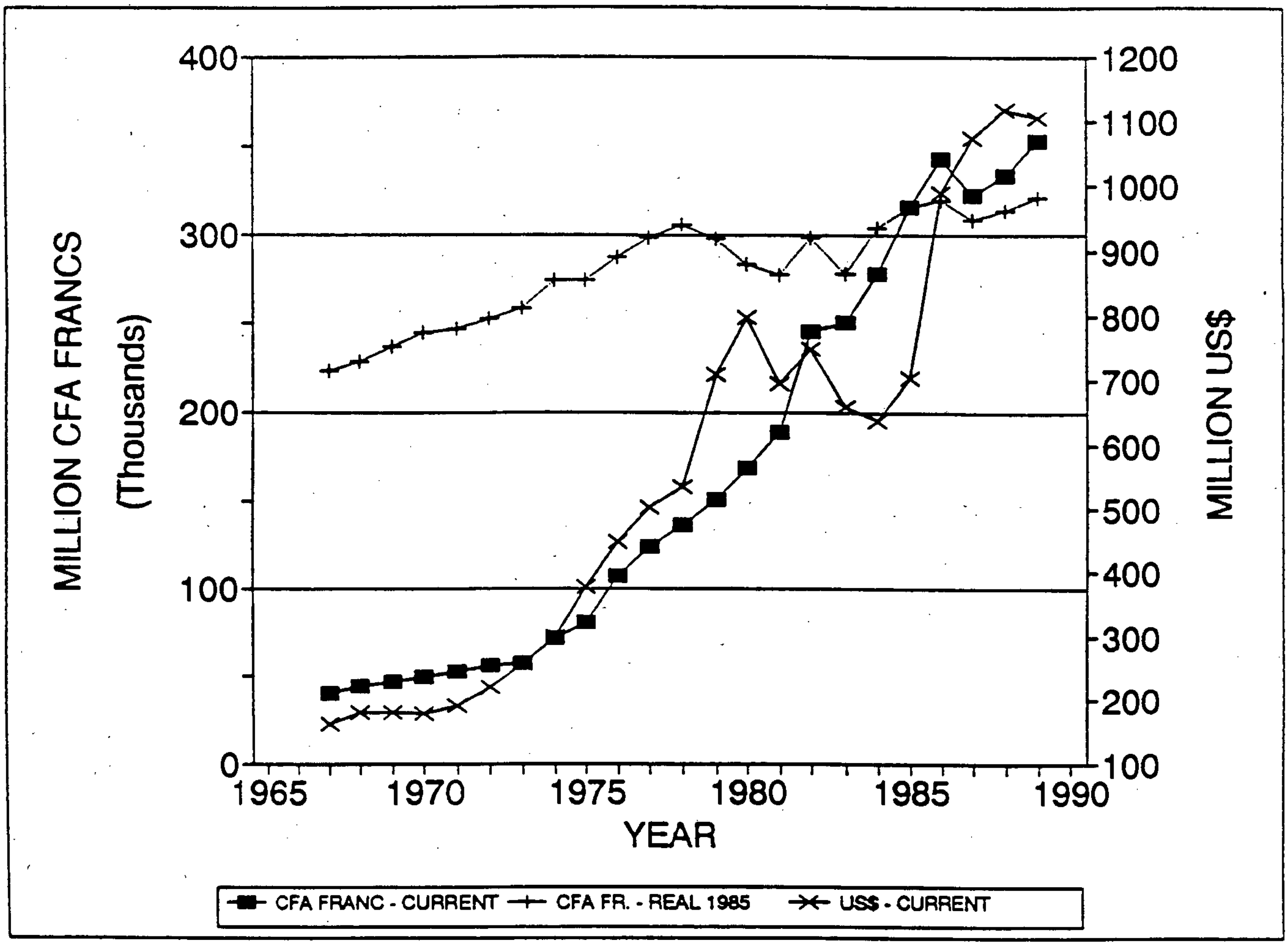


Figure 4. Gross domestic product (at market prices)

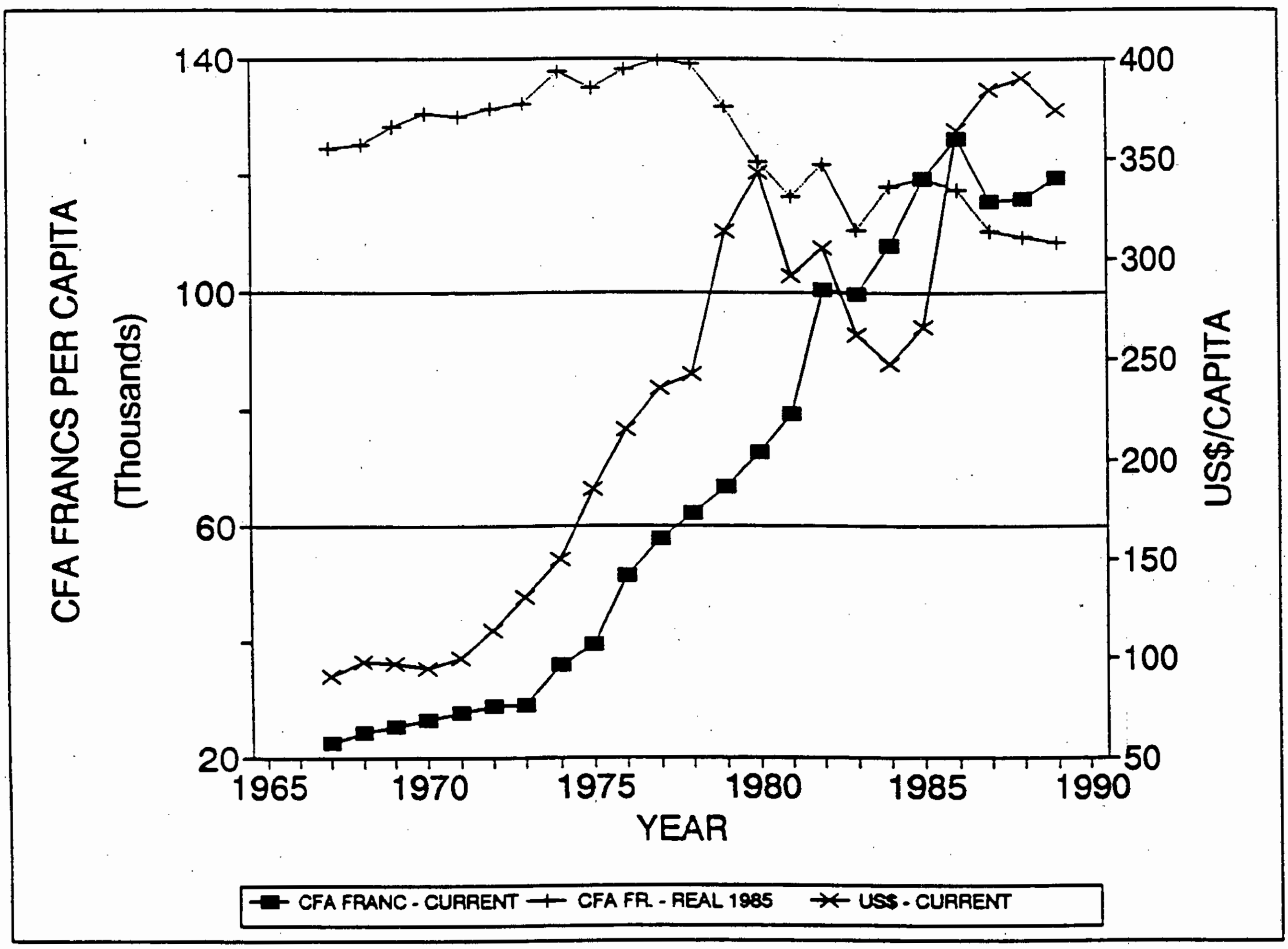


Figure 5. GDP per capita

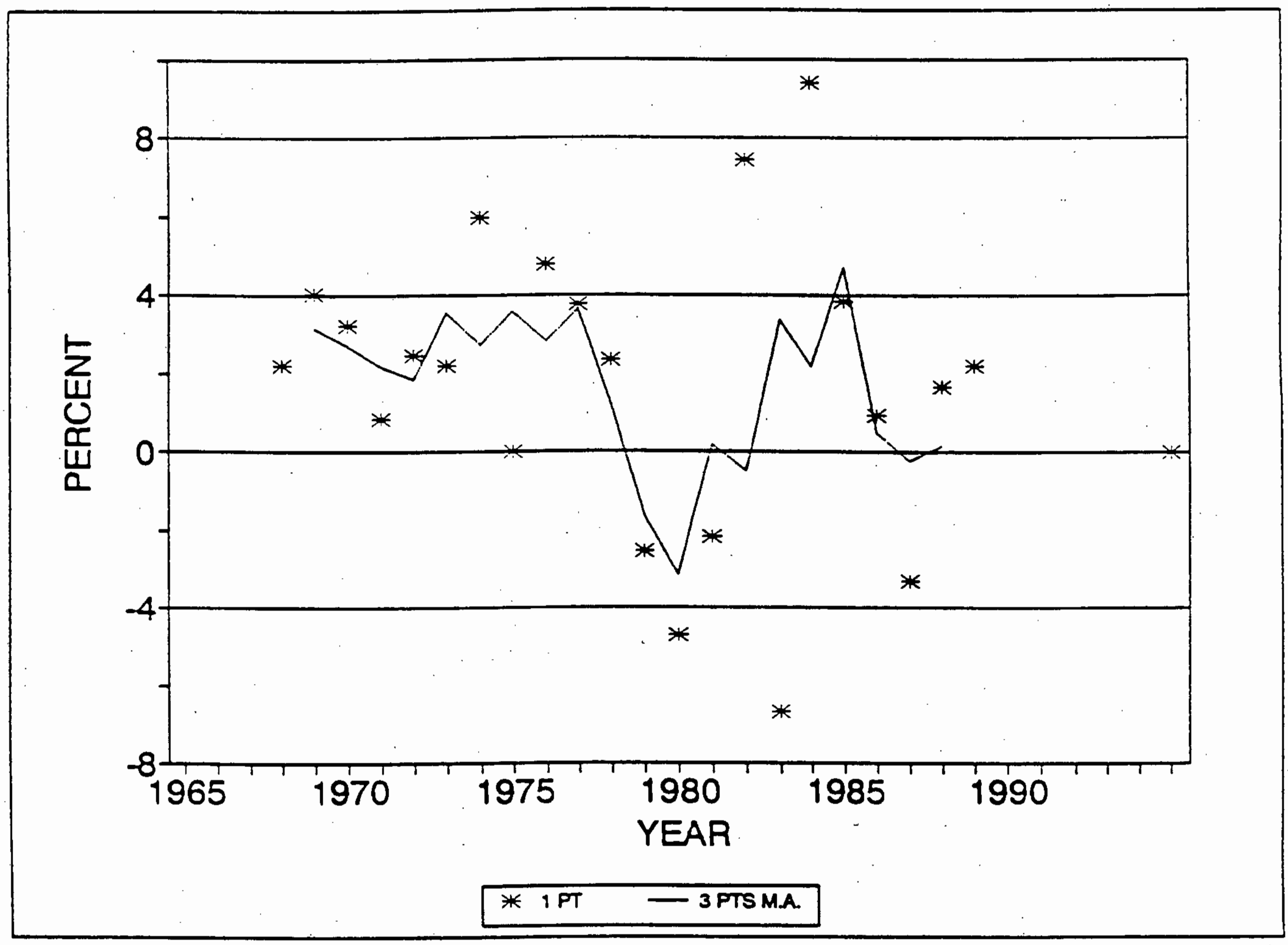


Figure 6. Gross domestic product growth rate: percentage per year (Real 1985)

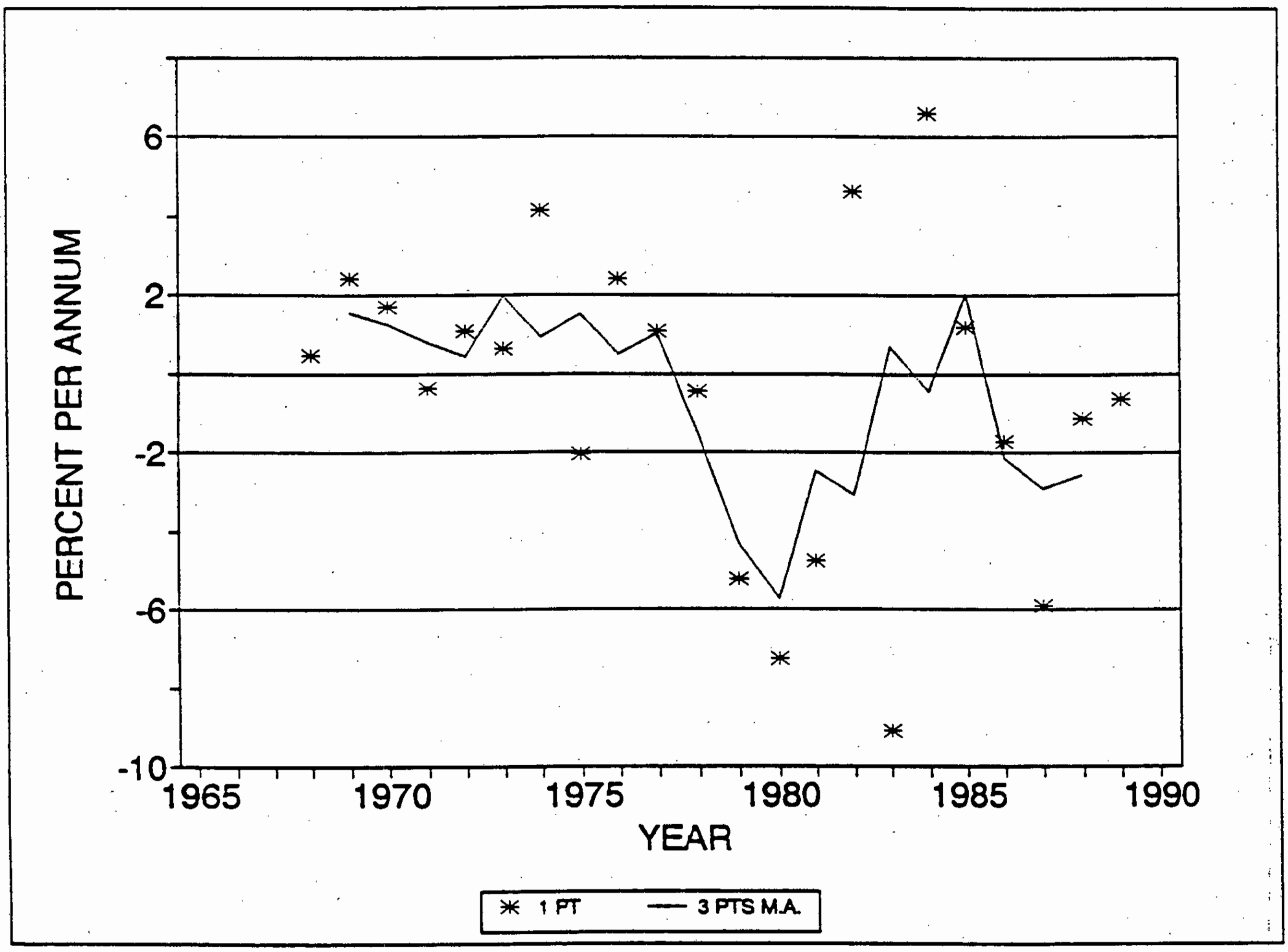


Figure 7. GDP per capita growth rate: percentage / year (Real 1985)

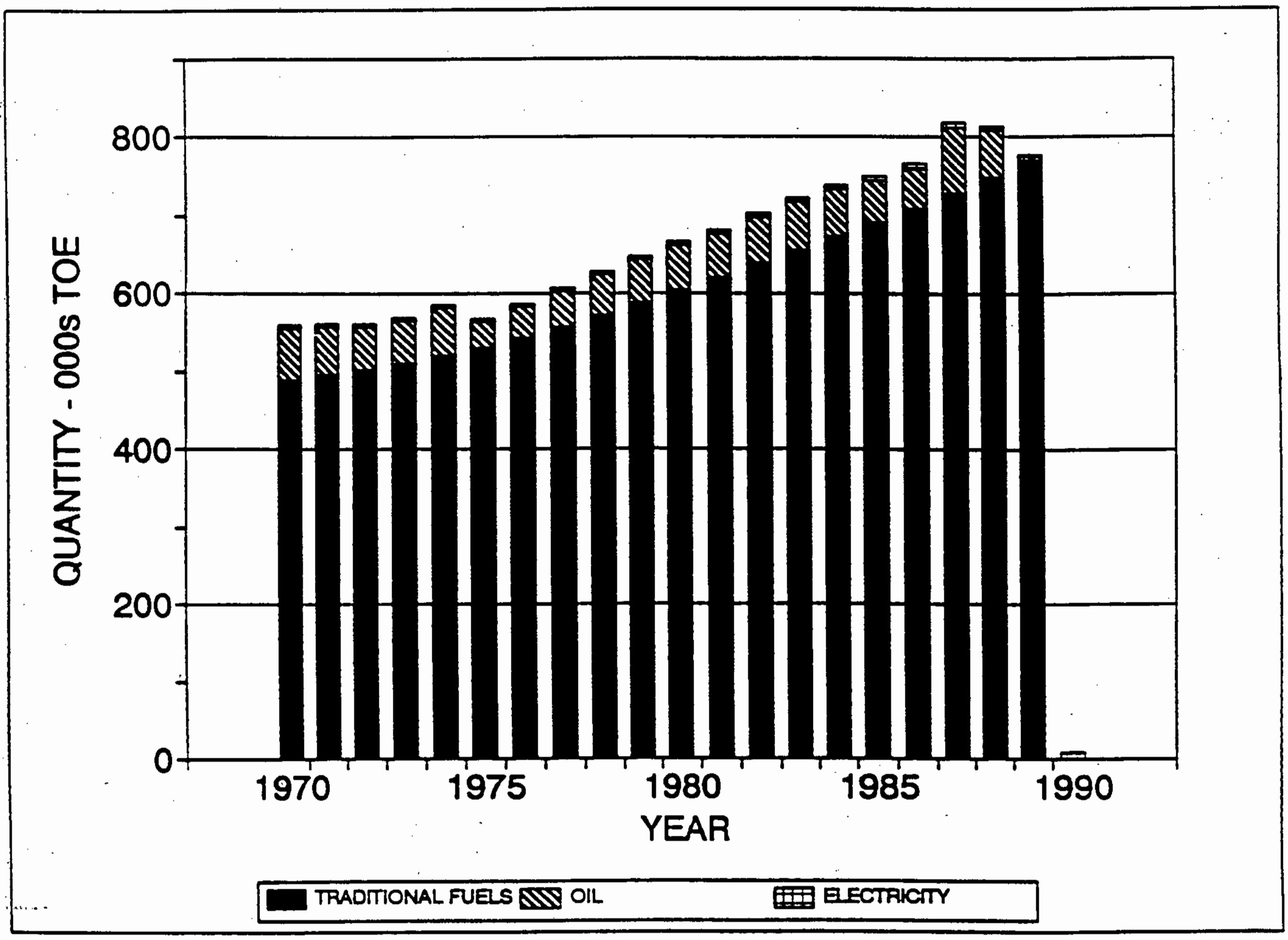


Figure 8. Total final consumption: quantity shares of components

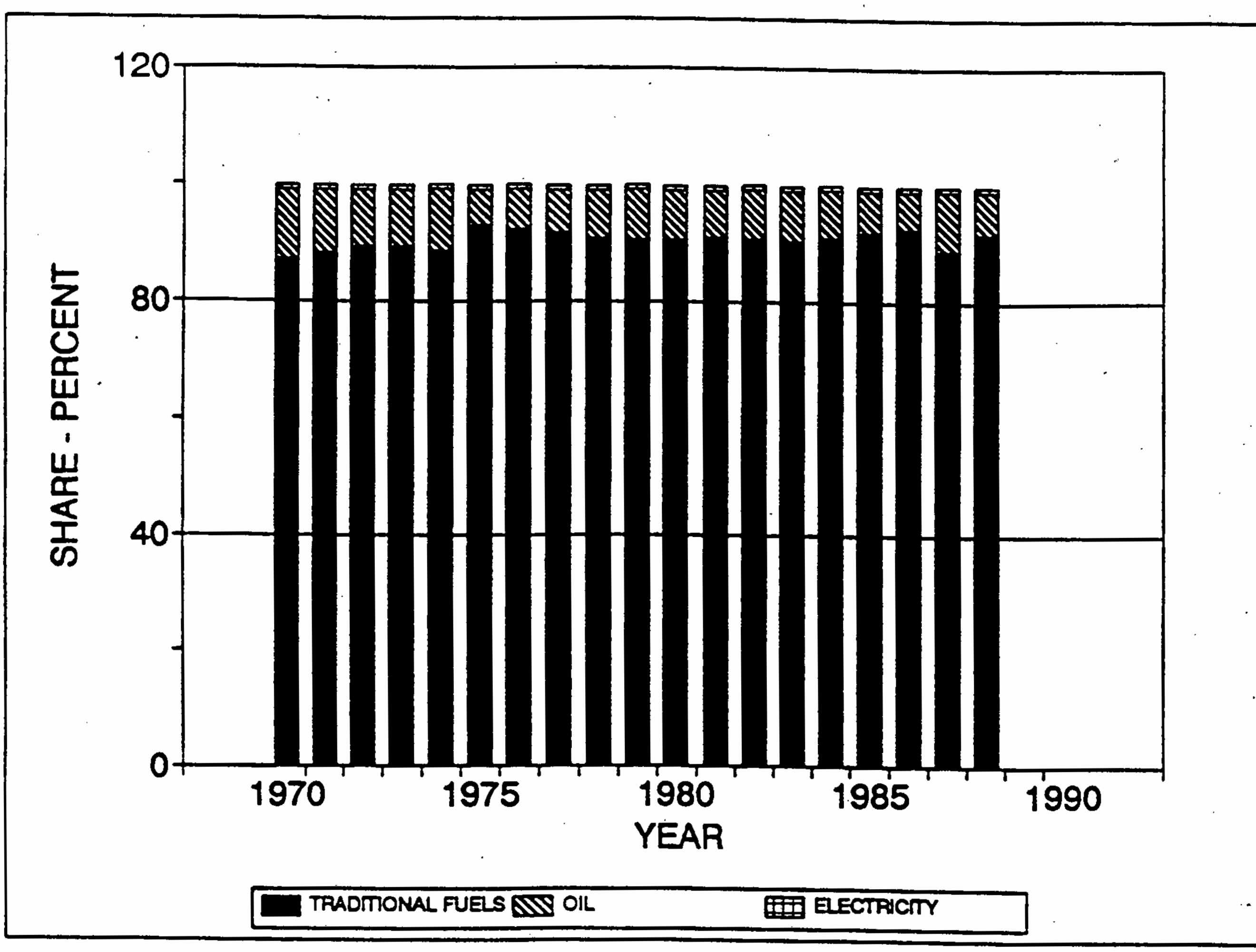


Figure 9. Total final consumption: percentage shares of components

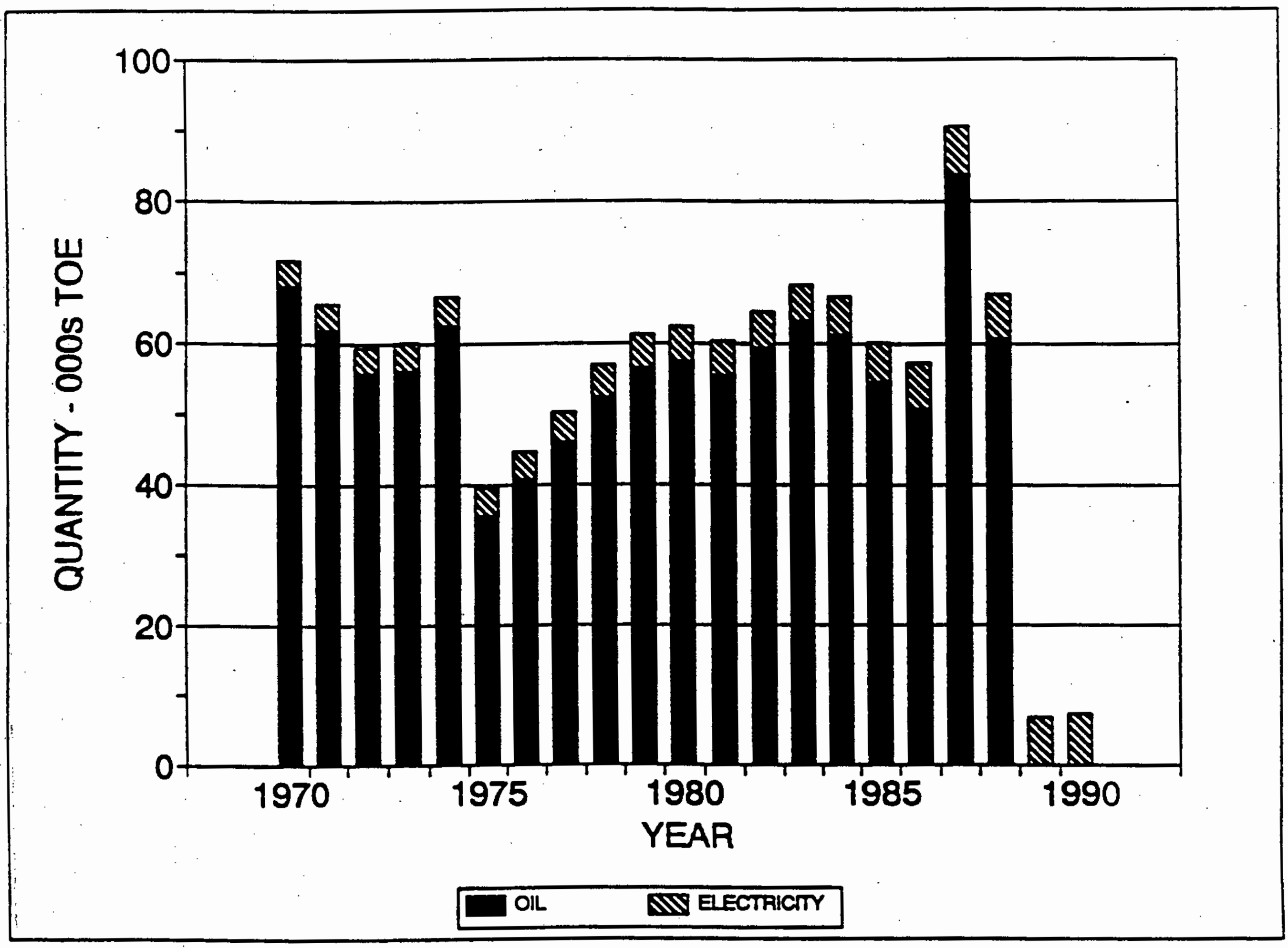


Figure 10. Commercial energy final consumption: quantity shares of components

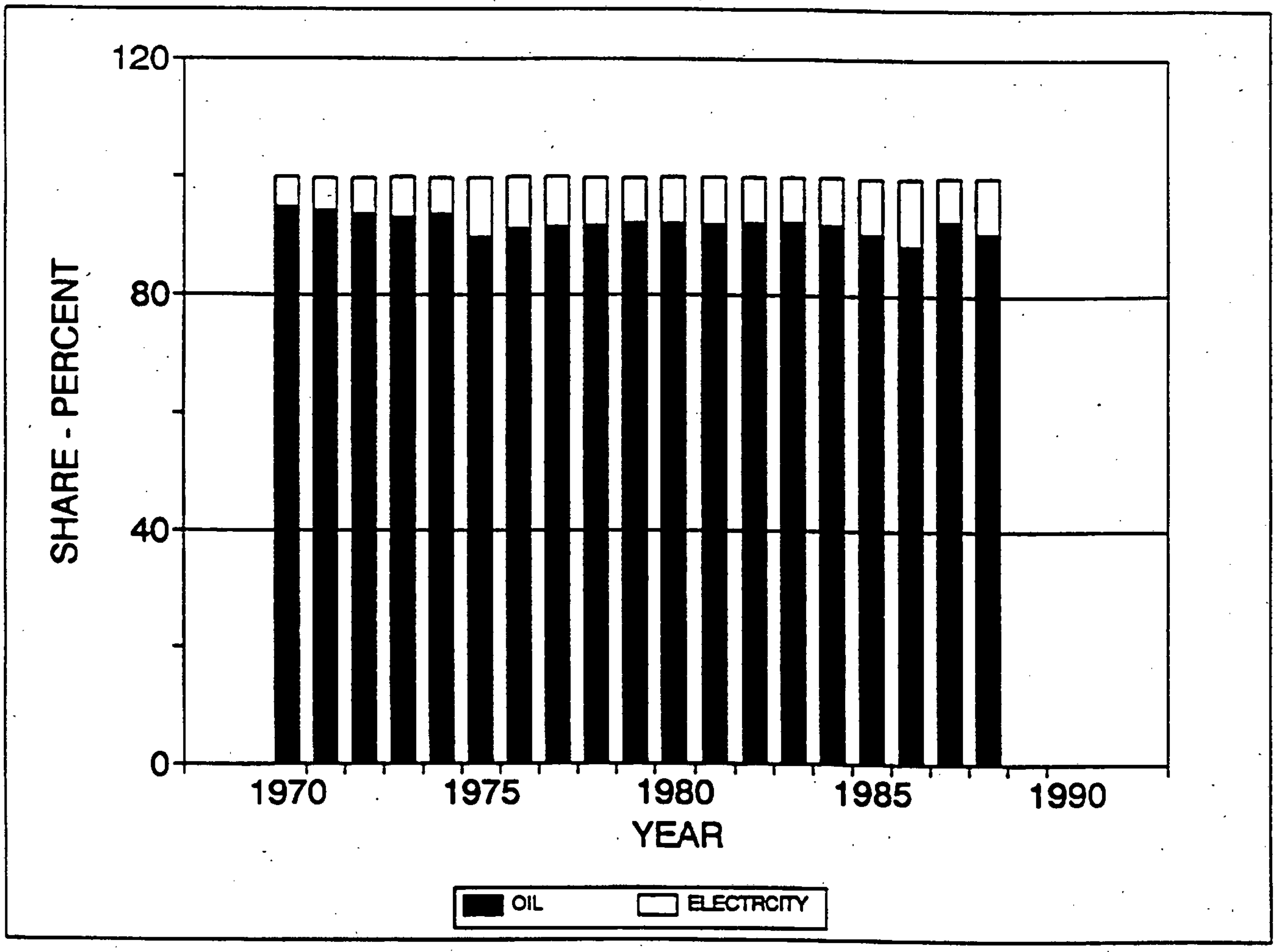


Figure 11. Commercial energy final consumption: percentage shares of components

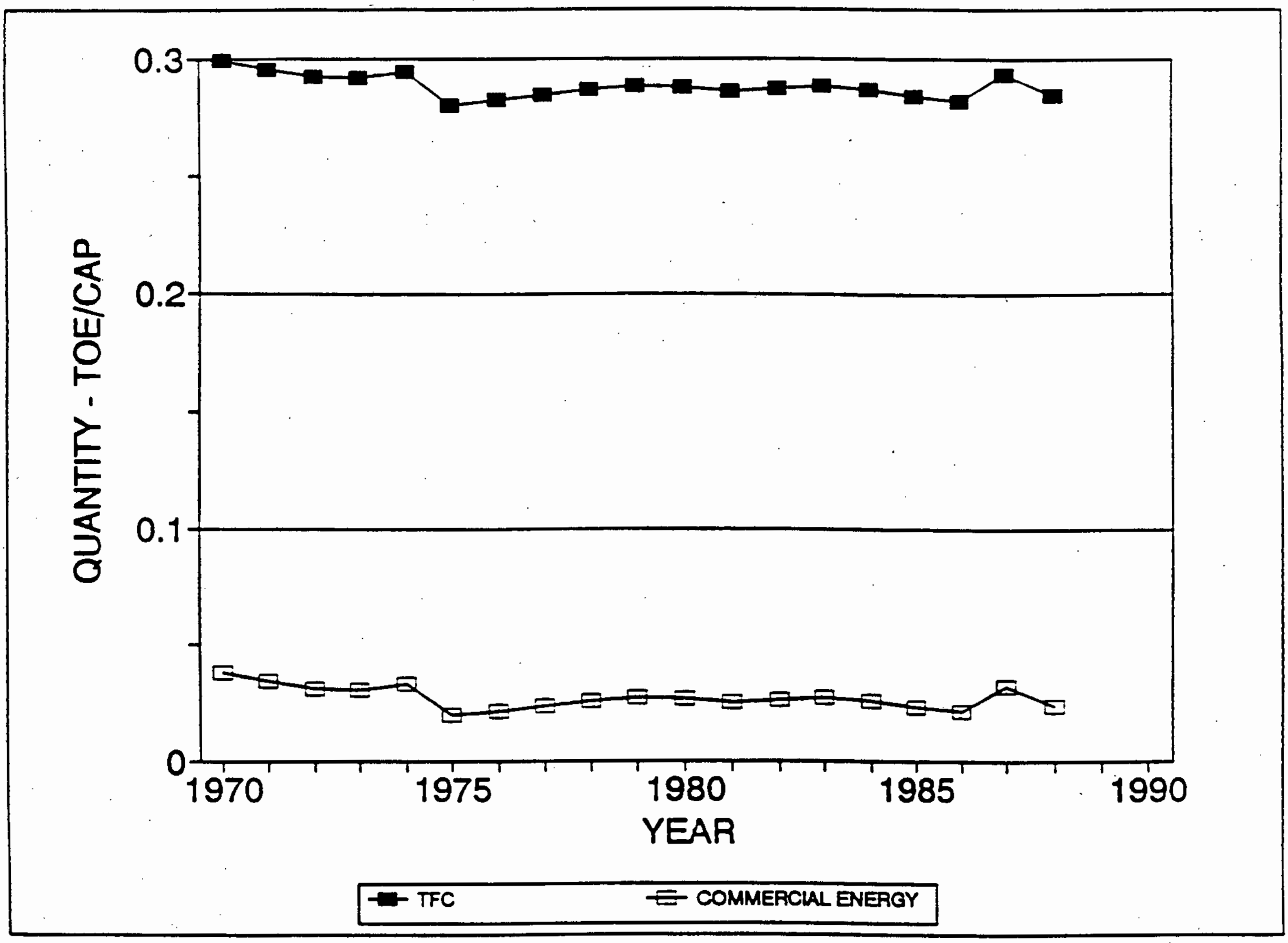


Figure 12. Energy final consumption per capita

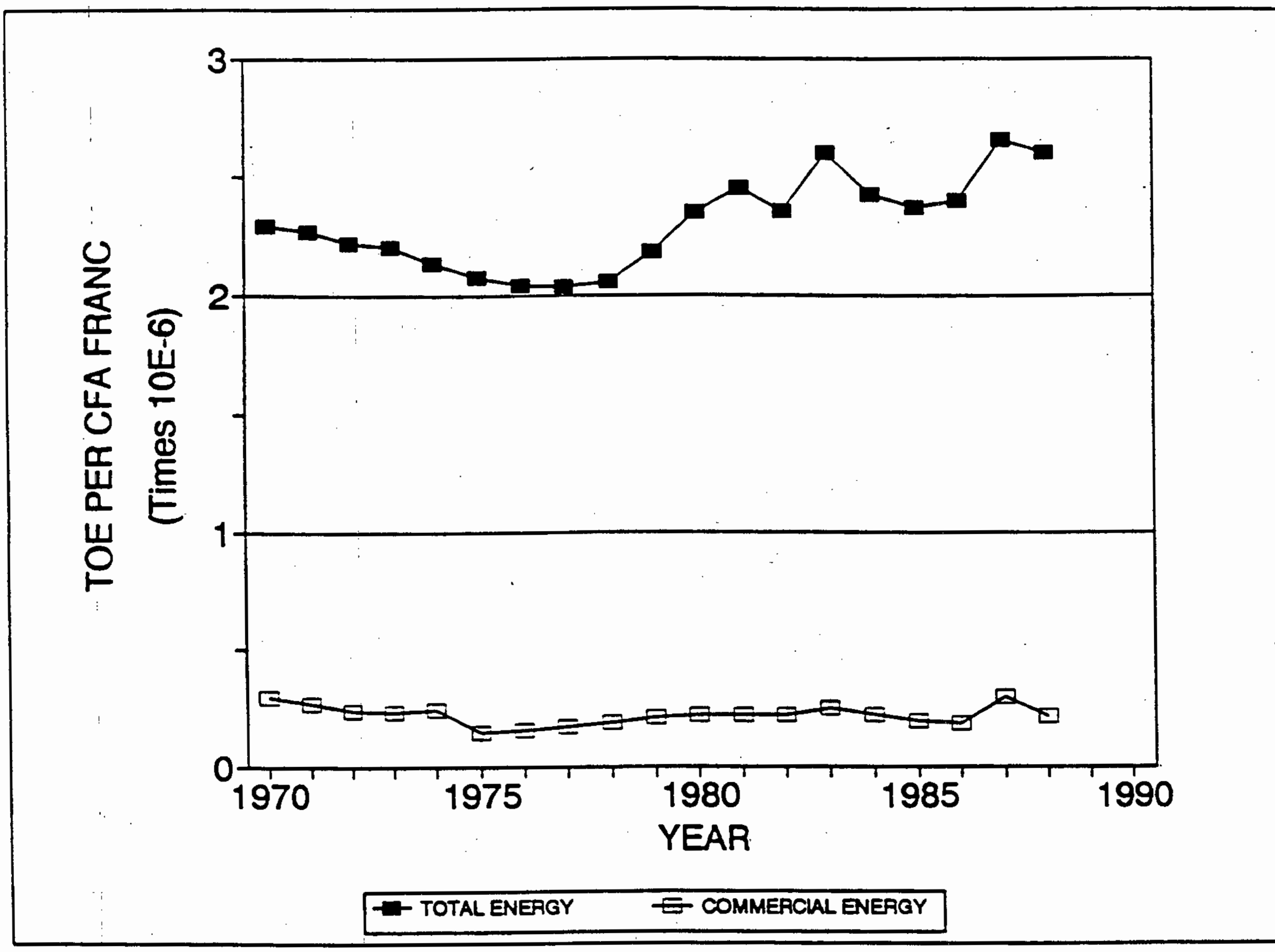


Figure 13. Energy intensity: final consumption / GDP (Real 1985)

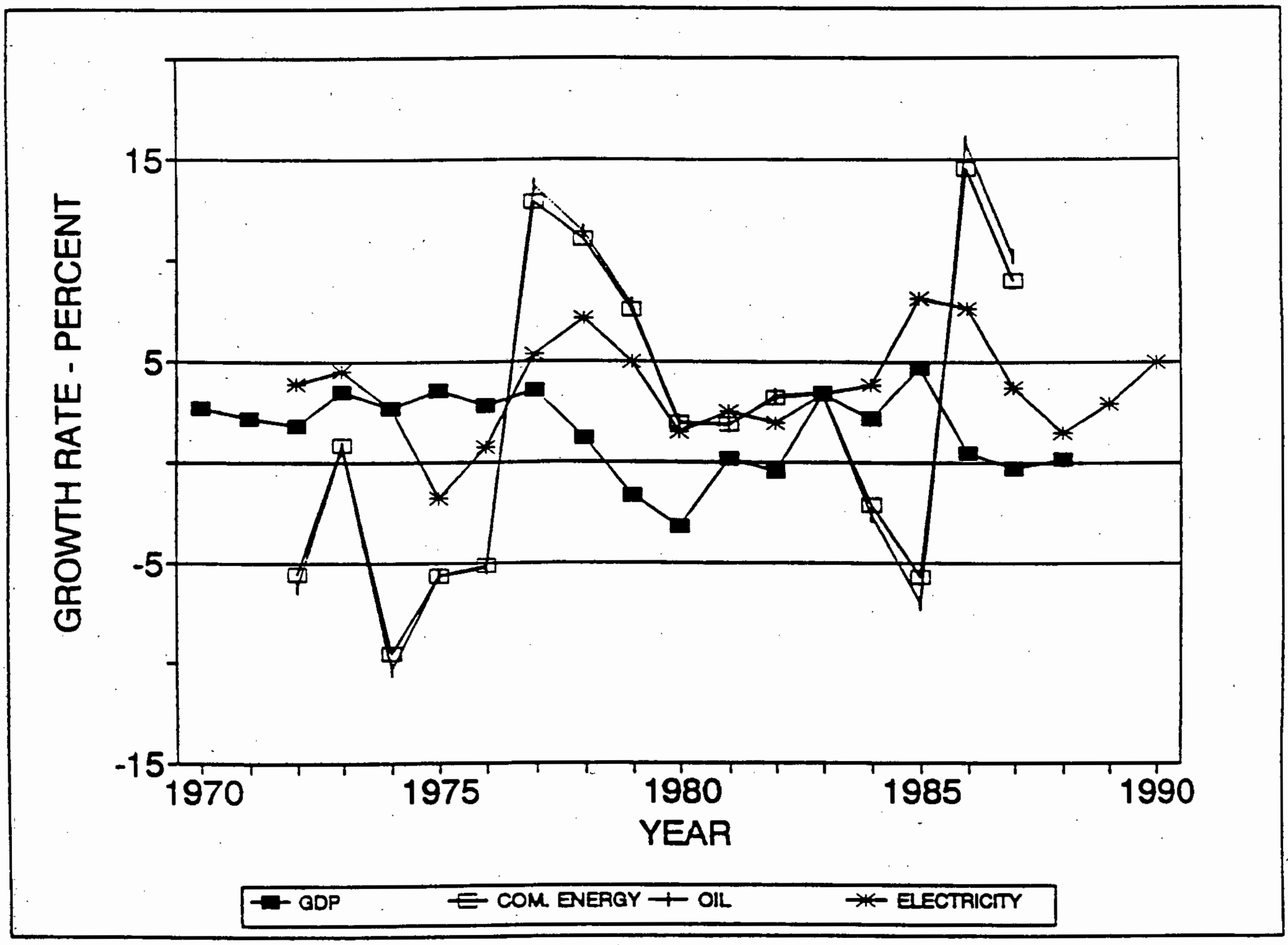


Figure 14. Growth rates (3 pts M.A.)

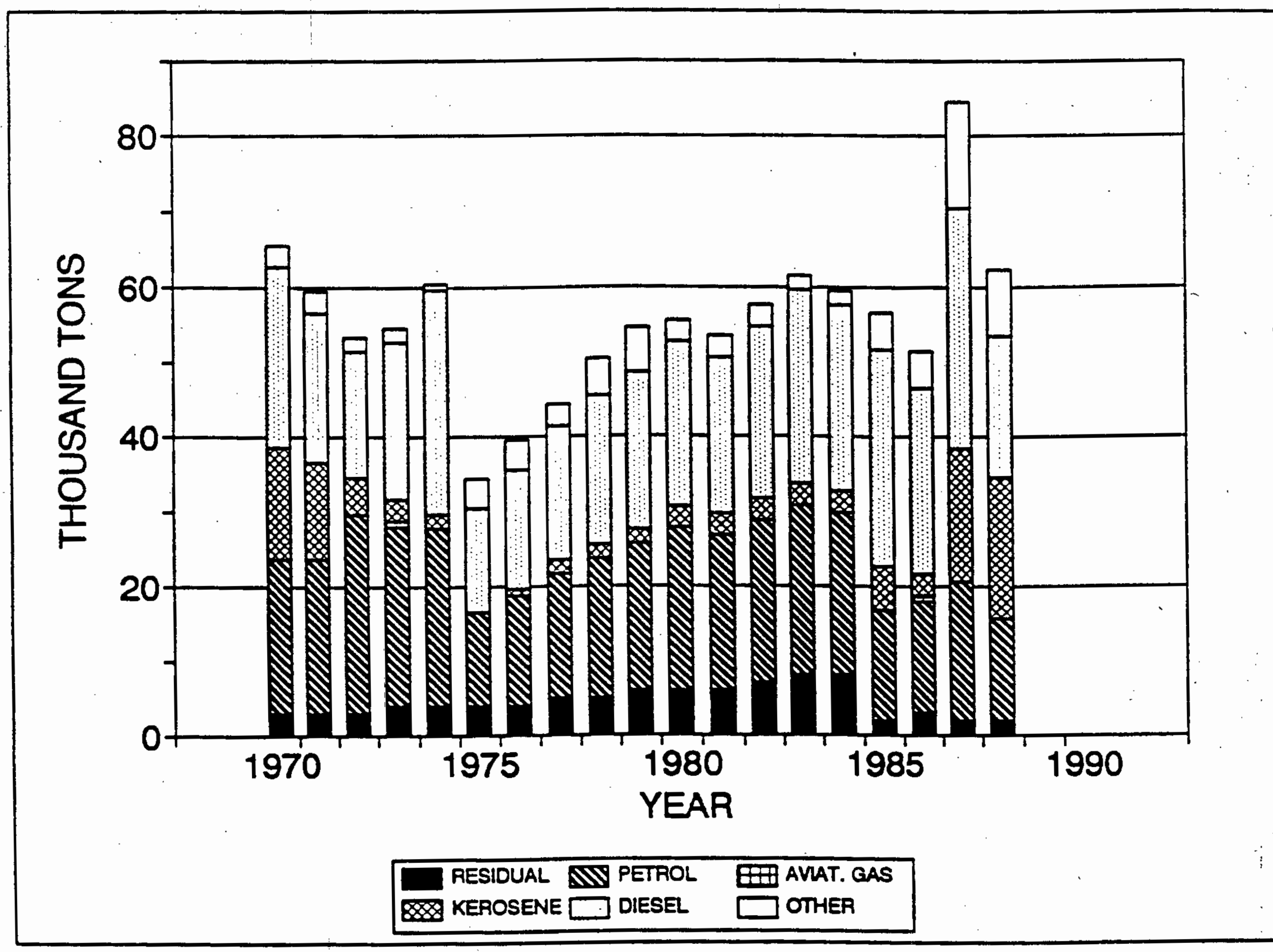


Figure 15. Oil products consumption by type

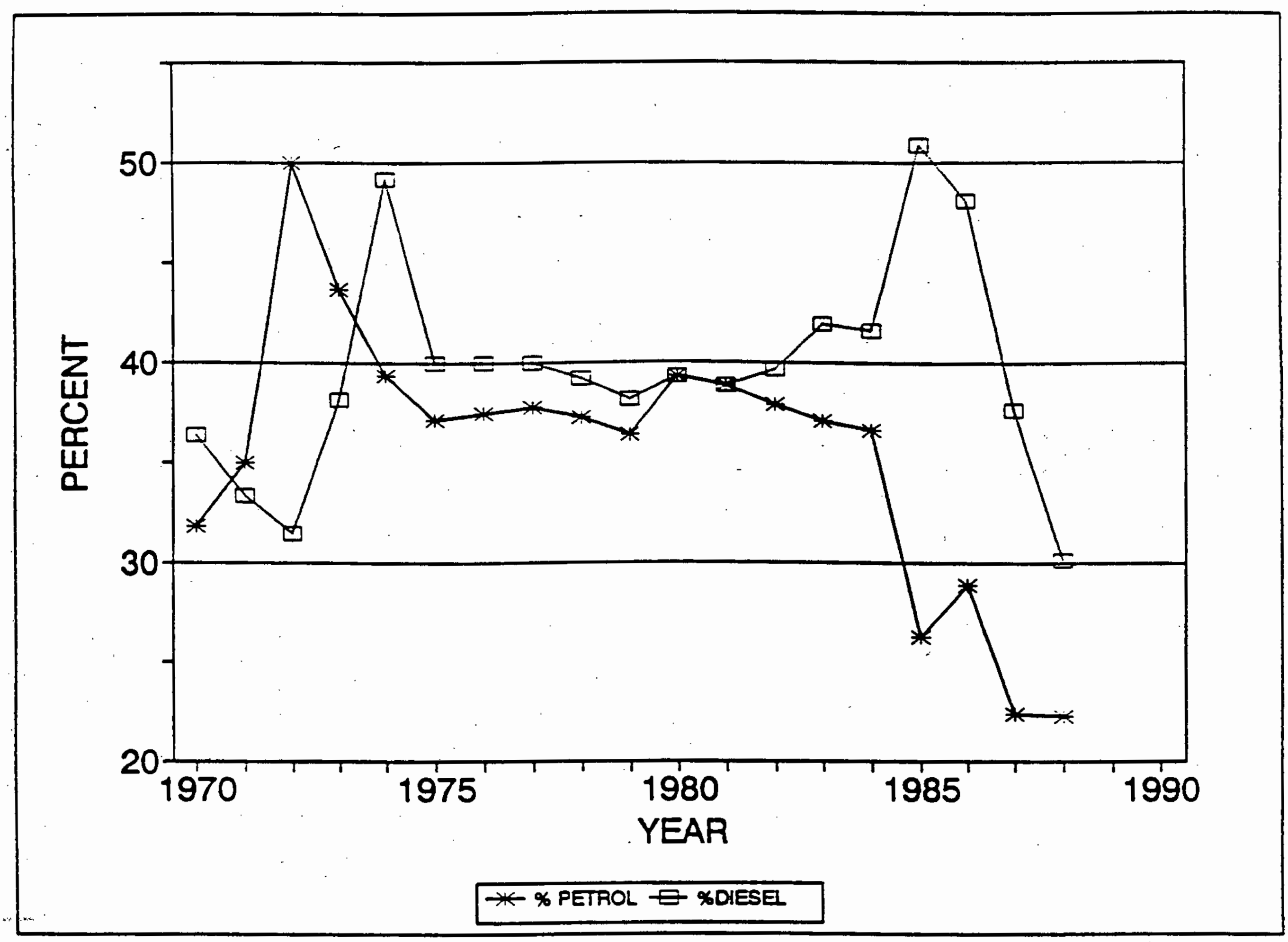


Figure 16. Petrol and diesel as a percent of oil consumption

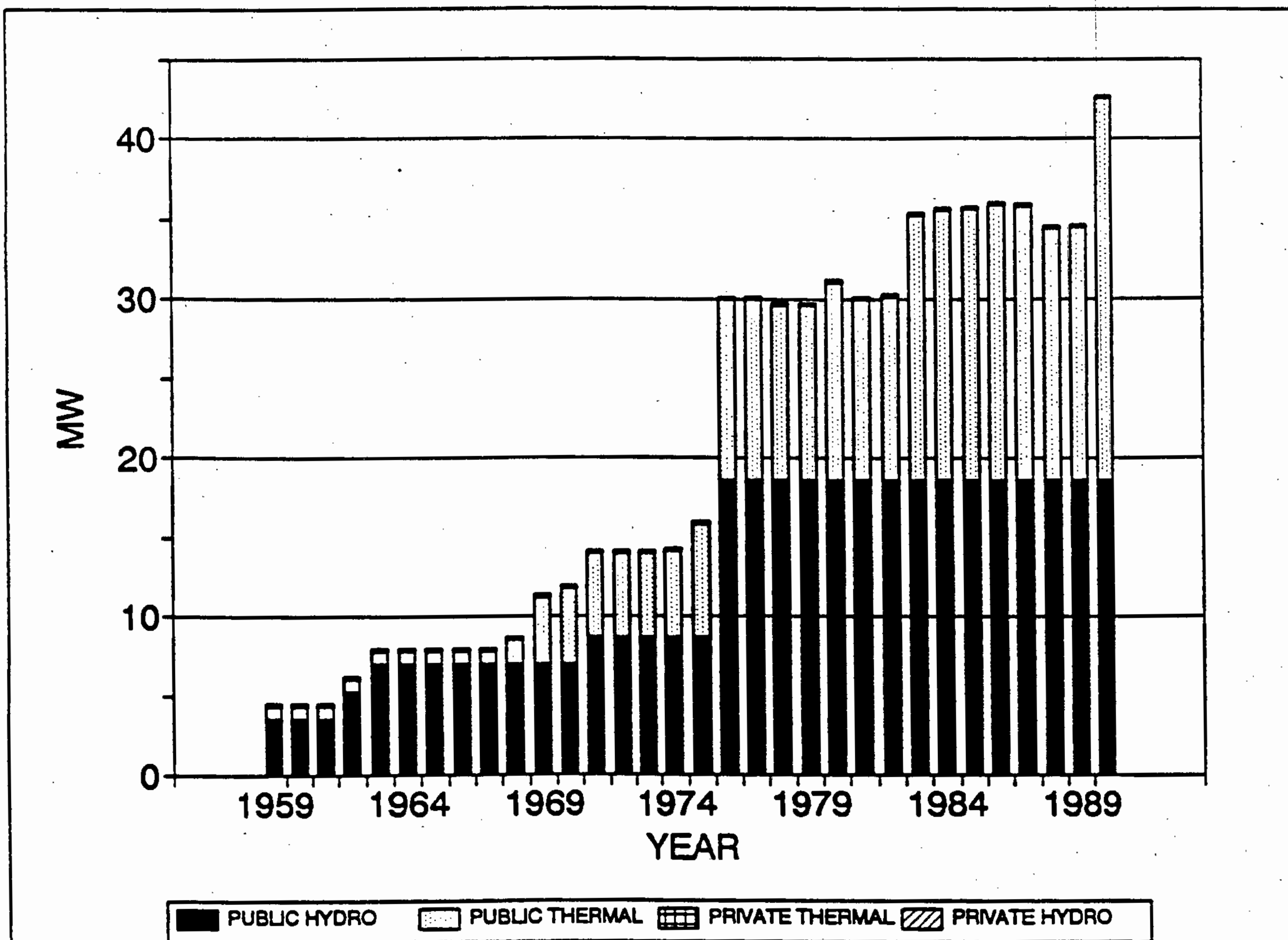


Figure 17. Electrical installed capacity

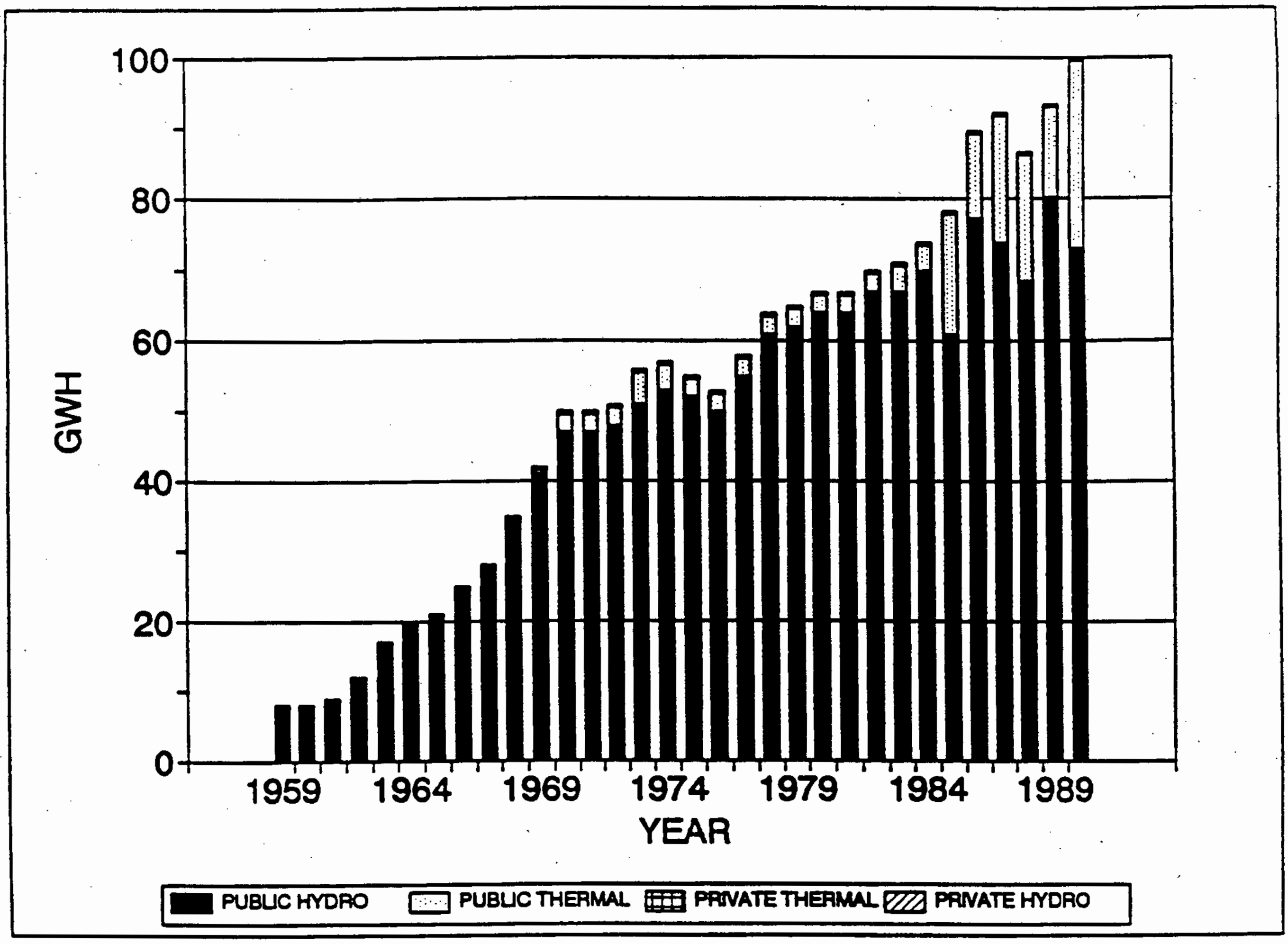
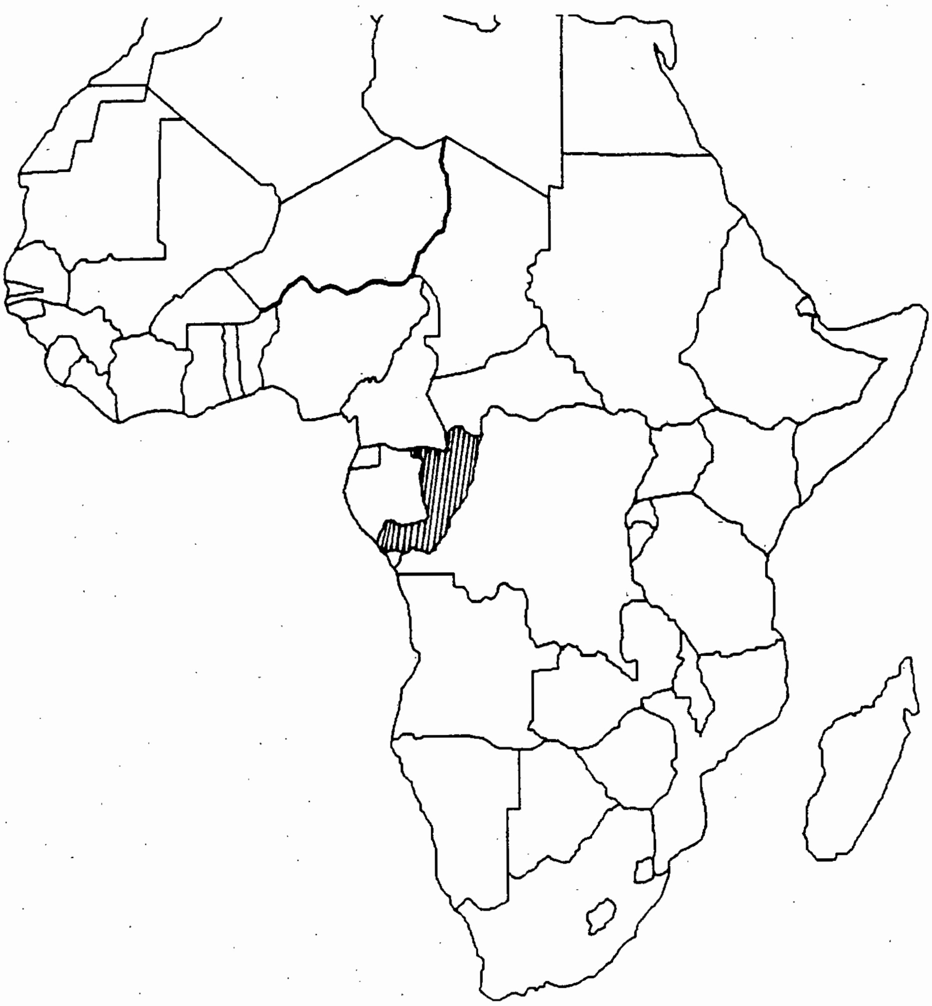


Figure 18. Electricity production

CONGO

1. INTRODUCTION



2. COUNTRY PROFILE

2.1 Introduction

Formerly known as the Middle Congo, the Congo was the administrative centre of French Equatorial Africa, a federation including the Congo, Gabon, Chad and Oubangi-Chari (the Central African Republic). It achieved autonomy within the French community in 1958 and gained independence two years later.

There have been five regimes in power since the country gained independence. The first civilian government led by Filbert Youlou lasted until August 1963. It was followed by the second civilian government which, under Massamba Debat, installed a single-party system and directed the country on a revolutionary path. This trend continued following the coup of 1968 by Captain Marien Ngouabi. His military regime introduced the ideology of scientific socialism and lasted until the assassination of its leader in a military coup on 18 March 1977.

The second military regime led by Yombi Opango was very short lived. He was obliged to surrender power in February 1979 to his long standing rival, Col. Denis Sassou Nguesso, after a charge of autocratic rule and corruption was directed against him. Although committed to remain loyal to Ngouabi-style socialism, he adopted liberal economic and increasingly pro-Western foreign policies. He played a significant role in the negotiations between Angola, Cuba, South Africa and the USA. This led to the signing, in December 1988, of the Brazzaville accord, which covered the withdrawal of Cuban troops from Angola and the question of the independence of Namibia.

As a result of the political changes that have recently taken place in Eastern Europe, the single-party system was abolished and other parties legalized. In March 1991 a sovereign national conference was held, that culminated in the formation of a transitional government in preparation for the country's first free multiparty elections. Mr Nguesso was however allowed to remain as symbolic head of state during the transition period.

2.2 Geographical situation and demography

Straddling the equator, the Congo covers an irregularly shaped area of 342 000 sq km. It shares its international boundaries with Cameroon and the Central African Republic to the north, Gabon to the west, Zaire to the east, and the enclave of Cabinda (a province of Angola) to the south.

According to World Bank estimates[(1)], the population was 2,1 million in 1988. Fig. 1 shows the population and the population growth on a yearly basis over the period 1967-88. The population is very young, with 42,1% under the age of 15[(2)]. With an average nationwide population density of 5,4 per sq km, it is one of the least densely populated countries in Central Africa. In the agricultural areas, the average density is however 15 per sq km[(3)]. About 51% of the population lives in urban areas. Three-quarters of the population is concentrated in one-third of the land area consisting of the five southern regions: Pool, Bouenza, Lekoumou, Nairi and Kouilu.

Outside this area, settlements are concentrated along the navigable stretches of the Zaire River. Large areas in the north and in the Bateke plateau remain totally uninhabited.

The Congolese population is made of about 75 tribes which can be grouped into 15 main ethnic groups. The four most important ethnic groups are the Kongo (45% of the population), the Teke (20%), the Mboshi (16%), and the Sanga. Small groups formed by Sudanese immigrants, pygmies, etc. also exist. In the absence of reliable statistics, the economically active population is estimated to be between 180 000 and 320 000. This labour force is shared by agriculture (62%), industry (12%), and service (26%)(3).

2.3 Economy

The Congo is a middle income country, with a GDP per capita of about 1038 US$ in 1988. Centralized, socialist-orientated with a dominant public sector, its agriculture-based economy has became overwhelmingly dependent on oil since 1979. As can be seen in Fig. 2, the GDP has increased significantly in real terms as a result of revenue earned through the export of oil from successively discovered deposits. Real GDP profited from the brief petroleum boom of 1973-74; it reached a maximum in 1984, before decreasing as oil output declined.

GDP per capita, shown in Fig. 3, has followed a similar trend, but the decline has been more significant because of the increase in population growth. This is confirmed in Figs 4 and 5 which show the growth rates of per capita GDP and GDP respectively. These figures also show some setbacks in 1971, 1975/77, and 1981, due to oil extraction difficulties and practical handicaps in selling a very viscous crude. Oil has provided the stimulus behind the economic growth and has financed almost all public sector investment. In 1988 it accounted for 40% of GDP, 90% of exports, and two-thirds of budgetary receipts. Trade, transport and services account for the second largest portion (29%) of GDP(4). Fig. 6 shows the percentage shares of GDP's components.

Industry is the most important sector of the economy. Mining accounted for 43% of GDP in 1988. Oil remains the only significant mining operation. Natural gas is exploited. Lead, zinc and copper are also produced but in small quantities.

Potassium mines have been closed due to technical and marketing difficulties. Manufacturing is relatively well developed. Its share in the economy (only 8% of the GDP in 1987) has been significantly reduced by the expansion of the petroleum sector. The country's prospects for manufacturing and trade are very limited because of the modest size of the domestic market and the low rate of domestic capital formation. Food processing, lumber and plywood, tobacco, textiles, cement, and boat building are the main manufacturing activities.

Agriculture remains small in term of income generation, as reflected by the GDP ratio (agriculture/industry) shown in Fig. 7. Export crops (sugar-cane, tobacco, groundnuts, and oil palm) contribute very little to foreign earnings. Agricultural developments have been hampered by neglect resulting from hasty nationalizations. Moreover, there is a progressive reduction in the farm labour force as a result of the rapid urbanization. Until 1973 timber was the country's main export. The forestry sector's future depends on foreign capital-intensive exploitation of the northern forests and the improved productivity in easily accessible but almost depleted forests in the south which are now reserved for local interests.

The economy has suffered from some structural imbalances. Firstly, the country inherited from the colonial rulers an overstaffed administration, a disproportionately large economic and transport infrastructure built as a vision of the French Equatorial Africa federation. Secondly, the scientific socialism introduced in 1969, which preached a strong State control of the economy, led to the nationalization of all public services and the transport system. It also favoured a full employment policy, guaranteeing university graduates employment in the already overstaffed public sector. As a result, government and state enterprises became seriously inefficient and their payrolls glutted.

Thirdly, expansionary domestic and financial policies and an ambitious capital-intensive development programme adopted by the government, accelerated economic and financial imbalances, especially after a brief petroleum boom in 1973-74[(3)]. Efforts to redress these deficiencies and streamline the economy have been made. Some sectors like the petroleum sector have been opened to private investment. Trading monopolies have been removed from some State marketing corporations. An economic liberation policy has been implemented, with revised taxation procedures intending to foster private sector activities. Retrenchment in the Civil Service has been planned.

The Congo, Cameroon, Central African Republic, Equatorial Guinea and Gabon are members of UDEAC (Union Douanière et Économique de l'Afrique Centrale). They share together a common central bank, the Banque des Etats de l'Afrique Centrale (BEAC) and a common currency (the CFA franc or franc de la Communauté Financière Africaine).

3. ENERGY: GENERAL

3.1 Introduction

The energy sector is and will remain very important as long as oil is the backbone of the economy. Oil's contribution to the national energy balance is however very small when traditional fuels are taken into account. Local crude oil does not fit the domestic market requirements and the use of a suitable crude is envisaged. Promotion of hydro-electricity is being considered, as well as a gradual reduction of petroleum consumption.

3.2 Energy institutions

The Ministry of Mines and Energy is the main organization overseeing the energy scene. It supervises the petroleum sector through the two parastatal bodies operating in the sector.

The exploitation and exploration of petroleum resources are mainly in the hands of Elf Congo and Agip Recherches Congo. The Congolese state holds a 20% share in each. However, other companies such as Amoco and Conoco are also involved in exploration activities. A national company, Hydro-Congo, was set up in 1974 and given the responsibility for research into and production of petroleum resources. It had the monopoly of distribution of petroleum products in the country until 1990, owns a refinery at Pointe-Noire (CORAF) and is a manufacturer of lubricants. The exploitation of natural gas is entrusted to Gaz-Congo, a company jointly owned by Elf, Agip and Hydro-Congo.

In the power sector the parastatal Société Nationale d'électricité (SNE) is responsible for the generation, transmission and distribution of electricity.

In general, forestry issues are handled by the Congolese Forestry Office. However, some reforestation programmes have been undertaken by other institutions such as the Unité d'Afforestation Industrielle du Congo (UAIC).

4. ENERGY RESOURCES

4.1 Fuelwood

Two-thirds of the land area is covered by large natural forest resources. In the south of the country, where three-quarters of the population live, forests are now almost completely depleted. Being easily accessible, they have been exploited since the colonization period. Dense equatorial forests are found in the north. Because of difficulties of access, their exploitation is still difficult. There are also planted forests, estimated to cover between 40 000 and 50 000 ha.

4.2 Oil and natural gas

Systematic oil prospecting started in 1928, but it was only after 29 years that the French Société des Pétroles de l'Afrique Equtoriale (SPAFE) found a small onshore deposit at Pointe-Indienne. Almost exhausted by 1971, it was abandoned in 1977 with the closure of Hollé's potash mine, to which it had been supplying fuel.

Major oil discoveries, mainly offshore deposits, followed the exploitation of Pointe-Indienne's deposit. The vast Emeraude field, discovered by Elf Congo in 1969, went into production in 1972. It is believed to have resources of 60 million tons of heavy viscous petroleum which requires expensive steam-injection exploitation procedures. Its recovery will remain uneconomical until the world price reaches US$35/barrel[(5)].

Another major field, located in the Loango concession, was discovered by Agip Recherches Congo in 1971, but for technical reasons it did not come on stream until 1977. The Likouala field, estimated to have a reserve of 40 million tons, came into operation in 1980. It was followed by the Sendji Marine field in 1981 and the Yanga field in 1982. These two offshore fields accounted for one-half of the country's production in 1987. With estimated recoverable reserves of 12 million tons, the

Tchibouela field came into operation at the end of 1987. Its yield was expected to reach about 2 million tons per year by 1990. In late 1988 the Zachi Marine field came into operation. It was scheduled to have an output of 310 000 tons in 1989.

The country's total oil production was 7,04 million tons in 1988. With the prospect of Amaco's Marine field coming on stream in 1992, it is expected to reach 10 million tons per annum(5). The trend in crude oil output is given in Fig. 8. By 1986 there were about 540 wells(4).

Oil production comes from the sedimentary Coastal Basin (28 000 km^2) where almost all exploration activities have been carried out. It bears all present reserves, estimated to lie between 1065 and 2050 million standard barrels. 91% of them are offshore. The Coastal Basin consists of an offshore segment (7000 km^2) with little oil production to date, an offshore shelf area (about 7800 km^2) with abundant production, and a deep offshore section with no discoveries or production. Geologically, the Coastal Basin is divided by an evaporate layer (salt) into a pre-salt lower section and a post-salt section, in which are found the bulk of known reserves to date and where exploratory drilling is easier and cheaper(4).

Another sedimentary basin, the Central Basin or Cuvette (100 000 km^2) is a potential oil-bearing area. However, it is remote and not easily accessible.

Natural gas deposits, discovered with oil at Pointe-Indienne in 1957, were almost exhausted by 1980. New gas reserves were discovered off Pointe-Noire in 1981. The country's natural gas resources are loosely estimated at 50 billion m^3(6).

4.3 Hydro-electricity

The extensive network of the tributaries of the Congo (Zaire) River offers significant hydro-electric potential. The estimated potential of all sites, regardless of economic or other considerations, is 11 000 MW, producing annually 50 000 GWh. In the absence of more accurate data, it is estimated that only one-third of this potential can be developed at a cost competitive with other sources and with no unacceptable social or environmental impacts(7).

4.4 Other energy sources

There are no data available on solar and wind energy. Wood residues, generated by industrial logging operations, timber cutting and wood processing, are estimated at about 500 000 tons per year.

5. ENERGY SUPPLY AND DEMAND

5.1 General

In 1988 the total final consumption of energy totalled 661 000 TOE, of which 65% was in the form of traditional fuels, mainly fuelwood. The balance was provided by oil and electricity. Figures 9 and 10 give the estimated contribution of the various forms to the total final consumption on a yearly basis over the period 1971-88, according to IEA statistics[8]. As shown in Fig. 11, estimated from a combination of IEA and World Bank data, the household/commercial sector is the largest consuming sector and is mainly satisfied by wood fuels. It is followed by the transport and petroleum sectors. The total final consumption on a per capita basis is shown in Fig. 12. For 1988 it shows a consumption of about 0,31 TOE, with 0,11 TOE coming from commercial fuels.

Commercial energy is consumed mainly in the form of oil. Electricity's share is small, but it is increasing. The quantity and percentage shares of commercial energy carriers in commercial energy are shown in Figs 13 and 14 respectively. As can be seen in Fig. 15, transport is the main commercial energy-consuming sector, followed by the petroleum industry.

The trend in energy intensity, defined as the energy per unit of GDP, is given in Fig. 16. A large difference is noted between commercial energy intensity and total energy intensity, highlighting the large share of traditional fuels in total energy. Traditional fuels are mainly used in the informal sector such as households. The oil industry is the only energy-intensive industry in the country. The decrease in commercial energy intensity with time is not accounted for by structural changes in the economy, but is due to increases in the recovery rates and prices of oil. Sectorially, industry has the lowest commercial energy intensity because of the contribution of the oil industry to GDP. This is shown in Fig. 17. In agriculture virtually no commercial energy is used as it relies mainly on human labour. The growth rates of GDP and electricity final consumption follow the same trends and are shown in Fig. 18.

5.2 Traditional fuels

As shown in Figs 9 and 10, traditional fuels represent the most important energy form consumed in the country. Supply is mainly in the form of firewood (about 96,4% in 1985). The consumption of charcoal and agricultural residues is small, representing 2% and 1,6% of traditional fuels consumption respectively in 1985. Fig. 19 shows the sectorial distribution of net domestic consumption of traditional fuels in 1985. The household/commercial sector is the most important consumer of traditional energy and accounted for 98,4% of supply in 1985.

Forest resources are still significant in the north, although they are seriously depleted in the south. Because the north is remote and access is difficult, its resources are not easily exploitable. Demand for wood is greater in the south where the bulk of the population is concentrated. There is no foreseeable danger of wood-fuel shortages as current annual consumption seems to be well below the sustainable production of natural forests. However, deforestation is increasing as a result of wood-fuel gathering and the expansion of agricultural land. Forests around important urban centres such as Brazzaville are becoming less and less dense. A peri-urban plantation for Brazzaville is under consideration.

Apart from natural forests, there are between 40 000 and 50 000 ha of replanted forests in the country. Some of them were intended to be used as feedstock for paper pulp projects which are no longer economically viable. Two of them, located at Loudima and Pointe-Noire respectively in the southern part of the country, are exploited for the production of both energy and electric poles. With over 23 000 ha of eucalyptus, the Pointe-Noire plantation, whose planting operation started in 1978, has an average yield of 25 m^3/ha/year. Its production costs are about 325 000 CFAF/ha (US$90/ha). The Loudima plantation, with 6000 ha of pine and eucalyptus, can give an annual sustainable supply of between 84 000 and 109 000 ha/year. Its standing stock has an annual productivity ranging from 8,5 to 21 m^3/ha[4].

The wood-fuels market is organized formally in urban areas and remains informal in rural areas. Charcoal production potential is significant and it is estimated to be more than 126 000 tons/year for the Pointe-Noire plantation, and between 14 000 and 18 000 tons/year for the Loudima plantation. But the small size of the domestic market is a major handicap to a large-scale production. In fact, household consumption was around 11 000 tons in 1985 and is likely to average between 30 000 and 40 000 tons/year in the short to medium term. Potential use of charcoal in industry is between 25 000 and 34 000 tons/year. The largest important potential market for Congolese charcoal is Kinshasa, the capital of Zaire. Located across the river from Brazzaville and with a population of about 4 million people, it has a charcoal demand estimated at 220 000 tons/year[(4)].

5.3 Petroleum products

Petroleum requirements are met by locally refined products. Fig. 20 gives the consumption of oil products over the period 1971-88. The percentage shares of petrol and diesel in oil consumption are shown in Fig. 21.

The sectorial breakdown of the domestic consumption of oil in 1985 is shown in Fig. 22 and indicates that the transport and petroleum industries are the main consumer of oil products. In 1985 about 27,6% of the oil industry's petroleum needs was provided by crude oil.

Until January 1990 the supply and distribution of petroleum products was the monopoly of the parastatal marketing corporation HydroCongo. Created in 1973, it took over the assets of the oil companies involved in product marketing. This resulted in high increases in personnel and financial costs. HydroCongo obtains finished products from CORAF (Compagnie Congolaise de Raffinage), the refining company in which the government has a majority holding. CORAF is also allowed to import petroleum products to meet local demand and to make up for shortfalls in the refinery's production.

CORAF processes the local Djelo crude which is relatively heavy, with a high fuel oil content. The resultant high refinery output of fuel oil is unsuitable for the requirements of the very limited domestic market. As a result, over 300 000 tons of excess fuel oil are exported each year to industrialized countries at uneconomic rates. Plans to use the lighter Palanca crude from Angola are under way[(4)].

The refinery facilities, operated by CORAF, are installed at Pointe-Noire. Designed in the early 1970's and commissioned in 1976, they were brought on stream only in December 1982, after being rebuilt by a French firm. After the conversion of one of the old strippers to a vacuum unit in July 1986, the processing capacity was reduced from 1 million tons to 800 000 tons/year with a hydrocracker's feedstock capacity of 12 tons/hour. The refinery output, 580 000 tons in 1988, is generally below its optimal capacity. Prospects to improve the refinery's profitability were expected after the conclusion, in March 1989, of an agreement providing the export of refined products to Angola[5].

5.4 Electricity

With its 149 MW capacity, in 1988 the Congo had 0,2% of the installed capacity of Africa, of which 29 MW was thermal. Fig. 23 shows the installed capacity from 1950 to 1988. Total generation amounted to 289 GWh or 0,2% of the production in the continent in 1988. Imports from Zaire (about 55 GWh) helped to meet the shortfalls experienced, giving a total consumption of 347 GWh. Fig. 24 shows the electricity production over the period 1960-88. Electricity consumption per capita was estimated at 184 KWh in 1988. Sectorial breakdown of electricity final consumption in 1985, shown in Fig. 25, indicates that the industry and household/commercial sectors are the main consumers of electricity.

Electricity distribution is the monopoly of the Société Nationale d'électricité (SNE). It was created in 1967 and took over the former Energie Electrique du Congo (ENELCO). SNE's supply system consists of about 15 small isolated centres and two important networks: the Brazzaville and the Pointe-Noire/southwest networks. Centred on the two major population centres of the country, Brazzaville and Pointe-Noire, these networks account for 90% of electricity sales (48% for Brazzaville and 42% for Pointe-Noire in 1985), with total electricity sales estimated at 315 GWh. Their interconnection was scheduled for completion in 1988.

The Brazzaville network, with a consumption of 209 GWh and a peak load of 38 MW in 1985*, is served by the small run-of-river Djoue hydropower station (12-15 MW)

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* Loads include unbilled consumption and technical losses.

on the Congo River and is interconnected by a 225 kV transmission line to the Inga hydro plants in Zaire. About 2 MW of thermal capacity were available as reserve in the mid-1980's.

Centred on Pointe-Noire, the second network extends south-west (Pointe-Noire-Loudima-Bouenza-N'kayi). With a total consumption of 199 GWh and a total demand load of 40 MW in 1985*, this system is mainly served by the 4 x 18,5 MW Moukoukoulou hydro plant (74 MW installed, 23 MW firm) on the Bouenza River, a 110 kV transmission line to Loudima and nearby towns, and nearly 150 km of 225 kV transmission lines from Loudima to Pointe-Noire. Located near Loudima and built with Chinese assistance, the Moukoukoulou hydro-electric plant came into operation in 1980. In 1985 Pointe-Noire had a consumption of 165 GWh and a peak load of 33 MW.

In the short term, imports from Zaire (Inga) were expected to be reduced after the completion of the interconnection link between the two main networks. Talks to link Inga to Pointe-Noire via the Angolan enclave of Cabinda** are underway. Finances for this link are expected to obtained from the German Kredietanstalt für Wiederaufban (KFW). If carried out, this connection would pave the way for linking Inga, which has an enormous hydro-potential and cheap generation costs, to West Africa (Nigeria, Togo and Ghana) through Gabon and Cameroon[10].

About half of the SNE's sales are at low voltage. Distribution in Brazzaville and Pointe-Noire is done by 30 kV and 6,6 kV lines. The reliability of public supply is poor because of frequent overload and maintenance problems. For this reason, many consumers have developed autogeneration capacity (12 MW in Brazzaville, 35 MW in Pointe-Noire and 5-10 MW in the rest of the country in 1983) either for baseload generation or as backup during outages in the public supply system[4].

A second major hydropower station, built with Chinese aid, was scheduled for completion in 1989/90. Located at Imboulou on the Lefini River, it was planned for a

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* Loads include unbilled consumption and technical losses.

** Pointe Noire and Cabinda are important oil mining centres.

capacity of 100 MW[5]. A number of sites to build future hydro-electric dams have been identified. They are Kandemo (2 MW) and Assoumoundele (1 MW) on the Sangha River, Etoumbi (1 MW) on the Likoula River in the Cuvette area, and Sounda Gorge (240 MW) on the Kouilou River, 75 km from the Atlantic coast.

6. PRICING

Petroleum product prices are set by the Government according to a cost structure prepared by HydroCongo. It comprises the ex-refinery prices, taxes, distribution costs and a retail margin. Ex-refinery prices include the cost of crude oil and the actual refining expenses. Distribution costs take into account HydroCongo's operating expenses, financial charges and wholesale margin. Distribution costs constitute a significant part of the retail price and are very high relative to other neighbouring countries. This is due to overstaffing and the poor financial discipline at HydroCongo[4]. There is a cross-subsidization among products to the benefit of kerosene and bunker sales. Retail prices, which are uniform nationwide, are adjusted according to subsidization requirements.

In 1986 electricity from Zaire was sold to SNE at a very low price of 10 CFAF/kWh (2,9 US cts), which included transmission losses and probably incremental supplies to existing users. SNE's electricity tariff has a complex structure, with declining blocks within each voltage category, adjusted according to regional differentials. It requires the use of two meters per customer and bears little relation to the marginal costs of supply associated with the present and planned regional allocation of generating capacity, and the transmission and distribution infrastructure. In order to simplify its structure, to increase rates and to bring them more in line with marginal costs, they were reviewed by Electricité de France in 1982. However, SNE has been reluctant to increase the electricity price without improving the reliability of its supply[4]. In 1987 the average revenue was 8,85 US cts/kWh[9].

The price of wood-fuels is higher than those normal in most West Africa's markets. In 1986 retail price was about 30 CFAF/kg (8,7 US cts) for firewood and 100 CFAF/kg (29 US cts) for charcoal. Transport and distribution account for up to 80% of retail prices, and the true cost of the resource itself is rarely included in the prices. The high supply cost is accounted for by the poor condition of the transport routes and distribution circuits rather than by the extent of deforestation.

7. DISCUSSION

The country is self-sufficient in all energy forms except electricity. In order to ensure AN efficient energy supply, sound economic pricing, leading to cost recovery, is required in both the oil and electricity sectors.

Deforestation is eroding forest cover. The impact of plantation projects, even on a large scale, will remain minimal if deforestation is due to any great extent to agricultural patterns.

Electricity supply has to be enhanced by an improvement in maintenance and operating of facilities. The country is willing to take more advantage of power excess in Zaire. In this regard, plans to link Inga in Zaire to Pointe-Noire via Cabinda are underway.

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(10) Network Interconnections with Southern Africa, Research and Development Department of SNEL, Zaire, June 1991.

FIGURES

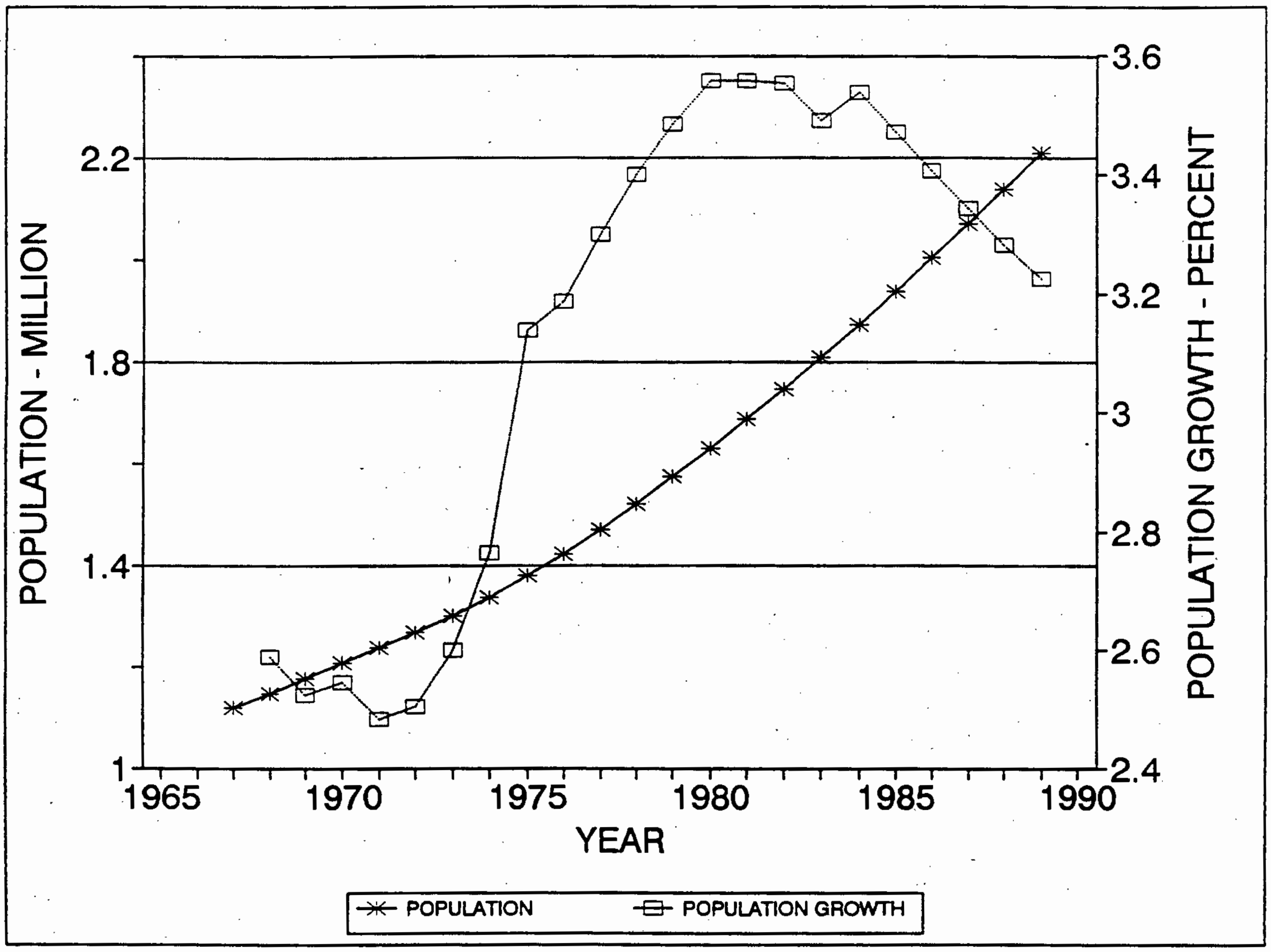


Figure 1. Population and population growth

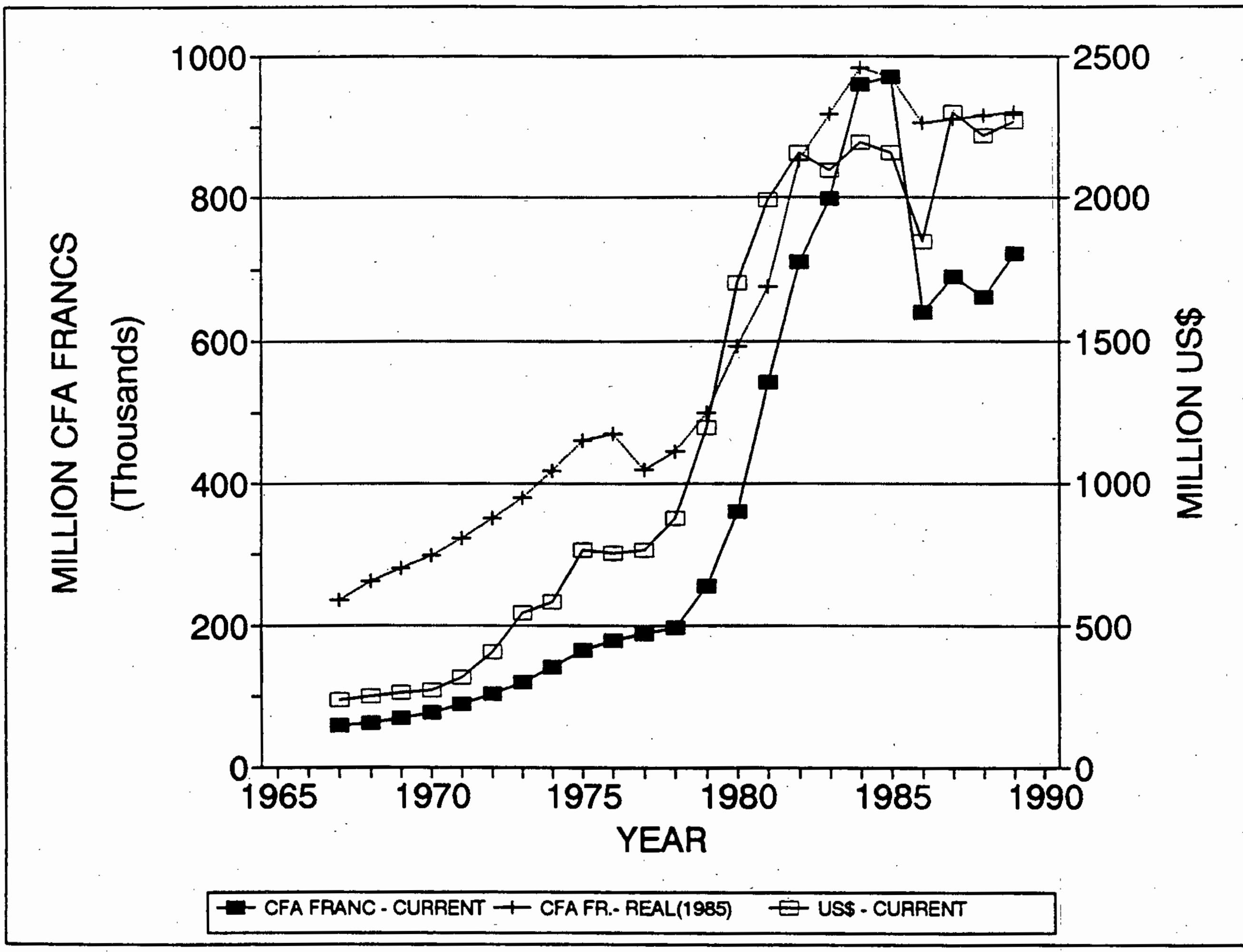


Figure 2. Gross Domestic Product (at market cost)

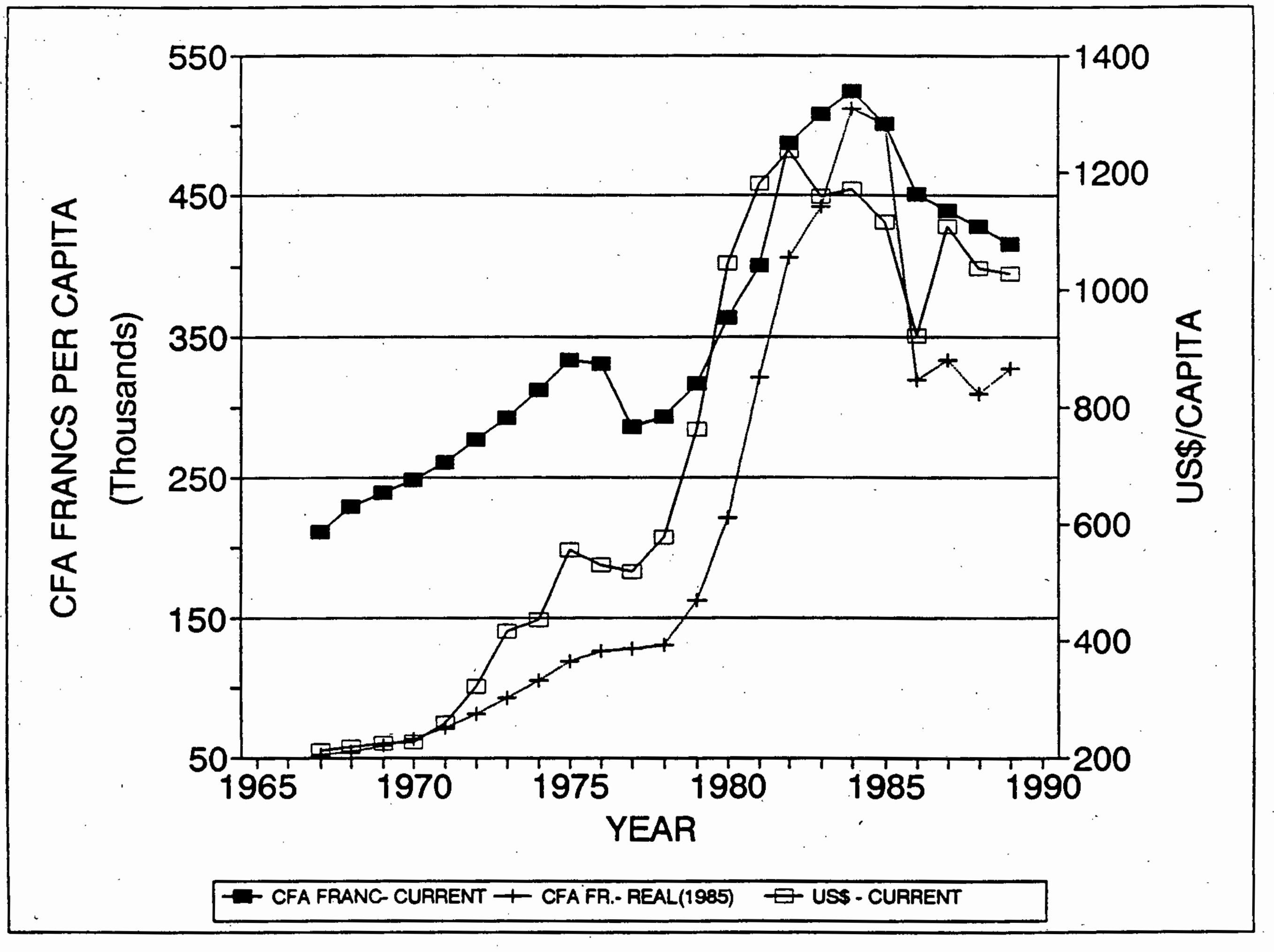


Figure 3. GDP per capita

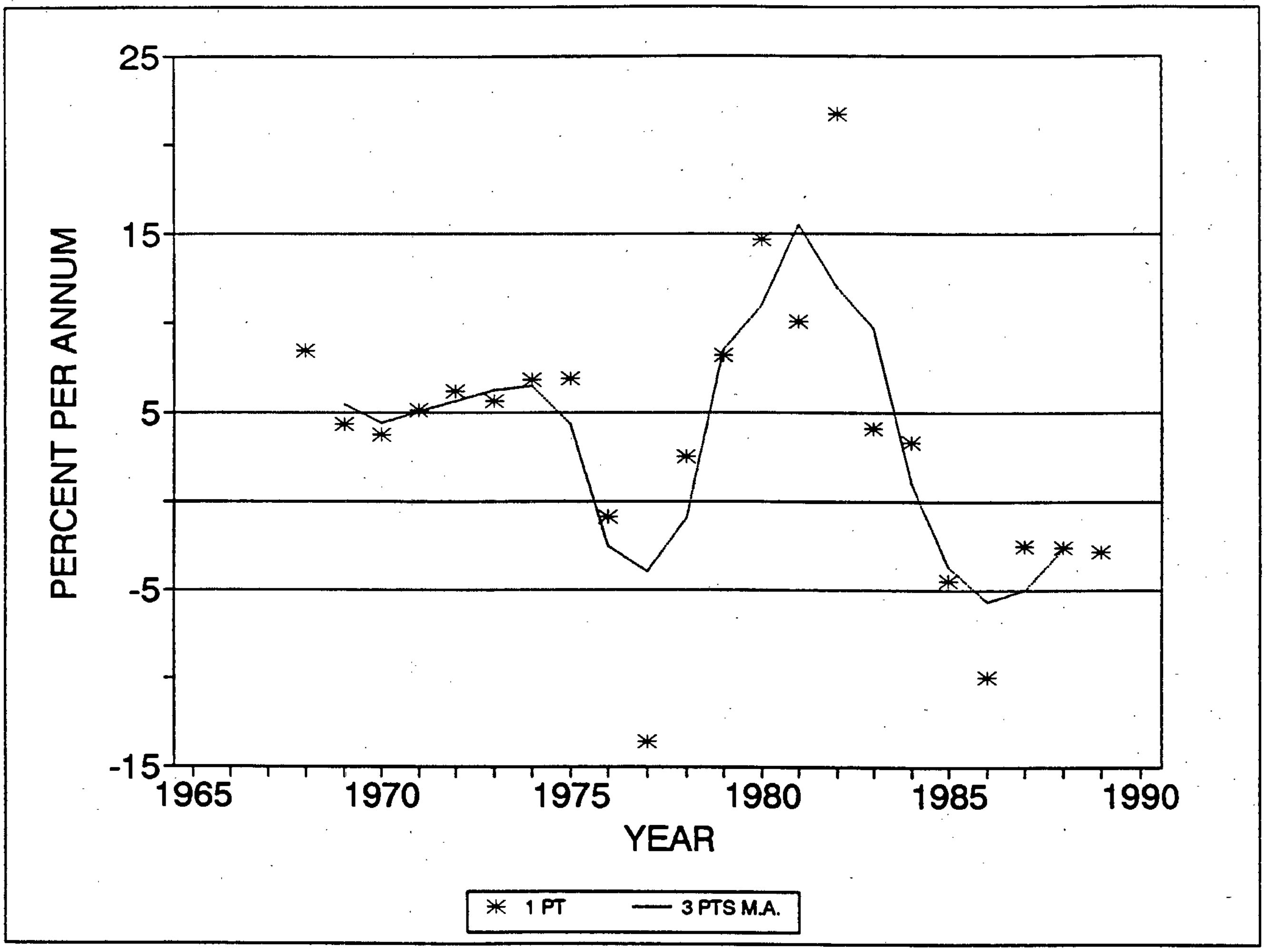


Figure 4. GDP per capita growth rate: percentage/Year (Real 1985)

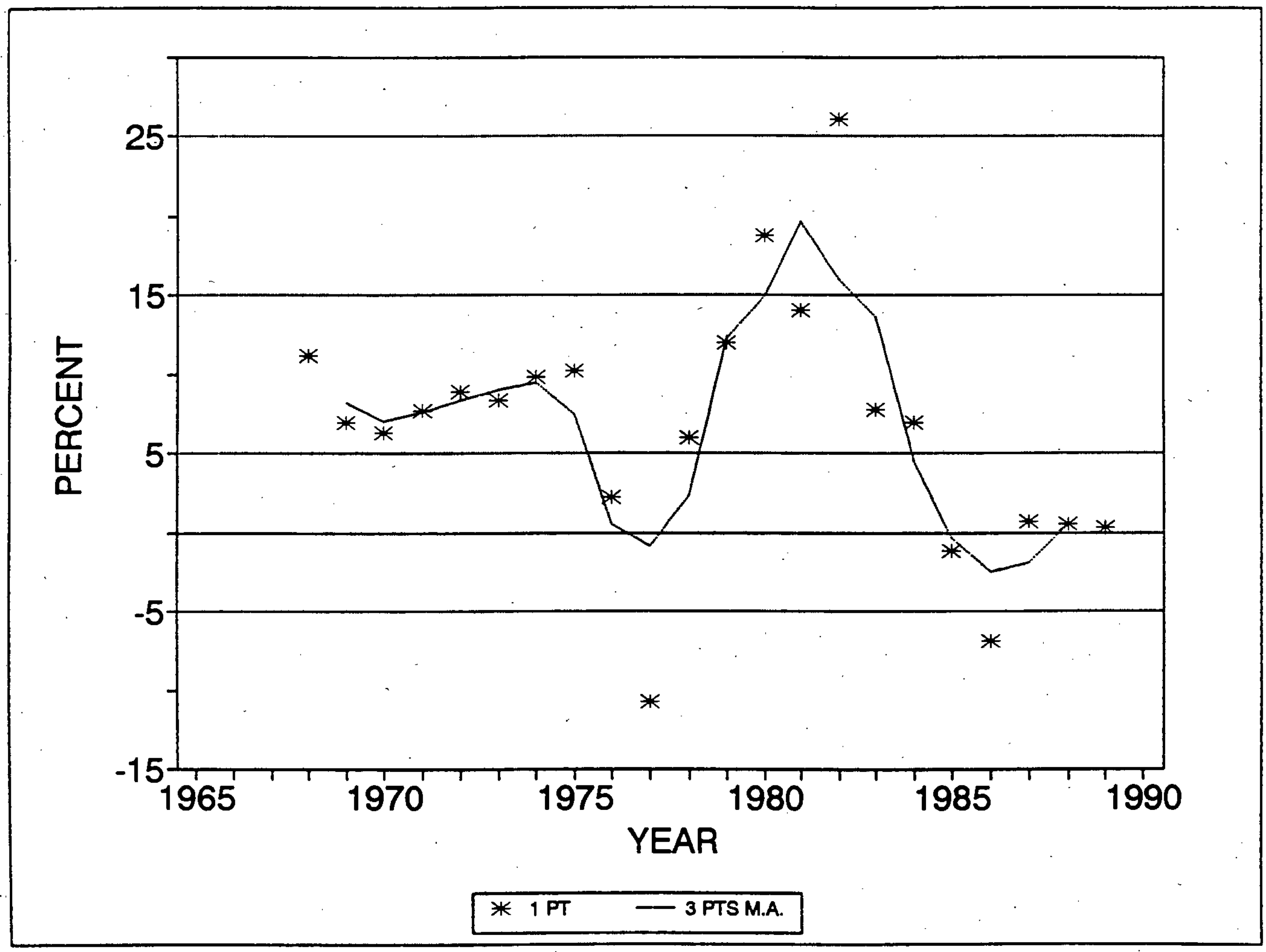


Figure 5. Gross domestic product growth rate: percentage per year (Real 1985)

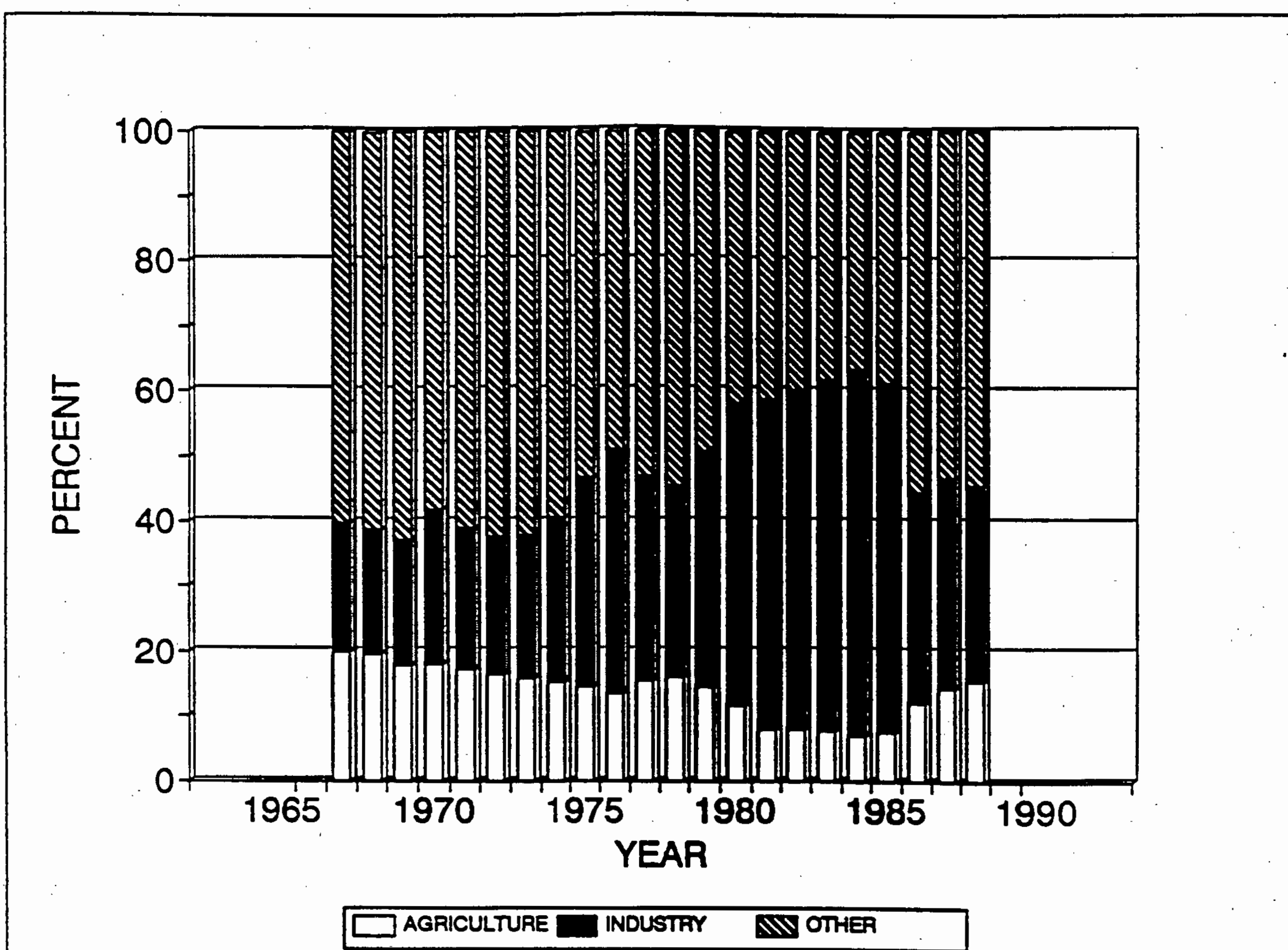


Figure 6. GDP components as percentage of total

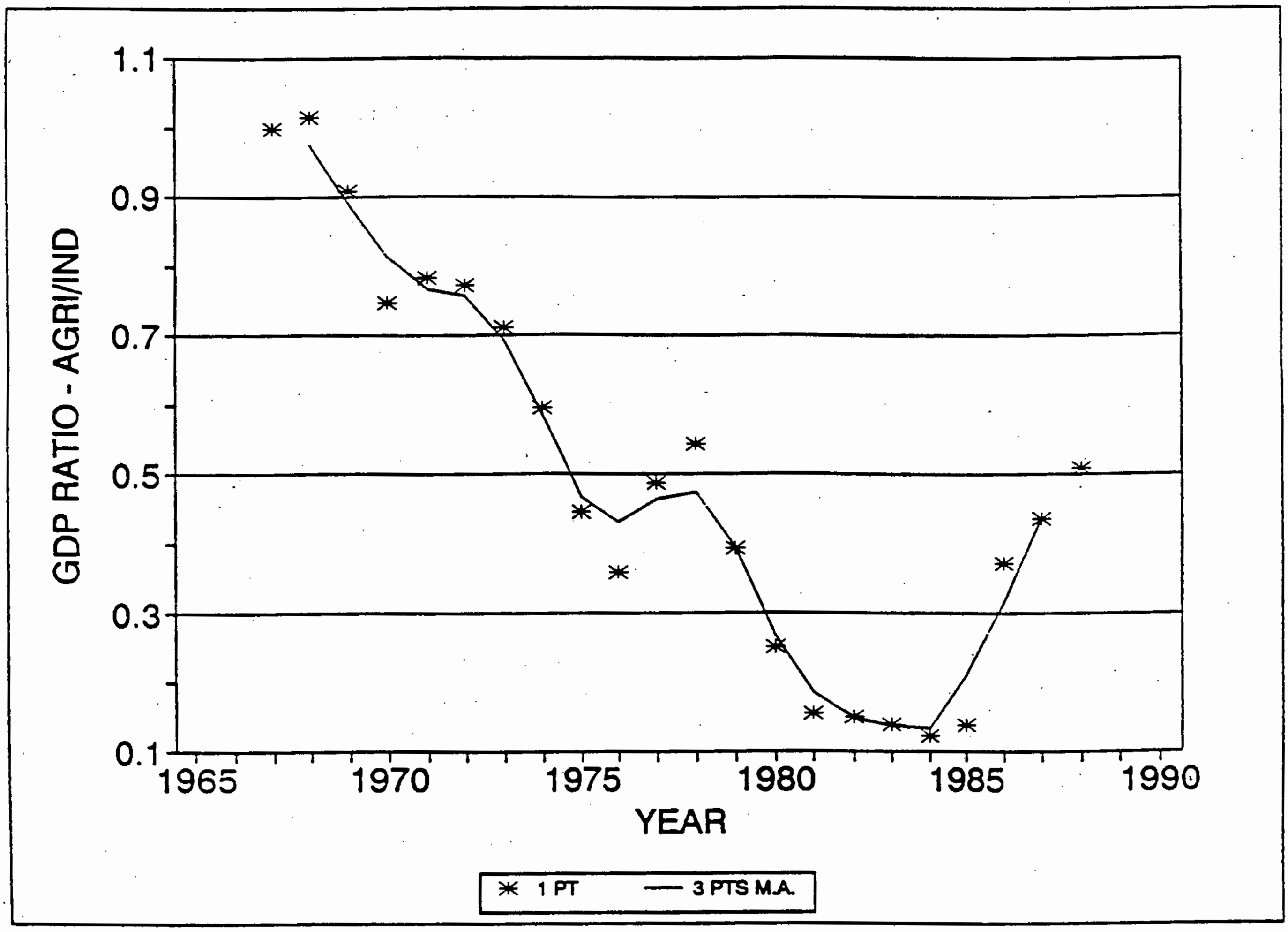


Figure 7. GDP ratio - Agriculture/Industry

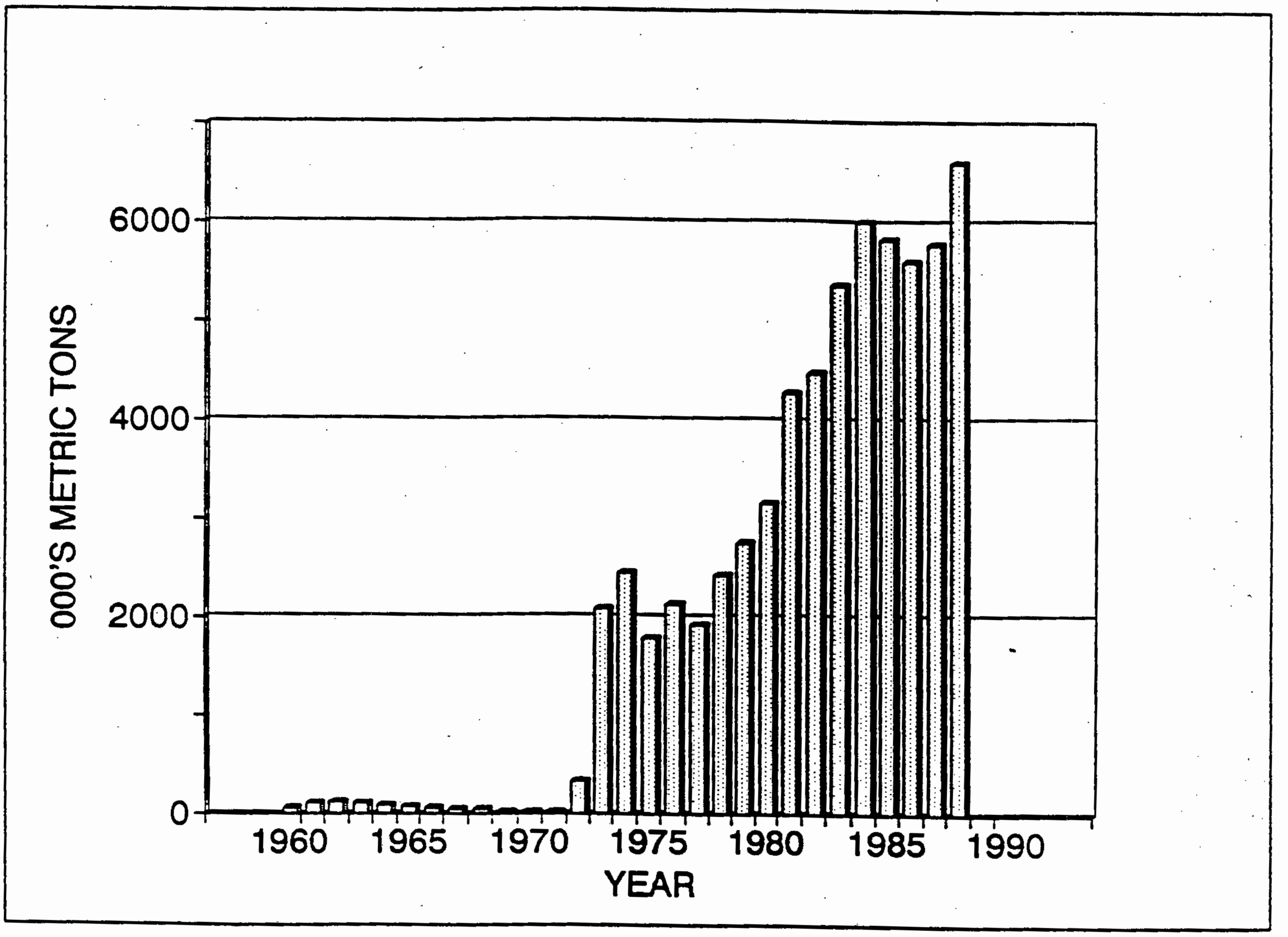


Figure 8. Crude oil production

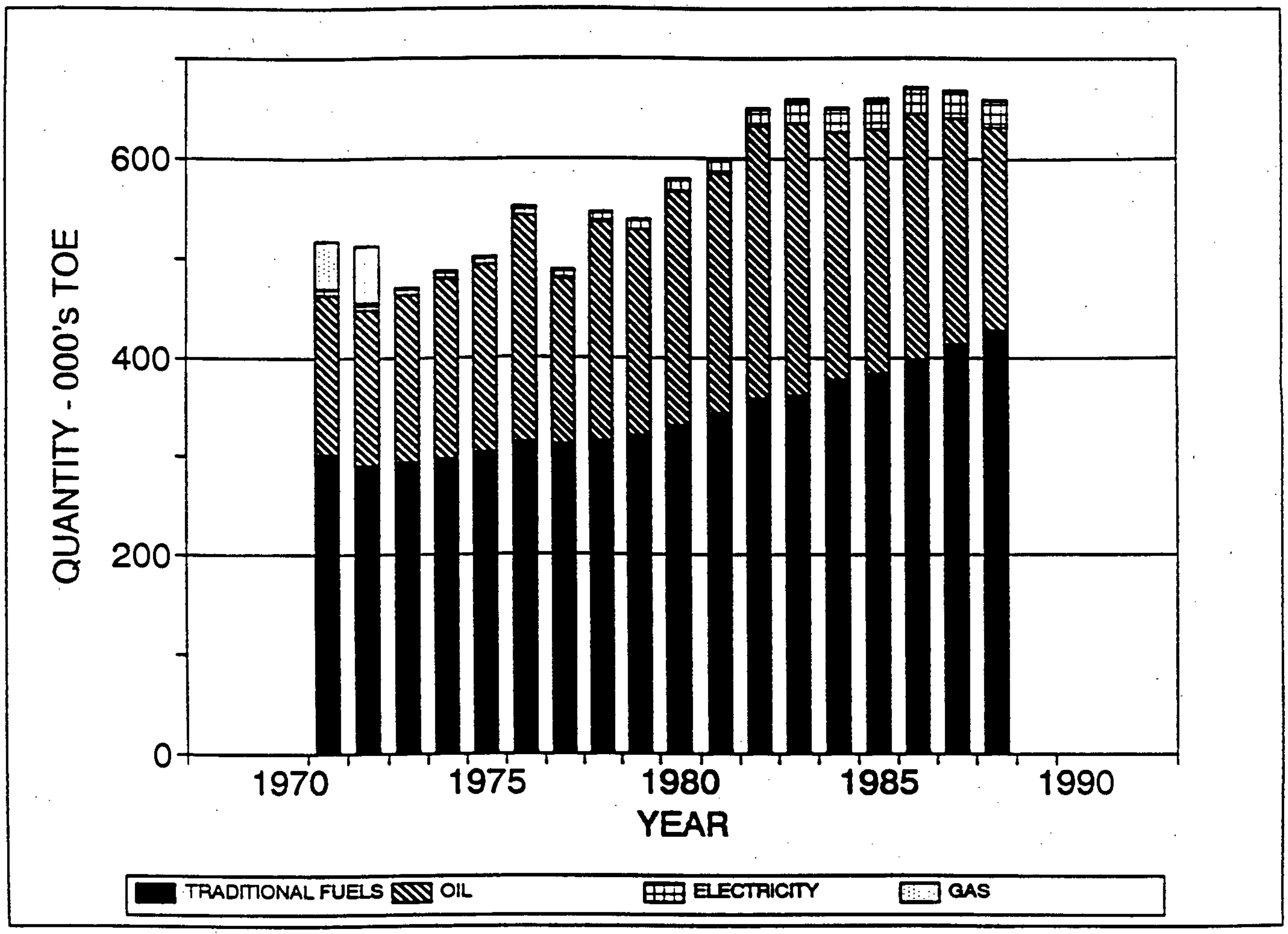


Figure 9. Total final consumption: Quantity shares of components

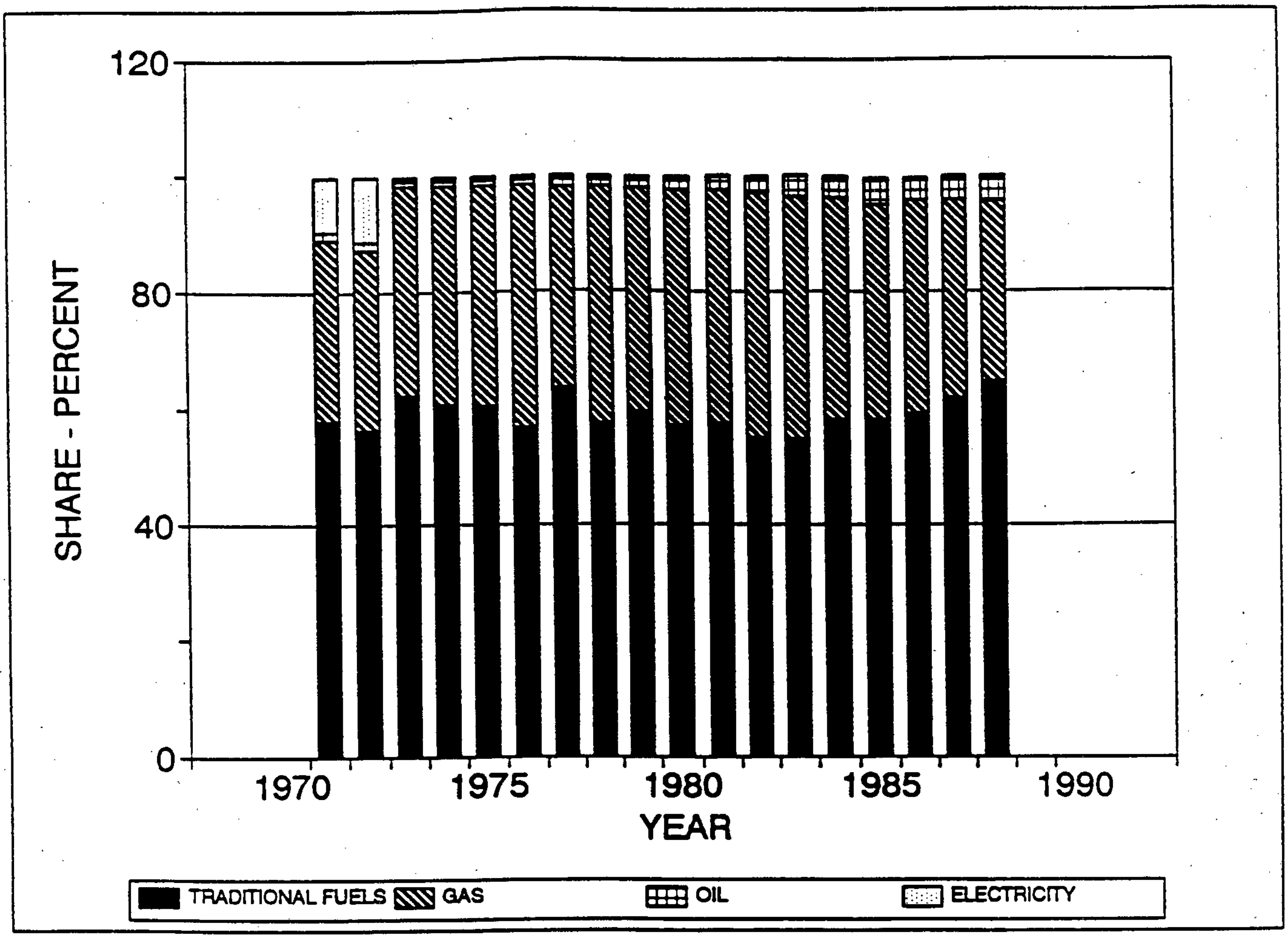


Figure 10. Total final consumption: percentage shares of components

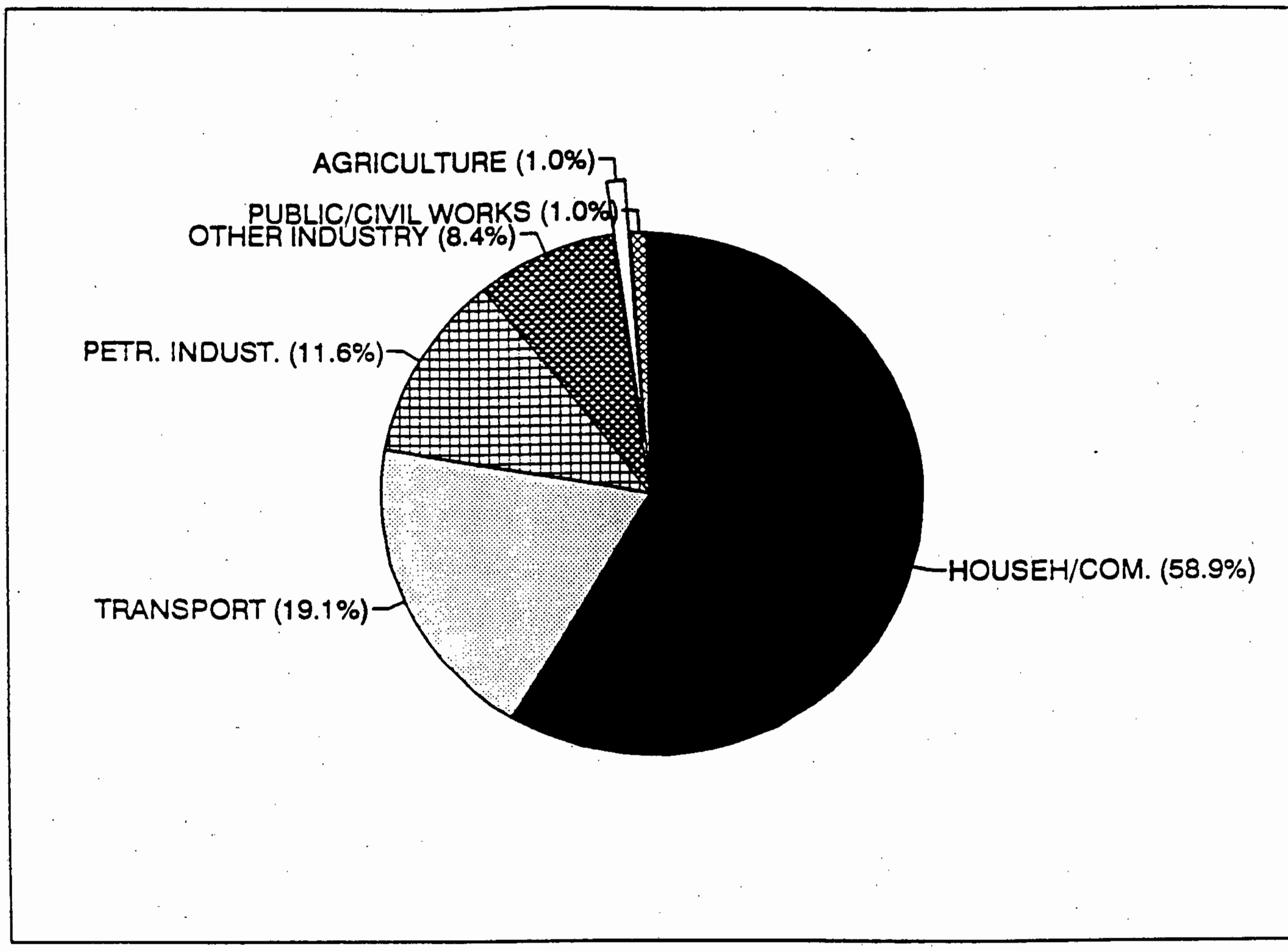


Figure 11. 1985 energy net consumption balance

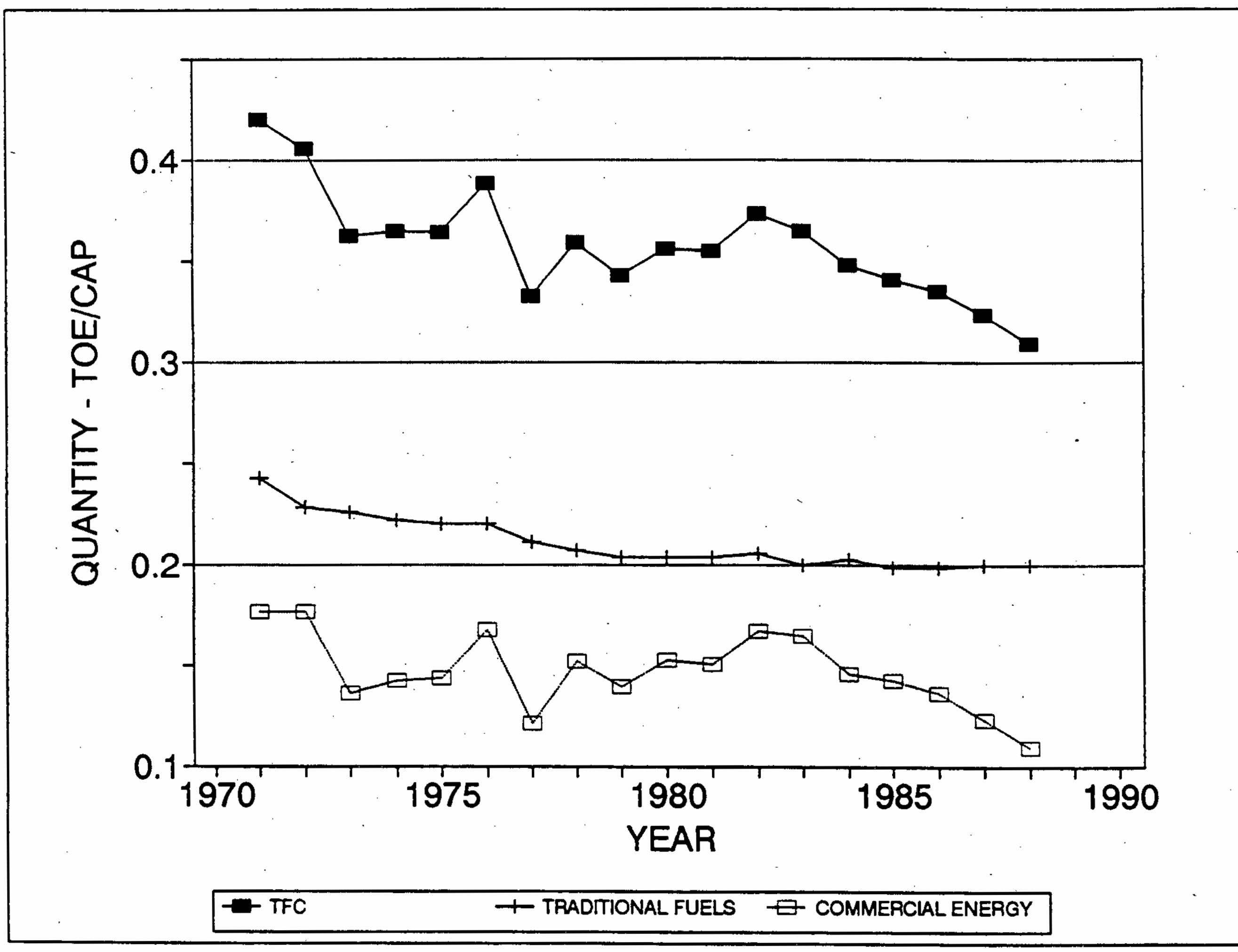


Figure 12. Energy final consumption per capita

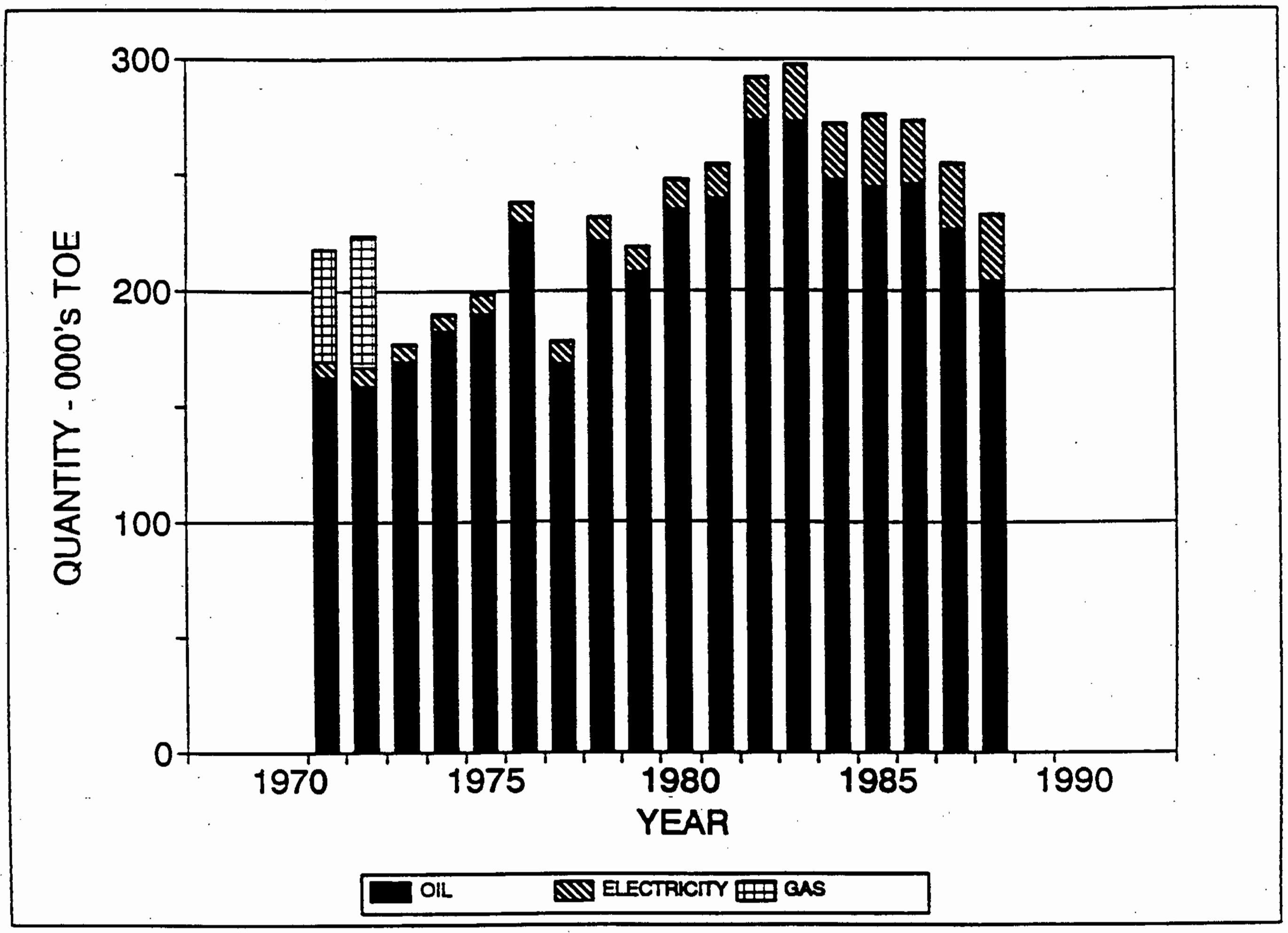


Figure 13. Commercial energy final consumption: quantity shares of components

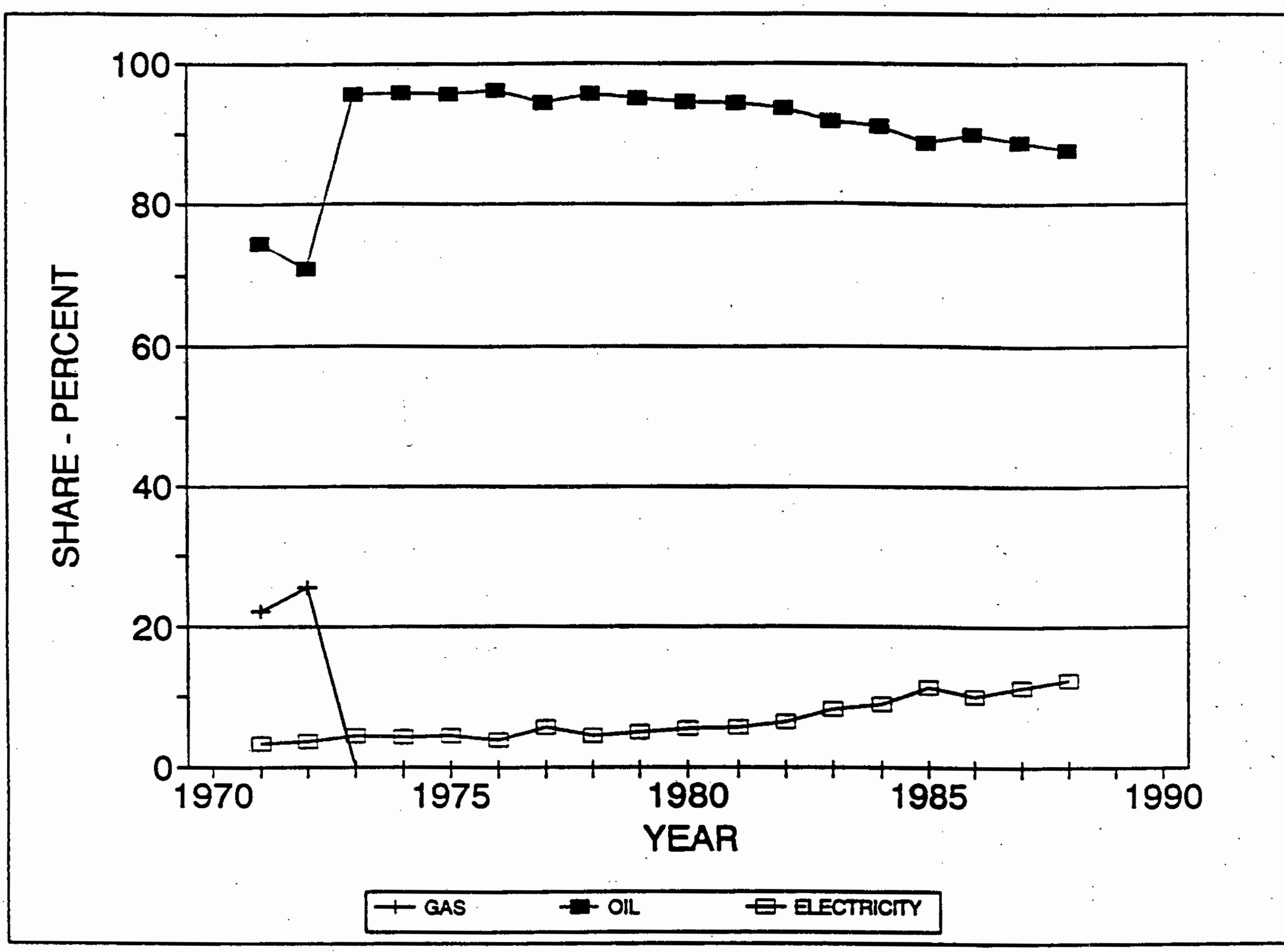


Figure 14. Commercial energy final consumption: percentage shares of components

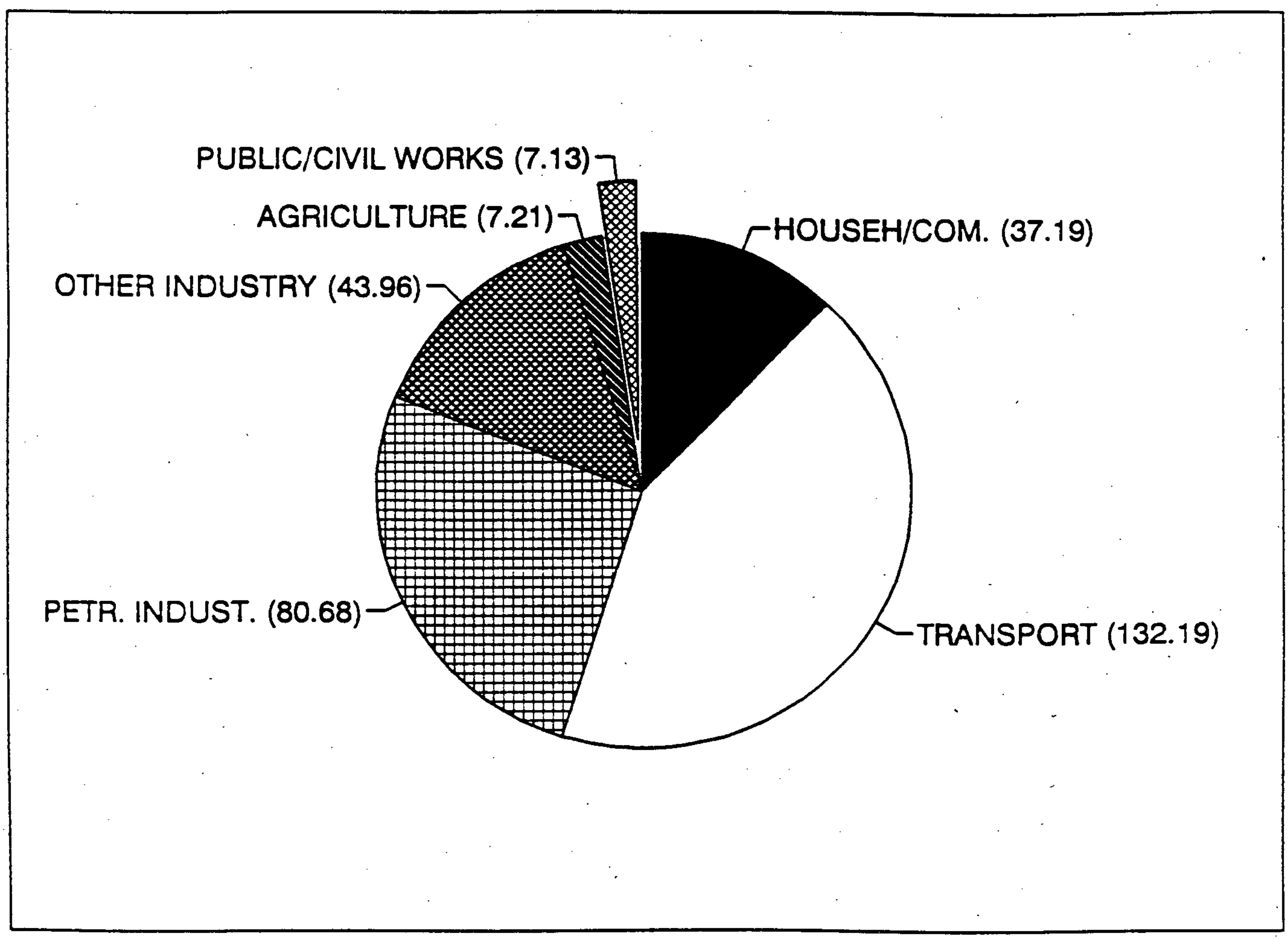


Figure 15. 1985 commercial energy net consumption: sectorial distribution (000's TOE)

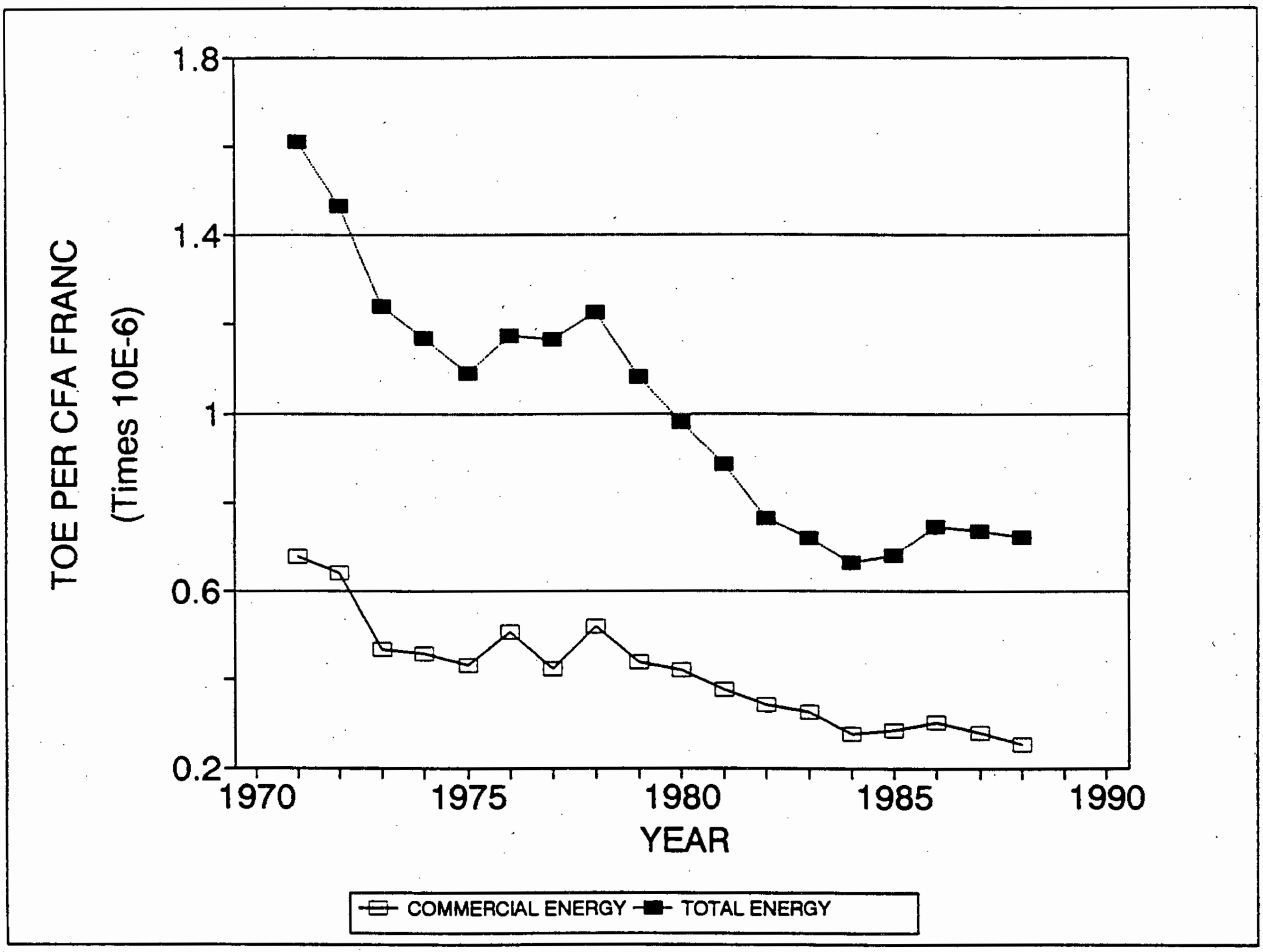


Figure 16. Energy intensity: final consumption/GDP (Real 1985)

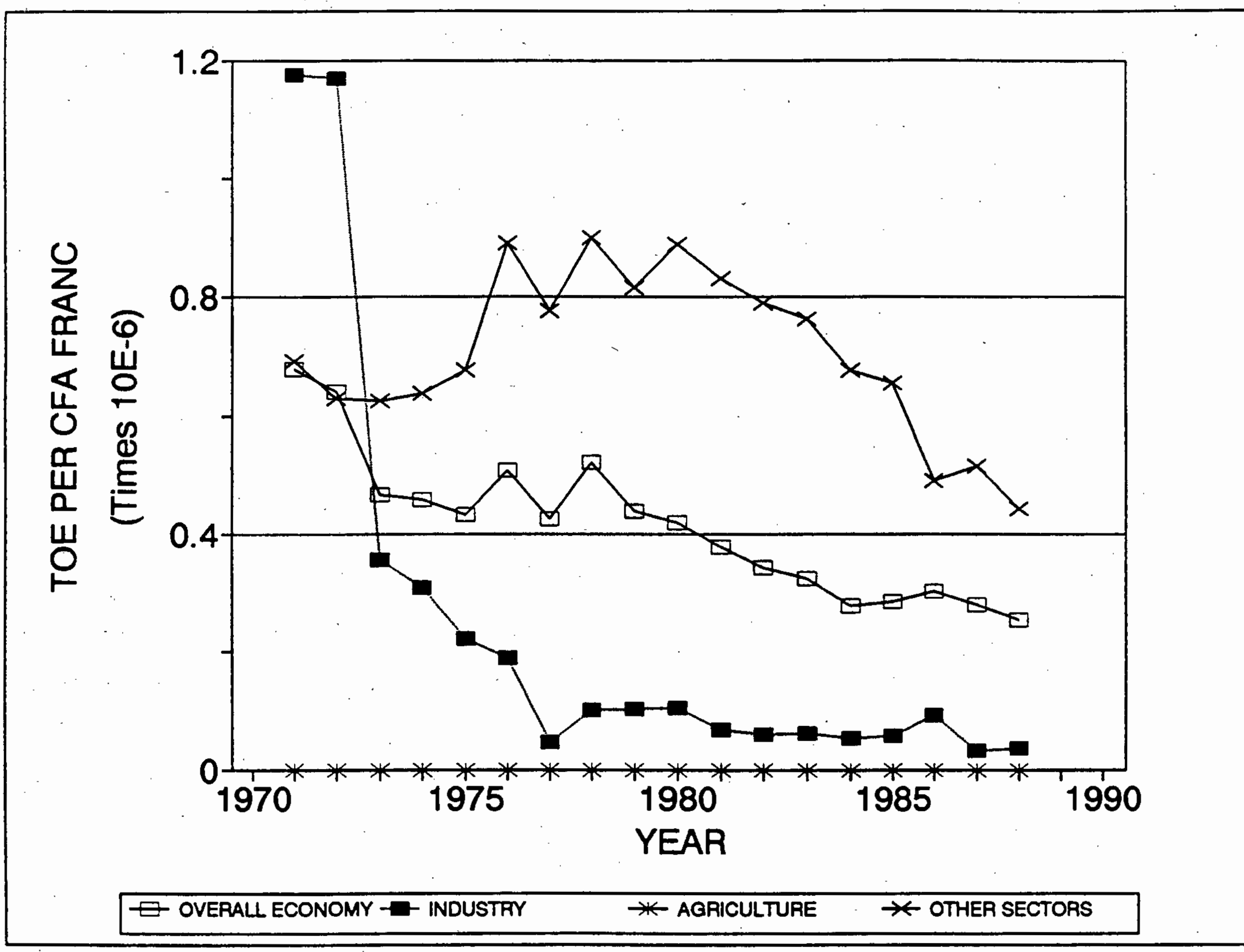


Figure 17. Commercial energy intensity: final consumption/GDP (Real 1985)

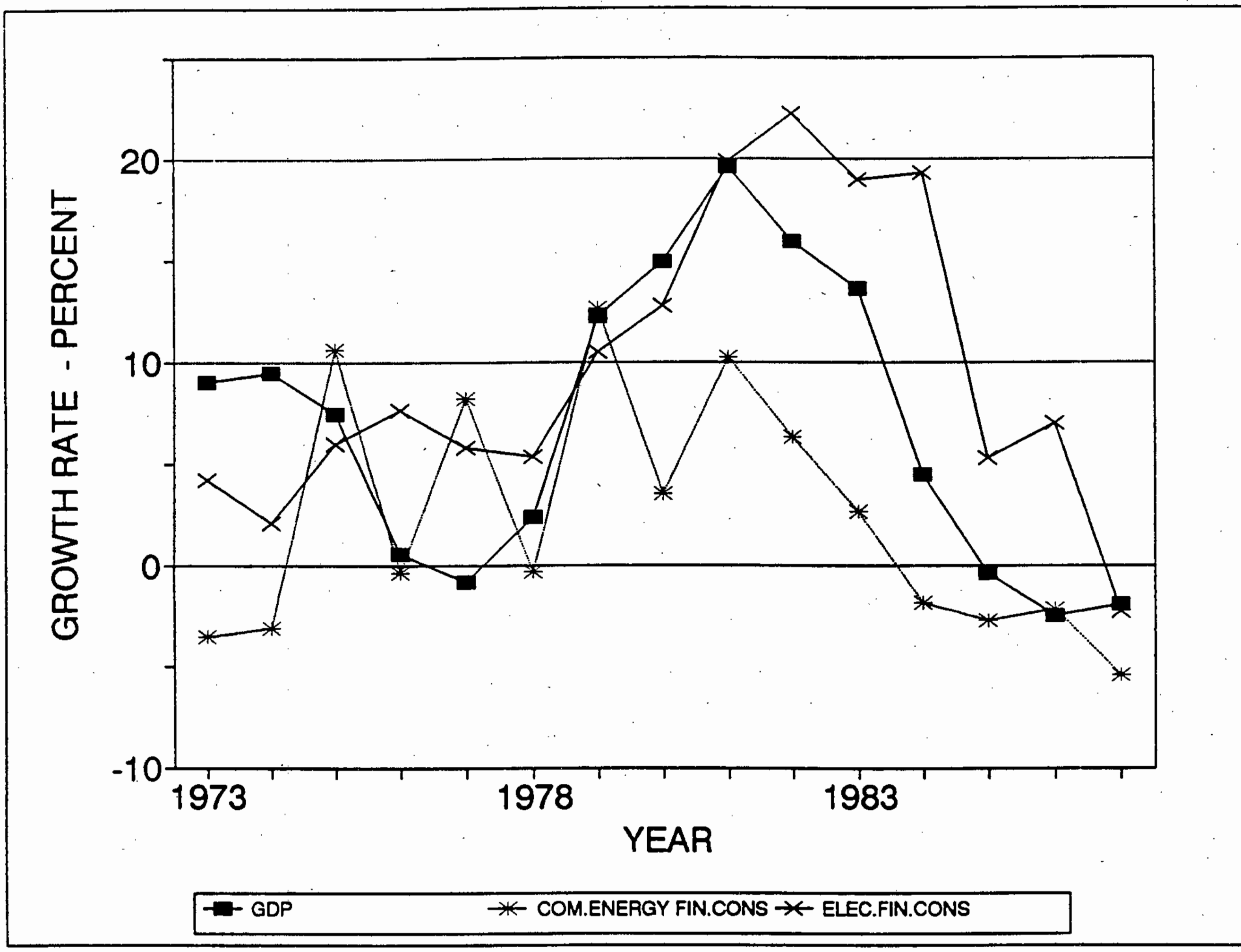


Figure 18. Growth rates (3 pts M.A.)

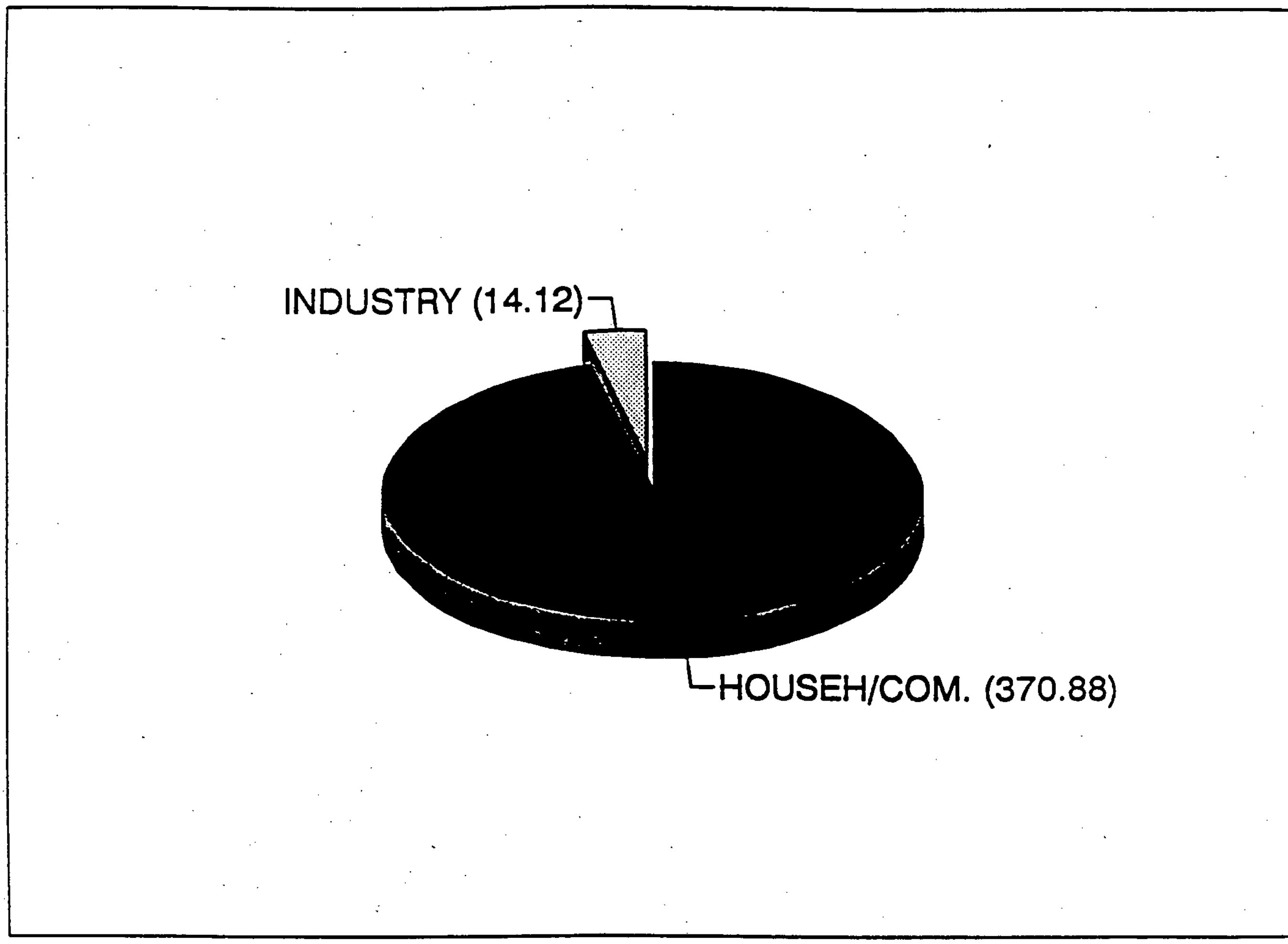


Figure 19. 1985 Traditional energy net consumption: sectorial distribution (000's TOE)

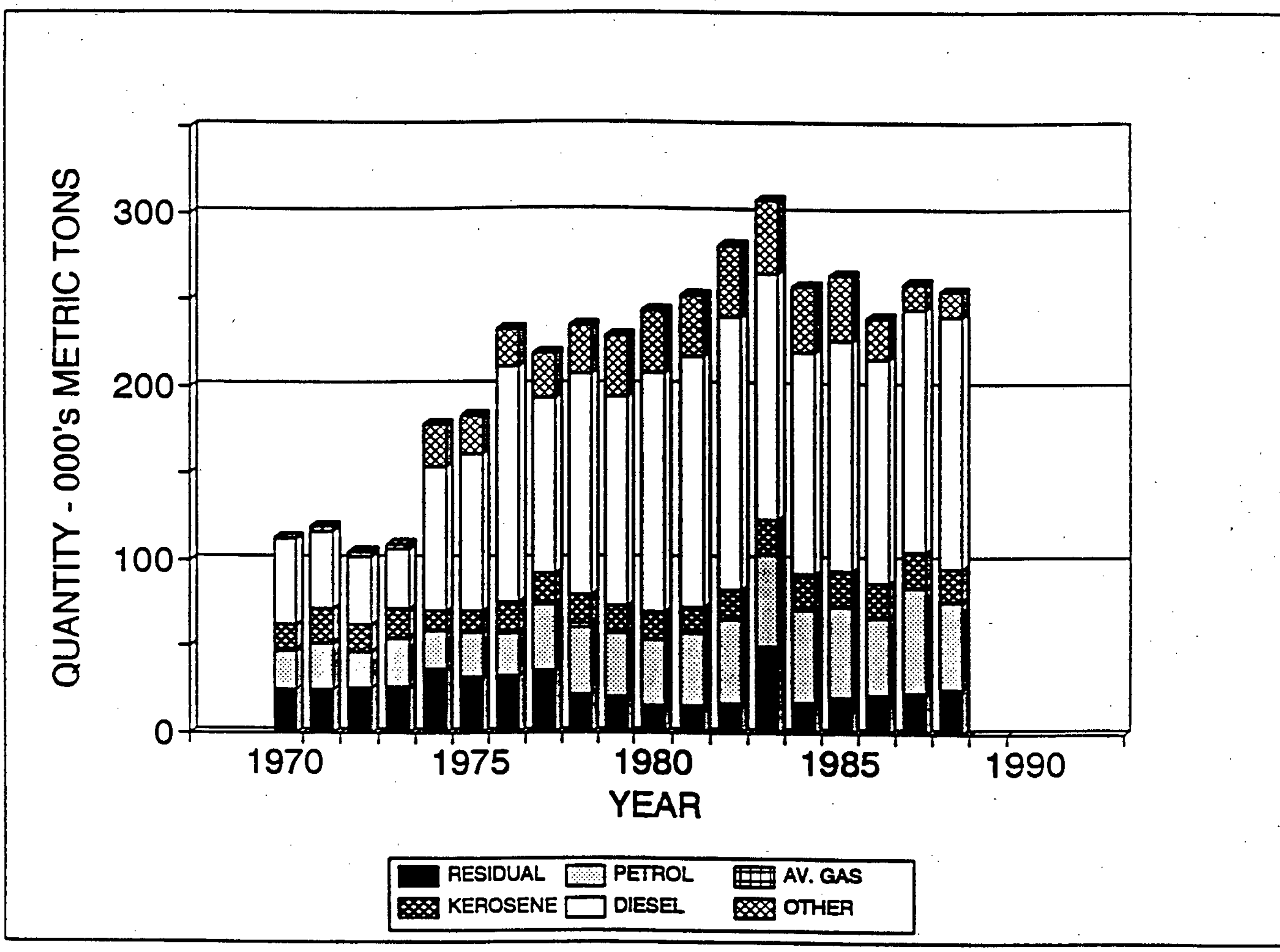


Figure 20. Oil products consumption

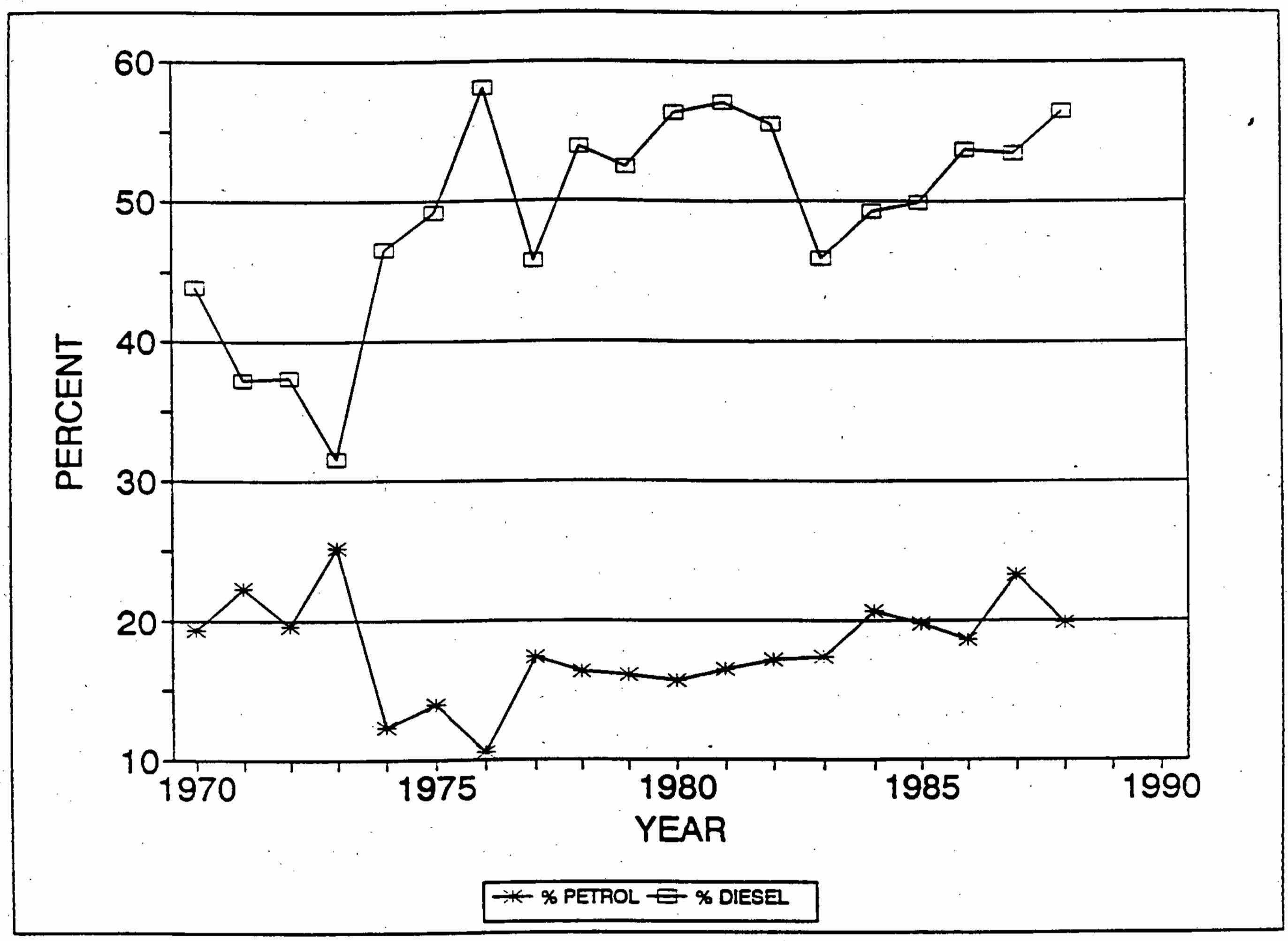


Figure 21. Petrol and diesel as percentage of oil consumption

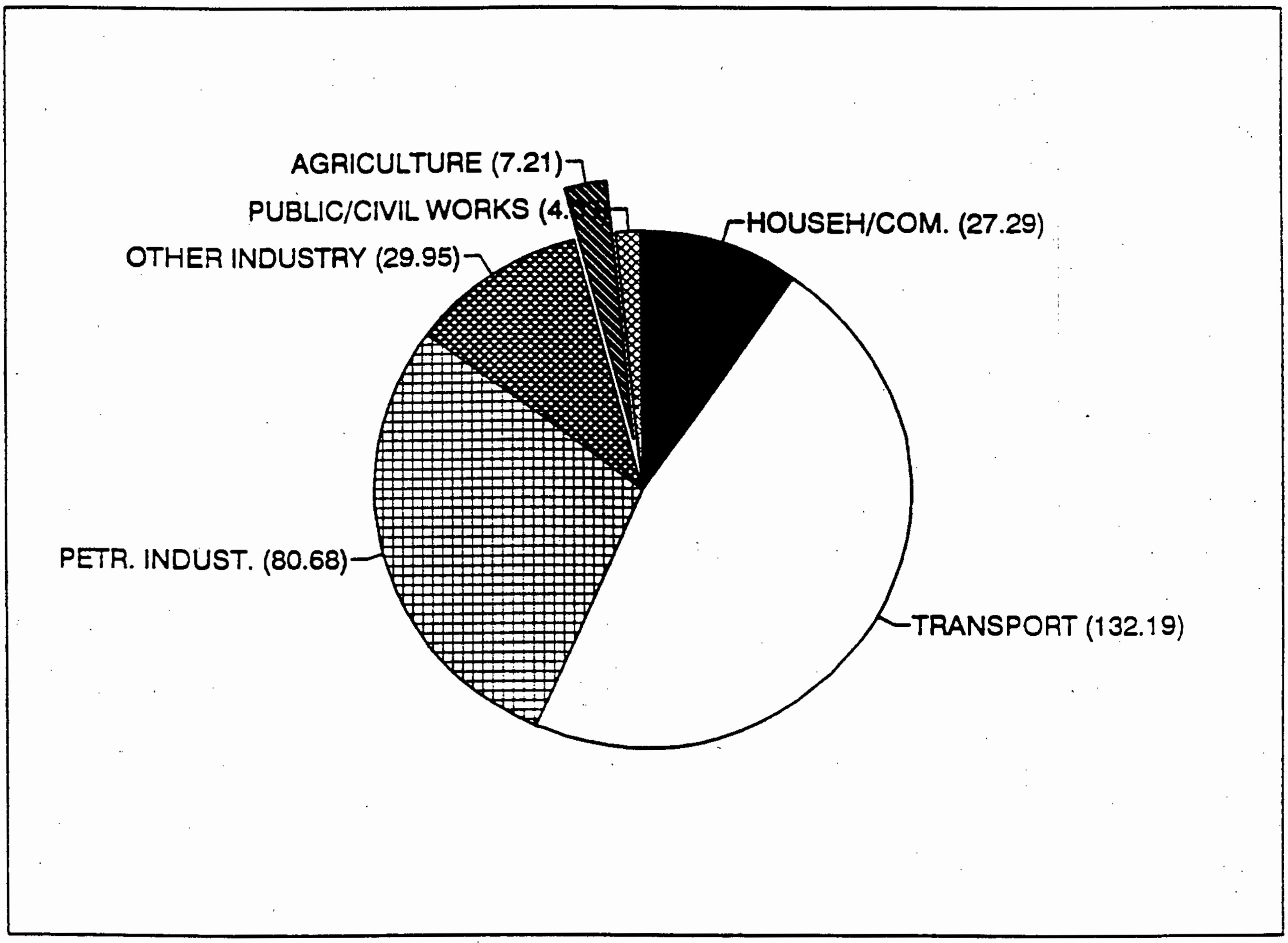


Figure 22. 1985 Oil net consumption: sectorial distribution (000's TOE)

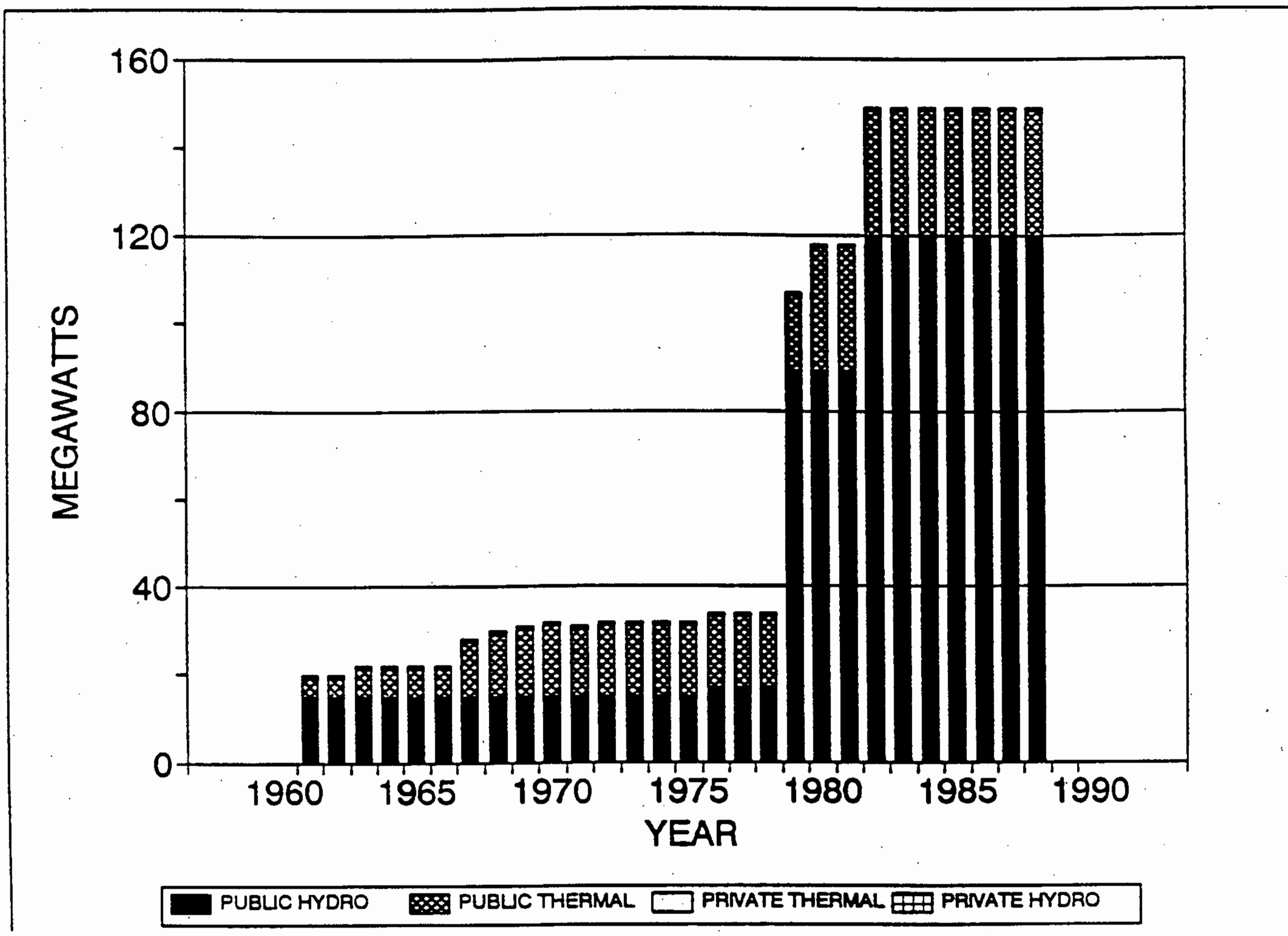


Figure 23. Electricity installed capacity

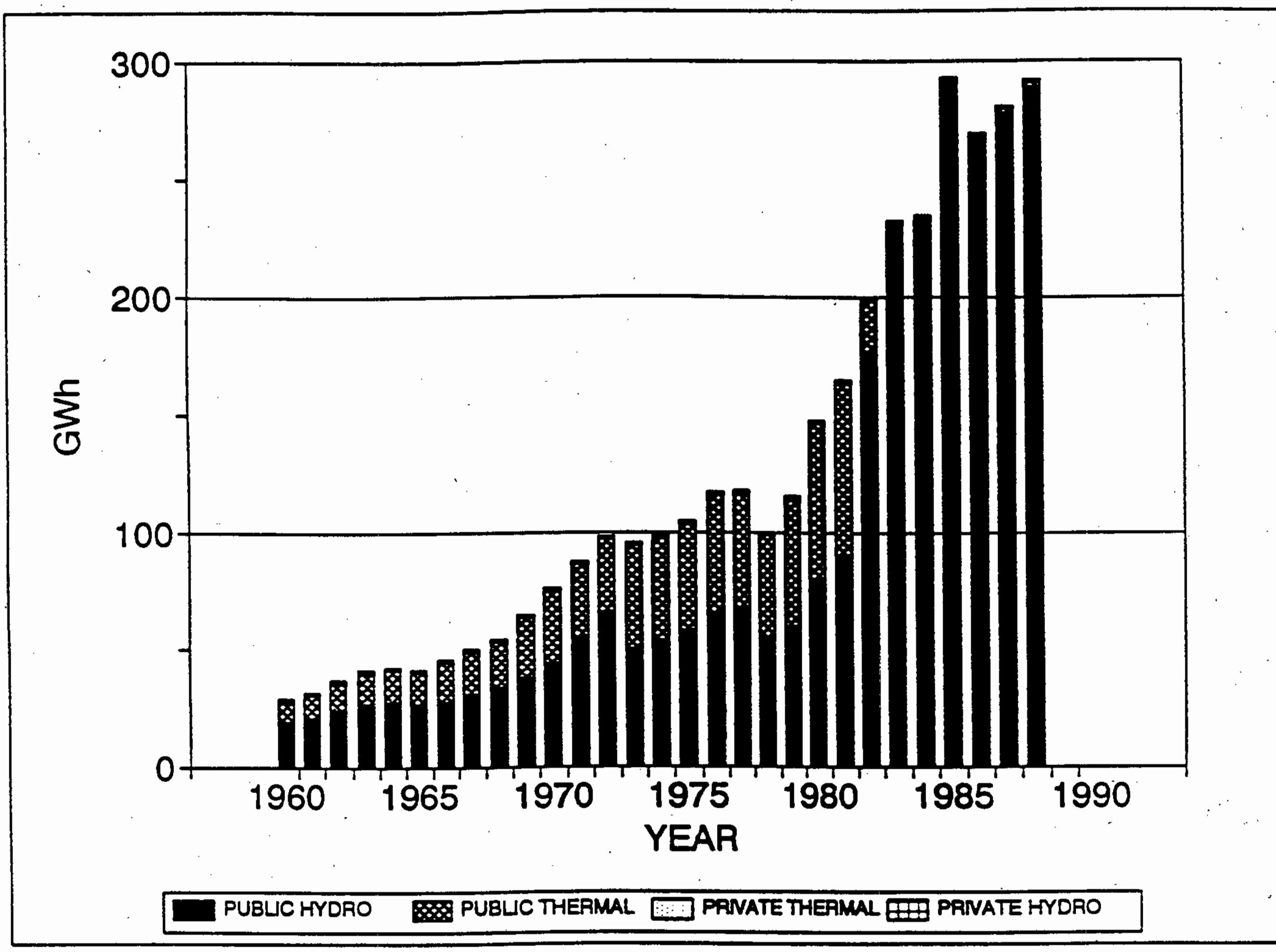


Figure 24. Electricity production

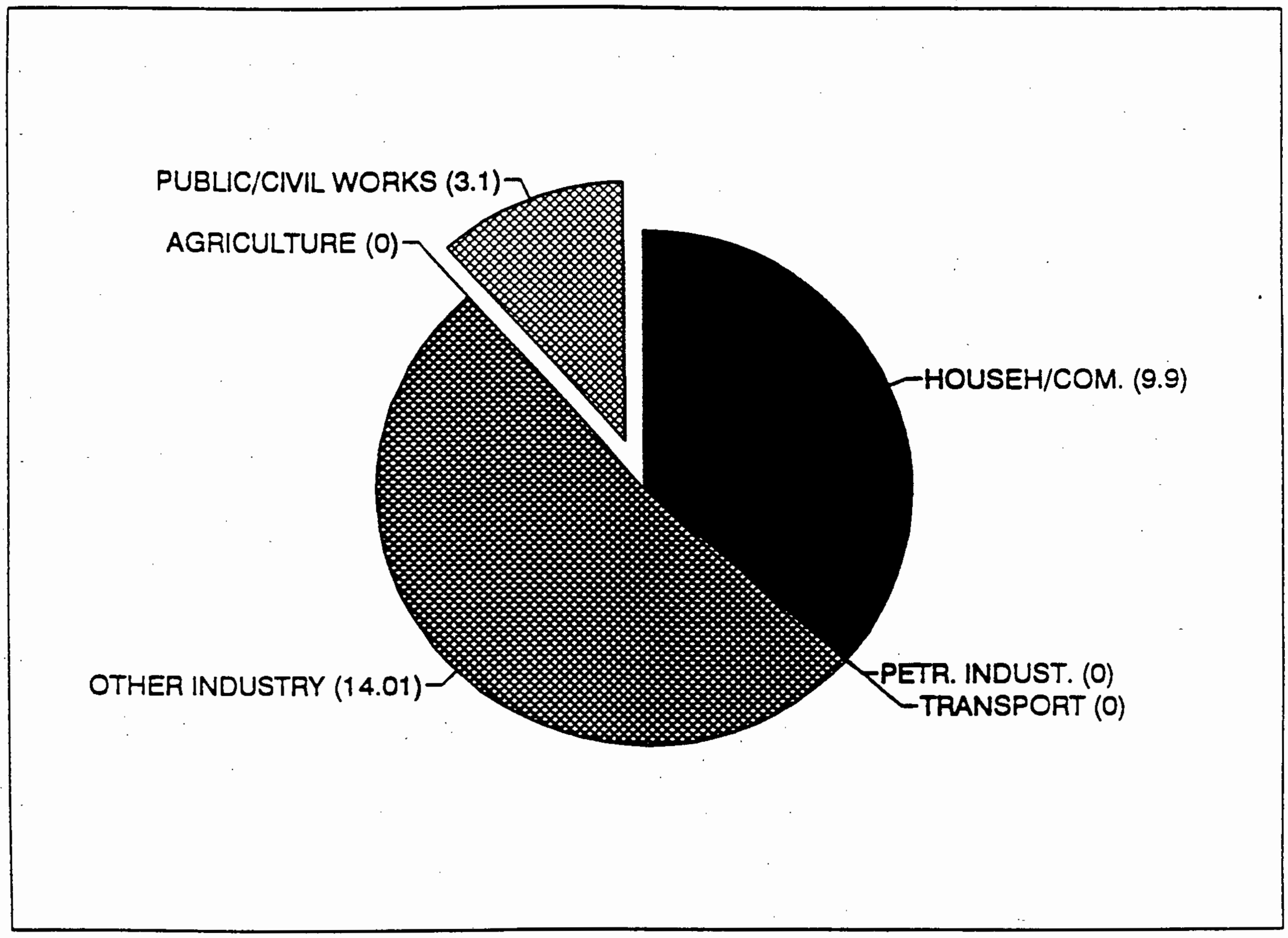


Figure 25. 1985 Electricity net consumption: sectorial distribution (000's toe)

TABLES

TABLE A: ECONOMIC INDICATORS

CURRENCY: CFA FRANCS

MILLIONS OF NATIONAL CURRENCY UNLESS INDICATED

YEAR	POPULATION: MILLIONS	POPULATION: GROWTH RATE (%)	GROSS DOMESTIC PRODUCT AT MARKET COST: AGRICULTURE	INDUSTRY: TOTAL INDUSTRY	INDUSTRY: MINING QUARRY	INDUSTRY: MANUFACTURE	INDUSTRY: ELEC,WTR, GAS	INDUSTRY: CONSTRUCTION	OTHER SERVICES + TAXES	GDP AT MARKET COST	GDP DEFLATOR	GDP AT 1985 PRICES MARKET	GDP/CAPITA: CURRENT	GDP/CAPITA: REAL 1985	EXCHANGE RATE CFA FRANCS PER US$	GDP IN US$(MILL): CURRENT PRICE MARKET	GDP IN US$(MILL): AT 1985 PRICE MARKET	GDP PER CAPITA: US$/CAP	GDP PER CAPITA: US$(1985)/CAPITA
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	1.120	NA	11600	11600	NA	NA	NA	NA	35200	58400	24.7	236437	52143	211105	246.85	237	526	211	470
1968	1.149	2.59	12200	12000	NA	NA	NA	NA	38000	62200	23.7	263002	54134	228897	246.85	252	585	219	509
1969	1.178	2.52	12200	13400	NA	NA	NA	NA	43300	68900	24.5	281359	58489	238845	259.71	265	626	225	532
1970	1.208	2.55	13600	18200	NA	NA	NA	NA	44200	76000	25.4	299236	62914	247712	277.71	274	666	227	551
1971	1.238	2.48	15200	19400	NA	NA	NA	NA	54100	88700	27.5	322301	71648	260340	277.13	320	717	259	579
1972	1.269	2.50	17000	22000	NA	NA	NA	NA	64500	103500	29.5	350942	81560	276550	252.21	410	781	323	616
1973	1.302	2.60	19000	26700	NA	NA	NA	NA	75100	120800	31.8	380275	92780	292070	222.70	542	846	417	650
1974	1.338	2.76	21300	35800	NA	NA	NA	NA	83800	140900	33.7	417634	105306	312133	240.50	586	930	438	695
1975	1.380	3.14	23800	53300	NA	NA	NA	NA	87300	164400	35.7	460390	119130	333616	214.32	767	1025	556	743
1976	1.424	3.19	24300	67800	NA	NA	NA	NA	88200	180300	38.3	470922	126615	330704	238.98	754	1048	530	736
1977	1.471	3.30	29000	59500	NA	NA	NA	NA	99500	188000	44.7	420292	127804	285718	245.67	765	936	520	636
1978	1.521	3.40	31800	58500	NA	18600	NA	NA	108000	198300	44.5	445584	130375	292955	225.64	879	992	578	652
1979	1.574	3.48	36500	92800	NA	21500	NA	NA	125700	255000	51.1	499028	162008	317045	212.72	1199	1111	762	706
1980	1.630	3.56	42100	168000	NA	27000	NA	NA	150300	360400	60.8	592728	221104	363637	211.30	1706	1319	1046	809
1981	1.688	3.56	42700	275700	NA	34300	NA	NA	223300	541700	80.1	675972	320912	400457	271.73	1994	1505	1181	891
1982	1.748	3.55	55800	373200	NA	33900	NA	NA	281000	710000	83.3	852129	406178	487488	328.62	2161	1897	1236	1085
1983	1.809	3.49	60600	434200	NA	44100	NA	NA	304400	799200	87.0	918245	441791	507598	381.07	2097	2044	1159	1130
1984	1.873	3.54	66300	542400	NA	46500	NA	NA	349800	958500	97.6	982332	511746	524470	436.96	2194	2187	1171	1167
1985	1.938	3.47	72300	523400	398041	54600	11906	55895	375100	970800	100.0	970800	500929	500929	449.26	2161	2161	1115	1115
1986	2.004	3.41	77400	208500	99444	61300	9054	38806	354500	640400	70.8	904376	319561	451286	346.30	1849	2013	923	1005
1987	2.071	3.34	82400	247200	155188	59800	10614	21580	361000	690600	75.8	910901	333462	439837	300.54	2298	2028	1110	979
1988	2.139	3.28	90900	206200	NA	58900	NA	NA	364000	661100	72.2	915957	309070	428217	297.85	2220	2039	1038	953
1989	2.208	3.23	99100	256700	NA	61800	NA	NA	368000	723800	78.8	918857	327808	416149	319.01	2269	2045	1028	926
1990	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)
REGIONAL SURVEY OF THE WORLD, AFRICA, SOUTH OF SAHARA 1991 (20th EDITION)

TABLE B: ENERGY BREAKDOWN

YEAR	TOTAL FINAL CONSUMPTION (000s TOE): COMMERCIAL FORMS OF ENERGY COAL	OIL	HYDRO	GAS	ELECT	TOTAL	TRAD. ENERGY	TOTAL ENERGY (TRAD + COM)	ENERGY FORMS AS % OF TFC COM. ENERGY	TRAD. ENERGY	ENERGY FORMS PER CAPITA (TOE/CAPITA): OIL	ELECTRICITY	COM. ENERGY	TRAD. ENERGY	TOTAL ENERGY	RATIO COM.ENERGY/ TRAD.ENERGY	FINAL CONSUMPTION OF OIL IN OIL REFINERIES 000s TOE	% OF OIL TFC
1970	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1971	0	162.9	0	48.5	7.2	218.6	301	519.6	42.1	57.9	0.13	0.01	0.18	0.24	0.42	0.73	0.0	0.0
1972	0	159.2	0	57.2	8.2	224.6	290	514.6	43.6	56.4	0.13	0.01	0.18	0.23	0.41	0.77	0.0	0.0
1973	0	169.7	0	0.0	7.9	177.6	294	471.6	37.7	62.3	0.13	0.01	0.14	0.23	0.36	0.60	0.0	0.0
1974	0	183.0	0	0.0	8.1	191.1	297	488.1	39.2	60.8	0.14	0.01	0.14	0.22	0.36	0.64	0.0	0.0
1975	0	190.1	0	0.0	8.7	198.8	304	502.8	39.5	60.5	0.14	0.01	0.14	0.22	0.36	0.65	0.0	0.0
1976	0	229.5	0	0.0	9.4	238.9	314	552.9	43.2	56.8	0.16	0.01	0.17	0.22	0.39	0.76	0.0	0.0
1977	0	168.5	0	0.0	10.1	178.6	311	489.6	36.5	63.5	0.11	0.01	0.12	0.21	0.33	0.57	0.0	0.0
1978	0	221.5	0	0.0	10.3	231.8	315	546.8	42.4	57.6	0.15	0.01	0.15	0.21	0.36	0.74	0.0	0.0
1979	0	208.2	0	0.0	11.0	219.2	321	540.2	40.6	59.4	0.13	0.01	0.14	0.20	0.34	0.68	0.0	0.0
1980	0	235.3	0	0.0	13.5	248.8	332	580.8	42.8	57.2	0.14	0.01	0.15	0.20	0.36	0.75	0.0	0.0
1981	0	240.3	0	0.0	14.7	255.0	344	599.0	42.6	57.4	0.14	0.01	0.15	0.20	0.35	0.74	0.0	0.0
1982	0	273.9	0	0.0	18.8	292.7	360	652.7	44.8	55.2	0.16	0.01	0.17	0.21	0.37	0.81	0.0	0.0
1983	0	273.4	0	0.0	24.4	297.8	362	659.8	45.1	54.9	0.15	0.01	0.16	0.20	0.36	0.82	88.1	32.2
1984	0	248.3	0	0.0	24.2	272.5	379	651.5	41.8	58.2	0.13	0.01	0.15	0.20	0.35	0.72	77.4	31.2
1985	0	244.8	0	0.0	31.2	276.0	385	661.0	41.8	58.2	0.13	0.02	0.14	0.20	0.34	0.72	80.6	32.9
1986	0	246.0	0	0.0	27.4	273.4	399	672.4	40.7	59.3	0.12	0.01	0.14	0.20	0.34	0.69	62.4	25.4
1987	0	226.6	0	0.0	28.6	255.2	414	669.2	38.1	61.9	0.11	0.01	0.12	0.20	0.32	0.62	61.3	27.1
1988	0	204.4	0	0.0	28.9	233.3	428	661.3	35.3	64.7	0.10	0.01	0.11	0.20	0.31	0.55	70.8	34.6
1989	NA	NA	NA	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	NA

DATA OBTAINED FROM: IEA WORLD ENERGY STATISTICS AND BALANCES (1971-1988)

TABLE C: SECTORIAL DISTRIBUTION OF TOTAL FINAL CONSUMPTION (000's TOE)

YEAR	GAS		OIL						ELECTRICITY						TOTAL					
	IND	TOTAL	IND	TRANS	AGRI	RESID.	OTHER	TOTAL	IND	TRANS	AGRI	RESID.	OTHER	TOTAL	IND	TRANS	AGRI	RESID.	OTHER	TOTAL
1970	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1971	48.5	48.5	30.7	121.6	0.0	10.6	0.0	162.9	3.6	0.0	0.0	3.6	0.0	7.2	82.8	121.6	0.0	14.2	0.1	218.7
1972	57.2	57.2	25.9	122.6	0.0	10.6	0.1	159.2	4.1	0.0	0.0	4.0	0.1	8.2	87.2	122.6	0.0	14.6	0.2	224.6
1973	0.0	0.0	25.9	131.0	0.0	12.7	0.1	169.7	4.0	0.0	0.0	4.0	-0.1	7.9	29.9	131.0	0.0	16.7	0.0	177.6
1974	0.0	0.0	28.8	140.3	0.0	13.8	0.1	183.0	4.0	0.0	0.0	4.0	0.1	8.1	32.8	140.3	0.0	17.8	0.2	191.1
1975	0.0	0.0	28.8	147.6	0.0	13.8	-0.1	190.1	4.4	0.0	0.0	4.3	-0.0	8.7	33.2	147.6	0.0	18.1	-0.1	198.8
1976	0.0	0.0	28.8	185.9	0.0	14.8	-0.0	229.5	4.7	0.0	0.0	4.6	0.1	9.4	33.5	185.9	0.0	19.4	0.1	238.9
1977	0.0	0.0	1.0	149.8	0.0	17.8	-0.1	168.5	5.1	0.0	0.0	5.1	-0.1	10.1	6.1	149.8	0.0	22.9	-0.2	178.6
1978	0.0	0.0	8.1	181.1	0.0	19.9	12.4	221.5	5.2	0.0	0.0	5.2	-0.1	10.3	13.3	181.1	0.0	25.1	12.3	231.8
1979	0.0	0.0	13.1	176.1	0.0	19.0	0.0	208.2	5.5	0.0	0.0	5.5	0.0	11.0	18.6	176.1	0.0	24.5	0.0	219.2
1980	0.0	0.0	22.1	188.6	0.0	23.5	1.1	235.3	6.8	0.0	0.0	6.7	0.0	13.5	28.9	188.6	0.0	30.2	1.1	248.8
1981	0.0	0.0	15.9	204.3	0.0	19.1	1.0	240.3	7.4	0.0	0.0	7.3	-0.0	14.7	23.3	204.3	0.0	26.4	1.0	255.0
1982	0.0	0.0	17.0	227.3	0.0	22.3	7.3	273.9	9.5	0.0	0.0	9.4	-0.1	18.8	26.5	227.3	0.0	31.7	7.2	292.7
1983	0.0	0.0	18.9	229.9	0.0	10.0	14.6	273.4	12.2	0.0	0.0	12.2	0.0	24.4	31.1	229.9	0.0	22.2	14.6	297.8
1984	0.0	0.0	17.9	205.8	0.0	10.0	14.6	248.3	12.1	0.0	0.0	12.0	0.1	24.2	30.0	205.8	0.0	22.0	14.6	272.4
1985	0.0	0.0	17.9	202.6	0.0	6.6	17.7	244.8	12.2	0.0	0.0	19.0	0.0	31.2	30.1	202.6	0.0	25.6	17.7	276.0
1986	0.0	0.0	17.9	202.5	0.0	10.0	15.6	246.0	9.5	0.0	0.0	18.0	-0.1	27.4	27.4	202.5	0.0	28.0	15.5	273.4
1987	0.0	0.0	0.0	218.8	0.0	7.7	0.1	226.6	10.3	0.0	0.0	18.2	0.1	28.6	10.3	218.8	0.0	25.9	0.1	255.1
1988	0.0	0.0	0.0	197.8	0.0	6.6	-0.0	204.4	10.3	0.0	0.0	18.6	-0.0	28.9	10.3	197.8	0.0	25.2	-0.0	233.3
1989	NA	NA	NA	NA	NA	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	NA	NA	NA

DATA OBTAINED FROM: IEA WORLD ENERGY STATISTICS AND BALANCES (1971-1988)

TABLE D: SECTORIAL DISTRIBUTION OF TOTAL FINAL CONSUMPTION AS A PERCENTAGE OF TOTAL

YEAR	GAS		OIL						ELEC						TOTAL					
	IND	TOTAL	IND	TRANS	AGRI	RESID.	OTHER	TOTAL	IND	TRANS	AGRI	RESID.	OTHER	TOTAL	IND	TRANS	AGRI	RESID.	OTHER	TOTAL
1970	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA						
1971	100	100	18.6	74.8	0.0	6.5	0.0	100.0	50.0	0.0	0.0	50.0	0.0	100.0	37.9	55.6	0.0	6.5	0.0	100.0
1972	100	100	16.3	77.0	0.0	6.7	0.1	100.0	50.0	0.0	0.0	48.8	1.2	100.0	38.8	54.6	0.0	6.5	0.1	100.0
1973	0	0	15.3	77.2	0.0	7.5	0.1	100.0	50.6	0.0	0.0	50.6	-1.3	100.0	16.8	73.8	0.0	9.4	0.0	100.0
1974	0	0	15.7	76.7	0.0	7.5	0.1	100.0	49.4	0.0	0.0	49.4	1.2	100.0	17.2	73.4	0.0	9.3	0.1	100.0
1975	0	0	15.1	77.6	0.0	7.3	-0.1	100.0	50.6	0.0	0.0	49.4	-0.0	100.0	16.7	74.2	0.0	9.1	-0.1	100.0
1976	0	0	12.5	81.0	0.0	6.4	-0.0	100.0	50.0	0.0	0.0	48.9	1.1	100.0	14.0	77.8	0.0	8.1	0.0	100.0
1977	0	0	0.6	88.9	0.0	10.6	-0.1	100.0	50.5	0.0	0.0	50.5	-1.0	100.0	3.4	83.9	0.0	12.8	-0.1	100.0
1978	0	0	3.7	81.6	0.0	9.0	5.6	100.0	50.5	0.0	0.0	50.5	-1.0	100.0	5.7	78.1	0.0	10.8	5.3	100.0
1979	0	0	6.3	84.6	0.0	9.1	0.0	100.0	50.0	0.0	0.0	50.0	0.0	100.0	8.5	80.3	0.0	11.2	0.0	100.0
1980	0	0	9.4	80.2	0.0	10.0	0.5	100.0	50.4	0.0	0.0	49.6	0.0	100.0	11.6	75.8	0.0	12.1	0.4	100.0
1981	0	0	6.6	85.0	0.0	7.9	0.4	100.0	50.3	0.0	0.0	49.7	-0.0	100.0	9.1	80.1	0.0	10.4	0.4	100.0
1982	0	0	6.2	83.0	0.0	8.1	2.7	100.0	50.5	0.0	0.0	50.0	-0.5	100.0	9.1	77.7	0.0	10.8	2.5	100.0
1983	0	0	5.9	84.1	0.0	3.7	6.3	100.0	50.0	0.0	0.0	50.0	0.0	100.0	10.4	77.2	0.0	7.5	4.9	100.0
1984	0	0	7.2	82.9	0.0	4.0	5.9	100.0	50.0	0.0	0.0	49.6	0.4	100.0	11.0	75.6	0.0	8.1	5.4	100.0
1985	0	0	7.3	82.8	0.0	2.7	7.2	100.0	39.1	0.0	0.0	60.9	0.0	100.0	10.9	73.4	0.0	9.3	6.4	100.0
1986	0	0	7.3	82.3	0.0	4.1	6.3	100.0	34.7	0.0	0.0	65.7	-0.4	100.0	10.0	74.1	0.0	10.2	5.7	100.0
1987	0	0	0.0	96.6	0.0	3.4	0.0	100.0	36.0	0.0	0.0	63.6	0.3	100.0	4.0	85.8	0.0	10.2	0.0	100.0
1988	0	0	0.0	96.8	0.0	3.2	-0.0	100.0	35.6	0.0	0.0	64.4	-0.0	100.0	4.4	84.8	0.0	10.8	-0.0	100.0
1989	NA	NA	NA	NA	NA	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	NA	NA	NA

DATA OBTAINED FROM: IEA WORLD ENERGY STATISTICS AND BALANCES (1971-1988)

TABLE E: ENERGY DATA FOR GRAPHS

YEAR	TFC COMPONENTS AS %			TFC COMPONENTS AS %			COM.TFC GROWTH RAT			TFC GROWTH RATE			ENERGY INTENSITY (TOE/CFA FRANC) COMMERCIAL ENERGY INTENSITY				TFC
	GAS	OIL	ELECTRICIT	GAS	OIL	ELECTRICIT	%	3 PTS	5 PTS M.A.	%	3 PT M.A.	5 PTS M.A.	TOTAL	INDUSTRY	AGRICU	OTHER	INTENSITY
1970	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1971	22.2	74.5	3.3	9.3	31.4	1.4	NA	NA	NA	NA	NA	NA	6.8E-07	1.2E-06	0	6.9E-07	1.6E-06
1972	25.5	70.9	3.7	11.1	30.9	1.6	2.7	NA	NA	-1.0	NA	NA	6.4E-07	1.2E-06	0	6.3E-07	1.5E-06
1973	0.0	95.6	4.4	0.0	36.0	1.7	-20.9	-3.5	NA	-8.4	-1.9	NA	4.7E-07	3.5E-07	0	6.2E-07	1.2E-06
1974	0.0	95.8	4.2	0.0	37.5	1.7	7.6	-3.1	2.7	3.5	-0.6	1.4	4.6E-07	3.1E-07	0	6.3E-07	1.2E-06
1975	0.0	95.6	4.4	0.0	37.8	1.7	4.0	10.6	-2.9	3.0	5.5	-0.7	4.3E-07	2.2E-07	0	6.7E-07	1.1E-06
1976	0.0	96.1	3.9	0.0	41.5	1.7	20.2	-0.3	7.3	10.0	0.5	3.3	5.0E-07	1.9E-07	0	8.9E-07	1.2E-06
1977	0.0	94.3	5.7	0.0	34.4	2.1	-25.2	8.2	4.7	-11.4	3.4	2.4	4.2E-07	4.6E-08	0	7.7E-07	1.2E-06
1978	0.0	95.6	4.4	0.0	40.5	1.9	29.8	-0.3	6.6	11.7	-0.3	3.3	5.2E-07	1.0E-07	0	9.0E-07	1.2E-06
1979	0.0	95.0	5.0	0.0	38.5	2.0	-5.4	12.6	3.0	-1.2	6.0	1.9	4.4E-07	1.0E-07	0	8.1E-07	1.1E-06
1980	0.0	94.6	5.4	0.0	40.5	2.3	13.5	3.5	11.0	7.5	3.1	6.0	4.2E-07	1.0E-07	0	8.9E-07	9.7E-07
1981	0.0	94.2	5.8	0.0	40.1	2.5	2.5	10.3	5.4	3.1	6.5	3.9	3.8E-07	6.7E-08	0	8.3E-07	8.8E-07
1982	0.0	93.6	6.4	0.0	42.0	2.9	14.8	6.3	4.8	9.0	4.4	3.9	3.4E-07	5.9E-08	0	7.9E-07	7.6E-07
1983	0.0	91.8	8.2	0.0	41.4	3.7	1.7	2.7	2.4	1.1	2.9	2.7	3.2E-07	6.2E-08	0	7.6E-07	7.2E-07
1984	0.0	91.1	8.9	0.0	38.1	3.7	-8.5	-1.8	1.7	-1.3	0.4	2.4	2.8E-07	5.4E-08	0	6.7E-07	6.6E-07
1985	0.0	88.7	11.3	0.0	37.0	4.7	1.3	-2.7	-2.6	1.5	0.6	0.5	2.8E-07	5.8E-08	0	8.6E-07	6.8E-07
1986	0.0	90.0	10.0	0.0	36.6	4.1	-0.9	-2.1	-4.7	1.7	0.9	0.1	3.0E-07	9.3E-08	0	4.9E-07	7.5E-07
1987	0.0	88.8	11.2	0.0	33.9	4.3	-6.7	-5.4	NA	-0.5	0.0	NA	3.0E-07	3.7E-08	0	5.4E-07	7.8E-07
1988	0.0	87.6	12.4	0.0	30.9	4.4	-8.6	NA	NA	-1.2	NA	NA	2.7E-07	3.9E-08	0	4.7E-07	7.6E-07
1989	NA	NA	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 F: ELECTRICITY DATA INSTALLED CAPACITY (MEGAWATTS)

YEAR	PUBLIC HYDRO	PUBLIC THERMAL	PUBLIC TOTAL	SELFPRODUCERS HYDRO	SELFPRODUCERS THERMAL	SELFPRODUCERS TOTAL	TOTAL HYDRO	TOTAL THERMAL	TOTAL INSTALLED
1960	NA	NA	NA	NA	NA	NA	NA	NA	NA
1961	15.0	5.0	20.0	0	0	0.0	15.0	5.0	20.0
1962	15.0	5.0	20.0	0	0	0.0	15.0	5.0	20.0
1963	15.0	7.0	22.0	0	0	0.0	15.0	7.0	22.0
1964	15.0	7.0	22.0	0	0	0.0	15.0	7.0	22.0
1965	15.0	7.0	22.0	0	0	0.0	15.0	7.0	22.0
1966	15.0	7.0	22.0	0	0	0.0	15.0	7.0	22.0
1967	15.0	13.0	28.0	0	0	0.0	15.0	13.0	28.0
1968	15.0	15.0	30.0	0	0	0.0	15.0	15.0	30.0
1969	15.0	16.0	31.0	0	0	0.0	15.0	16.0	31.0
1970	15.0	17.0	32.0	0	0	0.0	15.0	17.0	32.0
1971	15.0	16.0	31.0	0	0	0.0	15.0	16.0	31.0
1972	15.0	17.0	32.0	0	0	0.0	15.0	17.0	32.0
1973	15.0	17.0	32.0	0	0	0.0	15.0	17.0	32.0
1974	15.0	17.0	32.0	0	0	0.0	15.0	17.0	32.0
1975	15.0	17.0	32.0	0	0	0.0	15.0	17.0	32.0
1976	17.0	17.0	34.0	0	0	0.0	17.0	17.0	34.0
1977	17.0	17.0	34.0	0	0	0.0	17.0	17.0	34.0
1978	17.0	17.0	34.0	0	0	0.0	17.0	17.0	34.0
1979	89.0	18.0	107.0	0	0	0.0	89.0	18.0	107.0
1980	89.0	29.0	118.0	0	0	0.0	89.0	29.0	118.0
1981	89.0	29.0	118.0	0	0	0.0	89.0	29.0	118.0
1982	120.0	29.0	149.0	0	0	0.0	120.0	29.0	149.0
1983	120.0	29.0	149.0	0	0	0.0	120.0	29.0	149.0
1984	120.0	29.0	149.0	0	0	0.0	120.0	29.0	149.0
1985	120.0	29.0	149.0	0	0	0.0	120.0	29.0	149.0
1986	120.0	29.0	149.0	0	0	0.0	120.0	29.0	149.0
1987	120.0	29.0	149.0	0	0	0.0	120.0	29.0	149.0
1988	120.0	29.0	149.0	0	0	0.0	120.0	29.0	149.0
1989	NA	NA	NA	NA	NA	NA	NA	NA	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA

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

TABLE G: OIL PRODUCT CONSUMPTION (000's TONS)

YEAR	LPG	RESIDUAL	PETR	OTHER	AVGAS	KEROSI	DIESEL	OTHER	TOTAL	DIESEL/ PETROL	% PETRO	% DIESEL	OIL TFC GROWTH RATE 1 PT	OIL TFC GROWTH RATE 3 PTS
1970	1.0	25.0	22.0	1.0	2.0	14.0	50.0	0.0	114.0	2.3	19.3	43.9	NA	NA
1971	2.0	25.0	27.0	3.0	1.0	20.0	45.0	1.0	121.0	1.7	22.3	37.2	NA	NA
1972	2.0	26.0	21.0	3.0	1.0	16.0	40.0	1.0	107.0	1.9	19.6	37.4	-2.3	NA
1973	2.0	27.0	28.0	3.0	1.0	17.0	35.0	1.0	111.0	1.3	25.2	31.5	6.6	4.1
1974	2.3	36.7	22.1	24.2	1.4	11.4	83.6	21.9	179.3	3.8	12.3	46.6	7.8	6.1
1975	1.8	32.4	25.8	22.1	1.4	12.2	91.1	20.4	185.1	3.5	13.9	49.2	3.9	10.8
1976	2.1	33.4	24.7	21.5	1.8	17.2	136.6	19.3	235.1	5.5	10.5	58.1	20.7	-0.7
1977	2.0	36.1	38.4	26.2	1.3	17.9	101.2	24.2	221.1	2.6	17.4	45.8	-26.6	8.5
1978	1.7	22.6	38.8	28.0	2.2	17.5	127.7	26.3	236.9	3.3	16.4	53.9	31.5	-0.4
1979	2.3	20.9	37.3	35.2	1.2	15.6	121.3	32.9	231.3	3.3	16.1	52.4	-6.0	12.8
1980	2.3	15.7	38.5	36.3	1.1	15.7	138.6	34.0	246.0	3.6	15.7	56.3	13.0	3.0
1981	2.5	15.6	41.8	35.5	0.9	15.2	144.8	33.0	253.6	3.5	16.5	57.1	2.1	9.7
1982	3.0	17.4	48.6	42.0	1.1	17.0	157.3	38.9	283.3	3.2	17.1	55.5	14.0	5.3
1983	3.1	49.7	53.8	42.7	1.0	19.9	142.1	39.6	309.2	2.6	17.4	46.0	-0.2	1.5
1984	3.4	17.9	54.0	38.3	1.0	21.1	128.3	34.8	260.5	2.4	20.7	49.3	-9.2	-3.6
1985	3.9	20.5	52.7	38.2	0.8	21.1	132.9	34.2	266.1	2.5	19.8	49.9	-1.4	-3.4
1986	4.0	22.0	45.0	24.0	1.0	20.0	130.0	20.0	242.0	2.9	18.6	53.7	0.5	-2.9
1987	4.0	24.0	61.0	15.0	1.0	21.0	140.0	11.0	262.0	2.3	23.3	53.4	-7.9	-5.7
1988	4.0	26.0	51.0	15.0	1.0	19.0	145.0	11.0	257.0	2.8	19.8	56.4	-9.8	NA
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 OBTAIN YEARBOOK OF WORLD ENERGY STATISTICS (1981)
ENERGY STATISTICS YEARBOOK (1983, 1985, 1988)
CONGO: ISSUES AND OPTIONS IN THE ENERGY SECTOR
ESTIMATIONS

TABLE H: GDP DATA FOR GRAPHS

YEAR	GDP GROWTH RATE (REAL 1985 PRICES) %/YEAR	3PT MA	5PT MA	AGRICULTURE/ INDUSTRY 1 PT	3 PT M.A.	% CONTRIBUTION TO GDP AGRI	IND	MINE QUARRY	MANU	ELEC,WTR GAS	CONSTR	OTHER	AGRI/MANU	% OF CHANGE GDP DEFLATOR 1 PT	3PT M.A.	ANNUAL CHANGE OF GDP PER CAPITA CURRENT %	3 PT M.A.	REAL %	3 PT M.A.
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	1.0	NA	19.9	19.9	NA	NA	NA	NA	60.3	NA	NA	NA	NA	NA	NA	NA
1968	11.2	NA	NA	1.0	1.0	19.6	19.3	NA	NA	NA	NA	61.1	NA	-4.3	NA	3.8	NA	8.4	NA
1969	7.0	8.2	NA	0.9	0.9	17.7	19.4	NA	NA	NA	NA	62.8	NA	3.5	1.0	8.0	6.5	4.3	5.5
1970	6.4	7.0	8.2	0.7	0.8	17.9	23.9	NA	NA	NA	NA	58.2	NA	3.7	5.2	7.6	9.8	3.7	4.4
1971	7.7	7.6	7.7	0.8	0.8	17.1	21.9	NA	NA	NA	NA	61.0	NA	8.4	6.4	13.9	11.8	5.1	5.0
1972	8.9	8.3	8.2	0.8	0.8	16.4	21.3	NA	NA	NA	NA	62.3	NA	7.2	7.7	13.8	13.8	6.2	5.6
1973	8.4	9.0	9.0	0.7	0.7	15.7	22.1	NA	NA	NA	NA	62.2	NA	7.7	7.0	13.8	13.7	5.6	6.2
1974	9.8	9.5	7.9	0.6	0.6	15.1	25.4	NA	NA	NA	NA	59.5	NA	6.2	6.6	13.5	13.5	6.9	6.5
1975	10.2	7.4	4.0	0.4	0.5	14.5	32.4	NA	NA	NA	NA	53.1	NA	5.8	6.4	13.1	11.0	6.9	4.3
1976	2.3	0.6	3.5	0.4	0.4	13.5	37.6	NA	NA	NA	NA	48.9	NA	7.2	10.0	6.3	6.8	-0.9	-2.5
1977	-10.8	-0.8	4.0	0.5	0.5	15.4	31.6	NA	NA	NA	NA	52.9	NA	16.8	7.8	0.9	3.1	-13.6	-4.0
1978	6.0	2.4	5.7	0.5	0.5	16.0	29.5	NA	9.4	NA	0.0	54.5	1.7	-0.5	10.4	2.0	9.1	2.5	-0.9
1979	12.0	12.3	8.0	0.4	0.4	14.3	36.4	NA	8.4	NA	NA	49.3	1.7	14.8	11.1	24.3	20.9	8.2	8.5
1980	18.8	14.9	15.4	0.3	0.3	11.7	46.6	NA	7.5	NA	NA	41.7	1.6	19.0	21.9	36.5	35.3	14.7	11.0
1981	14.0	19.6	15.7	0.2	0.2	7.9	50.9	NA	6.3	NA	NA	41.2	1.2	31.8	18.3	45.1	36.1	10.1	15.5
1982	26.1	16.0	14.7	0.1	0.1	7.9	52.6	NA	4.8	NA	NA	39.6	1.6	4.0	13.4	26.6	26.8	21.7	12.0
1983	7.8	13.6	10.7	0.1	0.1	7.6	54.3	NA	5.5	NA	NA	38.1	1.4	4.5	6.8	8.8	17.1	4.1	9.7
1984	7.0	4.5	6.6	0.1	0.1	6.9	56.6	NA	4.9	NA	NA	36.5	1.4	12.1	6.4	15.8	7.5	3.3	1.0
1985	-1.2	-0.3	1.5	0.1	0.2	7.4	53.9	41.0	5.6	1.2	5.8	38.6	1.3	2.5	-4.9	-2.1	-7.5	-4.5	-3.7
1986	-6.8	-2.4	0.0	0.4	0.3	12.1	32.6	15.5	9.6	1.4	6.1	55.4	1.3	-29.2	-6.5	-36.2	-11.3	-9.9	-5.6
1987	0.7	-1.9	-1.3	0.3	0.4	11.9	35.8	22.5	8.7	1.5	3.1	52.3	1.4	7.1	-9.0	4.4	-13.1	-2.5	-5.0
1988	0.6	0.5	NA	0.4	0.4	13.7	31.2	NA	8.9	NA	NA	55.1	1.5	-4.8	3.8	-7.3	1.0	-2.6	-2.7
1989	0.3	NA	NA	0.4	NA	13.7	35.5	NA	8.5	NA	NA	50.8	1.6	9.1	NA	6.1	NA	-2.8	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE I: CRUDE OIL AND NATURAL GAS

YEAR	CRUDE OIL (000s TONS) PRODUCTION	OFF SHORE	EXPORT	IMPORT	CONSUMPTION	NATURAL GAS (000's CU METRES) PRODUC	CONSUMPTION
1960	52	NA	34	0	0	0	0
1961	103	NA	93	0	0	0	0
1962	123	NA	135	0	0	0	0
1963	109	NA	101	0	0	0	0
1964	83	NA	79	0	0	0	0
1965	71	NA	71	0	0	0	0
1966	62	NA	65	0	0	0	0
1967	50	NA	38	0	0	0	0
1968	43	NA	55	0	0	0	0
1969	24	NA	32	0	0	3000	3000
1970	19	19	17	0	0	10000	10000
1971	14	14	20	0	0	65608	65608
1972	336	336	296	0	0	74945	74945
1973	2091	1696	1461	0	100	14067	14067
1974	2455	1870	2450	0	NA	15355	15355
1975	1790	NA	1821	0	0	14926	14926
1976	2146	NA	NA	NA	NA	7516	7516
1977	1923	NA	NA	NA	NA	4832	4832
1978	2430	NA	2000	0	30	2040	2040
1979	2762	NA	1916	0	446	2040	2040
1980	3168	1940	3100	0	3	1074	1074
1981	4283	2487	4101	0	2	537	537
1982	4481	2809	4400	0	0	1933	1933
1983	5365	3348	5160	0	0	1825	1825
1984	6007	3510	6000	0	0	1825	1825
1985	5830	3490	5770	0	50	2900	2900
1986	5610	NA	NA	NA	NA	1825	1825
1987	5777	NA	NA	NA	NA	1933	1933
1988	6600	NA	NA	NA	NA	2040	2040
1989	NA	NA	NA	NA	NA	NA	NA
1990	NA	NA	NA	NA	NA	NA	NA

DATA OBTAINED FROM: WORLD ENERGY SUPPLIES (1950-1974)
YEARBOOK OF WORLD ENERGY STATISTICS (1981)
ENERGY STATISTICS YEARBOOKS (1983, 1985, 1988)
WORLD ENERGY STATISTICS AND BALANCES (1971-1988), IEA STATISTICS
AFRICAN STATISTICAL YEARBOOK 1976, CENTRAL AFRICA

TABLE J: ELECTRICITY DATA AND PRODUCTION (GWhs)

YEAR	PUBLIC HYDR	PUBLIC THERMAL	PUBLIC TOTAL	SELF PRODUCERS HYDR	SELF PRODUCERS THERMA	SELF PRODUCERS TOTAL	TOTAL HYDRO	TOTAL THERMAL	TOTAL	IMPORT EXPORT	ELEC. TFC GWTH RATE % PA	ELEC. TFC GWTH RATE 3 PT MA	ELEC. TFC GWTH RATE 5 PT MA	ELEC. INTENSITY TOE/GDP REAL 1985	RATIO ELEC.GWTH/GDP GWT 1 PT	RATIO ELEC.GWTH/GDP GWT 3 PT MA	ELEC/CAP KWh/CAP	RATIO ELEC GW GDP GWTH	3 PT MA
1958	NA	NA	NA	0	0	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1959	NA	NA	21	0	0	0	NA	NA	21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1960	19	10	29	0	0	0	19	10	29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1961	21	11	32	0	0	0	21	11	32	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1962	24	13	37	0	0	0	24	13	37	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1963	27	15	42	0	0	0	27	15	42	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1964	28	15	43	0	0	0	28	15	43	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1965	27	15	42	0	0	0	27	15	42	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1966	28	18	46	0	0	0	28	18	46	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1967	31	19	50	0	0	0	31	19	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1968	34	21	55	0	0	0	34	21	55	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1969	38	27	65	0	0	0	38	27	65	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1970	44	32	76	0	0	0	44	32	76	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1971	55	33	88	0	0	0	55	33	88	NA	NA	NA	NA	2.23E-08	NA	NA	67	NA	NA
1972	66	33	99	0	0	0	66	33	99	NA	13.9	NA	NA	2.34E-08	1.6	NA	75	1.6	NA
1973	50	46	96	0	0	0	50	46	96	NA	-3.7	4.3	NA	2.07E-08	-0.4	0.5	70	-0.4	0.5
1974	54	45	99	0	0	0	54	45	99	NA	2.5	2.1	5.6	1.93E-08	0.3	0.2	70	0.3	0.2
1975	58	47	105	0	0	0	58	47	105	NA	7.4	6.0	4.4	1.88E-08	0.7	1.5	73	0.7	1.5
1976	65	52	117	0	0	0	65	52	117	NA	6.0	7.6	5.5	1.99E-08	3.4	1.1	77	3.4	1.1
1977	68	50	118	0	0	0	68	50	118	6	7.4	5.8	6.3	2.39E-08	-0.7	1.0	80	-0.7	1.0
1978	55	45	100	0	0	0	55	45	100	38	2.0	5.4	9.4	2.30E-08	0.3	0.1	79	0.3	0.1
1979	60	56	116	0	0	0	60	56	116	31	6.8	10.5	9.6	2.19E-08	0.6	0.7	82	0.6	0.7
1980	80	68	146	0	0	0	80	88	148	13	22.7	12.8	13.7	2.27E-08	1.2	0.8	98	1.2	0.8
1981	90	75	165	0	0	0	90	75	165	12	6.9	19.6	19.2	2.17E-08	0.6	1.0	103	0.6	1.0
1982	176	24	200	0	0	0	178	24	200	21	27.9	22.2	17.7	2.20E-08	1.1	1.6	128	1.1	1.8
1983	231	2	233	0	0	0	231	2	233	55	29.6	19.0	18.9	2.64E-08	3.6	1.6	160	3.6	1.6
1984	233	2	235	0	0	0	233	2	235	98	-0.8	19.3	14.7	2.45E-08	-0.1	-4.0	154	-0.1	-4.0
1985	291	2	293	0	0	0	291	2	293	76	28.9	5.3	10.0	3.21E-08	-15.7	-4.7	192	-15.7	-4.7
1986	268	2	270	0	0	0	268	2	270	57	-12.2	7.0	4.3	3.04E-08	1.7	-4.9	163	1.7	-4.9
1987	278	3	281	0	0	0	278	3	281	53	4.4	-2.3	NA	3.34E-08	-0.9	0.5	164	-0.9	0.5
1988	289	3	292	0	0	0	289	3	292	55	1.0	NA	NA	3.32E-08	0.6	NA	160	0.6	NA
1989	NA	NA	NA	NA	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	NA	NA

DATA OBTAI WORLD ENERGY SUPPLY (1950-1974)
WORLD ENERGY SUPPLY (1973-1978)
YEARBOOK OF WORLD ENERGY STATISTICS (1981)
ENERGY STATISTICS YEARBOOKS (1983, 1985, 1988)
CONGO: ISSUES AND OPTIONS IN THE ENERGY SECTOR

TABLE K: 1985 TFC ENERGY BALANCE (000's TOE)

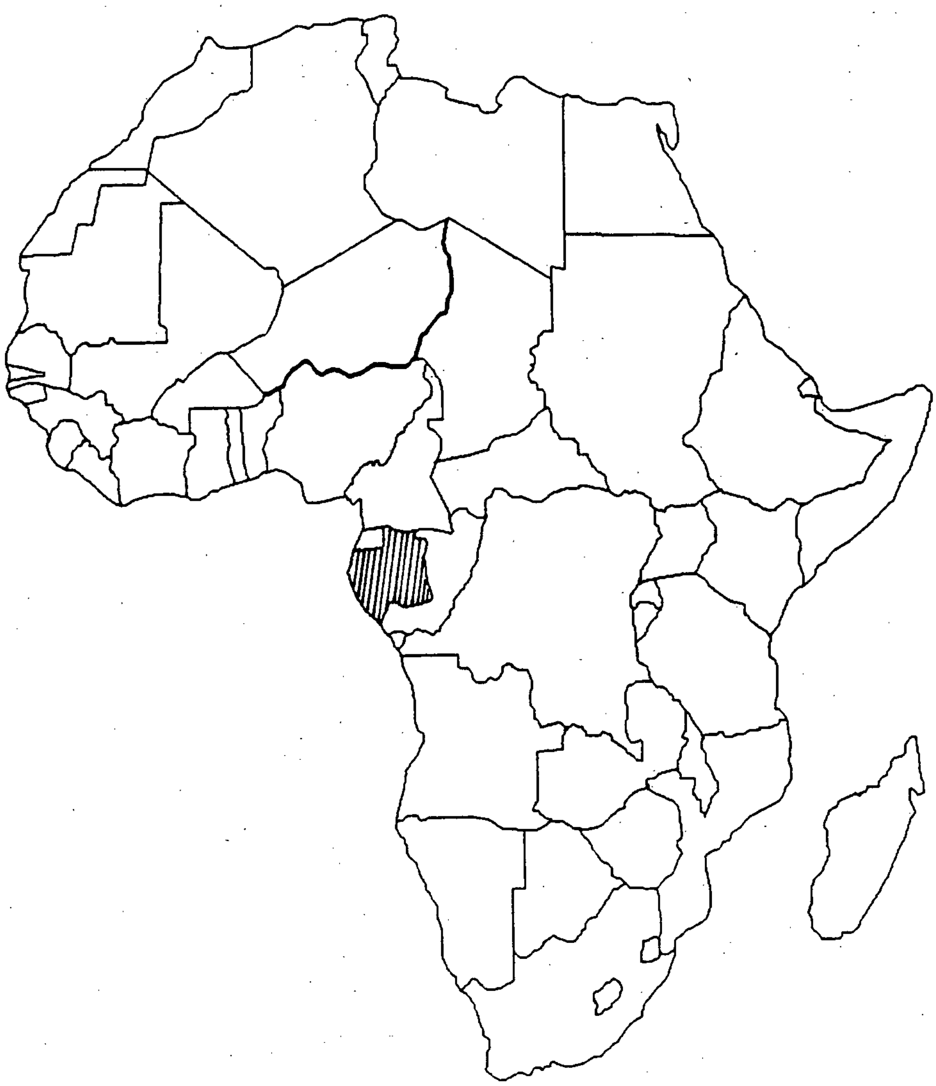
	FUELWOOD	CHARCO	AGRI. RESIDUES	ELEC	CRUDE OIL	PETROL PRODUCTS	TOTAL	SHARE (%)	PETROL	COM.ENERG	TRAD.FUELS	TRAD.FUELS	
HOUSEH/CO	363.3	7.6	0.0	9.9	0.0	27.3	408.1	58.9	27.3	37.2	370.9	370.88	HOUSEH/C
TRANSPORT	0.0	0.0	0.0	0.0	0.0	132.2	132.2	19.1	132.2	132.2	0.0	14.12	INDUSTRY
PETR. INDUS	0.0	0.0	0.0	0.0	22.3	58.4	80.7	11.6	80.7	80.7	0.0		
OTHER INDU	8.0	0.0	6.1	14.0	0.0	30.0	58.1	8.4	30.0	44.0	14.1		
AGRICULTU	0.0	0.0	0.0	0.0	0.0	7.2	7.2	1.0	7.2	7.2	0.0		
PUBLIC/CIVIL	0.0	0.0	0.0	3.1	0.0	4.0	7.1	1.0	4.0	7.1	0.0		
TOTAL	371.3	7.6	6.1	27.0	22.3	27.3	693.4						
SHARE (%)	53.5	1.1	0.9	3.9	3.2	37.4							

DATA OBTAI IEA WORLD ENERGY STATISTICS AND BALANCES (1971-1988)
CONGO: ISSUES AND OPTIONS IN THE ENERGY SECTOR (JANUARY 1988)

MAP

GABON

1. INTRODUCTION



2. COUNTRY PROFILE

2.1 Introduction

Before the beginning of the French colonial rule in the mid-19th century, the Gabon (Komo) River estuary was already used as a base for French ships implementing the ban on slavery trade declared in 1815. Annexed to the French Congo in 1888, Gabon became a separate administrative region in 1903 and a separate colony in 1910, one of the four members of French Equatorial Africa. It was granted internal autonomy in November 1958, with Mr M'Ba as Prime Minister and effective head of state. Gabon became fully independent on 17 August 1960.

Mr M'Ba was elected the first President of the republic in February 1961. Deposed in a military coup in 1964, his authoritarian regime survived only because of French military intervention. On his death in November 1967, power was transferred to his chosen successor, the 31-year-old Vice-President Omar Bongo. He introduced a single-party system based on his new Parti Démocratique Gabonais (PDG).

The social and political situation has been strained since the beginning of 1990. A national conference was held in March in order to facilitate the return of the country to multi-party politics. It was followed in May by constitutional amendments intended to further facilitate the transition. However, these reforms were overshadowed by the death under obscure conditions of Mr Rendjambe, Secretary-General of an opposition movement, the Parti Gabonais du Progrès (PGP). Following allegations of government involvement in the incident, civil unrest and riots spread nationwide. They were particularly violent in Port Gentil, birthplace of Rendjambe and the centre of the petroleum industry. They caused severe disruptions of the oil sector and threatened the economy of the country. France sent troops to protect its interests and to help evacuate its nationals.

2.2 Geographical situation and demography

Located in western equatorial Africa, Gabon covers a land area of 267 667 sq km and has a coastline of 800 km on the Atlantic Ocean. It lies astride the equator and is bounded by the Atlantic Ocean to the west, Equatorial Guinea to the north-west, Cameroon to the north, and Congo to the east and south. The country has an extensive river network dominated by the 1200 km long westward-flowing Ogooué River. Together with its tributaries, the main being the N'Gounié in the south and the Ivindo in the north, it drains close to four-fifths of the territory.

As can be seen in Fig. 1, the population size is modest, 1077 million people in 1988 according to the World Bank[1]. The average population density is, according to national estimates, 4,5 persons per sq km. The population is very young, with 32,3% under 15 years of age in 1990. Life expectancy was 51 years for the period 1985-90. In 1985 the literacy level was 70% among adult males and 53% among adult females[2].

The population consists of a few thousand Pygmies and 40 tribes grouped into four main ethnic groups: the Fang comprising 30% of the total population, the Eshira 25%, the Mbede 22%, and the Okande 23%. The urban component of the population was 41% in 1983[3]. The three main urban concentrations, accounting for about a quarter of the total population, are found in the capital Libreville (more than 250 000) and in the mining centres: Port Gentil (80 000), Moanda and Franceville (30 000). Major rural concentrations are found around cash crops plantations in Woleu N'Tem for coffee and cocoa, and Lambarene for palm oil and coffee[4].

The labour force is estimated at 137 867, of whom 38,8% are women. This work force is engaged in agriculture and forestry (about 10,2% compared to 67% in 1960), mining (2,9%), construction (9,5%), manufacturing (3%), commerce and industry (2,7%), civil service (31%), and other sectors (40,7%)[3]. The country is short of manpower and unemployment is virtually non existent.

2.3 Economy

The overall GDP for the period 1967-88 is shown in Fig. 2. With a GDP per capita of US$ 3003 in 1988 (see Fig. 3), Gabon has the highest level of GDP per capita in Sub-Saharan Africa. The economy is now based mainly on minerals and timber products.

Dominated originally by the slave trade, the Gabonese economy was supplemented from the beginning of the 19th century by the trade of a few local commodities such as ivory, ebony, and gum copal. It was followed by profitable plantations of export crops (cocoa, coffee, etc.) and the exploitation of wild rubber. Timber products, mainly okoumé whose export in bulk to Europe became significant by 1920, remained the driving force of the economy until the early 1960s, accounting for nearly three-quarters of export earnings during the 1950s. Around the time of independence, the exploitation of mineral resources (manganese, uranium, and above all, oil) took the lead and brought about important structural changes in export earnings. Mining operations' share in the annual total export earnings increased from 21% in 1961 to 60% in 1970 and to 94% in 1975[4]. These sectorial changes are illustrated by the ratio of the contributions of agriculture and industry to the overall GDP in Fig. 4.

The hydrocarbon sector, whose development started in 1957, remains the backbone of the economy. Table 1 shows the contribution of the petroleum sector to the economy. Other mineral resources currently exploited on a significant scale are manganese at Moanda, and uranium at Mounana. They account for 6-11% and 3-7% of total annual export earnings respectively. Deposits of high-grade iron ore, lead and zinc have been found but not yet exploited. Prospecting is continuing for other minerals. Transportation problems are seen as a serious constraint to mining.

Table 1. Contribution of petroleum sector in the economy[4]

Year	GDP	Export earnings	Government revenue
1975	-	83%	-
1985	43%	83%	65%
1986	18%	66%	58%
1988	32%	63%	33%

The manufacturing sector is small and is based mainly on natural resources such as agricultural products processing, timber processing and the production of mineral concentrates. Its share of the GDP in current terms is between 3,6% and 5,6%. Prospects for large development are slight because of the small size of the domestic market and a shortage of manpower. Most manufacturing establishments are located near Libreville and Port Gentil.

In 1988 agriculture, the principal sector of the economy prior to oil exploitation, accounted in real terms for 11% of the overall GDP, while forestry, still the main subsector of the agricultural sector, represented 16% of the total annual export earnings. Gabon is famous for okoumé timber, of which it is the largest world producer. The okoumé tree provides an ideal wood for the manufacture of plywood because of its regular peeling qualities, and is also used to makes canoes due to its buoyancy. The country ranks fourth among the world largest exporters of tropical wood (such as ozigo).

Agricultural production is inadequate. Only 20%[3] of the total land is capable of being cultivated as a result of the large cover of tropical rain forest. That part of the total land actually under cultivation remains insignificant at 0.5%[4] in the late 1980s. In addition, there is little farming tradition among the population. Consequently 25% of the country's food requirements are imported. The principal agricultural export is cocoa, followed by palm oil, coffee, and refined sugar. The incidence of tsetse fly has hindered the development of animal husbandry.

The percentage shares of various economic sectors to GDP for the period 1967-88 are shown in Fig. 5. In general, the percentage contribution of agriculture has been declining steadily, but recovered in 1986 with the shrinking of oil revenues. The growth rates of GDP and GDP per capita are given in Figs 6 and 7 respectively, in real terms. The economic (GDP) growth has been subjected to the vagaries of oil output and price. Of particular interest are the impressive growth rates for 1968 (77%) and 1974 (39,4%). The first is ascribed to the advent of the production of important oil deposits (see section 4.2), and the second is accounted for by the oil crisis which helped the country to acquire significant wealth. Following the collapse of oil prices in 1986, the growth rate decreased.

Gabon is a member of the Union Douanière et Economique de l'Afrique Centrale (UDEAC), of the Communauté Economique des Etats de l'Afrique Centrale (CEEAC), and of the Organisation of Petroleum Exporting Countries (OPEC).

3. ENERGY: GENERAL

3.1 Introduction

Except for some oil imports, Gabon is self-sufficient in energy. The country has abundant and diverse natural resources which include wood, oil, natural gas, hydro-electricity, uranium, and solar energy. With all this energy potential, combined with the modest size of its population, the country should not experience energy shortages for many years to come.

With the increase in population growth, the share of traditional fuels to the total final consumption has increased from 19,8% in 1971 to 61,2% in 1988. However it remains small compared to other African countries. The contribution of petroleum to the national energy balance is important, but has decreased from 77,5% of the TFC in 1971 to 32,7% of the TFC in 1988. The other commercial fuels are electricity, representing 6,1% of the TFC in 1988, and natural gas which accounts for the remainder.

3.2 Energy institutions

The Ministry of Mines, Hydrocarbons, Energy and Water Resources, through its Directorate General of Energy, controls the energy scene. However, other Ministries are involved in energy related affairs, especially in the petroleum sector. The Ministry of Mines and Hydrocarbons, through the Directorate General of Hydrocarbons, monitors oil exploration and production as well as domestic refinery activities. The Ministry of Finance, Budget and Participations and the Ministry of Planning and Economy play important roles in the supervision of operations, investments, planning and pricing in the petroleum sector.

The petroleum sector is dominated by oil prospecting companies. By 1988 a total of 28 companies had exploration interests in the country. Among them are Elf-Gabon, Shell-Gabon, Amoco, Agip, the Gulf Oil Company of Gabon, Conoco, Phillips, Norsk Hydro, British Gas, and Ameralda Hess. The national oil corporation Petrogab was liquidated in 1987. There are six oil marketing companies in the country.

In the electricity subsector, the publicly-owned Société d'Energie et d'Eau du Gabon (SEEG) has the monopoly rights for the generation and distribution of electrical power as well as water supply. It owns and operates all the hydro plants.

The exploitation and the marketing of uranium is in the hands of the Compagnie des Mines d'Uranium de Franceville (COMUF).

4. ENERGY RESOURCES

4.1 Fuelwood

Gabon is endowed with significant forest resources. About 76% of the total land area or 20,4 million ha is with covered dense tropical rain forests. In addition, grasslands or savannas are estimated to cover 20% of the land, mainly in the upper Ogooué around Franceville, the upper N'Gounié above Mouila, and in the middle Nyanga River valley - especially beyond Tchibanga. Along the coast north of the Nyanga River there is a narrow zone of marshes and mangrove trees[(5)]. The forest reserves are estimated to be about 300 million cubic metres[(6)].

Log-cutting is significant. In 1987 timber output was 1,2 million m^3, of which 896 thousand m^3 was okoumé[(4)]. It reached a peak of 2,2 million m^3 in 1972, with okoumé accounting for 1,8 million m^3 [(6)]. The country is divided into three logging zones. The first zone, easily accessible, has almost been depleted and is reserved exclusively for national Gabonese firms. Exploitation has been expanded to the second zone which covers the central part of the country. The completion of the second section of the Transgabon railway, in 1986, improved the accessibility of the third zone, but did not bring the development of industrial plantations on the expected substantial scale. Wood wastes from forestry operations and wood processing industries are estimated at 3 million m^3/year (720 kTOE)[(7)].

Mineral extraction, the extension of coffee and cocoa farms, and to some extent wood cutting are destroying a significant part of the forest cover. In order to maintain the okoumé output at its present levels, the government has embarked on reforestation programmes. Government investment in forestry amounted to 2000 million CFA francs (7,41 million US$) for the period 1980-82[(4)].

4.2 Petroleum

Gabon has two sedimentary basins, a small eastern basin of 45 000 km^2 and a coastal/offshore basin of 155 000 km^2 composed of cretaceous sedimentary rocks. The coastal/offshore basin is divided into two sections: a shallow water (depth less than 200m) continental shelf of 3500 km^2, and a deep water (200-300m) offshore section of 120 000 km^2 [(7)].

The continental shelf accounts for all known commercial oil deposits which were estimated to be 133,4 million tons in 1987. Oil exploration in Gabon dates back to 1928. However the first oil discovery, an offshore deposit, was made in 1956 by the French Societe des Petroles de l'Afrique Equatoriale (SPAFE), now known as Elf Gabon.

Figure 9 shows the production of crude oil for the period 1959-88. Oil exploitation started in 1957 when three fields (Ouzouri, Pointe Clairette, and Port Gentil) went into production, yielding 177 thousand tons per year. Exploration extended southward from the Port Gentil area to Mayumba and the Congo. By 1964 sixteen new oil fields had been discovered by Mobil, Shell and SPAFE, who started joint exploration schemes in 1957. As a result of this special emphasis on exploration, production grew slowly, reaching 1447 thousand tons in 1966.

However, following the coming on stream of the Gamba-Ivinga deposits and the exploitation of the offshore Anguille deposit, the output grew significantly, totalling 3444 thousand tons in 1967. Exploration was renewed in 1970 leading to the discovery of 15 new fields. The upward trend in oil production persisted until 1976 when the output reached a peak of 11 325 thousand tons. This climax was followed by a period of stagnation. In fact, oil output declined to 7600 thousand tons in 1981 before recovering slowly in the next two years. Oil production increased significantly to 8725 thousand tons in 1984, after the West Oguendjo field, operated by Amoco, entered production in 1983. This was followed by a downward trend and a recovery (7,9 million tons in 1988) due to the coming into production in December 1987 of the Obando Marin Concession. A significant recovery came from the onshore Rabi-Kounga oil field which started production in January 1989. This large deposit (about 65 million tons of recoverable reserves), exploited principally by Shell Gabon, had in early 1990 a daily recovery of 18,4 thousand tons. The overall oil output totalled 10 million tons in 1990[4,7].

The bulk of production is generally shared among Elf-Gabon (85%), Shell-Gabon (6%) and Gulf-Oil of Gabon (6%)[3]. However these different contributions to the total output might have changed following the coming into production of the new oil fields. The Gabonese state is in a 25% partnership with all the oil companies.

Total proven reserves of natural gas are officially estimated to be between 40 and 45 billion Nm^3 [7]. They are mainly associated with oil and scattered in various deposits along the 400 km coastline. Large-scale production of natural gas is hindered by the deposit distribution patterns. Production, about 2 billion Nm^3 in 1985, is in association with petroleum. The bulk of natural gas production is flared and the remainder is mainly used to fuel gas turbine power stations. Plans to reinject natural gas in oil deposits, in order to conserve it, are underway.

Cape Lopez, a former important port for the slave trade, has been fitted with new tanker facilities, for export purposes and for support of vessels of up to 250 000 tons[3].

4.3 Hydro-electricity

Potential for hydro-electric power is considerable given the country's extensive river network. The total technical potential is estimated at 18 000 MW, capable of producing annually 80 000 GWh[8]. However, the total economically exploitable potential is 4900-6000 MW and 33 500 GWh per year[7,8].

The most important exploitable sites are shown in table 2.

Table 2. Important hydro-electric sites[7]

	Number of main sites	Power (MW)	Energy (GWh/year)
Libreville Region:			
River MBEI	3	121	610
River KOMO	5	312	1980
River ABANGA	3	245	1510
Others	2	85	540
SUB-TOTAL	13	763	4640
South-east Region			
S-E Lastoursville & Franceville:			
High Ogooue	4	322	2335
Others	4	316	2435
SUB-TOTAL	8	638	4770
Other regions:	8	3325	9540
TOTAL	**29**	**4726**	**18950**

4.4 Other sources

Alternative energy resources are not presently exploited. Solar energy is not exploited in spite of the country's high degree of insolation, and uranium is exported. France agreed to supply Gabon with a 300 MW nuclear power station[3].

Uranium has been exploited from the Mounana mine since 1961 by the Compangnie des Mines d'Uranium de Franceville (COMUF), in which the government has a 25% partnership with French interests. Known reserves, estimated at 35 000 tons, have increased following new discoveries at Boyindzi and Okla. As can be seen from Table 3, uranium output has been declining in recent years as a result of the international economic slowdown.

Table 3. **Production of uranium**[2,5,9,10,11]

Production of uranium (in metric tons)			
Year	**Production**	**Year**	**Production**
1961	969	1975	1766
1962	1161	1976	1297
1963	1317	1977	1850
1964	1288	1978	1407
1965	1644	1979	1100
1966	1599	1980	1033
1967	1452	1981	1020
1968	1371	1982	970
1969	1388	1983	1006
1970	1077	1984	918
1971	1274	1985	940
1972	523	1986	900
1973	1412	1987	793
1974	1713	1988	912

5. ENERGY SUPPLY AND DEMAND

5.1 General

Energy needs in Gabon are met by wood, oil, natural gas and electricity. Local wood resources are significant. The country refines a part of its local crude to meet its oil requirements. Imports of butane make up the shortfall in the local refinery. Electricity comes from gas and diesel-fired thermal plants and some hydroplants which have been built since 1970.

The country displays a unique pattern of energy consumption in Sub-Saharan Africa. It is characterized by a high level of energy consumption per capita amounting to 1 TOE in 1988. However, the most striking feature is its high level of commercial energy consumption per capita. In 1988 the final consumption of commercial energy per capita totalled 400 Kgoe, consisting of 320 Kgoe from oil, 60 Kgoe from electricity, and the remainder being provided by gas. This can explained by the small size of the population and the large oil-consuming petroleum industries. The consumption of energy per capita for the period 1971-88 is given in Fig. 9.

Figures 10 and 11 show the contribution of the various energy forms to the total final consumption for the period 1971-88, as given by the International Energy Agency (IEA)[12]. As can be seen from these figures, the energy consumed in Gabon has been predominantly commercial, with an 80% share or more of the TFC during the 1970s and the mid-1980s before shifting significantly to traditional fuels, mainly as a result of population growth.

The contribution of different commercial energy carriers to the final consumption of commercial energy for the period 1971-88 is given in Figs 12 and 13. It can be seen from Fig. 14, which gives the sectorial distribution of commercial energy, that transport and industry are the main commercial energy consumers.

Figure 15 gives the energy intensity. Commercial energy intensity and total energy intensity trends were close to each other until 1985. However, following the dramatic increase in the use of traditional fuels, the gap between the two has widened significantly. Figure 16 shows the energy intensity in different sectors of the economy, with industry being the lowest. This is easily understood as this sector produces the largest part of the GDP (see section 2.3). The low energy intensity of agriculture excludes the large usage of human power. The growth rates of different energy carriers and GDP are shown in Fig. 17. In general, the commercial energy growth trends have followed those of GDP. However, the changes in GDP patterns are more marked (due to the vagaries of oil prices on the international market). Electricity growth is a better indicator of changes in GDP as electricity schemes, especially hydro ones, require large investments. After the decline of oil prices in 1986, commercial energy and oil growths displayed similar trends.

5.2 Fuelwood and other traditional fuels

The share of traditional fuels in the total final consumption over the period 1971-88 as given by IAE statistics is shown in Figs 10 and 11.

Forest resources are abundant and there is no foreseeable woodfuel shortage.

Log cutting and the farming of cash and export crops are eroding the forest cover of the country. However, the modest size of the population, the high urbanization rate, and high reliance on minerals for economic development offer good chances for forest conservation.

5.3 Petroleum products

About two-thirds of petroleum requirements are met by finished products from the local refinery, the Société Gabonaise de Raffinage (SOGARA), which refines the local Mandji crude. These finished products cover all local demand for gasoline, kerosene, gas oil, and fuel oil. Additional requirements are met by imports of butane (3000 tons/year in 1986). However, the high refinery output of fuel oil is unsuitable for the very limited domestic market. As a result, 100 000 tons of excess fuel oil, as well as occasional batches of naphta, are sold annually on the international market.

SOGARA's crude oil needs are met by the oil mining companies operating in the country. These oil companies are bound, by government statute, to supply a portion of their (after tax) production. The crude is purchased from Elf Gabon which delivers it to SOGARA in batches of 65 000 barrels via a 17 km pipeline from its terminal at Cap Lopez. The government has a 25% share in the refinery and is planning to increase it to 51%.

SOGARA was formerly known as the Equatorial Refinery Company and was designed to supply the central African market. In 1974 the Gabonese government bought the shares of the other central African countries and renamed it. Figure 18 gives SOGARA production for the period 1975-1985. For rationalization purposes, SOGARA merged in 1985 with a second refinery, the Compangie Gabon-Elf de Raffinage (COGER). Since its creation in 1976, COGER, which was jointly owned by Elf Gabon (70%) and the government (30%), operated as an export-orientated refinery, aiming principally at the Western European market. After the integration of the two refineries, the nominal distillation capacity of SOGARA became 1,2 million tons/year. However, as a result of cracking and reforming capacities, its efficient production capacity was limited to 700-750 000 tons/year. In 1986, the refinery was operated at about 650 000 tons throughput[(7)].

Figure 19 gives the consumption of various oil products for the period 1970-88. The shares of automobile fuels, petrol and diesel, in oil consumption are given in Fig. 20. The sectorial breakdown of oil final consumption is shown in Fig. 21. Transport, followed by industry, is the largest oil-consuming sector. In the

industrial sector, oil mining and refining companies account for an important part of the consumption.
In 1986 there were six oil marketing companies: BP, Agip, Mobil, Total, Texaco (with the government holding 10% of their stock), and Pizo, the national oil marketing company with a 50% state partnership. Pizo was established in 1975 in order to ensure that all regions of the country had access to petroleum products. However, following severe financial difficulties, Pizo was liquidated at the end of 1987. A new marketing company was formed by Shell, with the government as a minority shareholder. Oil storage facilities outside Port Gentil are handled by the Société Gabonaise d'Entreposage des Produits Pétroliers (SGEPP) which is jointly owned by the oil marketing companies.

5.4 Electricity

Figures 22 and 23 give the installed capacity and the production of electricity respectively for the period 1959-88. Until the early 1970s, electricity came exclusively from gas and oil-fired thermal plants. With the building of hydroplants, hydro-electricity has been progressively increasing its share, accounting for 168,8 MW out of a total installed capacity of 251,9 MW in 1988. Hydro-electricity represented about 77% of the total electricity generated in the country (877 GWh) in 1989. However, less than 1% of the hydropower potential is harnessed. Electricity consumption per capita, according to the United Nations 1988 Energy Statistical Yearbook, was 800 kWh in 1988.

Electricity supply is almost completely in the hands of Société d'Energie et d'Eau du Gabon (SEEG), a semi-public corporation with a 63% state partnership. SEEG owns and operates all the hydroplants. Two of the four hydroplants found in the country are located on the Mbei River: the 68,4 MW (3 x 22,8 MW) Tchimbele (built between 1980 and 1985, with a 220 million m^3 reservoir), and downstream, the 57,6 MW (2 x 9,6 MW + 2 x 19,2 MW) Kinguele (with a negligible reservoir). The first two units were built in 1972 and 1973, while the last two units were built from 1975 to 1978. With a total installed capacity of 126 MW, altogether they can generate 670 GWh/year. However, their output is reduced in dry years to 108 MW and 490 GWh. The remaining hydro-electric stations are the 18,56 MW (4 x 4,64 MW) Poubara I and the 19,2 MW (2 x 9,6 MW) Poubara II. Poubara III is planned for the future.

Private sector generation is small in both installed capacity and power generated and is limited to individuals, remote villages, and large farms, which own some thermal sets to meet their own requirements.

SEEG's operational activities are divided into 22 small isolated centres served by diesel plants, and three important and independent subsystems, respectively centred on Libreville and Port Gentil on the Atlantic coast, and Franceville/Moanda in the interior of the country. Plans to interconnect the Libreville and Port Gentil networks have been frozen.

Libreville, the capital and largest population centre of the country, has the largest electricity network and is the largest load centre, accounting for approximately 60% of both the installed capacity and the power generated by SEEG, and for 65% of SEEG's consumers in 1985. It is served by the Kinguele hydro-electric power station, the Tchimbele hydroplant (completed in 1985), and the 41,6 MW (2 x 20,8 MW) gas-fired thermal power station installed at the port of Owendo in 1986. The two hydroplants are synchronized into one system and linked by a 225 kV line (40 km). A 90 kV (104 km) transmission line runs from Kinguele to the Bissegue substation on the outskirts of Libreville via N'Toum.

The second largest network and load system is found at Port Gentil, which accounted for 15% of SEEG's consumers in 1985. Port Gentil is the country's economic capital, the centre of the petroleum industry, and the largest population centre outside Libreville. The electricity supply is entirely thermally generated as the potential for natural gas is important in the region. The bulk of natural gas from the oil fields is flared. A 41,8 MW (2 x 20,9 MW) gas-fired thermal plant, located on the edge of the city, covers all the electricity needs, including current peak demand. Natural gas is piped in from offshore oil fields. An old 5 x 3 MW diesel plant is kept as backup.

The third important electricity system covers the mining centres of Franceville and Moanda in the interior of the country. Together they represent the third largest population centre and accounted for about 5% of SEEG's consumers in 1985. This system is served by the Poubara hydro-electric stations and the 13,8 MW (5 x 2,2 MW + 2 x 1,4 MW) diesel plant at Moyabi. A 63 kV transmission line extends from the Poubara station to Franceville (21 km) and to Moanda (54 km) via the substations of Mvengue and Moyabi.

In 1985 the total number of consumers amounted to 58 506 (360 high voltage (HV) and medium voltage (MV), and 58 146 low voltage (LV)). The sectorial breakdown of electricity final consumption is given in Fig. 24. Industry is the largest consumer of electricity, followed by the residential sector.

6. PRICING

6.1 Oil

The wholesale price levels of crude oil and petroleum products are set by the government. The government levies substantial tax on oil products. In 1986 the tax content of the retail price ranged from 12,5% for kerosene to 55% for regular gasoline. Butane and kerosene are subsidized because of their social importance. However, there is also a cross-subsidization among products through the equalization fund which tries to minimize the difference in the selling prices of products throughout the country. A stabilization fund is used to stabilize consumers prices over time in order to avoid frequent adjustments. In 1986 the selling price per litre ranged from 80 CFAF (22,8 USc) for kerosene to 280 CFAF (0,8 US$) for premium gasoline.

6.2 Electricity

For medium voltage consumers, the electricity pricing structure has two components, varying from one subsystem to another. The first component is a demand charge per kW of subscribed capacity (with peak and off-peak rates for the Libreville subsystem). The second is a declining block rate structure energy charge.

In the low voltage subsector, consumers with a demand capacity of less than 1 kW have a special tariff with a two-block rate structure. It is called the "social residential tariff" and is the same all over the country. Other residential consumers have a declining block structure tariff. Tariffs for industrial users have a single block structure.

The electricity pricing levels are expected to cover the general costs of electricity supply. However, there is some cross-subsidization and a number of specialized costs incorporated into electricity billing. In 1986 the price of 1 kWh of electricity was 10,70 USc for residential low consumption (<20 kWh/month), 15,24 USc for residential high and commercial (>20 kWh and <400 kWh/month), 17,32 USc for small industry (>400 kWh and <2000 kWh/month), and 16,28 USc for large industry (>2000 kWh and <100 000 kWh/month). The average revenue from electricity sales was 12,56 USc[13].

7. DISCUSSION

Gabon enjoys the advantages of having a small population and being endowed with important economic energy resources. Except for some additional oil imports, the country is self-sufficient in all energy forms.

In 1985 the two refineries of the country were merged for rationalization purposes. However, the country produces a surplus of fuel oil which is exported at a considerable loss.

The bulk of natural gas associated with crude oil is flared, and the remainder is used for electricity generation. The Port Gentil electricity subsystem is, and will remain for the foreseeable future, dependent on natural gas-fired thermal plants. Less than 1% of the hydropower potential has been harnessed.

Since 1920 timber has been an important export commodity. Although forest resources are abundant, log cutting and the farming of cash and export crops are eroding the forest cover. Reforestation programmes are under way in order to maintain the timber output.

Oil and electricity pricing tend to reflect the energy cost recovery. However, there is some cross-subsidization and special costs are included in the billing.

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GABON

TABLES

TABLE A. ECONOMIC INDICATORS

MILLIONS OF NATIONAL CURRENCY UNLESS INDICATED

YEAR	POPUL MILLIONS	POPUL. GROWTH RATE (%)	GROSS DOMESTIC PRODUCT AT MARKET COST: AGRICULTURE	INDUSTRY: TOTAL INDUSTR	INDUSTRY: MINING QUARRY	INDUSTRY: MANUFACTURE	INDUSTRY: ELEC,WT AND GAS	INDUSTRY: CONSTRUCTION	OTHER SERVICE + TAXES	TOTAL	GDP DEFLATO	GDP AT 1985 PRICES MARKET	GDP/CAPITA CURREN	GDP/CAPITA REAL 1985	EXCHAN RATE CFA FRANCS PER US$	GDP IN US$(MILL) CURREN PRICES MARKET	GDP IN US$(MILL) AT 1985 PRICES MARKET	GDP PER CAPITA US$/CAPI	GDP PER CAPITA US$(1985)/ CAPITA
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	0.499	NA	16100	25300	NA	NA	NA	NA	25400	66800	19.8	337886	133868	677126	246.9	271	752	542	1507
1968	0.488	-2.2	13400	33200	NA	NA	NA	NA	26300	72900	12.2	598031	149385	1225474	246.9	295	1331	605	2728
1969	0.493	1.0	15400	37700	NA	5900	NA	NA	29600	82700	12.8	644884	167748	1308081	259.7	318	1435	646	2912
1970	0.504	2.2	16600	42600	NA	6100	NA	NA	35900	95100	12.8	745543	188690	1479253	277.7	342	1659	679	3293
1971	0.525	4.2	19900	47900	NA	7500	NA	NA	40800	108600	13.6	800038	206857	1523882	277.1	392	1781	746	3392
1972	0.550	4.8	16300	55600	NA	8400	NA	NA	53800	125700	12.6	996088	228545	1811068	252.2	498	2217	906	4031
1973	0.578	5.1	18700	77100	NA	10700	NA	NA	65300	161100	17.0	948484	278720	1640976	222.7	723	2111	1252	3653
1974	0.607	5.0	30500	235500	NA	13600	NA	NA	105700	371700	28.1	1322602	612356	2178917	240.5	1546	2944	2546	4850
1975	0.637	4.9	29600	288000	NA	19700	NA	NA	144800	462400	29.3	1576461	725903	2474822	214.3	2158	3509	3387	5509
1976	0.668	4.9	36000	448400	NA	27800	NA	NA	234700	719100	33.6	2138338	1076497	3201105	239.0	3009	4760	4505	7125
1977	0.698	4.5	37700	402100	NA	32600	NA	NA	250400	690200	36.9	1870302	988825	2679515	245.7	2809	4163	4025	5964
1978	0.728	4.3	35100	311800	NA	32200	NA	NA	192300	539200	38.0	1419151	740659	1949383	225.6	2390	3159	3282	4339
1979	0.761	4.5	48000	398100	NA	32300	NA	NA	198500	644600	45.2	1427468	847043	1875779	212.7	3030	3177	3982	4175
1980	0.797	4.7	65300	556300	NA	49800	NA	NA	282900	904500	61.9	1461959	1134881	1834328	211.3	4281	3254	5371	4083
1981	0.835	4.8	66900	642100	NA	53700	NA	NA	340600	1049600	74.8	1403938	1257006	1681360	271.7	3863	3125	4626	3743
1982	0.875	4.8	72900	738600	NA	63500	NA	NA	377400	1188900	82.5	1441627	1358743	1647574	328.6	3618	3209	4135	3667
1983	0.916	4.7	83000	769000	NA	77000	NA	NA	435000	1287000	88.5	1454697	1405022	1588097	381.7	3372	3238	3681	3535
1984	0.957	4.5	96600	974100	NA	97300	NA	NA	465300	1536000	99.2	1548677	1605016	1618282	437.0	3515	3447	3673	3602
1985	0.997	4.2	102200	1004900	NA	117500	NA	NA	538900	1646000	100.0	1646000	1650953	1650953	449.3	3664	3664	3675	3675
1986	1.023	2.6	109300	538200	NA	110000	NA	NA	553400	1200900	65.6	1833874	1173900	1792644	346.3	3468	4062	3390	3990
1987	1.050	2.6	107400	469800	NA	96800	NA	NA	443400	1020600	68.2	1496200	972000	1424952	300.5	3398	3330	3234	3172
1988	1.077	2.6	108000	377000	NA	98700	NA	NA	478300	963300	64.3	1497559	894429	1390491	297.9	3234	3333	3003	3095
1989	1.105	2.6	112500	510200	NA	89000	NA	NA	474400	1097100	70.5	1556969	992851	1409021	319.0	3439	3466	3112	3136
1990	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 B. ENERGY BREAKDOWN

YEAR	TOTAL FINAL CONSUMPTION (000s TOE): COMMERCIAL FORMS OF ENERGY COAL	OIL	HYDRO	GAS	ELECT	(TOTAL)	TRADIT. ENERGY	TOTAL ENERGY (TRAD+COM)	ENERGY FORMS AS % OF TFC: COM. ENERGY	TRADIT. ENERGY	ENERGY FORMS PER CAPITA: OIL	ELECT	COM. ENERGY	TRAD. ENERGY	TOTAL ENERGY	RATIO COM. ENERGY/ TRAD. ENERGY	FINAL CONSUMPT. OF OIL IN OIL REFINERIES: 000s TOE	% OF OIL TFC
1970	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1971	0.0	234.6	0.0	0.0	8.3	243.1	60.0	303.1	80.2	19.8	0.45	0.02	0.5	0.1	0.6	4.1	90.4	38.5
1972	0.0	250.2	0.0	0.0	9.7	259.9	61.0	320.9	81.0	19.0	0.45	0.02	0.5	0.1	0.6	4.3	67.3	26.9
1973	0.0	269.3	0.0	0.0	11.6	280.9	62.0	342.9	81.9	18.1	0.47	0.02	0.5	0.1	0.6	4.5	88.1	32.7
1974	0.0	275.2	0.0	0.0	13.2	288.4	62.0	350.4	82.3	17.7	0.45	0.02	0.5	0.1	0.6	4.7	65.0	23.6
1975	0.0	280.5	0.0	0.0	17.6	298.1	63.0	361.1	82.6	17.4	0.44	0.03	0.5	0.1	0.6	4.7	68.2	24.3
1976	0.0	285.4	0.0	0.0	22.3	307.7	63.0	370.7	83.0	17.0	0.43	0.03	0.5	0.1	0.6	4.9	102.7	36.0
1977	0.0	328.9	0.0	0.0	26.5	355.4	67.0	422.4	84.1	15.9	0.47	0.04	0.5	0.1	0.6	5.3	93.9	28.5
1978	0.0	332.7	0.0	0.0	33.9	366.6	84.0	450.6	81.4	18.6	0.46	0.05	0.5	0.1	0.6	4.4	102.2	30.7
1979	0.0	334.7	0.0	0.5	37.6	372.8	71.0	443.8	84.0	16.0	0.44	0.05	0.5	0.1	0.6	5.3	78.4	23.4
1980	0.0	362.1	0.0	0.5	41.7	404.3	76.0	480.3	84.2	15.8	0.45	0.05	0.5	0.1	0.6	5.3	100.9	27.9
1981	0.0	434.4	0.0	0.5	41.5	476.4	77.0	553.4	86.1	13.9	0.52	0.05	0.6	0.1	0.7	6.2	52.3	12.0
1982	0.0	431.5	0.0	0.5	49.3	481.3	77.0	558.3	86.2	13.8	0.49	0.06	0.6	0.1	0.6	6.3	39.7	9.2
1983	0.0	425.1	0.0	0.5	55.0	480.6	77.0	557.6	86.2	13.8	0.46	0.06	0.5	0.1	0.6	6.2	66.7	15.7
1984	0.0	441.7	0.0	0.5	59.0	501.2	75.0	576.2	87.0	13.0	0.46	0.06	0.5	0.1	0.6	6.7	56.5	12.8
1985	0.0	475.3	0.0	0.5	64.0	539.6	75.0	614.6	87.8	12.2	0.46	0.06	0.5	0.1	0.6	7.2	33.3	7.0
1986	0.0	433.7	0.0	0.5	66.6	501.0	675.0	1176.0	42.6	57.4	0.42	0.07	0.5	0.7	1.1	0.7	77.2	17.8
1987	0.0	362.1	0.0	0.6	63.2	425.9	691.0	1116.9	38.1	61.9	0.34	0.06	0.4	0.7	1.1	0.6	66.1	23.8
1988	0.0	340.8	0.0	0.6	63.3	404.7	638.0	1042.7	38.8	61.2	0.32	0.06	0.4	0.6	1.0	0.6	91.1	26.7
1989	NA	NA	NA	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	NA

DATA OBTAINED FROM: IEA WORLD ENERGY STATISTICS AND BALANCES (1971-1988)

TABLE C. SECTORIAL DISTRIBUTION OF TOTAL FINAL CONSUMPTION (000'S TOE)

YEAR	GAS		OIL						ELECTRICITY						TOTAL				TOTAL	
	IND	TOTAL	IND	TRANS	AGRI	RESID.	OTHER	TOTAL	IND	TRANS	AGRI	RESID.	OTHE	TOTAL	IND	TRANS	AGRI	RESID.	OTHER	TOTAL
1970	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1971	0.0	0	50.3	137.3	11.4	18.0	17.8	234.8	2.9	0.0	0.4	2.8	2.2	8.3	53.2	137.3	11.8	20.8	20	243.1
1972	0.0	0	55.4	139.3	12.4	23.2	19.9	250.2	3.4	0.0	0.5	3.3	2.5	9.7	58.8	139.3	12.9	26.5	22.4	259.9
1973	0.0	0	55.4	154.2	13.5	25.4	20.8	269.3	4.0	0.0	0.6	4.0	3	11.6	59.4	154.2	14.1	29.4	23.8	280.9
1974	0.0	0	58.6	156.2	13.5	24.3	22.6	275.2	4.7	0.0	0.8	4.2	3.5	13.2	63.3	156.2	14.3	28.5	26.1	288.4
1975	0.0	0	57.5	159.4	13.5	26.4	23.7	280.5	5.9	0.0	0.9	6.1	4.7	17.6	63.4	159.4	14.4	32.5	28.4	298.1
1976	0.0	0	61.3	161.6	13.5	25.4	23.6	285.4	8.4	0.0	1.4	6.8	5.7	22.3	69.7	161.6	14.9	32.2	29.3	307.7
1977	0.0	0	76.8	178.2	18.6	26.5	28.8	328.9	8.3	0.0	1.5	9.5	7.2	26.5	85.1	178.2	20.1	36	36	355.4
1978	0.0	0	70.6	201.8	16.6	15.1	28.6	332.7	14.1	0.0	2.3	9.1	8.4	33.9	84.7	201.8	18.9	24.2	37	366.6
1979	0.5	0.5	78.5	198.5	17.8	15.1	25	334.7	16.7	0.0	2.4	9.7	6.8	37.6	95.7	198.5	20	24.6	33.8	372.8
1980	0.5	0.5	89.7	206.9	20.7	15.1	29.7	362.1	18.8	0.0	2.7	10.6	9.6	41.7	109	206.9	23.4	25.7	39.3	404.3
1981	0.5	0.5	107.5	239.4	29.0	24.5	34	434.4	17.1	0.0	2.8	11.3	10.3	41.5	125.1	239.4	31.8	35.8	44.3	476.4
1982	0.5	0.5	105.8	235.1	29.0	26.6	35	431.5	21.2	0.0	3.0	13.3	11.8	49.3	127.5	235.1	32	39.9	46.8	481.3
1983	0.5	0.5	101.8	232.0	26.9	28.6	37.8	425.1	24.5	0.0	3.3	14.5	12.7	55	126.6	232	30.2	41.1	50.5	480.6
1984	0.5	0.5	104.4	239.5	26.9	32.1	38.8	441.7	26.4	0.0	3.5	15.5	13.6	59	131.3	239.5	30.4	47.6	52.4	501.2
1985	0.5	0.5	120.4	252.1	30.0	31.1	41.7	475.3	28.7	0.0	3.6	16.8	14.7	64	149.6	252.1	33.8	47.9	56.4	539.8
1986	0.5	0.5	109.7	253.7	0.0	30.0	40.3	433.7	31.1	0.0	3.9	18.9	14.9	66.6	141.3	253.7	3.9	46.9	55.2	501.0
1987	0.6	0.6	87.8	214.9	0.0	31.1	28.3	362.1	27.3	0.0	3.9	17.2	14.8	63.2	115.7	214.9	3.9	48.3	43.1	425.9
1988	0.6	0.6	80.6	194.6	0.0	31.1	34.5	340.8	27.3	0.0	3.9	17.2	14.9	63.3	108.5	194.6	3.9	48.3	49.4	404.7
1989	NA	NA	NA	NA	NA	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	NA	NA	NA

TABLE D. SECTORIAL DISTRIBUTION OF TOTAL FINAL CONSUMPTION AS FOR A PERCENTAGE OF TOTAL

YEAR	GAS		OIL					
	IND	TOTAL	IND	TRANS	AGRI	RESID	OTHER	TOTAL
1970	NA	NA	NA	NA	NA	NA	NA	NA
1971	0	0	21.4	58.5	4.9	7.7	7.6	100
1972	0	0	22.1	55.7	5.0	9.3	8.0	100
1973	0	0	20.6	57.3	5.0	9.4	7.7	100
1974	0	0	21.3	56.8	4.9	8.8	8.2	100
1975	0	0	20.5	56.8	4.8	9.4	8.4	100
1976	0	0	21.5	56.6	4.7	8.9	8.3	100
1977	0	0	23.4	54.2	5.7	8.1	8.8	100
1978	0	0	21.2	60.7	5.0	4.5	8.6	100
1979	100	100	23.5	59.3	5.3	4.5	7.5	100
1980	100	100	24.8	57.1	5.7	4.2	8.2	100
1981	100	100	24.7	55.1	6.7	5.8	7.8	100
1982	100	100	24.5	54.5	8.7	6.2	8.1	100
1983	100	100	23.9	54.6	8.3	6.3	8.9	100
1984	100	100	23.6	54.2	6.1	7.3	8.8	100
1985	100	100	25.3	53.0	6.3	6.5	8.8	100
1986	100	100	25.3	58.5	0.0	6.9	9.3	100
1987	100	100	24.2	59.3	0.0	8.6	7.8	100
1988	100	100	23.7	57.1	0.0	9.1	10.1	100
1989	NA	NA	NA	NA	NA	NA	NA	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA

YEAR	ELEC						TOTAL					
	IND	TRANS	AGRI	RESID	OTHER	TOTAL	IND	TRANS	AGRI	RESID	OTHE	TOTAL
1970	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1971	34.9	0.0	4.8	33.7	26.5	100	21.9	56.5	4.9	8.6	6.2	100
1972	35.1	0.0	5.2	34.0	25.8	100	22.6	53.6	5.0	10.2	8.6	100
1973	34.5	0.0	5.2	34.5	25.9	100	21.1	54.9	5.0	10.5	8.5	100
1974	35.6	0.0	6.1	31.8	26.5	100	21.9	54.2	5.0	9.9	9.0	100
1975	33.5	0.0	5.1	34.7	26.7	100	21.3	53.5	4.8	10.9	9.5	100
1976	37.7	0.0	6.3	30.5	25.6	100	22.7	52.5	4.8	10.5	9.5	100
1977	31.3	0.0	5.7	35.8	27.2	100	23.9	50.1	5.7	10.1	10.1	100
1978	41.6	0.0	6.8	26.8	24.8	100	23.1	55.0	5.2	8.6	10.1	100
1979	44.4	0.0	6.4	25.8	23.4	100	25.7	53.2	5.4	6.7	9.1	100
1980	45.1	0.0	6.5	25.4	23.0	100	27.0	51.2	5.8	6.4	9.7	100
1981	41.2	0.0	6.7	27.2	24.8	100	26.3	50.3	8.7	7.5	9.3	100
1982	43.0	0.0	6.1	27.0	23.9	100	26.5	48.8	6.6	8.3	9.7	100
1983	44.5	0.0	6.0	26.4	23.1	100	26.4	48.3	6.3	8.6	10.5	100
1984	44.7	0.0	5.9	26.3	23.1	100	26.2	47.8	6.1	9.5	10.5	100
1985	44.8	0.0	5.9	26.3	23.0	100	27.7	48.7	6.3	8.9	10.4	100
1986	46.6	0.0	5.8	25.3	22.3	100	28.2	50.6	0.8	9.4	11.0	100
1987	43.2	0.0	6.2	27.2	23.4	100	27.2	50.5	0.9	11.3	10.1	100
1988	43.1	0.0	6.2	27.2	23.5	100	26.8	48.1	1.0	11.9	12.2	100
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

TABLE E. ENERGY DATA FOR GRAPHS

YEAR	TFC COMPONENTS AS % OF TOTAL COMMERCIAL ENERGY GAS	OIL	ELECT	TFC COMPONENTS AS % OF TOTAL ENERGY GAS	OIL	ELECT	COM. TFC GROWTH RATE %	3 PT M.	5 PTS M.A.	TFC GROWTH RATE %	3 PT M.	5 PTS M.A.	ENERGY INTENSITY (TOE/CFA FRANC) COMMERCIAL ENERGY INTENSITY TOTAL	INDUSTRY	AGRIC	OTHER	TFC INTENSITY
1970	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1971	0.0	96.6	3.4	0.0	77.5	2.7	NA	NA	NA	NA	NA	NA	3.0E-07	1.5E-07	6.0E-08	5.9E-07	3.8E-07
1972	0.0	96.3	3.7	0.0	78.0	3.0	6.9	NA	NA	5.9	NA	NA	2.6E-07	1.3E-07	1.0E-07	4.4E-07	3.2E-07
1973	0.0	95.9	4.1	0.0	78.5	3.4	8.1	5.9	NA	6.9	5.0	NA	3.0E-07	1.3E-07	1.3E-07	5.4E-07	3.6E-07
1974	0.0	95.4	4.6	0.0	78.5	3.8	2.7	4.7	4.8	2.2	4.0	4.1	2.2E-07	7.6E-08	1.3E-07	5.6E-07	2.6E-07
1975	0.0	94.1	5.9	0.0	77.7	4.9	3.4	3.1	6.6	3.1	2.6	5.7	1.9E-07	6.5E-08	1.4E-07	4.5E-07	2.3E-07
1976	0.0	92.8	7.2	0.0	77.0	8.0	3.2	7.4	5.6	2.7	6.6	5.7	1.4E-07	5.2E-08	1.4E-07	3.2E-07	1.7E-07
1977	0.0	92.5	7.5	0.0	77.9	8.3	15.5	7.3	5.4	13.9	7.8	5.0	1.9E-07	7.8E-08	2.0E-07	3.7E-07	2.3E-07
1978	0.0	90.8	9.2	0.0	73.8	7.5	3.2	6.6	6.4	6.7	6.4	6.0	2.6E-07	1.0E-07	2.0E-07	5.2E-07	3.2E-07
1979	0.0	89.8	10.1	0.0	75.4	8.5	1.7	4.4	9.3	-1.5	4.5	8.5	2.6E-07	1.1E-07	1.9E-07	5.8E-07	3.1E-07
1980	0.0	89.8	10.3	0.0	75.4	8.7	6.4	9.3	6.4	8.2	7.3	5.9	2.8E-07	1.2E-07	2.2E-07	5.9E-07	3.3E-07
1981	0.0	91.2	6.7	0.0	78.5	7.5	17.8	9.1	5.6	15.2	6.1	4.5	3.4E-07	1.5E-07	3.6E-07	7.0E-07	3.9E-07
1982	0.0	89.7	10.2	0.0	77.3	8.8	1.0	6.2	6.3	0.9	5.3	5.5	3.3E-07	1.4E-07	3.6E-07	7.0E-07	3.9E-07
1983	0.0	88.5	11.4	0.0	76.2	9.9	-0.1	1.7	6.1	-0.1	1.4	5.2	3.3E-07	1.5E-07	3.2E-07	6.6E-07	3.8E-07
1984	0.0	88.1	11.8	0.0	76.7	10.2	4.3	3.9	1.1	3.3	3.3	20.4	3.2E-07	1.3E-07	3.1E-07	7.2E-07	3.7E-07
1985	0.0	88.1	11.9	0.0	77.3	10.4	7.7	1.8	-2.1	8.7	33.6	19.2	3.3E-07	1.5E-07	3.3E-07	6.6E-07	3.7E-07
1986	0.0	86.6	13.3	0.0	36.9	5.7	-7.2	-4.6	-3.0	91.3	31.0	17.9	2.7E-07	1.7E-07	2.3E-08	4.2E-07	6.4E-07
1987	0.0	85.0	14.6	0.0	32.4	5.7	-15.0	-9.1	NA	-6.0	26.5	NA	2.6E-07	1.7E-07	2.5E-08	4.7E-07	7.5E-07
1988	0.0	84.2	15.6	0.0	32.7	6.1	-5.0	NA	NA	-6.6	NA	NA	2.7E-07	1.9E-07	2.3E-08	3.9E-07	7.0E-07
1989	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	ERR	NA	NA	ERR	NA	NA	NA	NA	NA

TABLE F. ELECTRICITY DATA INSTALLED CAPACITY (MEGAWATTS)

YEAR	PUBLIC HYDRO	THERMAL	TOTAL	SELFPRODUCERS HYDRO	THERMAL	TOTAL	TOTAL HYDRO	TOTAL THERMAL	TOTAL INSTALLED
1958	0.0	NA	NA	0.0	0.0	0.0	0.0	NA	NA
1959	0.0	8.0	8.0	0.0	0.0	0.0	0.0	8.0	8.0
1960	0.0	8.0	8.0	0.0	0.0	0.0	0.0	8.0	8.0
1961	0.0	10.0	10.0	0.0	0.0	0.0	0.0	10.0	10.0
1962	0.0	10.0	10.0	0.0	0.0	0.0	0.0	10.0	10.0
1963	0.0	12.0	12.0	0.0	0.0	0.0	0.0	12.0	12.0
1964	0.0	16.0	16.0	0.0	0.0	0.0	0.0	16.0	16.0
1965	0.0	18.0	18.0	0.0	0.0	0.0	0.0	18.0	18.0
1966	0.0	22.0	22.0	0.0	0.0	0.0	0.0	22.0	22.0
1967	0.0	16.0	16.0	0.0	0.0	0.0	0.0	16.0	16.0
1968	0.0	22.0	22.0	0.0	0.0	0.0	0.0	22.0	22.0
1969	0.0	25.0	25.0	0.0	0.0	0.0	0.0	25.0	25.0
1970	0.0	40.0	40.0	0.0	0.0	0.0	0.0	40.0	40.0
1971	0.0	34.0	34.0	0.0	0.0	0.0	0.0	34.0	34.0
1972	3.0	34.0	37.0	0.0	0.0	0.0	3.0	34.0	37.0
1973	3.0	37.0	40.0	0.0	0.0	0.0	3.0	37.0	40.0
1974	3.0	37.0	40.0	0.0	0.0	0.0	3.0	37.0	40.0
1975	47.7	53.4	101.1	0.0	0.0	0.0	47.7	53.4	101.1
1976	52.3	53.8	106.1	0.0	0.0	0.0	52.3	53.8	106.1
1977	57.0	105.4	162.4	0.0	0.0	0.0	57.0	105.4	162.4
1978	76.2	90.8	167.0	0.0	0.0	0.0	76.2	90.8	167.0
1979	76.2	91.4	167.6	0.0	0.0	0.0	76.2	91.4	167.6
1980	121.8	87.2	209.0	0.0	0.0	0.0	121.8	87.2	209.0
1981	121.8	97.4	219.2	0.0	0.0	0.0	121.8	97.4	219.2
1982	121.8	99.2	221.0	0.0	0.0	0.0	121.8	99.2	221.0
1983	131.4	97.0	228.4	0.0	0.0	0.0	131.4	97.0	228.4
1984	141.0	98.5	239.5	0.0	0.0	0.0	141.0	98.5	239.5
1985	163.8	88.1	251.9	0.0	0.0	0.0	163.8	88.1	251.9
1986	163.8	88.1	251.9	0.0	0.0	0.0	163.8	88.1	251.9
1987	163.8	88.1	251.9	0.0	0.0	0.0	163.8	88.1	251.9
1988	163.8	88.1	251.9	0.0	0.0	0.0	163.8	88.1	251.9
1989	NA	NA	NA	NA	NA	NA	NA	NA	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA

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

TABLE G. ENERGY OIL PRODUCTS CONSUMPTION (000'S METRIC TONS)

YEAR	LPG	RESIDUAL	PETROL	AVGAS	KEROSEN	DIESEL	OTHER	TOTAL	DIES/PE	% PETROL	%DIESEL	OIL TFC GROWTH RAT 1 PT	OIL TFC GROWTH RAT 3 PTS M.A.	OIL INTENSITY TOE/GDP REL 1985	OIL TFC GROWTH/GDP GROWTH 1 PT	OIL TFC GROWTH/GDP GROWTH 3 PTS M.A.
1970	3.0	4.0	23.0	3.0	5.5	100.0	65.0	203.5	4.35	11.3	49.1	NA	NA	NA	NA	NA
1971	3.0	4.5	25.0	3.0	6.0	109.0	70.0	220.5	4.36	11.3	49.4	NA	NA	2.9E-07	NA	NA
1972	3.0	4.7	27.0	4.0	6.9	118.0	75.0	238.6	4.37	11.3	49.5	6.6	NA	2.5E-07	0.3	NA
1973	4.0	4.8	29.0	5.0	7.5	126.0	72.0	248.3	4.34	11.7	50.7	7.6	5.5	2.8E-07	-1.6	-0.4
1974	3.0	5.0	30.0	5.0	8.1	120.0	88.9	260.0	4.00	11.5	46.2	2.2	3.9	2.1E-07	0.1	-0.5
1975	3.0	5.4	35.0	5.0	8.6	113.0	99.0	269.0	3.23	13.0	42.0	1.9	2.0	1.8E-07	0.1	0.1
1976	4.0	5.8	37.0	6.0	9.4	130.0	83.8	276.0	3.51	13.4	47.1	1.7	6.3	1.3E-07	0.0	-0.4
1977	4.0	6.0	40.0	8.0	9.7	140.0	77.3	285.0	3.50	14.0	49.1	15.2	6.0	1.8E-07	-1.2	-0.4
1978	5.3	6.1	44.9	4.8	10.0	161.3	73.0	305.4	3.59	14.7	52.8	1.2	5.7	2.3E-07	-0.0	-0.1
1979	5.6	10.2	45.7	4.2	9.0	160.3	69.0	304.0	3.51	15.0	52.7	0.8	3.3	2.3E-07	1.0	1.5
1980	6.1	33.7	51.2	2.9	9.7	176.9	68.6	349.1	3.46	14.7	50.7	8.2	9.6	2.5E-07	3.4	-0.2
1981	6.7	29.5	53.6	2.6	10.1	204.3	75.6	382.4	3.82	14.0	53.4	20.0	9.2	3.1E-07	-5.0	-0.6
1982	7.3	24.3	56.8	2.2	10.7	207.2	74.8	383.4	3.65	14.8	54.0	-0.7	5.9	3.0E-07	-0.2	-2.3
1983	8.3	24.5	61.7	1.7	12.0	215.3	70.5	394.0	3.49	15.7	54.8	-1.5	0.6	2.9E-07	-1.6	-0.4
1984	8.9	30.4	62.2	1.6	14.7	221.6	78.3	417.7	3.56	14.9	53.1	3.9	3.3	2.9E-07	0.6	0.1
1985	8.9	38.1	65.3	1.8	15.8	234.7	81.5	446.1	3.59	14.6	52.8	7.6	0.9	2.9E-07	1.2	0.3
1986	9.8	28.6	64.7	1.3	16.8	201.8	73.4	396.2	3.12	16.3	50.9	-8.8	-5.9	2.4E-07	-0.8	0.4
1987	10.4	32.0	66.0	1.5	17.0	203.0	90.1	420.0	3.08	15.7	48.3	-16.5	-10.4	2.4E-07	0.9	-21.5
1988	11.8	38.0	68.0	1.8	19.0	201.0	122.4	460.0	2.96	14.6	43.7	-5.9	NA	2.3E-07	-64.8	NA
1989	NA	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

DATA OBTAINED FROM: YEARBOOK OF WORLD ENERGY STATISTICS (1981)
ENERGY STATISTICS YEARBOOK (1983)
GABON: ISSUES AND OPTIONS IN THE ENERGY SECTOR (JULY 1988)
ESTIMATIONS

TABLE H. GDP DATA FOR GRAPHS

YEAR	GDP GROWTH RATE (REAL 1985 PRICES) %/YEAR	3PT MA	5PT MA	AGRIC/ INDUSTRY 1 PT	3 PT MA	% CONTRIBUTION TO GDP AGRI	IND	MINE QUARRY	MANU	ELEC,WTR GAS	CONSTR	OTHER	AGRI/MANU	% OF CHANGE GDP DEFLATOR 1 PT	3PT MA	ANNUAL CHANGE OF GDP PER CAPITA CURRENT %	3 PT M.A.	REAL %	3 PT M.A.
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	0.6	NA	24.1	37.9	NA	NA	NA	NA	38.0	NA	NA	NA	NA	NA	NA	NA
1968	77.0	NA	NA	0.4	0.5	18.4	45.5	NA	NA	NA	NA	38.1	NA	-38.3	NA	11.6	NA	81.0	NA
1969	7.8	33.5	NA	0.4	0.4	16.6	45.6	NA	7.1	NA	NA	35.6	2.6	5.2	-11.2	12.3	12.1	6.7	33.6
1970	15.6	10.3	26.4	0.4	0.4	17.5	44.8	NA	6.4	NA	NA	37.7	2.7	-0.5	3.7	12.5	11.5	13.1	7.6
1971	7.3	15.8	10.1	0.4	0.4	18.3	44.1	NA	6.9	NA	NA	37.6	2.7	6.4	-0.4	9.6	10.9	3.0	11.6
1972	24.5	9.0	16.4	0.3	0.3	13.0	44.2	NA	6.7	NA	NA	42.6	1.9	-7.0	11.3	10.5	14.0	16.8	4.2
1973	-4.8	19.7	17.1	0.2	0.2	11.6	47.9	NA	6.6	NA	NA	40.5	1.7	34.6	31.0	22.0	50.7	-9.4	14.1
1974	39.4	18.0	22.8	0.1	0.2	8.2	63.4	NA	3.7	NA	NA	28.4	2.2	65.5	34.6	119.7	53.4	32.8	12.3
1975	19.2	31.4	15.4	0.1	0.1	6.4	62.3	NA	4.3	NA	NA	31.3	1.5	4.4	28.2	18.5	62.2	13.6	25.2
1976	35.6	14.1	11.5	0.1	0.1	5.0	62.4	NA	3.9	NA	NA	32.6	1.3	14.7	9.6	48.3	19.6	29.3	8.9
1977	-12.5	-0.3	3.6	0.1	0.1	5.5	58.3	NA	4.7	NA	NA	36.3	1.2	9.7	9.1	-6.1	5.0	-16.3	-4.7
1978	-24.1	-12.0	0.4	0.1	0.1	6.5	57.6	NA	6.0	NA	NA	35.7	1.1	3.0	10.5	-25.1	-6.3	-27.2	-15.8
1979	0.6	-7.0	-7.5	0.1	0.1	7.4	61.8	NA	5.0	NA	NA	30.6	1.5	16.9	19.6	14.4	7.7	-3.8	-11.1
1980	2.4	-0.3	-4.5	0.1	0.1	7.2	61.5	NA	5.5	NA	NA	31.3	1.3	37.0	25.6	34.0	19.7	-2.2	-4.8
1981	-4.0	0.4	0.5	0.1	0.1	6.4	61.2	NA	5.1	NA	NA	32.5	1.2	20.6	22.7	10.6	17.6	-8.3	-4.2
1982	2.7	-0.1	1.7	0.1	0.1	6.1	62.1	NA	5.3	NA	NA	31.7	1.1	10.3	12.6	8.1	7.4	-2.0	-4.7
1983	0.9	3.4	2.5	0.1	0.1	6.4	59.6	NA	6.0	NA	NA	33.6	1.1	7.3	9.9	3.4	6.6	-3.6	-1.2
1984	6.5	4.6	5.6	0.1	0.1	6.3	63.4	NA	6.3	NA	NA	30.3	1.0	12.1	6.7	14.2	6.6	1.9	0.1
1985	6.3	6.1	1.3	0.1	0.1	6.2	61.1	NA	7.1	NA	NA	32.7	0.9	0.6	-7.2	2.9	-3.9	2.0	4.2
1986	11.4	-0.2	1.2	0.2	0.2	9.1	44.6	NA	9.2	NA	NA	46.1	1.0	-34.5	-9.6	-28.9	-14.4	8.6	-3.3
1987	-16.4	-2.3	0.7	0.2	0.2	10.5	46.0	NA	9.5	NA	NA	43.4	1.1	4.2	-12.0	-17.2	-16.0	-20.5	-4.8
1988	0.1	-4.6	NA	0.3	0.2	11.2	39.1	NA	10.2	NA	NA	49.7	1.1	-5.7	2.7	-8.0	-4.7	-2.4	-7.2
1989	4.0	NA	NA	0.2	NA	10.3	46.5	NA	6.1	NA	NA	43.2	1.3	9.5	NA	11.0	NA	1.3	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE I. CRUDE OIL AND NATURAL GAS

	CRUDE OIL (000s METRIC TONS)					NATURAL GAS (000s CU. ME)
YEAR	PRODUCTION (TOTAL	OFF SHORE	EXPORT	IMPORT	CONSUMP	PRODUCTION
1955	NA	NA	NA	NA	NA	NA
1956	NA	NA	NA	NA	NA	NA
1957	NA	NA	NA	NA	NA	NA
1958	NA	NA	NA	NA	NA	NA
1959	753	NA	781	0	0	7000
1960	800	NA	775	0	0	7452
1961	774	NA	738	0	0	6700
1962	827	NA	818	0	0	8790
1963	890	NA	944	0	0	8612
1964	1058	NA	1068	0	0	9457
1965	1264	NA	1281	0	0	10647
1966	1447	NA	1408	0	0	11493
1967	3444	NA	3185	0	259	17422
1968	4642	NA	3842	0	800	24871
1969	5030	NA	4392	0	638	25000
1970	5423	1464	4510	0	913	25000
1971	5785	1373	4842	0	943	30539
1972	6304	2207	5354	0	950	34460
1973	7598	2888	6500	0	1098	39449
1974	10202	4000	9070	0	1132	45624
1975	11096	4300	10439	0	903	47429
1976	11325	4290	NA	0	981	239417
1977	11070	4270	NA	0	845	684227
1978	10600	5000	8780	0	1820	56000
1979	10316	NA	8358	0	1958	61000
1980	8895	7800	7687	0	1208	72000
1981	7600	6500	6300	0	1300	70000
1982	7792	6800	6552	0	1240	70000
1983	7842	6810	6728	0	1192	150000
1984	8725	7150	7497	0	1228	290000
1985	8619	7210	7087	0	1010	70000
1986	8269	5712	7250	0	1015	60000
1987	7781	6750	6710	0	1068	70000
1988	7750	6735	6695	0	1070	10000
1989	NA	NA	NA	NA	NA	NA
1990	NA	NA	NA	NA	NA	NA
1991	NA	NA	NA	NA	NA	NA

DATA OBTAINED FROM: HISTORICAL DICTIONARY OF GABON
WORLD ENERGY SUPPLY (1950-1974)
YEARBOOK OF WORLD ENERGY STATISTICS (1981)
ENERGY STATISTICS YEARBOOKS (1983, 1985, 1988)

TABLE J. ELECTRICITY PRODUCTION (GWhs)

YEAR	PUBLIC HYDRO	PUBLIC THERMAL	PUBLIC TOTAL	SELF PRODUCERS HYDRO	SELF PRODUCERS THERMAL	SELF PRODUCERS TOTAL	TOTAL HYDRO	TOTAL THERMAL	TOTAL (Gwhs)	ELEC. TFC GROWTH RATE % PA	ELEC. TFC GROWTH RATE 3PT MA	ELEC. TFC GROWTH RATE 5PT MA	ELECTRICITY INTENSITY TOE/GDP REL 1985	RATIO ELEC GWTH/GDP 1 PT	RATIO ELEC GWTH/GDP 3 PT MA	ELECT/CAP kWh/CAP
1958	0.0	NA	NA	0.0	0.0	0.0	0.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
1959	0.0	16.0	16.0	0.0	0.0	0.0	0.0	16.0	16.0	NA	NA	NA	NA	NA	NA	NA
1960	0.0	20.0	20.0	0.0	0.0	0.0	0.0	20.0	20.0	NA	NA	NA	NA	NA	NA	NA
1961	0.0	22.0	22.0	0.0	0.0	0.0	0.0	22.0	22.0	NA	NA	NA	NA	NA	NA	NA
1962	0.0	27.0	27.0	0.0	0.0	0.0	0.0	27.0	27.0	NA	NA	NA	NA	NA	NA	NA
1963	0.0	32.0	32.0	0.0	0.0	0.0	0.0	32.0	32.0	NA	NA	NA	NA	NA	NA	NA
1964	0.0	36.0	36.0	0.0	0.0	0.0	0.0	36.0	36.0	NA	NA	NA	NA	NA	NA	NA
1965	0.0	42.0	42.0	0.0	0.0	0.0	0.0	42.0	42.0	NA	NA	NA	NA	NA	NA	NA
1966	0.0	49.0	49.0	0.0	0.0	0.0	0.0	49.0	49.0	NA	NA	NA	NA	NA	NA	NA
1967	0.0	56.0	56.0	0.0	0.0	0.0	0.0	56.0	56.0	NA	NA	NA	NA	NA	NA	NA
1968	0.0	74.0	74.0	0.0	0.0	0.0	0.0	74.0	74.0	NA	NA	NA	NA	NA	NA	NA
1969	0.0	84.0	84.0	0.0	0.0	0.0	0.0	84.0	84.0	NA	NA	NA	NA	NA	NA	NA
1970	0.0	97.0	97.0	0.0	0.0	0.0	0.0	97.0	97.0	NA	NA	NA	NA	NA	NA	NA
1971	0.0	114.0	114.0	0.0	0.0	0.0	0.0	114.0	114.0	NA	NA	NA	1.04E-08	NA	NA	183
1972	5.0	129.0	134.0	0.0	0.0	0.0	5.0	129.0	134.0	16.9	NA	NA	9.74E-09	0.7	NA	205
1973	5.0	160.0	165.0	0.0	0.0	0.0	5.0	160.0	165.0	19.6	16.7	NA	1.22E-08	-4.1	-1.0	233
1974	7.0	166.0	173.0	0.0	0.0	0.0	7.0	166.0	173.0	13.8	22.2	22.1	9.98E-09	0.3	-0.7	252
1975	143.3	109.7	253.0	0.0	0.0	0.0	143.3	109.7	253.0	33.3	24.6	22.5	1.12E-08	1.7	0.9	321
1976	161.6	166.0	327.8	0.0	0.0	0.0	181.6	166.0	327.8	28.7	28.3	24.1	1.04E-08	0.7	0.3	387
1977	299.4	131.6	431.2	0.0	0.0	0.0	299.4	131.8	431.2	18.8	24.5	23.5	1.42E-08	-1.5	-0.6	440
1978	348.0	143.2	491.2	0.0	0.0	0.0	348.0	143.2	491.2	27.9	19.2	19.1	2.39E-08	-1.2	5.3	540
1979	389.5	135.3	524.8	0.0	0.0	0.0	389.5	135.3	524.8	10.9	18.8	13.6	2.63E-08	18.6	7.3	573
1980	415.8	150.7	566.5	0.0	0.0	0.0	415.8	150.7	566.5	10.9	7.1	13.6	2.85E-08	4.5	7.8	607
1981	459.5	152.3	611.8	0.0	0.0	0.0	459.5	152.3	611.8	-0.5	9.7	10.3	2.96E-08	0.1	3.9	577
1982	502.9	164.3	667.2	0.0	0.0	0.0	502.9	164.3	667.2	16.8	10.0	9.6	3.42E-08	7.0	6.6	654
1983	546.5	182.5	729.0	0.0	0.0	0.0	546.5	182.5	729.0	11.6	12.5	9.1	3.78E-08	12.8	7.0	697
1984	612.9	182.2	795.1	0.0	0.0	0.0	612.9	182.2	795.1	7.3	9.1	10.1	3.81E-08	1.1	5.1	715
1985	667.7	193.6	861.3	0.0	0.0	0.0	667.7	193.6	861.3	8.5	6.7	5.3	3.89E-08	1.3	1.0	745
1986	672.0	195.0	867.0	0.0	0.0	0.0	672.0	195.0	867.0	4.4	2.5	3.0	3.64E-08	0.4	0.7	757
1987	675.0	197.0	872.0	0.0	0.0	0.0	675.0	197.0	872.0	-5.4	-0.3	NA	4.22E-08	0.3	0.8	698
1988	676.0	201.0	877.0	0.0	0.0	0.0	676.0	201.0	877.0	0.2	NA	NA	4.23E-08	1.7	NA	682
1989	NA	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

DATA OBTAINED FROM: WORLD ENERGY SUPPLY (1950-1974)
WORLD ENERGY SUPPLY (1973-1978)
YEARBOOK OF WORLD ENERGY STATISTICS (1981)
GABON: ISSUES AND OPTIONS IN THE ENERGY SECTOR (JULY 1988)
ENERGY STATISTICS YEARBOOK (1988)

TABLE K. SOGARA PRODUCTION 1975-1985 (THOUSAND METRIC TONS)

YEAR	LPG	PETROL	KEROSE	DIESEL	RESIDUAL	OTHER	TOTAL
1975	4.99	127.40	96.52	233.50	352.31	0.56	815.28
1976	5.36	135.63	104.23	250.26	432.58	5.36	933.42
1977	3.97	116.94	86.74	226.63	325.17	13.02	772.47
1978	5.80	130.22	104.33	261.72	355.62	7.44	865.13
1979	3.14	101.08	90.26	184.26	293.33	3.74	675.81
1980	4.69	75.10	80.87	191.10	289.13	7.68	648.57
1981	4.55	71.63	88.30	230.97	235.35	6.35	637.15
1982	5.25	59.57	90.53	198.40	198.35	22.33	574.43
1983	3.93	53.04	68.06	182.88	154.10	20.67	482.68
1984	5.64	57.83	81.68	197.34	174.24	19.48	536.21
1985	7.30	61.74	87.45	228.19	189.81	21.09	595.58

DATA OBTAINED FROM: `GABON: ISSUES AND OPTIONS IN THE ENERGY SECTOR (JULY 1988)'

FIGURES

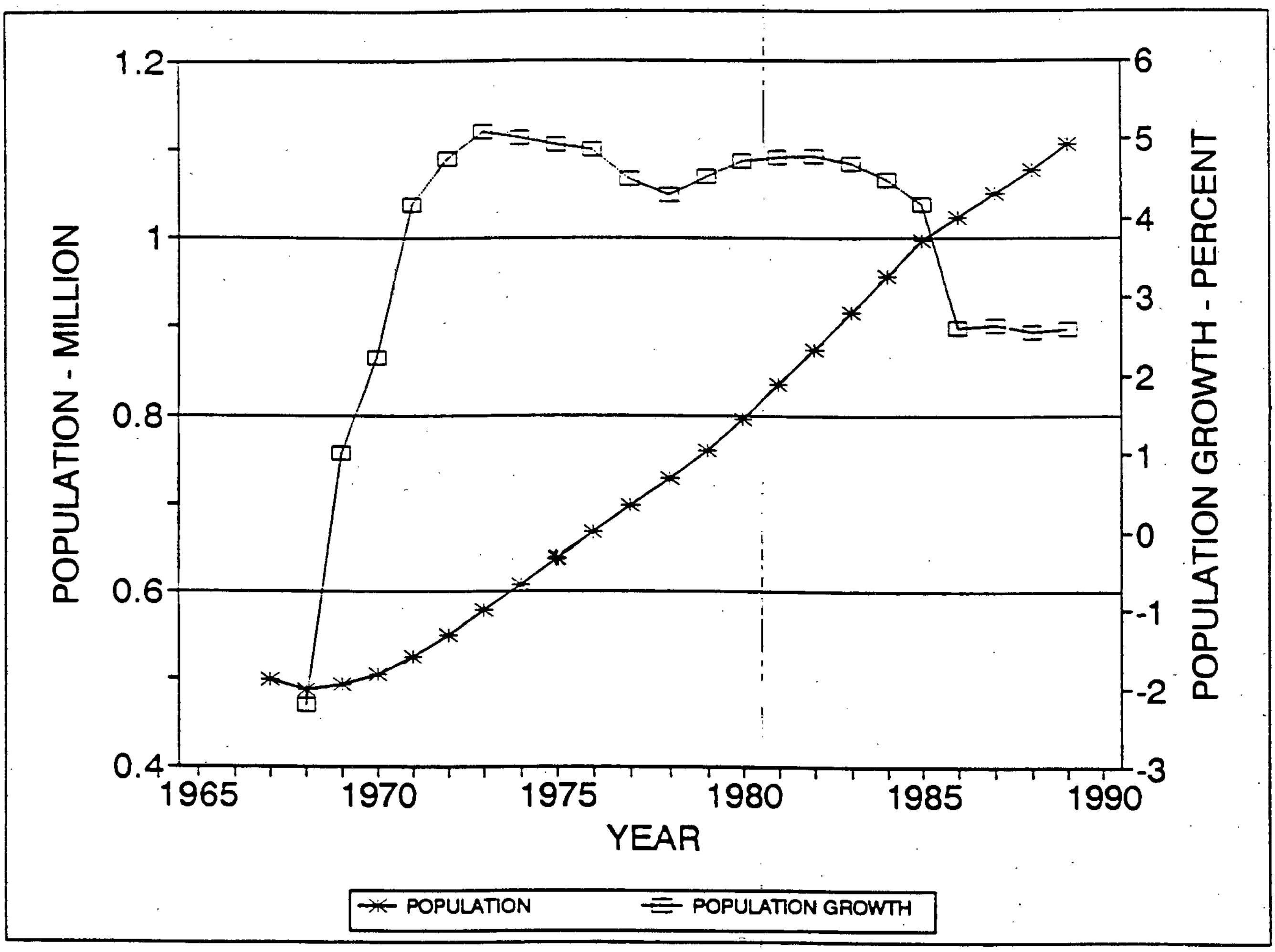


Figure 1. Population and population growth

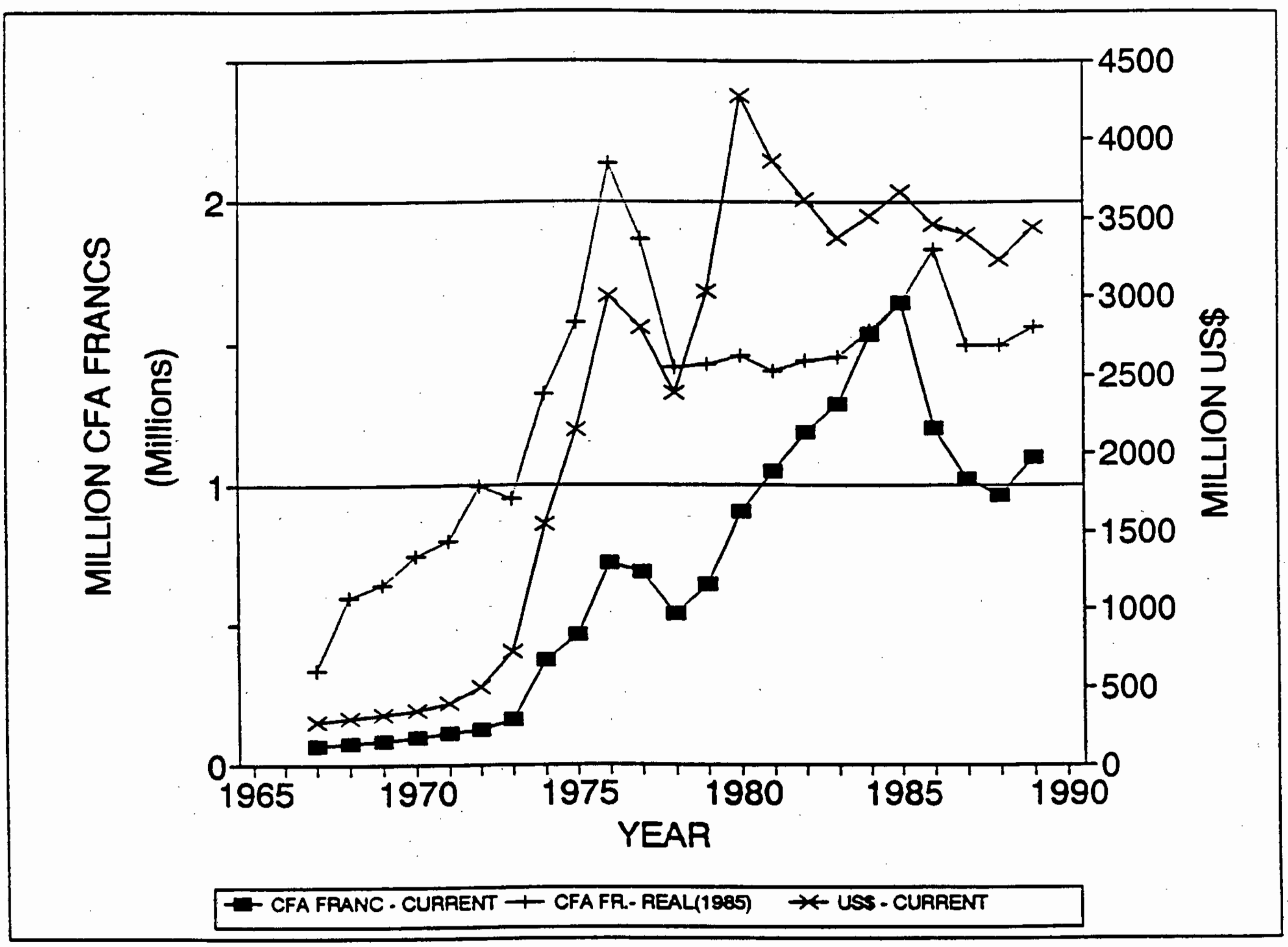


Figure 2. Gross domestic product (at market prices)

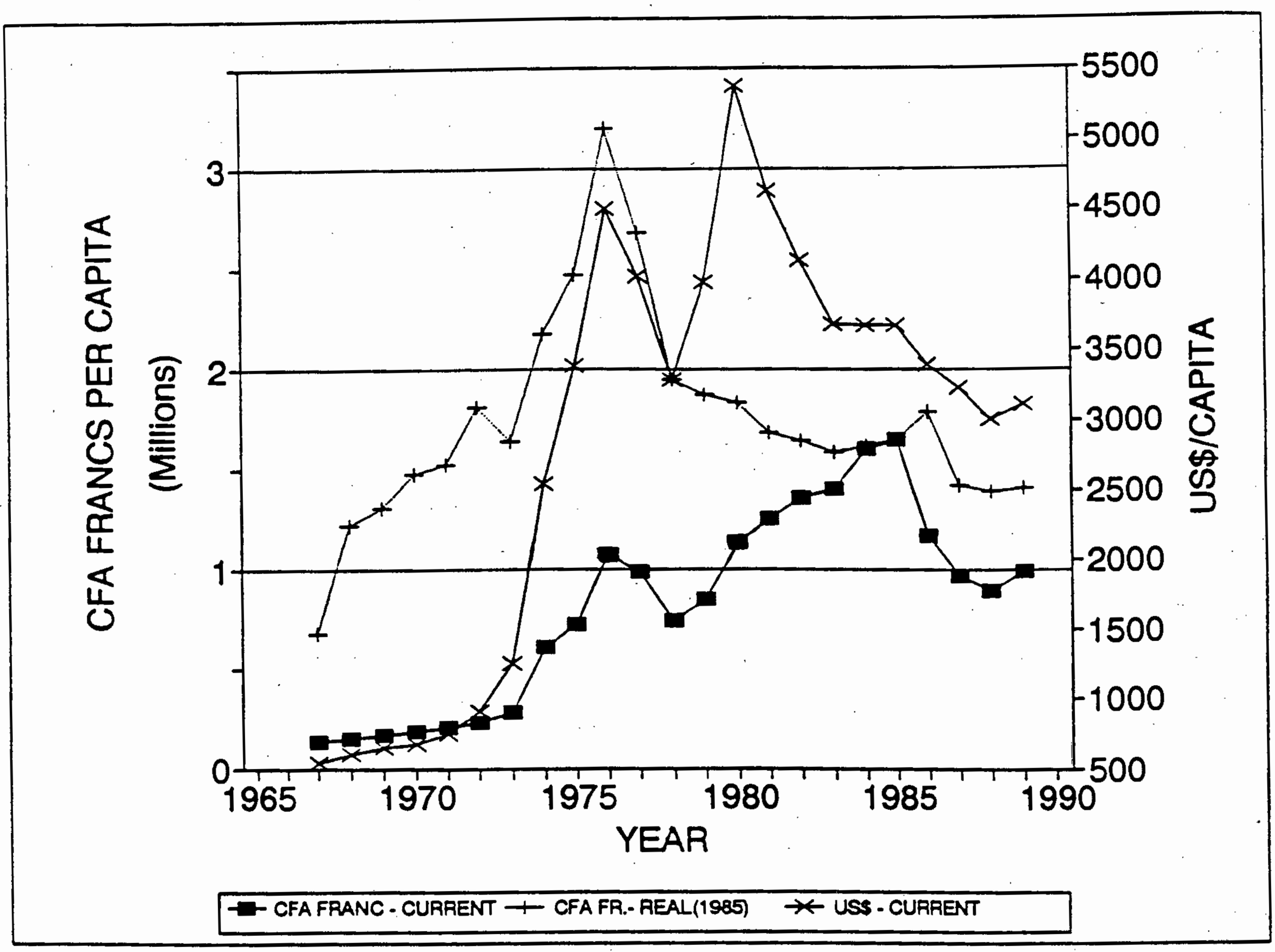


Figure 3. GDP per capita

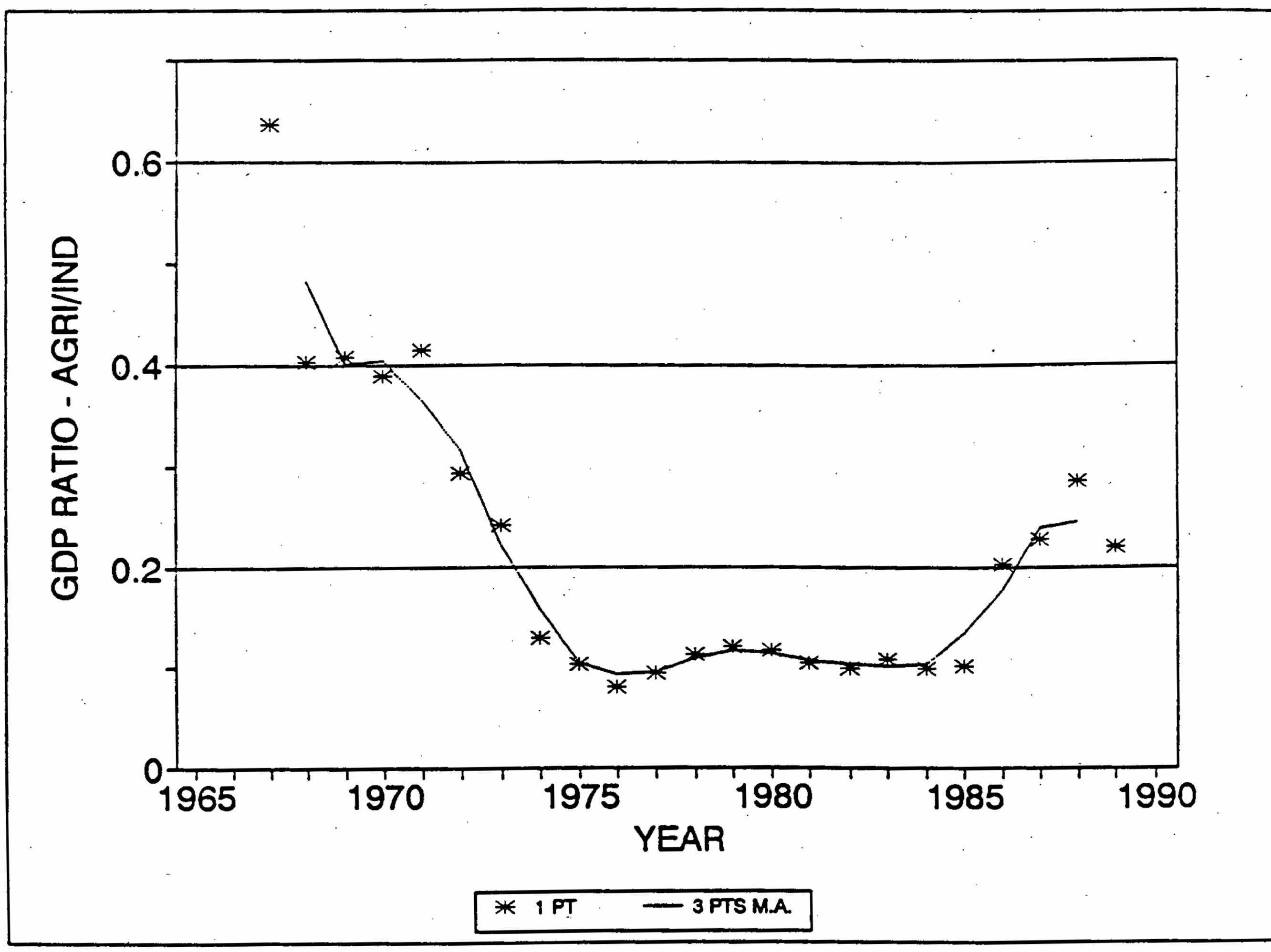


Figure 4. GDP ratio: Agriculture / Industry

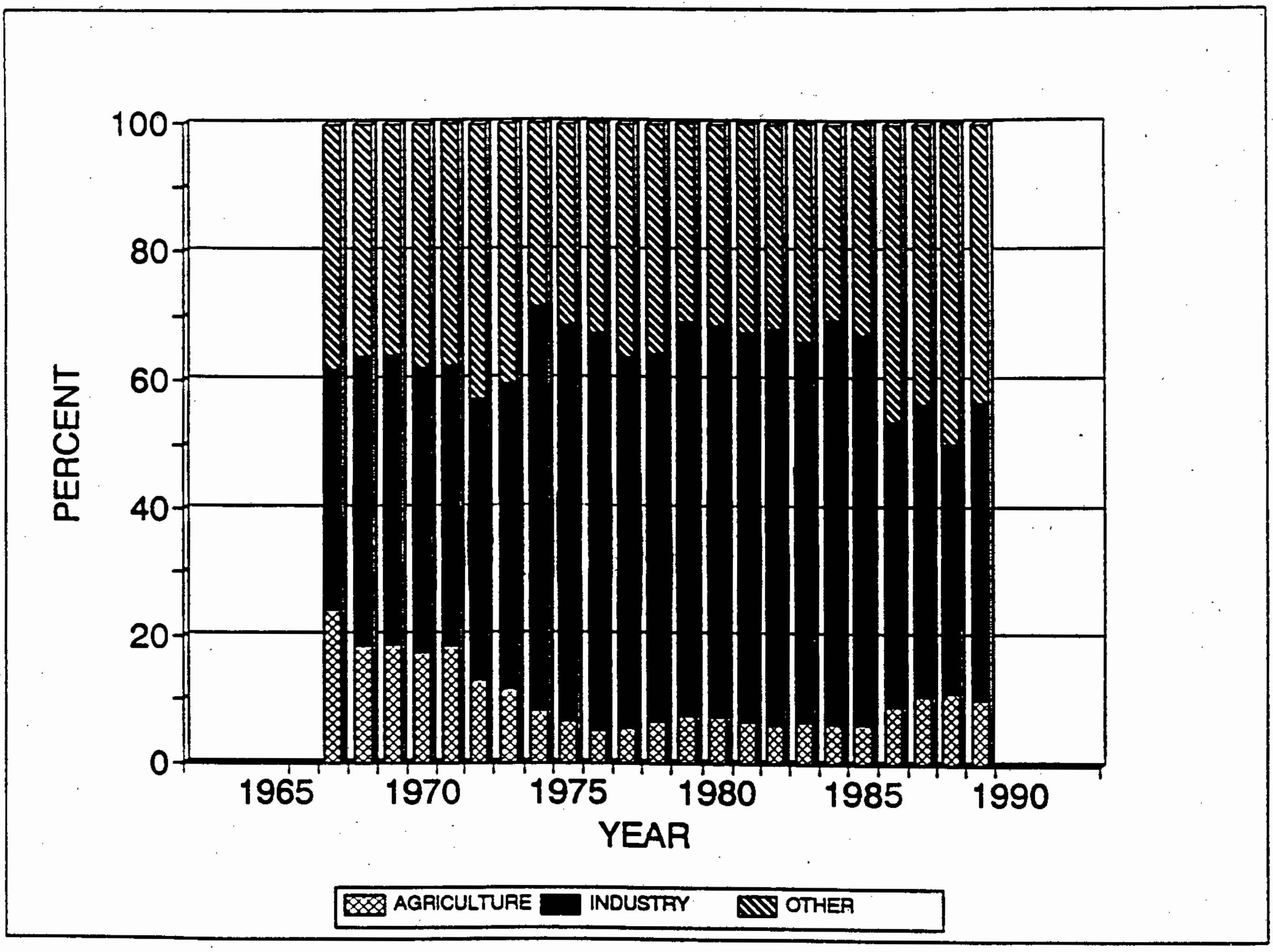


Figure 5. GDP components as percentage of total

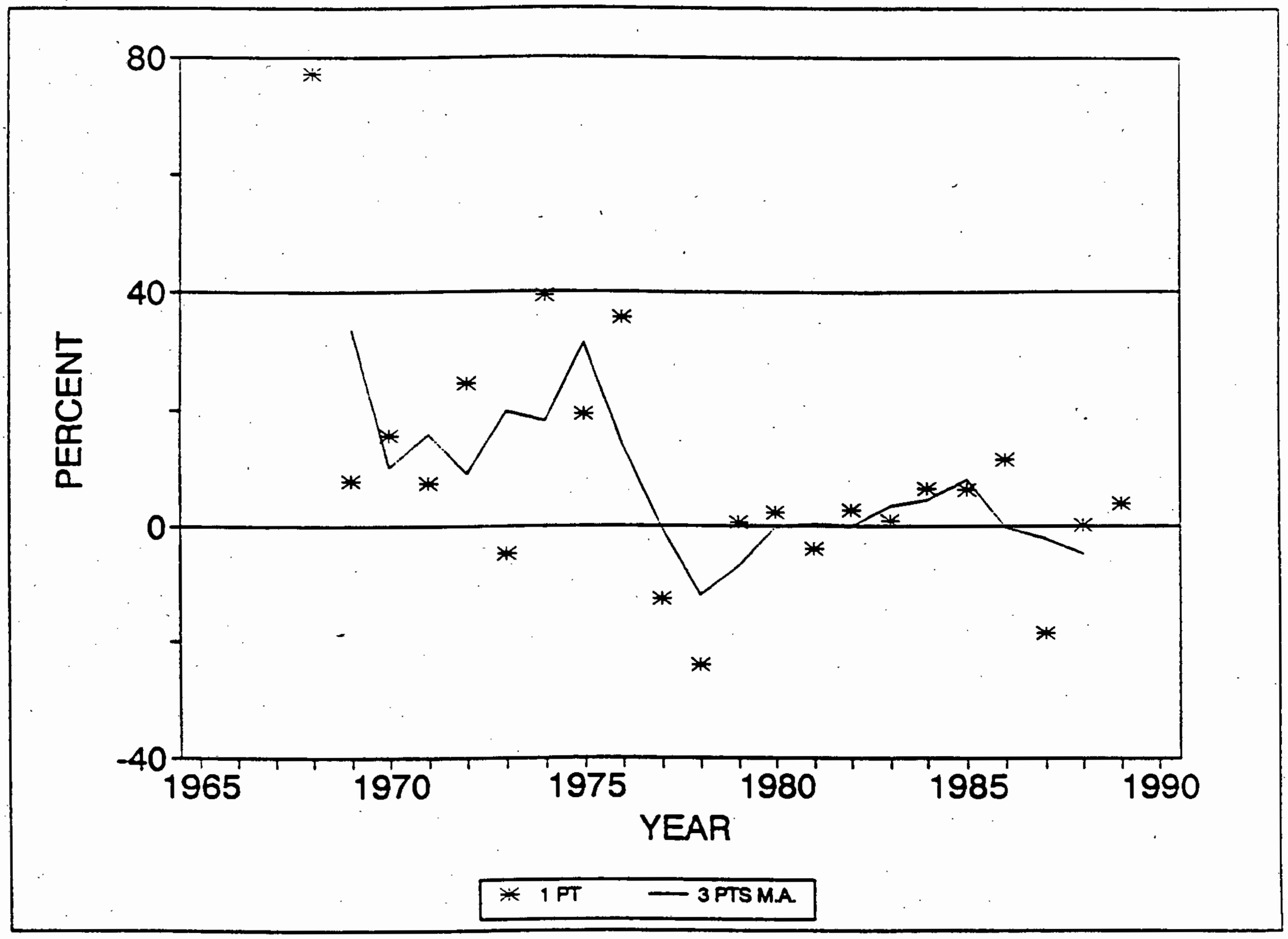


Figure 6. Gross domestic product growth rate: percentage per year (Real 1985)

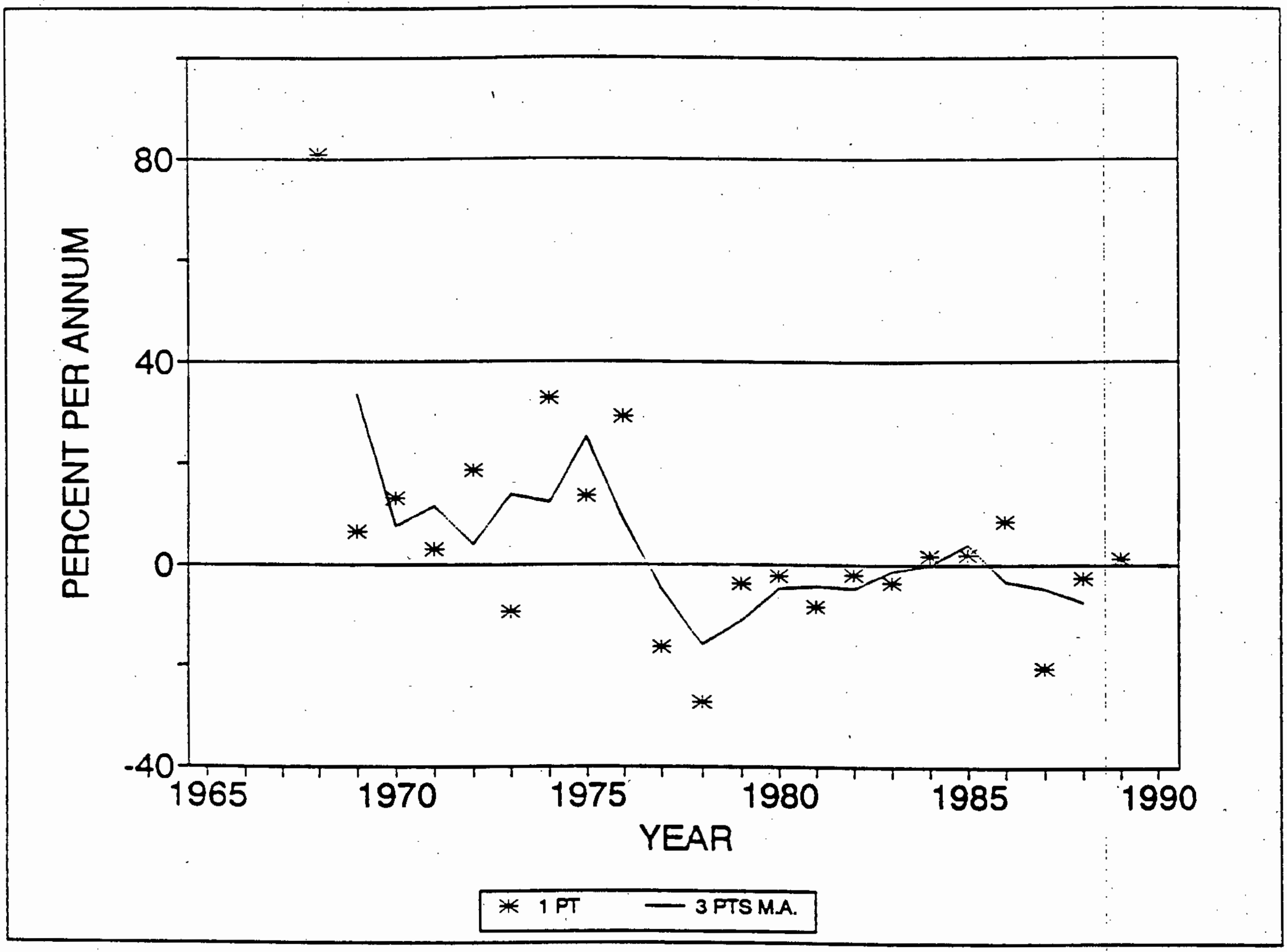


Figure 7. GDP per capita growth rate: percentage / year (Real 1985)

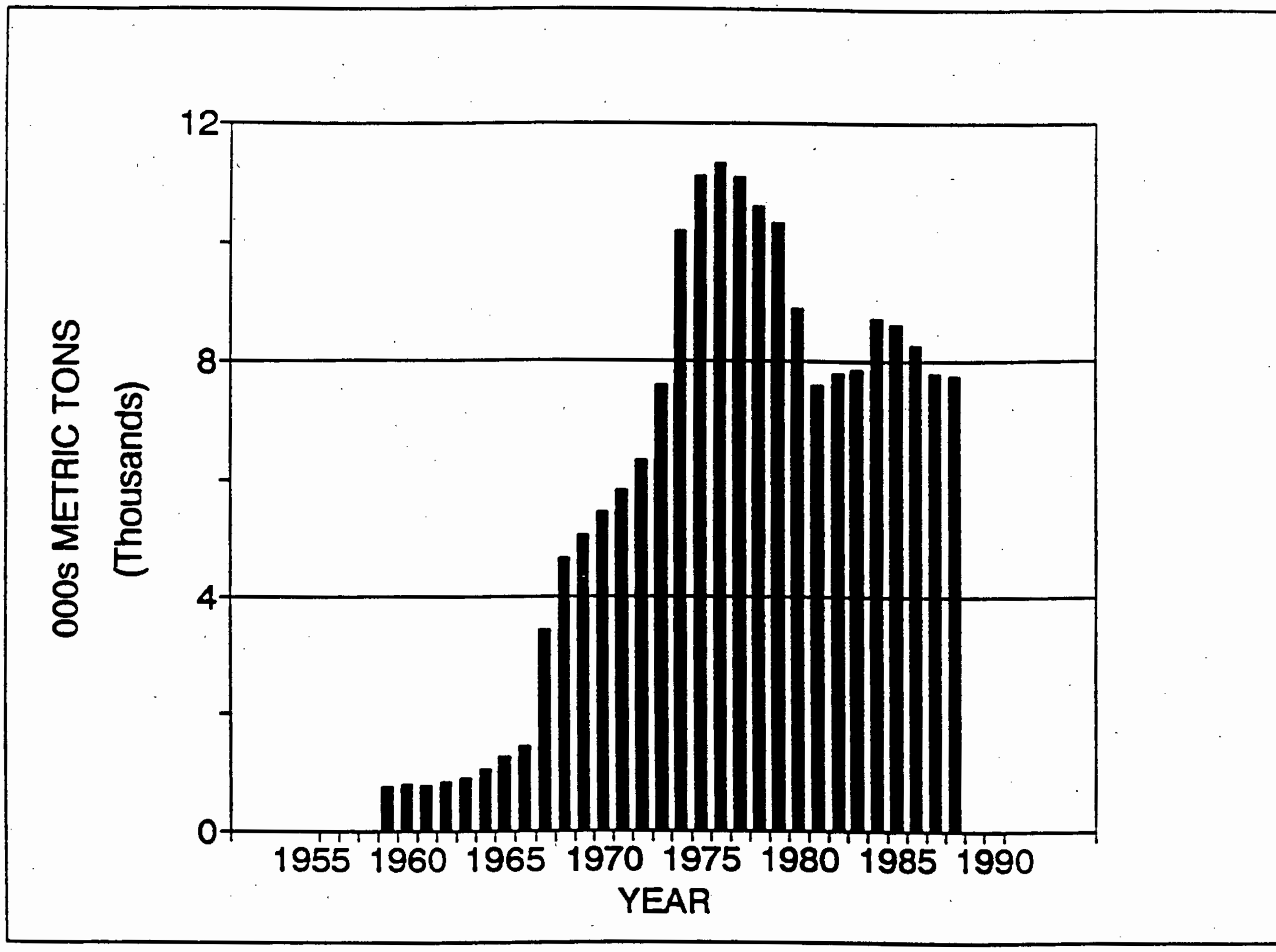


Figure 8. Crude oil production

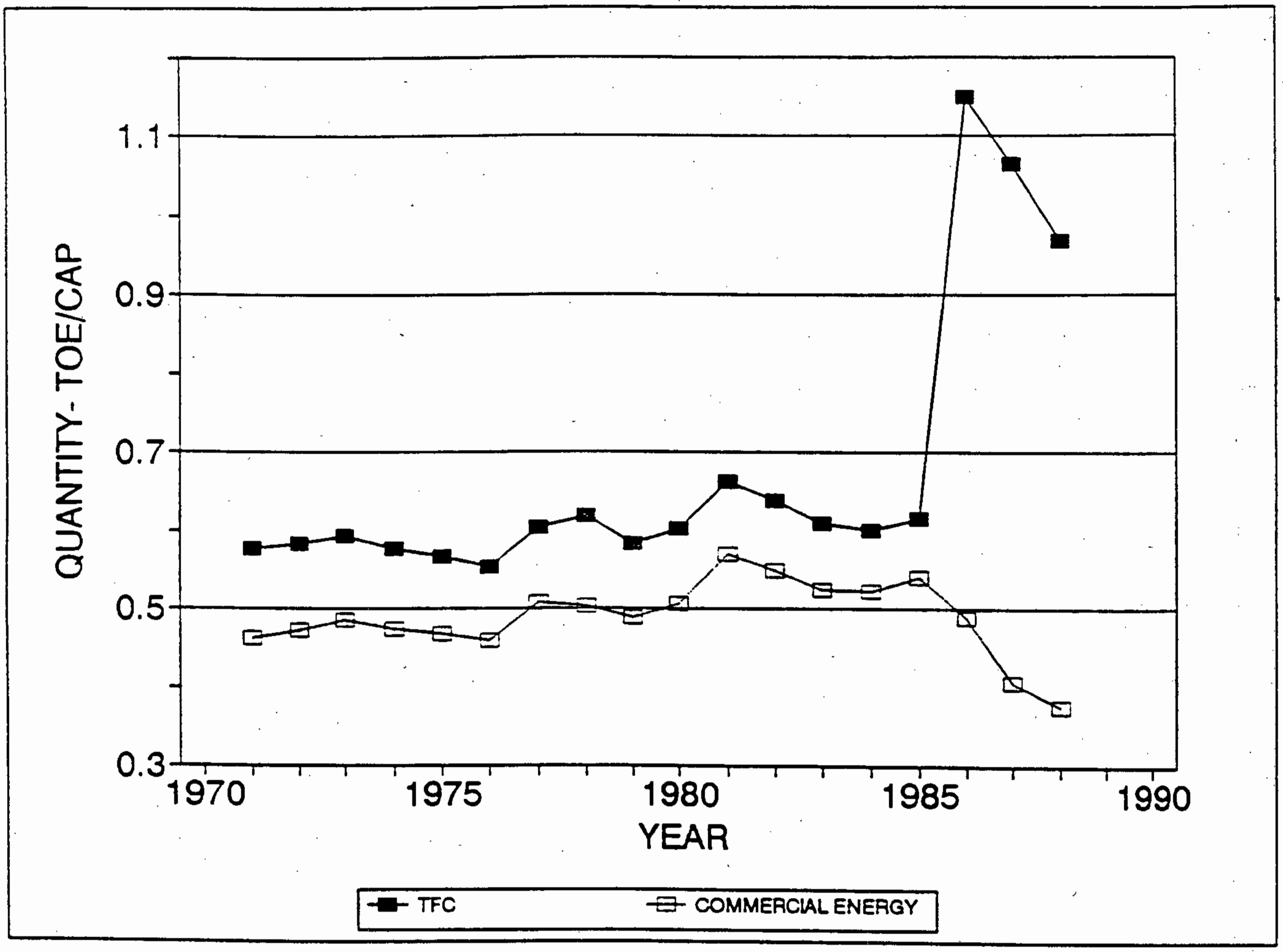


Figure 9. Energy final consumption per capita

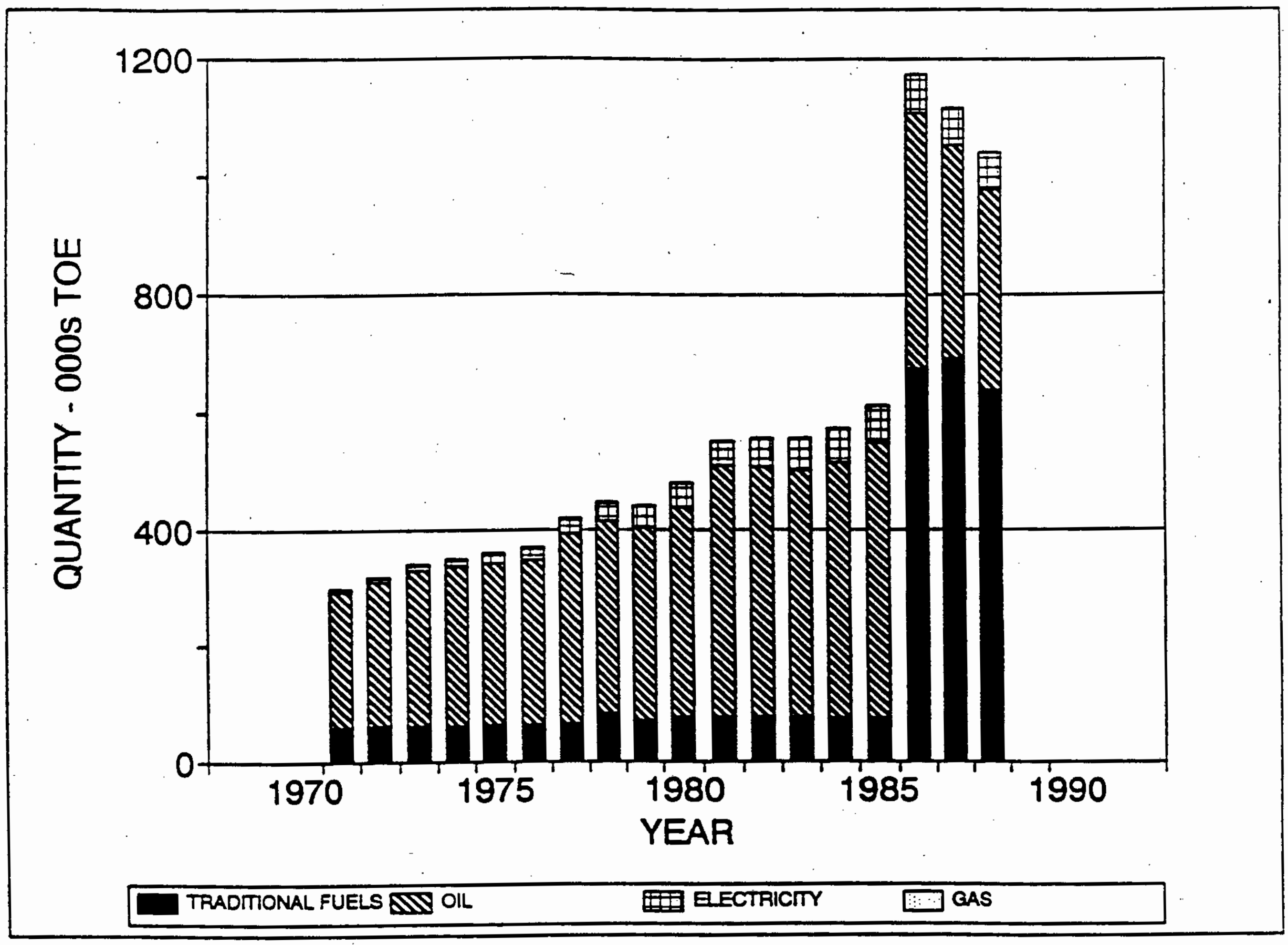


Figure 10. Total final consumption: quantity shares of components

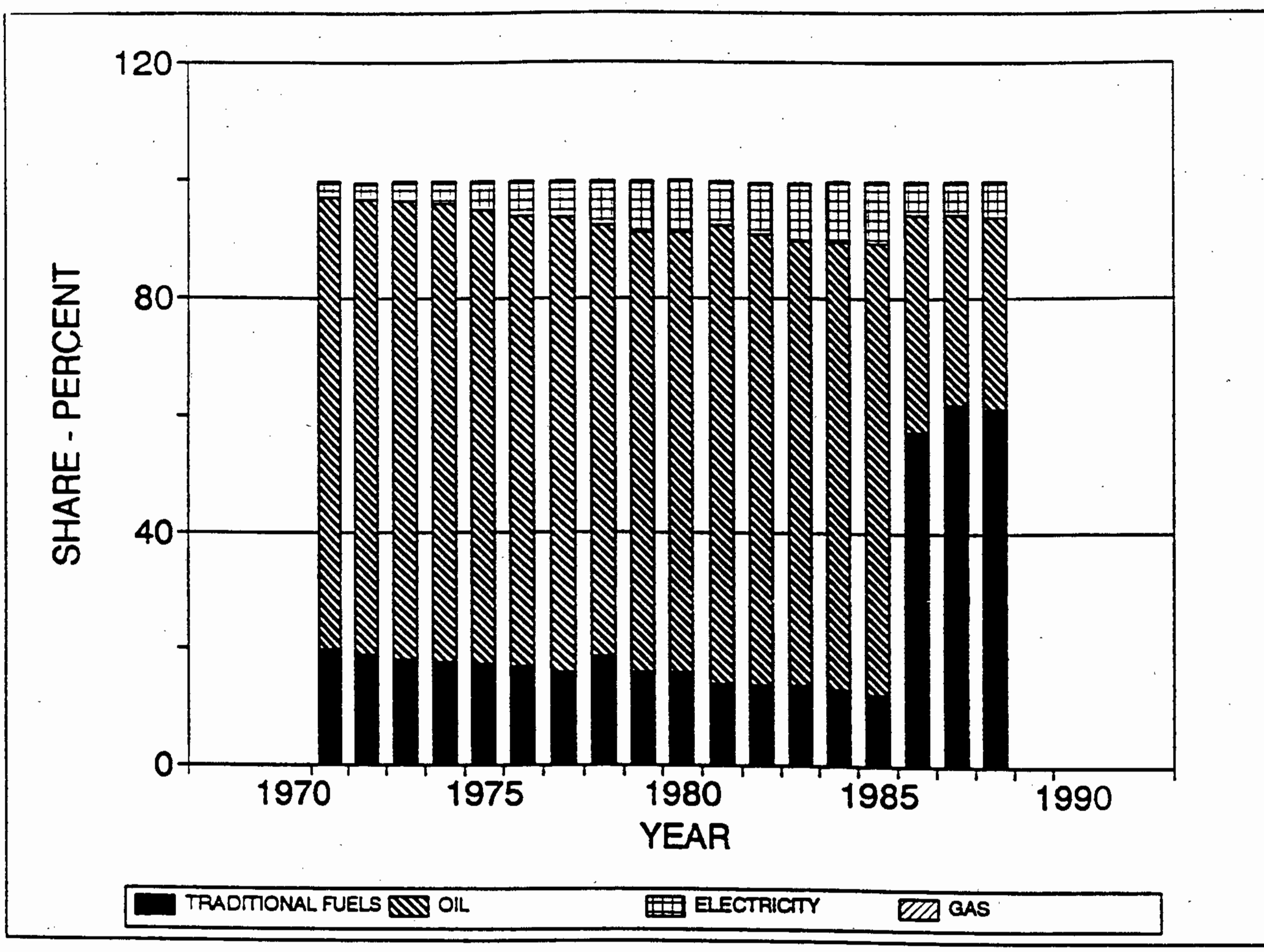


Figure 11. Total final consumption: percentage shares of components

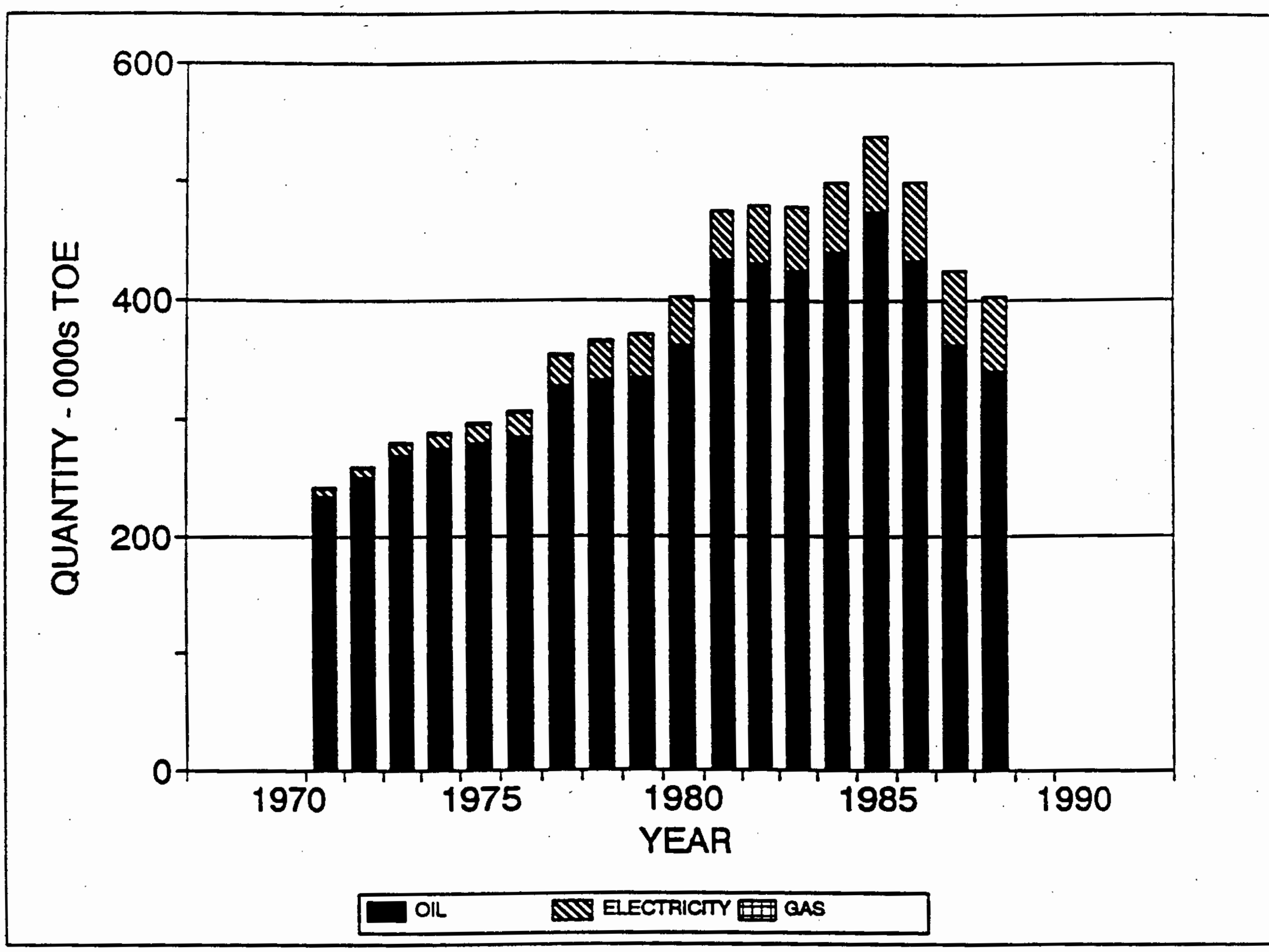


Figure 12. Commercial energy final consumption: quantity shares of components

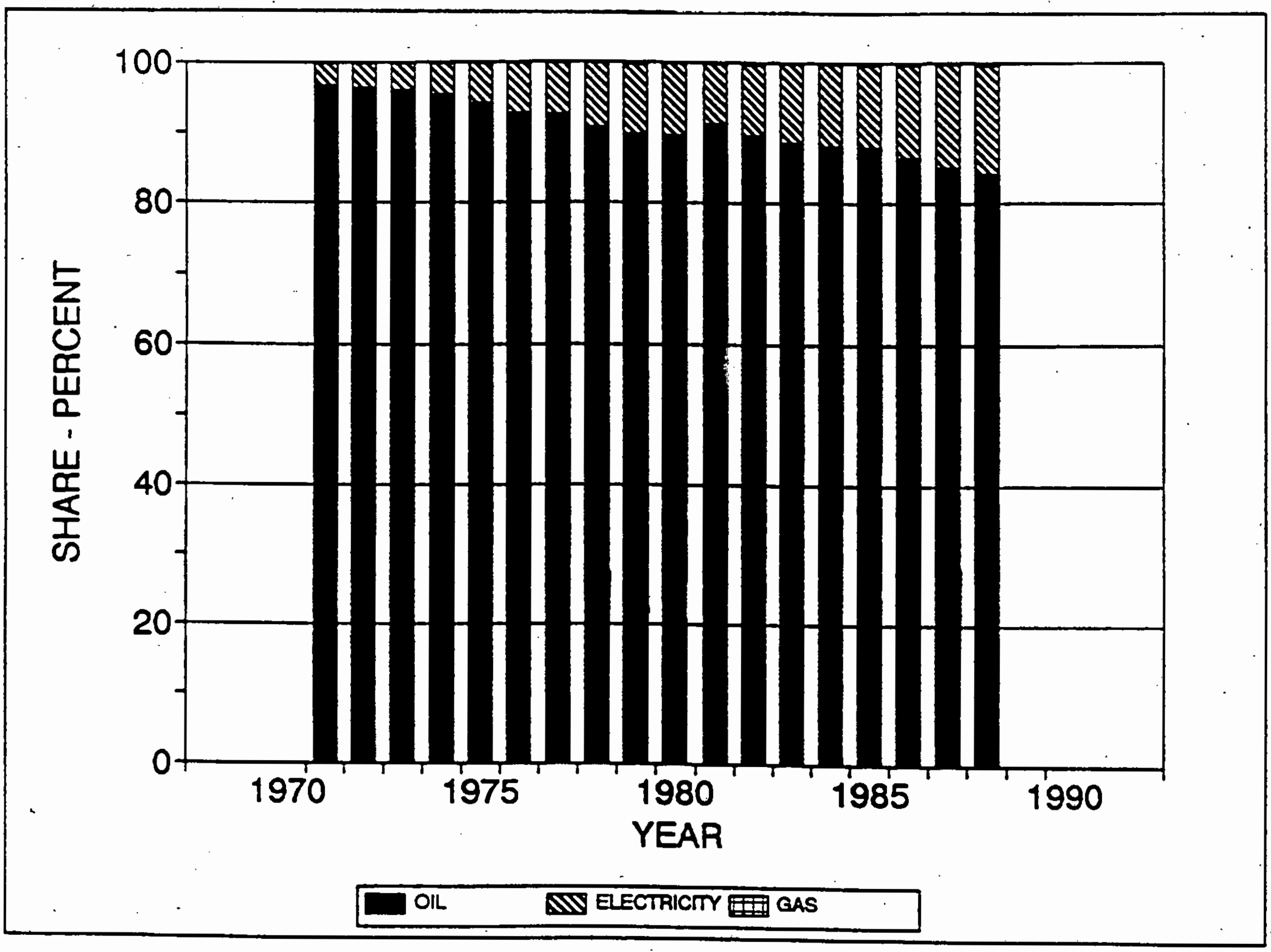


Figure 13. Commercial energy final consumption: percentage shares of components

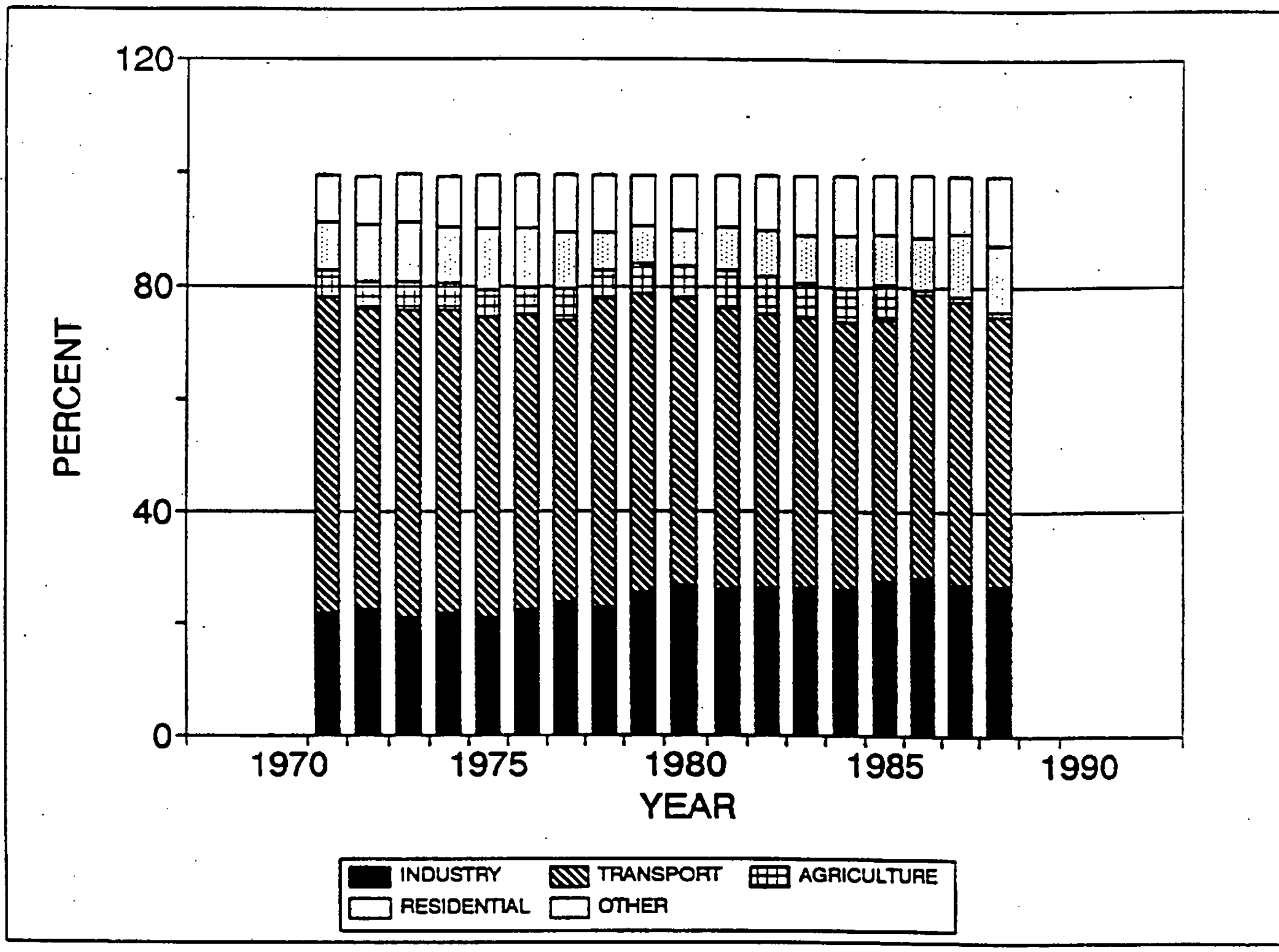


Figure 14. Commercial energy final consumption: sectorial breakdown (%)

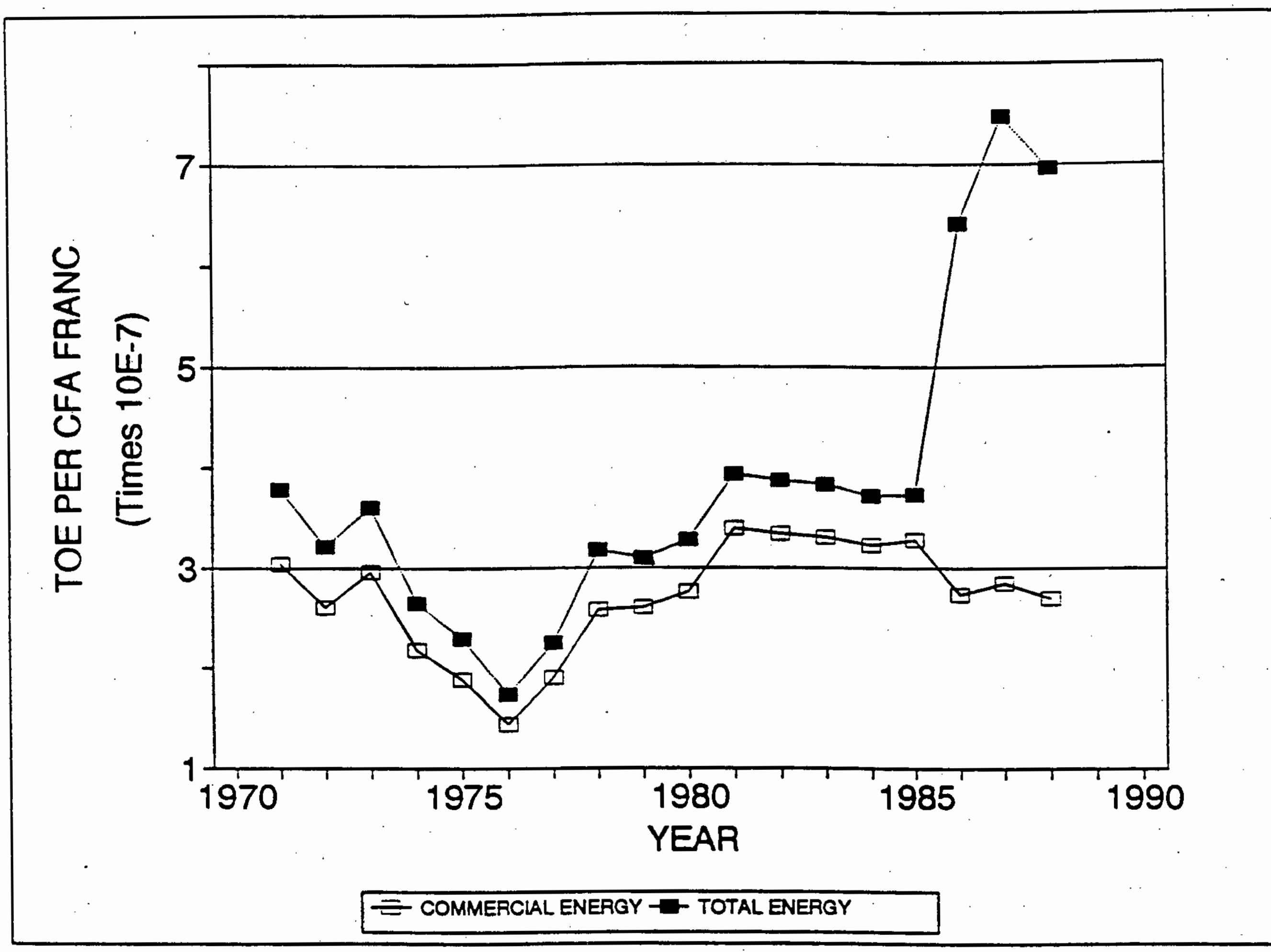


Figure 15. Energy intensity: final consumption / GDP (Real 1985)

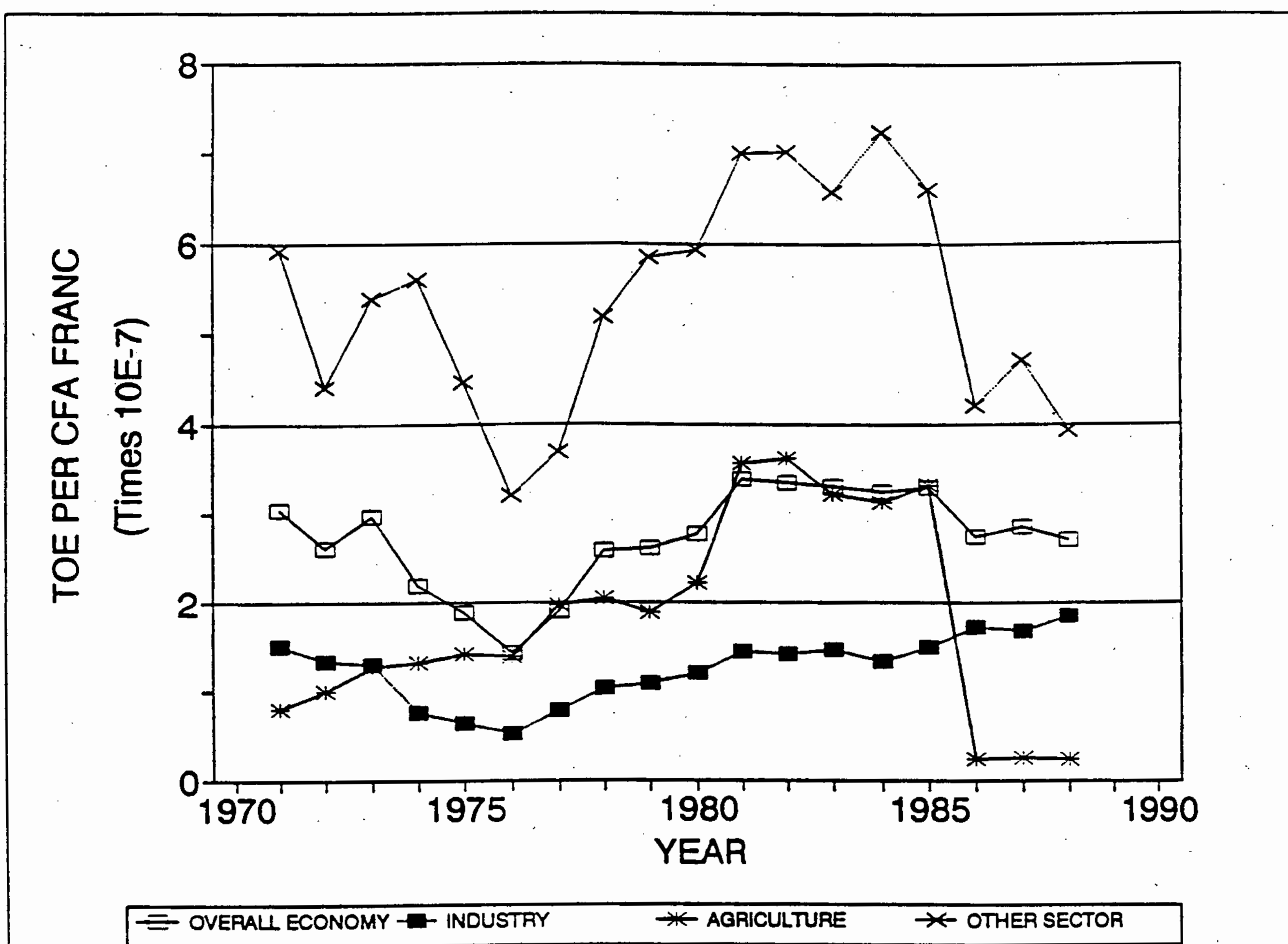


Figure 16. Commercial energy intensity: commercial energy final consumption / GDP (Real 1985)

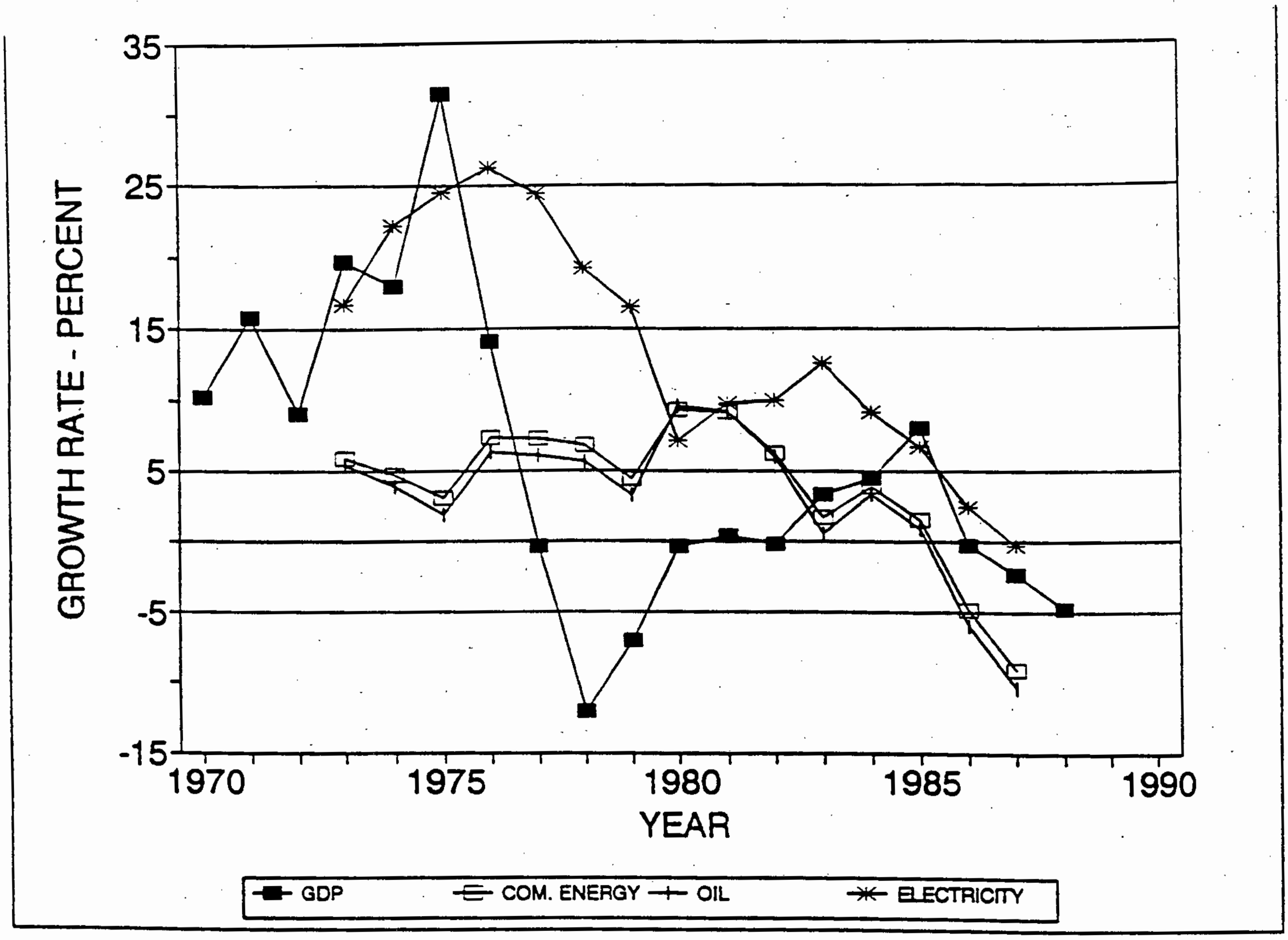


Figure 17. Growth rates (3 pts M.A.)

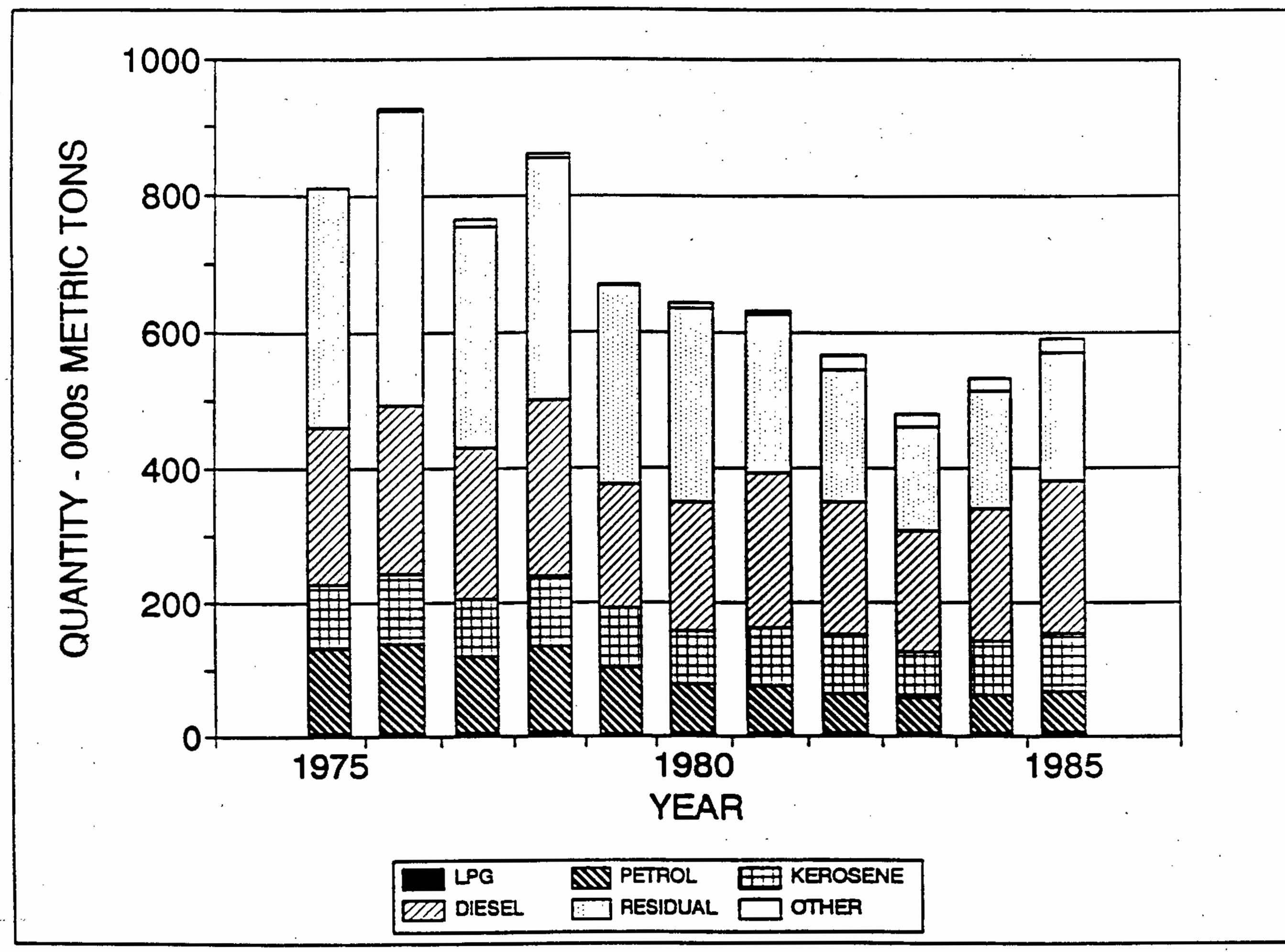


Figure 18. Sogara production 1975-1985

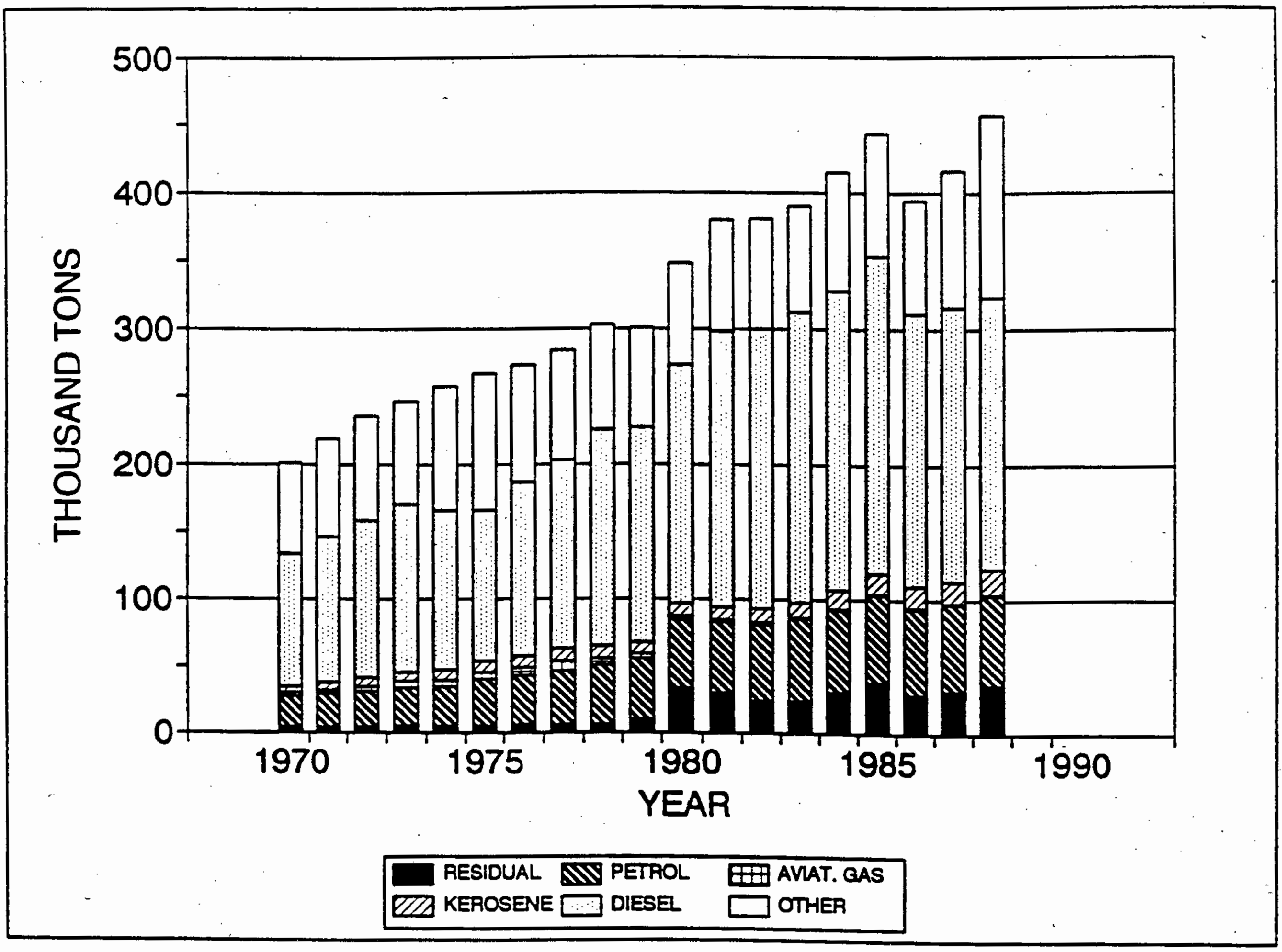


Figure 19. Oil product consumption by type

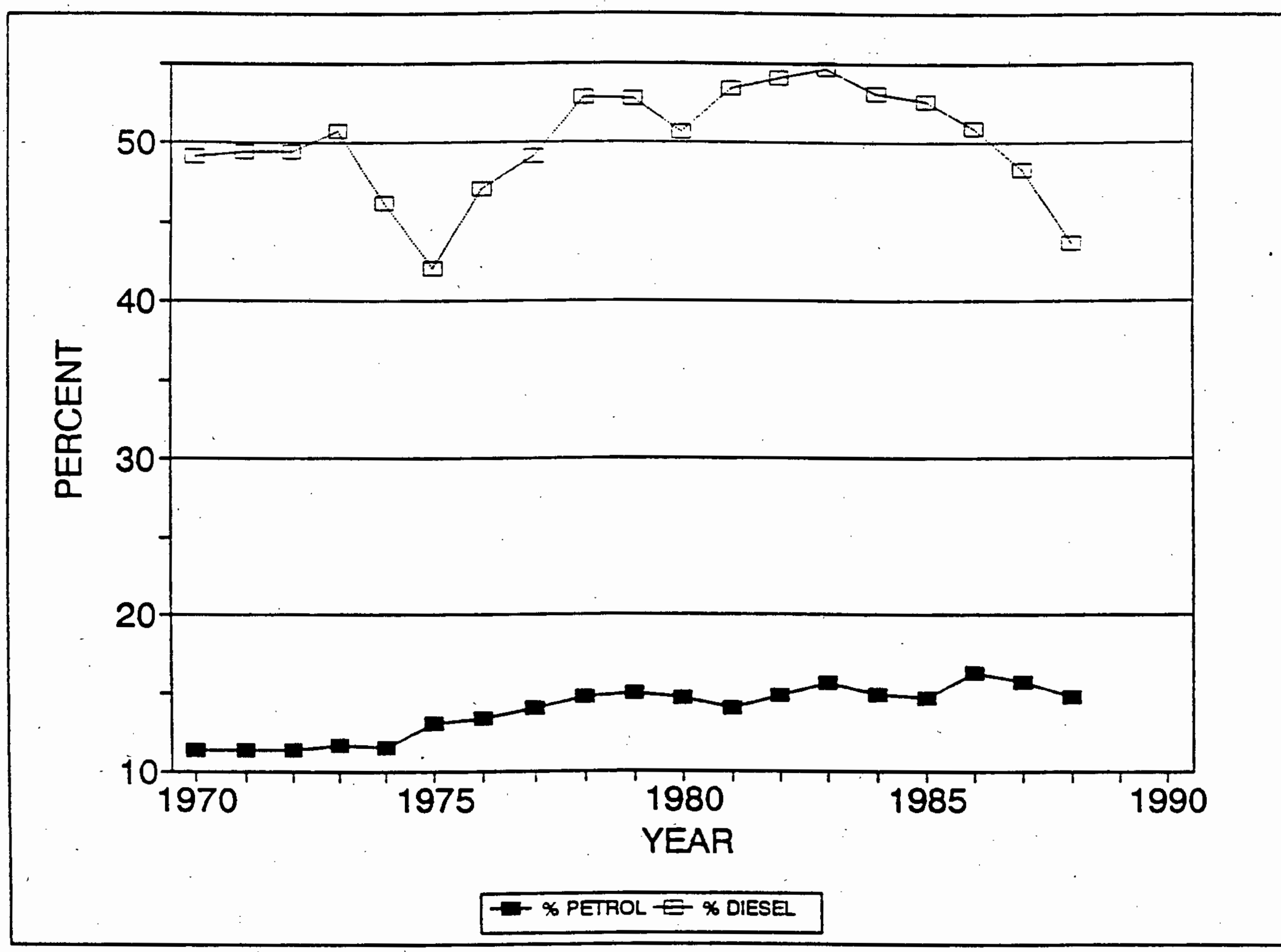


Figure 20. Petrol and diesel as a percent of oil consumption

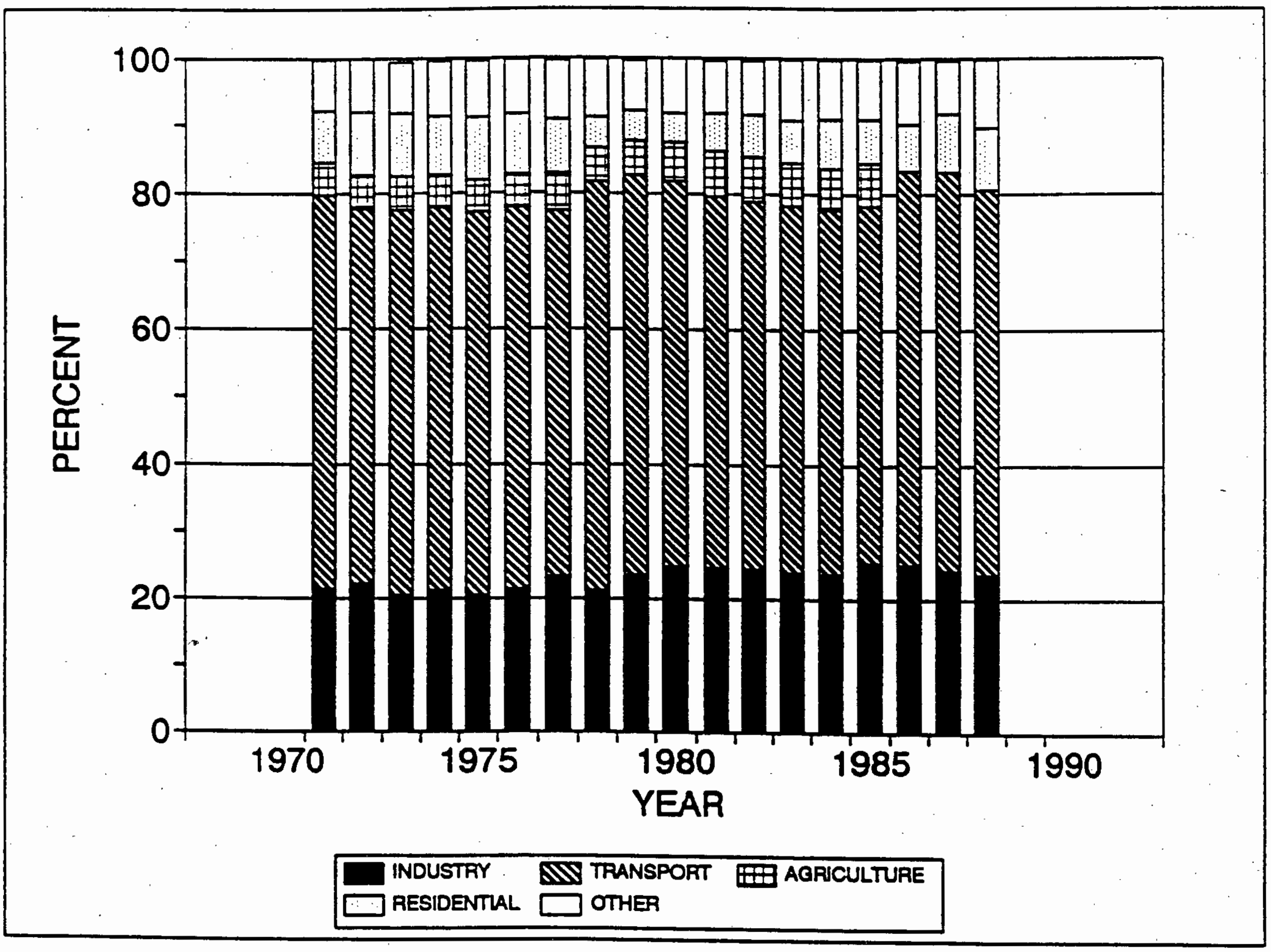


Figure 21. Oil final consumption: sectorial breakdown (%)

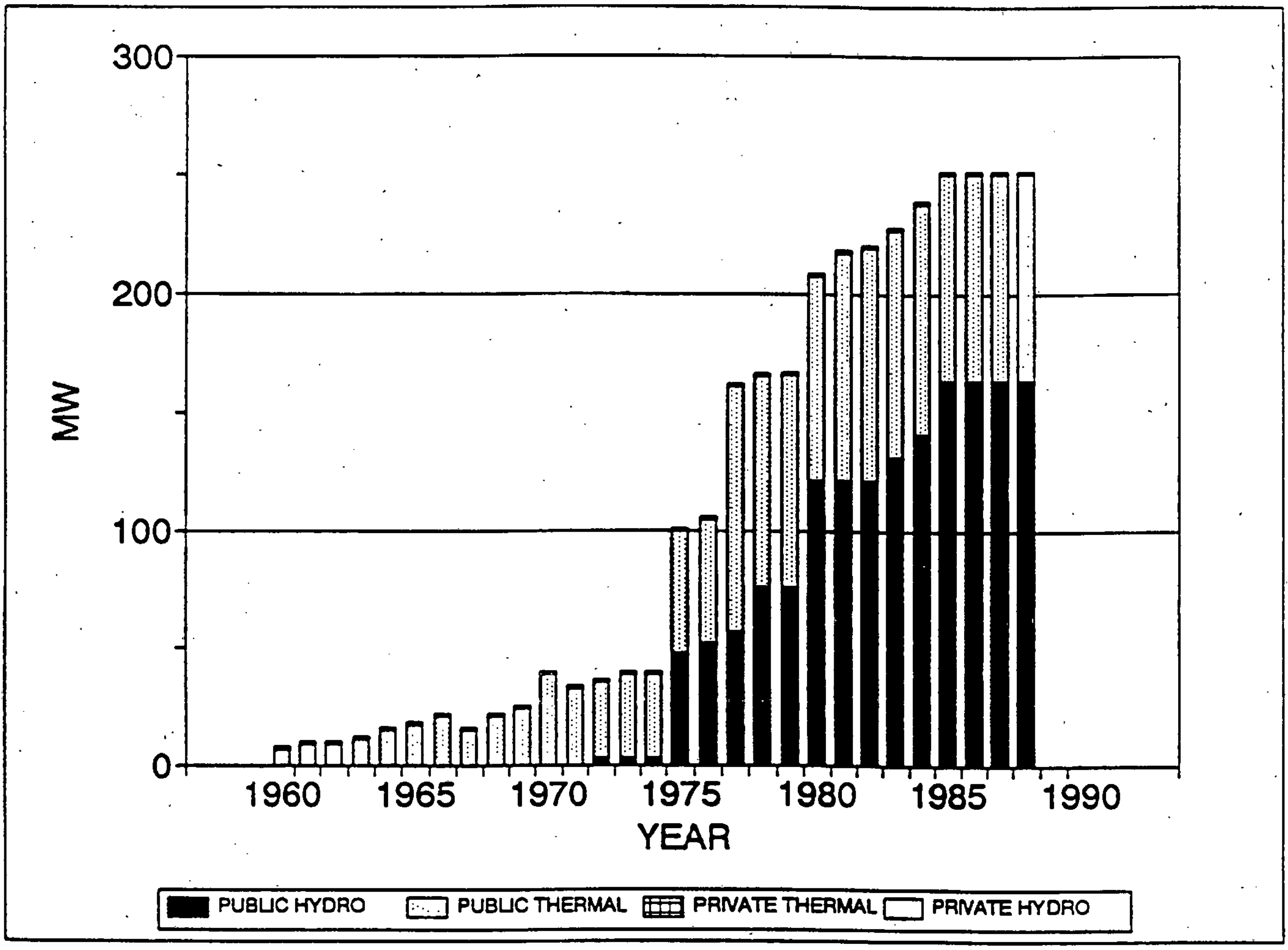


Figure 22. Electrical installed capacity

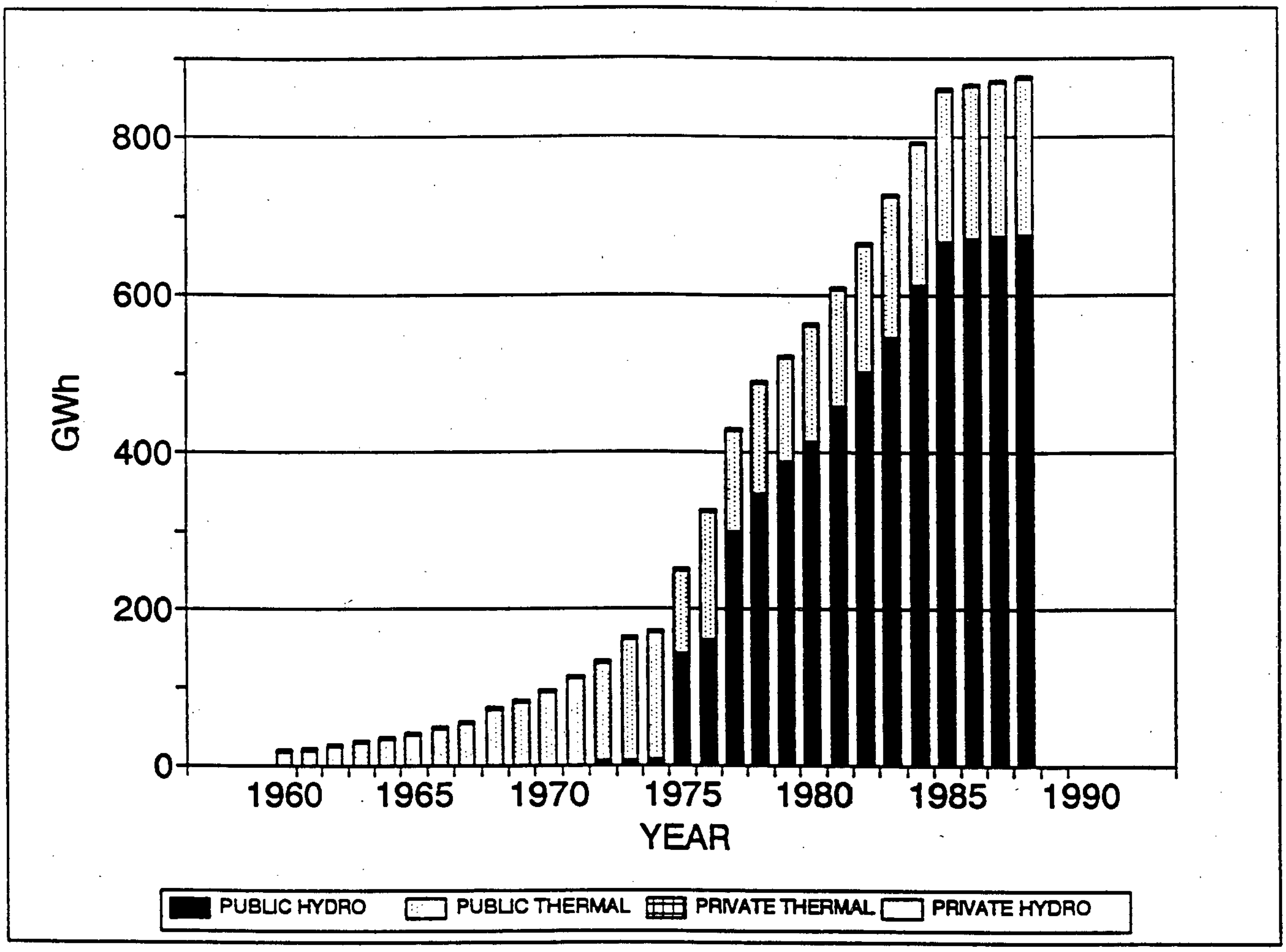


Figure 23. Electricity production

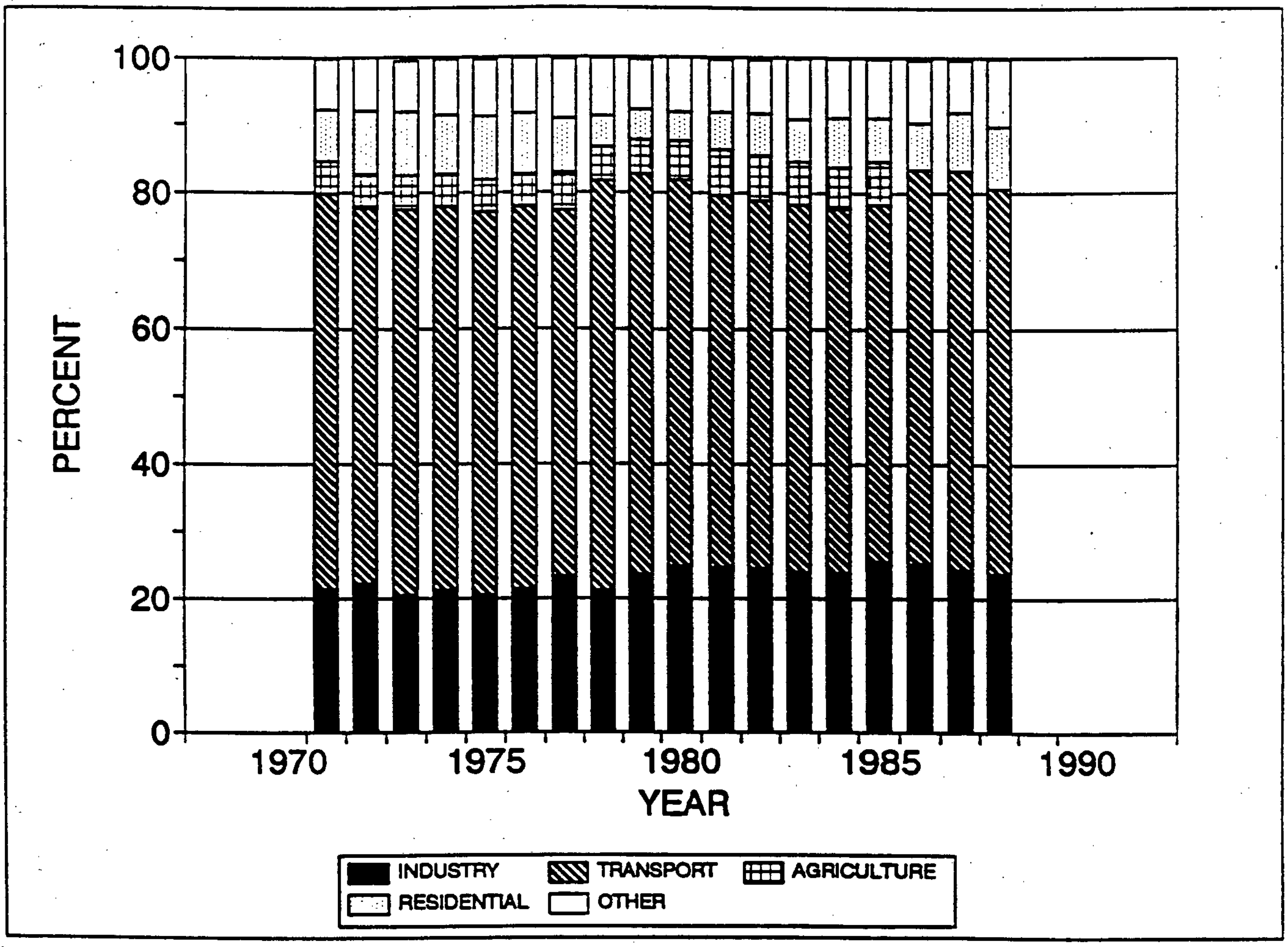
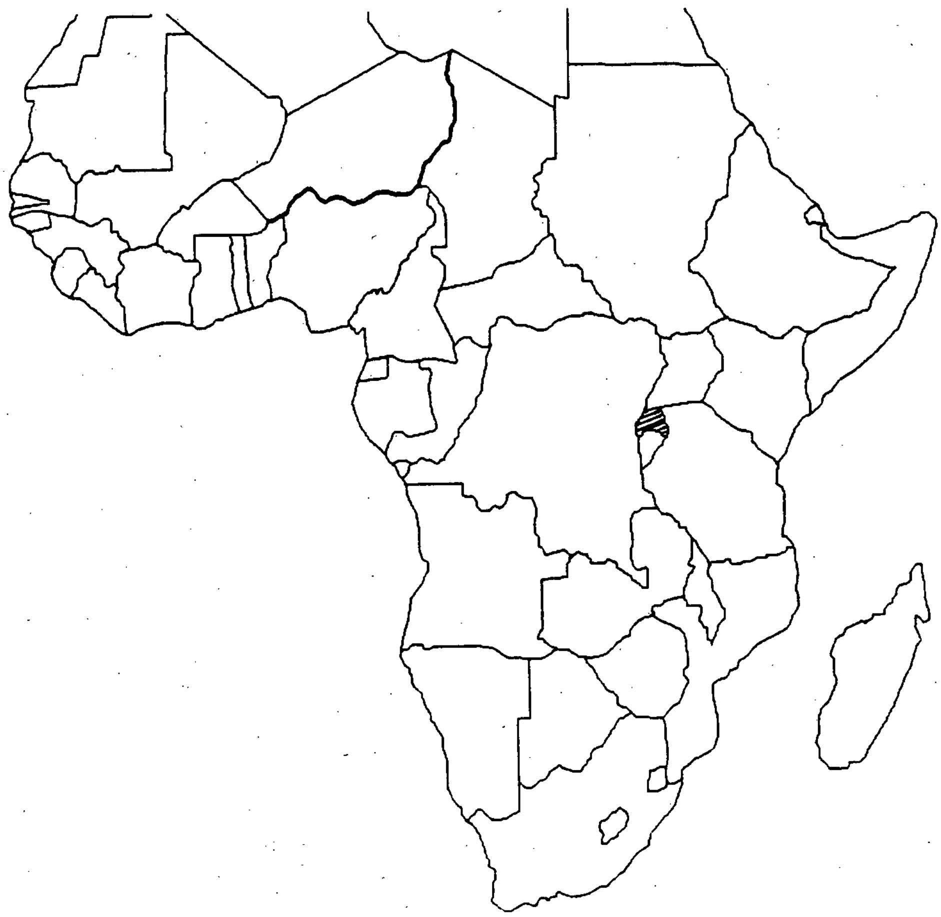


Figure 24. Electricity final consumption: sectorial breakdown (%)

- F -

RWANDA

1. INTRODUCTION



2. COUNTRY PROFILE

2.1 Introduction

Rwanda, which was formally an ancient kingdom, became a part of German East Africa in 1899. The Germans operated a system of indirect rule, exercised through the king. The king in turn used the colonial presence to strengthen and to extend his own authority throughout the territory. However, the colony was modernized and rendered more efficient in order to satisfy Europeans needs. Together with Burundi, Rwanda was occupied by Belgian troops in 1916, before being entrusted to Belgium as a League of Nations mandated territory in 1923 and as a trust territory under the United Nations in 1946. The Belgian colonial administration followed the German pattern of relying on the king and the aristocracy. The country obtained its independence from Belgium on 1 July 1962. The efforts of a UN commission to persuade Rwanda and neighbouring Burundi to remain as one political unit after independence failed, and by the end of 1963 even the customs and monetary union agreed by the two governments had been abolished(1).

Feudal masters of the land, the minority Tutsi ethnic tribes had ruled the country before independence. Following the controversial accession to the throne of Kigeri V, successor to Mutara III who died mysteriously in July 1959, the majority Hutu ethnic group rose in rebellion and riots. Massive exodus of Tutsi took place that year as a result of intensive conflicts. In municipal elections held in June-July 1960, after the restoration of order, the republican party (Parmehutu: parti de l'émancipation du peuple Hutu) overwhelmingly defeated the royalists. A referendum recommending the abolition of the monarchy was adopted the following year. The leader of the republican party, Gregoire Kiyibanda, was elected President, and he introduced a single party system in 1965. The restoration of the Hutu majority to their rightful role in the national life is considered as the main legacy of the Belgian rule.

After independence, the country became effectively controlled by the Hutu, with the Tutsi politically eliminated. In December 1963, some royalists (Tutsi), who fled to Burundi before independence, crossed back to Rwanda and tried to take the capital. More than 10 000 Tutsi were killed in fierce fighting between the Tutsi and the Hutu and many more fled to neighbouring countries[(2)]. Relations with Burundi, suspected to be implicated in the invasion, remained unfriendly until 1966 when Micombero overthrew the monarchy and installed a republic.

In a bloodless coup on 5 July 1973, the army seized power after the resurgence of ethnic conflicts between the Hutu and the Tutsi and an increasing antagonism between different individual Hutu tribes. The military regime, under the leadership of Major-General Habyarimana, brought a considerable degree of internal stability. It adopted a moderate stand on the Hutu-Tutsi relations issue and pledged reconciliation between the two rival ethnic groups. As a result, relations with the Tutsi-ruled Burundi improved markedly. The refugee issue remains an emotional problem for the country. Rwanda has always refused to accept the return of large numbers of refugees. The economy of the country is reportedly not able to sustain the influx of refugees. Tutsi exiles, regrouped under the Front Patriotique Rwandais (FRP) based in Uganda, invaded the country in October 1990. A formal cease-fire was signed on 29 March 1991 between the government and the FRP, with diplomatic efforts and the help of neighbouring countries, in order to find a political solution to the conflict.

Administratively, the country is divided into ten prefectures. The capital is Kigali.

2.2 Geographical situation and demography

Rwanda is a small landlocked country in east-central Africa. It is bordered by four countries: Zaire, Burundi, Tanzania and Uganda. Covering a land area of 26 338 km^2, it has a population of about 7,5 million people. Figure 1 shows the population and the population growth from 1967 to 1988. The average population density is 270 per km^2, but it is higher in agricultural areas (about 357 per sq km). It is one of the most densely populated areas in Africa apart from the Nile Delta. With an average annual increase of 3,7%, the population is set to double every twenty years[(2)].

The population is very young, with one half under 20 years of age. Life expectancy was estimated to be 48,5 years between 1985 and 1990. In 1985 the literacy level was 33% among adult females and 61% among adult males[(3)]. The total labour force was estimated to be 2,7 million in 1983 and was engaged in agriculture (88,6%), industry and commerce(3%), government (3%), and services (3%). Women constituted 48% of the economically active population[(4)]. Present population patterns are likely to be seriously affected by the high incidence of the Acquired Immunodeficiency Syndrome (AIDS).

The population is composed of three major ethnic groups: the Hutu (85%), the Tutsi (14%), and the Twa (1%). Racially, the Hutu belong to the Bantu family and are farmers, while the Tutsi are Nilotics and are warriors and herdsmen. The Twa are pygmoid hunters, descendants of the earlier settlers of the region. Approximately 45% of all Tutsi reside in the central region of the country near Nyanza, the former capital of the Tutsi kings. The urban component of the population is estimated to be less than 5%, growing annually by 6,8%[(4)]. A special effort has been made to reduce the human influx to the towns. The government is committed to reducing population concentration in some agricultural areas. Programmes for new settlements in unoccupied areas and better use of unexploited land in the east of the country and in the marshy plains were undertaken in past years. Over-population is a big problem for the country and emigration is thought to be a possible solution. In this regard, negotiations started some years ago with the under-populated Gabon and the neigbouring Tanzania[(2)].

2.3 Economy

The economy is based on the major cash crops of coffee and tea which account for more than 80% of all exports and 45% of the GDP[(5)]. The export of pyrethrum and quinquina barks were also profitable for the country in the past few years. As shown in Fig. 2, agriculture remains the most important sector of the economy. About 95% of the total value of agricultural production comes from subsistence crops. Erosion and land degradation associated with traditional intensive cultivation methods have greatly contributed to the decline of crop yields. As a result of the population strain, farms are more and more fragmented. The production of food has not kept pace with the rapid population growth since 1977. Severe food shortages were noticed in the late 1980s and signs of structural food deficits are emerging.

Food processing dominates the industrial sector, which in terms of income generation is small (see Fig. 3). There are also small textile concerns and small-scale chemical and engineering works. The contribution of manufacture to GDP is shown in Fig. 4. Mining activities, which are very limited, provided around 15% of exports at the beginning of the 1980s[5]. The main mineral resources are tin and tungsten, but small quantities of gold, beryl and colombo-tantalite are also found. The exploitation of tin, the third largest export earner in 1985, is no longer competitive because of the high transport costs and the sharp decline in world prices.

The overall GDP and the contribution of different economic sectors to it over the period 1967-88 are shown in Figs 5 and 6 respectively. With a GDP per capita of about US$ 350 in 1988 (see Fig. 7), Rwanda is a low income country. Both GDP and GDP per capita grew positively in the 1970s due to the coffee boom, and the government embarked on a large-scale expenditure programme. Beginning in the early 1980s, as coffee prices returned to long-term trend levels, the economy started showing signs of stress. As shown in Figs 8 and 9, the GDP and GDP per capita growth rates began to decline. Since early 1987 world coffee prices have displayed precipitous declines, and agricultural production was badly affected by unfavorable climatic conditions. As a result, coffee exports declined both in quantity and quality. Non-coffee export performance has been mediocre, largely because of an overvaluation of the exchange rate, low productivity, and excessive regulations and controls[5]. The economic development of the country has always been hindered by its long distance from the sea (making it dependent on lengthy trade routes through two countries to the Indian Ocean) and its high population density (aggravated by the high growth rate). In order to address the marked deterioration of the overall economy and its poor performance, the government began implementing a micro-economic reform programme in November 1990.

Rwanda is a member of the Economic Community of the Great Lakes Countries (CEPGL) established in 1976. It is also a member of the Organisation for the Management and Development of the Kagera River Basin (KBO). The KBO was formed in 1977 by Rwanda, Burundi and Tanzania and joined by Uganda in 1980. It oversees the integrated development of the Kagera Basin region. Projects include water, power and mineral resources, agriculture, transport and communication.

3. ENERGY GENERAL

3.1 Introduction

The overall energy situation is a reflection of the country's socio-economic and geographic patterns. Present economic difficulties do not allow the optimum use of the main energy resources of the country, hydro and methane. Futhermore, these resources are found along the boundaries with Zaire and Tanzania, and bilateral agreements are required for their exploitation. Landlocked, the country depends largely on lengthy transport routes (from Mombasa or Dar es Salam to Kigali) for petroleum product imports, leading to high costs and insecurity of supply. Due to its low level of income, the population resorts largely to traditional fuels (fuelwood, charcoal and agricultural by-products) which account for more than 90% of the country's total final energy requirements. As a result, fuelwood is becoming increasingly scarce and the overwhelming pressure of both the high density and the large growth in the population is putting reforestation efforts into competition for land with agricultural production.

The remainder of energy needs are met by petroleum products (about 5% of total energy consumption), electricity (less than 1%) and substitutes such as methane gas. Reserves of peat and papyrus are also being assessed as substitutes to woodfuels for homes and small factories in rural areas. The government is committed to the development of biogas in rural areas. Plans to achieve a reliable supply of electricity and to become self-reliant are underway. Hydropower development dominates the public sector's energy investment programme.

3.2 Institutions

The main player in the energy scene is the Ministry of Public Works, Energy and Water which, through its Energy Directorate, formulates sector policy and development strategy, supervises projects, and controls energy subsectors.

The petroleum subsector is controlled by the Ministry of Commerce and Consumption. It sets the structure and the pricing policy of petroleum products which are marketed by five oil companies.

In the electricity subsector, the state-owned Etablissement Public de Production, de Transport et de Distribution d'Electricité, d'eau et de Gaz (Electrogaz) has the monopoly right to operate the national interconnected grid. Electrogaz is also responsible for the gas subsector. Planning and programming processes are carried out by the Ministry of Public Works, Energy and Water. The Société Internationale d'Electricité des Pays de Grands Lacs (SINELAC), in which the government is a one-third shareholder, builds and operates the Ruzizi II hydroelectric plant.

The woodfuels subsector is under the responsibility of the Ministry of Public Works, Energy and Water and the Ministry of Agriculture, Livestock and Forests through its Forestry Department. The Forestry Department is concerned with the supply of woodfuels resources. It sets forestry policy in general, but has no energy responsibility. It receives recommendations from the Groupe Forestier du Rwanda, an organisation representing research institutions, government departments, and local and prefectural authorities involved in forestry.

The new and renewable energy subsector is managed by the New and Renewable Energy Division of the Energy Directorate. Energy research is undertaken by both the Energy Directorate and the Centre Energie de l'Institut de Recherches Scientifiques et Technologiques.

Apart from SINELAC, the other regional energy-related entities found on the energy scene are the energy wings of the CEPGL (Economic Community of the Great Lakes Countries) and KBO (Organisation for the Management and Development of the Kagera River Basin). Established in 1974 in order to deal with energy matters affecting Zaire, Rwanda and Burundi, the Energie des Pays de Grands Lacs (EGL) became the energy directorate of the CEPGL in 1981. After the planning and development of the Ruzizi II hydroelectric power station, the EGL has undertaken a variety of planning studies and pilot testing programmes of new energy technologies. Its prospects for the future include activities aimed at ensuring a new, low-cost energy supply to e region and better co-ordination of network operation. The KBO energy wing is concerned with the development of hydropower plant at the Rusumu Falls site on the Rwanda-Tanzania border (see sections 4.4 and 5.4).

4. ENERGY RESOURCES

4.1 Traditional fuels

A quarter of the total land is thought to be covered by trees. This includes 436 200 ha of natural forest located in and around three national parks, 35 200 ha of forest domains, 44 600 ha of village forests, and 149 000 ha of private forests and woody plants[5].

Forest resource depletion is taking place in certain areas, as shown by the increasing scarcity of woodfuels. Growing demands for both food and household energy are to a great extent responsible for present deforestation as more and more trees are harvested and agricultural land expanded. Furthermore, Rwanda, like Burundi, has entrenched pastoralist traditions. The social system encourages the maintenance of a large cattle population as a sign of wealth. The grazing of the animal population contributes to the land pressure.

The reforestation programme started in 1978 had reached a tree planting rate of 19 000 ha/year by 1984[6]. Projects are undertaken with the help of external assistance. Forest extension however remains weak.

4.2 Coal, peat and papyrus

Rwanda has no known coal resources, but is believed to have significant peat reserves. Their extent and potential for exploitation are being assessed, but proven reserves amount to at least 5 million tons (estimates vary between 5 and 50 million tons[5]). The most substantial peat reserves are in the Akanyuru River basin in the south-central part of the country, although they are under water most of the year. Potentially good quality peat reserves are found in the Rugezi basin. An assessment of possible ecological effects on Lakes Bulera and Luhondo is needed prior to their exploitation as the Ntaruka and Mukungwa power plants are located in them. Other peat deposits are found near Cyangungu in the south-western part of the country (Gishoma bog, Nyanza bog, etc.). The peat master plan study will start during the first term of 1992. Similar to peat, papyrus is relatively abundant. Papyrus swamps are estimated to cover some 23 000 ha of land.

4.3 Petroleum and gas

The country has no domestic oil reserves or refinery activities and the potential for petroleum exploration is apparently non-existent. The only hydrocarbon resource that the country has is in the form of methane gas dissolved in the deep waters of Lake Kivu on the border with Zaire. Reserves are estimated at 60 billion Nm^3, of which some 50 billion Nm^3 (equivalent to about 40 million TOE) are considered to be 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[(5)]. Only a small fraction is methane (25%); other components of the gas are carbon dioxide (73,5%), hydrogen sulfide (0,05%) and other, mainly nitrogen, (1,55%)[(7)].

4.4 Hydro-electricity

Land relief is dominated by mountains and rainfall is abundant (about 1250-1500 mm/year). This is ideal for power generation. Many potential sites for hydro schemes exist, but unfortunately they have two major disadvantages which make their exploitation costly. On one hand, their capacity is small and on the other hand, the topography of the land prevents the construction of large reservoirs to ensure water availability during dry seasons. The only possible hydro sources, for the generation of large amounts of power, are the Ruzizi River on the border with Zaire (Ruzizi schemes: see section 5.4) and the Kagera River on the border with Tanzania. The total hydropower potential of the country is estimated at about 150 MW[(5)].

The Kagera River forms part of the border of Tanzania with Uganda, Rwanda and Burundi. Its hydropower potential can be developed at three sites: Rusumo Falls, Kishanda Valley (potential capacity 180 MW), and Kakano. Concerning the Rusumo Falls on the Rwanda-Tanzania border, an agreement for joint development was signed in 1977 between Tanzania, Burundi and Rwanda. Feasibility studies have been carried out for flow control, water storage and to build a plant of between 60 and 100 MW, two kilometres downstream of the confluence of the Kagera and Ruvuvu Rivers. As the project can lead to flooding in Rwanda, the dam height issue has to be solved by Rwanda and Tanzania prior to further considerations. In the past, Rwanda and Burundi adopted a very cautious attitude on the scheme because of the lower unit cost of Ruzizi II. The project is of interest for Tanzania, which is eager to provide power to its remote north-western part which is far from the main load centres.

4.5 Other energy sources

4.5.1 Geothermal energy:

Rwanda is believed to have geothermal potential around Lake Kivu and the volcanoes along the north-western border. A number of exploitable sites have been identified. The viability of exploiting and developing them has not yet been assessed.

4.5.2 Wind and solar energy:

In general, wind is not a valuable source of energy. Although there are no detailed data on wind potential, available measurements indicate that it is very limited, with a low regime and a high percentage of windless days(5). A number of wind-driven generators which were installed in a sporadic manner are now inoperative. Potential for solar energy is relatively abundant. The insolation ranges from 5 to 6 kWh/day/m^2 and modest variations of about 20% of annual averages are noted(7). Current applications of solar energy include solar water heating (limited largely to commercial service establishments and dwellings) and photovoltaic systems for lighting, refrigeration and sterlization mainly in the rural areas. Cost is the major handicap to the wide development of solar energy. The absence of a domestic production and service capabilities are also considered as serious constraints. A research and testing programme is being undertaken by the Centre d'Etudes et d'Applications de l'Energie au Rwanda (CEAER), a research centre established at the National University of Rwanda.

4.5.3 Biogas:

The government has expressed its commitment to the propagation of the use of biogas plant in rural areas since the mid-1980s. By 1990, 30 biogas plants were installed, mainly for cooking purposes. However, biogas is unlikely to provide a significant energy substitute. Cattle dung is difficult to collect, pig manure is not available, and as a high altitude country, Rwanda has low temperatures (14-19°C) which militate against efficient digestion. Experiments are being undertaken to test a wide range of plant materials in biogas digesters(7). For socio-cultural reasons, human waste digestors are not easily accepted. The wide-scale implementation of biogas is also constrained by the poverty of rural households and the absence of a biogas tradition.

5. ENERGY SUPPLY AND DEMAND

5.1 General

Figure 10 gives the contribution of the various forms of energy to the total energy consumption in 1989. As can be seen, the bulk of the energy requirements (over 90%) are met by traditional fuels (fuelwood, crop residues and charcoal). The estimated quantity and percentage contributions of these various energy forms to the total final consumption for the period 1970-88 are shown in Figs 11 and 12 respectively.

Commercial energy consists of refined petroleum products (all imported from or through neighbouring countries), electricity (almost entirely from hydro sources with additional needs being met by imports), and a small amount of methane gas. The quantity and percentage shares of these components are shown in Figs 13 and 14.

As shown in Fig. 15, final energy consumption per capita is about 275 kgoe. The share of commercial energy is very small, only 20 kgoe/capita, reflecting the low level of income, the relatively high petroleum prices, the high connection cost for electricity, the dominance of subsistence agriculture in the economy, and the small size of the industrial sector.

Sectorally, households accounts for about 83,3% of the TFC. It is followed by transport and industry, as shown in Fig. 16.

Figure 17 gives the energy intensity in the economy. Commercial energy intensity is low, reflecting the large share of the non-mechanized agriculture in the economy. The growth rates of GDP and of the various forms of energy are shown in Fig. 18. GDP growth rates were positive due to the coffee boom, increasing to a maximum at the beginning of the 1980s before declining as coffee prices decreased. Commercial energy growth rate follows closely the growth of oil, which constitutes the bulk of commercial energy. A significant decline in oil consumption is noted during the period 1977-80. This is partly accounted for by the shortage of oil products due to the disruption of supply routes (see 5.3). Oil growth increased substantially after that period, but it declined with the civil disorder in Uganda during 1984 and 1985. Following the commissioning of some industrial units and the growth of the vehicle fleet, oil growth has increased in the past years. The trend in electricity growth is closer to that of GDP growth, showing that electricity is the priority of the public sector energy investment programme.

5.2 Woodfuels and crop residues

Traditional fuels, mainly woodfuels, are used for household needs, small industries, and miscellaneous services such as institutional cooking. It is estimated that 95% of the wood production in the country is for domestic energy consumption in the form of fuelwood and charcoal[5]. More and more, crop wastes (in the form of banana leaves, maize stalk, coffee husk, etc.) are being used as fuels, especially in the more densely populated rural areas.

The quantity and the percentage shares of traditional fuels in the total final consumption are shown on a yearly basis over the period 1970-88 in Figs 11 and 12 respectively. They are estimated on the assumption that the traditional energy demand per capita and per year is 0,9 m^3. About 85% of woodfuels are used directly as firewood, the rest being converted to charcoal. Woodfuels consumption by sector is as follows: households 96,9%, industry 2,4%, and miscellaneous services 0,7%.

Although data related to forestry and woodfuels are poor, forest resources are estimated to be declining on a national level under the present consumption pattern at a rate of 2,3% per year[3]. Significant imbalances exist between wood consumption and sustainable supply. In 1987 the national deficit was 505,8 thousand tons of woodfuels compared to sustainable supply, representing 16,3% of the total demand[5]. Using present energy consumption patterns for households and official population projections, woodfuels consumption by households, the dominant consumer category, will amount to some 70% more than present national demand just after the turn of the century. The high reliance on woodfuels for energy needs, the high population density and the rapid population growth have led to increasing depletion to meet the growing demand. Charcoal, which is resource-intensive in production as well as in use, is to a great extent responsible for the deforestation that has taken place in certain parts of the country. The use of agricultural residues as fuels instead of as fertilizers is contributing to the decline of soil fertility. Some studies have shown that when mulch and organic fertilizer are not used, a significant drop of 50% or more is noticed in the yield of coffee and other crops[7]. Soil quality is also affected by erosion. Extension of agricultural land to feed the growing population results in losses of forest resources.

The traditional fuels market in rural areas is not formal apart from missions, hospitals and rural factories. In urban areas it becomes more formal. Woodfuels are produced in all prefectures, with quantities varying from a low 171 000 tons/year in

Kibuye to a high 317 000 tons/year in Kigali. The contribution of different sorts of forests to supply varies from one prefecture to another. In 1987 the global supply came from plantations (31,8% of the total volume), woody plants (55,9%), savannahs (3,4%), and natural forest (9%). Legally protected, natural forests in the national parks are theorically not available for fuelwood. However, many rural dwellers collect their wood supply from them. The overall consumption of charcoal is estimated at 30 000 tons per year. In towns such as Kigali, charcoal is the principal cooking fuel for about 80% of the households. Charcoal has experienced a growing demand from low and medium income families. Retail sales in Kigali have increased from 2 400 tons in 1977 to the present level of 26 000 tons per year[(6)]. Charcoal and woodfuels become more expensive as the supply base shifts from natural reserves in the neighbourhood of towns to more and more distant plantations. This is the case for the capital, Kigali, whose supply base has moved from the eastern savannah of Bugesera and Kibungo to more distant plantations (up to 80 km) in the west and south-west. Now, as much as 55% of the charcoal purchased by Kigali retailers comes from Gikongoro (south-west) and 18% from Kibuye (west)[(5)].

Reforestation is encouraged by the government but remains insufficient. However, it is accompanied by an important programme of public education on fuelwood and charcoal economy, and environment conservation in rural areas. This is mounted with the help of non-government organisations (NGOs). Some 3000 wood stoves and charcoal burners with improved efficiencies are distributed every year in order to conserve fuelwood[(6)]. In this regard, the government is planning to introduce taxes on charcoal, with lower rates for charcoal produced by improved techniques.

5.3 Petroleum

Petroleum products form the bulk of commercial energy, as shown in Figs 13 and 14. All products are imported in their refined state. The consumption, low in the early 1980s (about 50 000 tons in 1981 or 1100 barrels/day[(7)]), is rising steadily and rapidly, reaching over 100 000 tons in 1987[(5)][1]. This is the result of the commissioning of some industrial enterprises. Figure 19 shows the consumption of petroleum products on a yearly basis over the period 1970-88.

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1 Data from the Ministry of Public Works, Energy and Water give 90,10 thousand tons. The difference is due to smuggled products estimated at 12 000 tons in 1987. The above figures include both the sales and commercial stocks (estimated to be 10% of annual sales).

The structure of consumption is characterized by the predominance of automobile fuels: gasoline and diesel. Their percentage shares from 1970 to 1988 are shown in Fig. 20. Heavy fuel oil, representing 11% of the consumption in 1987, is consumed by a few industrial units, the largest of which is the Mashyuza cement works (9000 tons/year). Consumption of LPG and kerosene is rising. They are used mainly for lighting, but also for cooking purposes.

Sectorially, transport accounts for 83,3% of the total petroleum energy consumption, households 10%, and industry 6,4%.

The import cost of petroleum products currently absorbs around 40% of the total export receipts and represents approximately 16-17% of the total import bill(5). This share is expected to rise in the future.

The petroleum market is shared among six companies: ERP (Enterprise Rwandaise de Pétrole), SGP (Société Générale de Pétrole), Rwanda Petrolgaz, PetroRwanda, BP-Fina and Shell. The first three companies belong to private Rwandan entrepreneurs and PetroRwanda has a State majority participation. ERP holds the largest share of the market (40%), followed by PetroRwanda (24%). Private companies are also allowed to import petroleum products for their own consumption. Competition exists between these companies. Rwandan companies' suppliers are mainly Kenyan subsidiaries of large international companies or oil trading companies present in Kenya or Tanzania. They also purchase petroleum products directly from Arabian-Persian Gulf suppliers in association with Kenyan or Ugandan companies(5).

The reliability of the supply of petroleum products is an issue of great importance. Rwanda relies on transport links with and refineries of other countries. The main supply route runs from the Mombasa refinery to Nairobi by a 485 km pipeline and on to Kigali via Uganda by tank trucks along a 1250 km road route. This route is vulnerable to interruptions. In fact, as a result of a dispute with Kenya, in 1977 President Amin of Uganda ordered a ban on heavy vehicles from neighbouring countries from using Uganda's roads. The complete closure of the border from February to May 1979, caused by the fighting in Uganda and the civil war in that country during 1984 and 1985, disrupted road transport. Alternative routes have been developed. The first and most important, used in times of unrest in Uganda, runs from Nairobi south of Lake Victoria across Tanzania. The second passes only through Tanzania, from the port of Dar es Salaam, either directly by a 1560 km road to Kigali, or by rail from Dar es Salaam to Tabora and Isaka, and then by a 600 km road from Isaka to Kigali. However, this route is not yet extensively used because the road modernization works between Isaka and the Rwanda frontier have not yet been completed[5].

The geographic location of the country imposes high transport costs along the supply route, representing in the present situation over half the price of CIF-Kigali. Transport cost per ton of petroleum products is US$ 260-300 for the main section via Nairobi-Kampala (US$ 40-50 for the Mombasa-Nairobi pipeline, plus US$ 220-250 for transportation by truck from Nairobi to Kigali) and US$ 230-280 for the routes starting at Dar es Salaam[5]. As a result, the prices of petroleum products are high.

Altogether oil companies hold, in the distribution stations, an operational stock of 8000 m^3 which is sufficient in normal conditions. The government has instituted 10 000 m^3 of buffer stocks to secure supply in serious situations. They are found in storage facilities near Kigali and at Gisenyi and were set up in 1979 when the country had to be supplied by air because road communications were cut for eight months. Additional storage facilities, about 15 000 m^3, were built in 1988 (3 x 3660 m^3 at Gatsatsa near Kigali, and 2 x 1950 m^3 at Butare). If they are filled, the country has a total buffer stock of 2,4 months of consumption at the 1988 demand level[5]. However, the optimum volume to be held in storage has to be assessed carefully. The cost of maintaining the stockpile must be compared with possible air freight. For instance, in 1977 and 1978 an air service was used as an alternative outlet to move stocks of coffee. It was found to be scarcely more expensive than land transport and appreciably more reliable[2].

5.4 Electricity

Electrical power is supplied by the State-owned Electrogaz and by various small producers for their private needs. The shares of hydro and thermal, public and private for both installed capacity and electricity produced over the period 1960-88 are shown in Figs 21 and 22. Additional electricity needs are met by imports from Zaire's Société Nationale d'electricité (SNEL) and from SINELAC.

National pubic production came almost entirely from hydroelectric sources as the mountainous characteristics of the land and the abundant rainfall are good for power generation. The existing public generating facilities, supplying the domestic network, are four interconnected hydroelectric stations totalling 26,5 MW and four diesel plants with a total capacity of 3,6 MW, which are on standby or out of service(5). The most important assets, accounting for 82% of domestic supply in 1987, are the Ntakuru and the Mukungwa I power stations. Supplied by Lake Bulera in northern Rwanda, the Ntakuru station consists of three sets of 3,75 MW each. It was commissioned in 1958 with two units, the third having been added in 1962. It was, in the 1970s, the main supplier of electricity to Kigali, to which it is linked by a 110 kV transmission line. The 2 x 6,23 MW Mukungwa I station is located downstream of the Ntakuru plant, at the outlet of Lake Luhondo and came into operation in 1981. In the north-western part of the country, Gisenyi, the second largest town, gets its electricity from the 2 x 0,5 MW Gisenyi hydroelectric generating station built in 1956. It was completely rehabilited in 1979 after aging and maintenance problems. A second plant, close to the town, the 2 x 0,9 MW Gahira power station, came on stream in 1985. The annual production of these different power stations is shown in Table 1.

Table 1. Electricity supply (1983-1990) in GWh[2]

Power plants	1983	1984	1985	1986	1987	1990
Hydroelectric						
Mukungwa I	53,60	58,33	55,23	55,85	60,54	42,95
Ntakuru	25,83	29,15	27,27	23,96	28,06	14,71
Gisenyi	5,98	6,42	5,66	6,03	8,22	8,65
Gihira	-	-	1,83	8,88	11,52	11,85
Diesel						
Gatsatsa	0,18	0,08	-	0,31	0,12	0,12
Imports						
Ruzizi I	12,45	10,87	20,67	21,85	18,79	7,07
Ruzizi II	-	-	-	-	-	88,60

2 Source: Rwanda: Issues and Options in the Energy Sector, 1991, Ministry of Public Works, Energy and Water.

Apart from the 3 x 0,7 MW Gatsatsa station which is available as standby for Kigali, the other diesel-driven electric generating plants, found at Gisenyi (0,3 MW), Kibungo (0,75 MW) and Kibuye (0,5 KVA), are out of service in order to minimize operating costs and especially petroleum product purchases.

The interconnected grid, linking the three CEPGL countries (Rwanda, Zaire and Burundi), is supplied by two hydroelectric plants located on the Ruzizi River: Ruzizi I and Ruzizi II. The 28,2 MW Ruzizi I belongs to Zaire and is operated by its electricity corporation SNEL. The 2 x 13,3 MW Ruzizi II, located downstream of Ruzizi I, is the common property of the three CEPGL countries. Each of them has right to one-third of the energy produced. This station, operated by SINELAC, came on stream in 1989 with an annual output estimated at 140 GWh; a third unit is expected to be installed around 1995.

A 110 kV transmission line from Ruzizi I to Kigali via the Mururu station on the border of the Ruzizi River was completed in 1978. Import from Ruzizi I generating station started in 1977 and accounted for 4% of electricity needs of the country. This proportion increased considerably from 1978 until the opening of the Mukungwa I station in 1981, reaching a maximum in 1980 when Zaire provided 45 GWh or 65% of Rwanda's electricity requirements. In fact, as a result of severe difficulties, all but one of the seven thermal plants were closed during this period. In order to maintain sufficient supply prior to the completion of the interconnection with Zaire, the Ntakuru hydropower plant was used at twice its regular load factor. It drew water equivalent to 43 GWh annually, while available annual sustainable supply from the Lake Bulera reservoir averaged only 20 GWh. As the level of the lake decreased, the plant was operated at low capacity in order to refill it and the country relied on Zaire for its electricity needs.

Power imports are shown in Table 1. In general, imports from Zaire, although obtained at a very competitive price, are steadily declining, representing 4% of the country's electricity needs or 7 GWh in 1990. This is due to two reasons. Firstly, Rwanda is trying to reduce its dependence by maximizing the use of its domestic plants. The negative effect of this practice has been the lowering of lake levels over time, as plants are operated beyond their rated annual sustainable production. Secondly, in 1989 the Ruzizi II station brought additional capacity (about 140 GWh/year) to the interconnected grid. Rwanda drew from this station 88 GWh or 50,7% of its electricity requirements in 1990. This means that it is making use of parts of Zaire's and Burundi's shares in the scheme. This trend is expected to continue with the installation of the third 13,3 MW unit at the Ruzizi II scheme.

The public supply network consists of about 12 distribution centres, of which Kigali is the largest, accounting for 60% of total consumption. The access to electricity is very limited: 1,4% of the population nationwide and 12% in Kigali(5). The total number of connections amounts to 13 717 (13 335 LV and 162 MV), with Kigali accounting for 8 107 (8 003 LV and 104 MV). Peak demand grew from 18 MW in 1984 to 24,9 MW in 1987, partly because of the growth in residential consumption. Peak demand has been rising more rapidly than average demand (the load factor has fallen from 66,5% in 1984 to 58,5% in 1987. Figure 23 gives the sectorial distribution of electricity consumption on a yearly basis over the period 1975-87. Increasing investment in public lighting has led to a growing share of the public sector in total consumption. Transmission consists of 349 km of 110 kV and 70 kV high voltage lines, 934 km of 30 kV, 15 kV and 6,6 kV medium voltage lines, and 380 V of low voltage lines.

The government has been considering other hydroelectric schemes. In 1989 Japan accorded a loan of US$ 23,4 million to be used for the construction of the 3,6 MW Mukungwa II hydroelectric station(2). The work on the station, for which the unit cost is estimated at US$ 4,7 million/kW[3], was delayed as the World Bank questioned the feasibility of the project on hydrological and geological grounds. The plant proposed at Rukarara (9,4 MW, US$ 3,4 million/kW) raises the same consideration. Other proposed facilities include the 3 MW Rusomo-Rugesi (US$ 4,42 million/KW), the 1,8 MW Keya (US$ 2,3 million/kW), the 9-14 MW Nyabarongo (US$ 2,9- 4,5 million/kW), the 2-2,5 MW Akanyaru (US$ 4,5-5,7 million/kW), and 10 other microplants. The most important project is the proposed hydropower station at Rusumo Falls, from which Rwanda can get 27,3 MW. At a cost of US$ 1,9 million/kW, this scheme is the cheapest on an installed unit cost basis, after the Ruzizi II plant (the unit cost for the third unit of the Ruzizi II scheme is US$ 600 thousand/kW). The government is also considering, in the long term, a methane-driven thermal power station to make use of the large methane gas resource.

5.5 Methane

A pilot plant, built in 1963 at Cap Rubona, on the Rwandan shore of Lake Kivu, is operated by Electrogaz. Up to 1987 some 20 million Nm^3 had been extracted. All

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3unit cost in 1987 US$

production is sold to the Gisenyi brewery which uses the bulk as boiler fuel, and small quantities are compressed into CNG for pilot use in converted gasoline-fuelled vehicles.

There are many potential uses of methane in the future. One of them is the processing of derivatives: nitrogenous fertilizers (ammonia and urea) for Rwanda, methanol for Zaire, and synthetic gasoline and diesel for the regional market. Methane can also be used as a fuel in many industrial processes (such as the generation of steam or hot water), in thermal power stations for electricity generation, and in vehicles and small engines.

Large-scale gas processing is not envisaged in the short term as the potential market is small. Cement works (Cimerwa at Mashyuza in Rwanda and Cimenki at Katana in Zaire) may become viable large users if production (extraction and enrichment) and transport costs are reduced. In this regard, studies on alternatives for optimal gas extraction and distribution, including laboratory tests and site experimentation, were carried out and concluded in the 1988. The production of compressed gas (CNG) and liquefied gas (LNG), to be transported by barge and road to end-users, was considered. Additional studies are needed.

In May 1975 Zaire and Rwanda signed a treaty and agreed to form a joint venture with a monopoly for the exploitation and marketing of the gas. In June 1987 the Societe Internationale d'Exploitation, de Transport et de Commercialisation du Gaz Methane du Lac Kivu (Socigaz) was established to exploit this commodity. However, there is need to provide an institutional framework for private sector involvement and to reduce the role of Socigaz. Methane gas will not become an effective alternative source of energy before environmental, economic, technical and institutional issues are resolved.

6. PRICING

Apart from the two major fuels (gasoline and diesel) whose maximum selling prices are fixed by the government, petroleum products prices are not controlled. The government's oil price policy is used to keep the selling price constant while adapting the level of taxation to compensate for changes in the world market. The tax content of the selling price of automobile gasoline is 44%, and of diesel 46%. This is in sharp contrast with the low taxation of kerosene (only 6,2%) and fuel oil (14,6%), showing a clear wish on behalf of the government to favour certain kinds of consumers. The tax content includes a road fund tax. There is no cross-subsidization of transport costs within the country; in provincial towns, transportation charges are added to prices in Kigali in order to obtain the retail prices. From 1981 to 1990 the price structure and level did not change, although world market prices fell notably during the period 1984-87. As a result of the high prices, between 1000 and 2000 tons of petroleum products (mainly diesel) are currently smuggled every year into Rwanda from neighbouring countries where prices are lower. Following the devaluation of the Rwanda franc in November 1990, petroleum products prices were raised considerably (from 65 to 120 RWF or approximately US$ 1/litre of gasoline). In order to retain larger consumers, oil companies grant them special discounts of between 2 and 5% of the selling price.

A new electricity tariff structure went into effect at the beginning of 1991. For LV consumers, domestic and small enterprises, the energy charge is set at RF 8,5/kWh (approximately US$ 0,11/kWh). There are two differentiated tariffs for the two categories of MV users, based on the subscribed peak demand. Below 100 kW the energy charge is RF 8,0/kWh (US$ 0,10) and the monthly peak demand charge is RF 486/kW (US$ 6,10). Above 100 kW these two components are respectively RF 5,0/kWh (US$ 0,06) and RF 744/kW (US$ 9,34). Average charges per kWh for the two types of MV users are RF 10,0 (US$ 0,13) and RF 7,5 (US$ 0,10) respectively. Electricity tariffs were increased by 50% in July 1991, following the 1990 devaluation. However rates remain low: 43% below the marginal costs for LV consumers and between 22% and 41% below the long-run marginal cost for MV users. Before the devaluation, the LRMC of electric power in Rwanda was estimated at US$ 0,17/kWh at MV and US$ 0,20/kWh at LV distribution. In 1987 the average purchase price paid to Zaire's SNEL by Electrogaz was RF 2,74/kWh (US$ 0,034) in the interconnected system, a price well below the marginal cost(5).

Prices of wood, although free-market orientated, are low and far from the actual costs. This reflects on one hand the low purchasing power of consumers relying on fuelwood for cooking, and on the other hand the small size of the commercial fuelwood market. Furthermore, most suppliers do not have a perception of the total cost of wood. Most transactions take place below RF 100/stere (US$ 1,26), far below the official price (which is RF 400/stere (US$ 5,02) for standing trees as stumpage fees for products coming from communal forests). The price of charcoal is influenced by high transport costs due to the shift of supply bases from peripheral zones to more and more distant regions. For instance, the price of a 35 kg sack of charcoal in Kigali increased from RF 142 (US$ 1,53) in 1976 to RF 500 (US$ 5,38) in 1981 and RF 550 (US$ 6,90) in 1987. The government plans to introduce a tax on charcoal marketing in the future, with special discounts for charcoal made with improved techniques. The tax will be levied by the communes for charcoal transported in their territory, paid by transporters, and divided between the commune and the government. This system is intended to increase the income of charcoalers, conserve the resource, and increase public revenue both on the communal level and the national level.

7. DISCUSSION

Fuelwood is the most important resource of the country. It is subject to depletion due to population pressure and expansion of agricultural land. Agricultural residues are being used more and more. Reforestation efforts have been accompanied by improvement in woodfuels efficiency utilization and educational programmes on woodfuels economy.

The country's geographic position imposes high prices on petroleum products and threatens supply security. Local hydroelectric resources are costly to harness, and regional schemes play an important role in improving electricity supply. Methane gas, peat and papyrus resources are large. However, for economic and environmental reasons, their viability as fuels is on an insignificant scale and is at present highly uncertain.

A greater improvement in planning, implementation and operations can be achieved by strengthening energy institutions.

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TABLES

TABLE A. ECONOMIC INDICATORS

MILLIONS OF NATIONAL CURRENCY UNLESS INDICATED

YEAR	POPUL. MILLIONS	POPUL. GROWTH RATE (%)	GROSS DOMESTIC PRODUCT AT MARKET COST: AGRICULTURE	INDUSTRY: TOTAL INDUSTRY	INDUSTRY: MINING QUARRY	INDUSTRY: MANUFACTURE	INDUSTRY: ELEC,WTR AND GAS	INDUSTRY: CONSTRUCTION	OTHER SERVICES + TAXES	TOTAL	GDP DEFLATOR	GDP AT 1985 PRICES MARKET	GDP/CAPITA CURRENT	GDP/CAPITA REAL 1985	EXCHANGE RATE RF PER US$	GDP IN US$(MILL) CURRENT PRICE MARKET	GDP IN US$(MILL) AT 1985 PRICE MARKET	GDP PER CAPITA US$/CAPI	GDP PER CAPITA US$(1985)/CAPITA
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	3.38	NA	10510	1560	NA	390	NA	NA	3890	15960	NA	NA	4718	NA	NA	NA	NA	NA	NA
1968	3.48	2.7	11240	1640	NA	750	NA	NA	4340	17220	22.1	78095	4954	22467	100.0	172	771	50	222
1969	3.58	3.0	12410	1770	NA	770	NA	NA	4690	18870	21.4	88032	5268	24576	100.0	189	869	53	243
1970	3.70	3.2	13550	1890	NA	790	NA	NA	6550	21990	23.6	93150	5951	25210	100.0	220	920	60	249
1971	3.82	3.3	13600	1930	NA	830	NA	NA	6700	22230	23.6	94166	5824	24670	99.7	223	930	58	244
1972	3.94	3.3	13520	2140	NA	930	NA	NA	7040	22700	24.0	94643	5756	23997	92.1	246	935	62	237
1973	4.08	3.4	14890	2130	NA	1000	NA	NA	7380	24400	24.9	97877	5985	24007	84.1	290	967	71	237
1974	4.22	3.4	16960	2640	NA	1250	NA	NA	9080	28680	29.1	98611	6804	23395	92.8	309	974	73	231
1975	4.36	3.4	25970	10010	NA	6480	NA	NA	16790	52770	52.1	101238	12109	23230	92.8	568	1000	130	229
1976	4.51	3.4	30450	11690	NA	7600	NA	NA	19730	61870	57.1	108298	13731	24034	92.8	666	1070	148	237
1977	4.66	3.4	33280	15190	NA	10200	NA	NA	23160	71630	63.0	113727	15378	24415	92.8	772	1123	166	241
1978	4.82	3.4	34380	17930	NA	12640	NA	NA	28740	81050	65.3	124214	16833	25797	92.8	873	1227	181	255
1979	4.98	3.3	47160	18020	NA	12300	NA	NA	30990	96170	70.4	136520	19327	27436	92.8	1036	1348	208	271
1980	5.14	3.3	49510	23270	NA	16480	NA	NA	35210	107990	71.8	150476	21014	29281	92.8	1163	1486	226	289
1981	5.31	3.2	49960	25580	NA	19300	NA	NA	47100	122640	74.9	163778	23113	30867	92.8	1321	1617	249	305
1982	5.48	3.2	52100	28910	NA	17660	NA	NA	49950	130960	78.7	166491	23911	30398	92.8	1411	1644	258	300
1983	5.65	3.2	54320	35020	NA	21830	NA	NA	52850	142190	80.4	176944	25153	31301	94.3	1507	1747	267	309
1984	5.84	3.2	64980	37890	570	22200	910	7880	56240	159110	94.3	168666	27264	28901	100.2	1588	1666	272	285
1985	6.03	3.3	72670	40310	460	23830	910	8390	60720	173700	100.0	173700	28825	28825	101.3	1715	1715	285	285
1986	6.23	3.3	63920	40420	310	27130	1020	9650	66000	170340	93.2	182766	27364	29360	87.6	1944	1805	312	290
1987	6.43	3.4	65350	37900	NA	24680	NA	NA	68660	171910	94.4	182053	26719	28295	79.7	2158	1798	335	279
1988	6.66	3.5	67430	38740	NA	25110	NA	NA	71760	177930	97.6	182232	26728	27374	76.4	2328	1800	350	270
1989	6.89	3.5	63880	39210	NA	25580	NA	NA	70420	173510	102.3	169665	25172	24614	80.0	2169	1676	315	243
1990	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 B. ENERGY BREAKDOWN

YEAR	TOTAL FINAL CONSUMPTION (000s TOE) COMMERCIAL FORMS OF ENERGY COAL	OIL	HYDRO	METHANE	ELECT	TOTAL	TRAD. ENERGY	TOTAL ENERGY	ENERGY FORMS AS % OF TFC COM. ENERGY	TRAD. ENERGY	ENERGY FORMS PER CAPITA (TOE/CAP) OIL	ELECT.	COM. ENERGY	TRAD. ENERGY	TOTAL ENERGY	RATIO COM.ENERGY/ TRAD.ENERGY	ENERGY INTENSITY(TOE/GDPreal TRAD. ENERGY	COM. ENERGY	TOTAL ENERGY
1965	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1966	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1967	0	NA	NA	NA	NA	NA	883.0	NA	NA	NA	NA	NA	NA	0.261	NA	NA	NA	NA	NA
1968	0	NA	NA	NA	NA	NA	907.2	NA	NA	NA	NA	NA	NA	0.261	NA	NA	1.2E-05	NA	NA
1969	0	NA	NA	NA	NA	NA	934.9	NA	NA	NA	NA	NA	NA	0.261	NA	NA	1.1E-05	NA	NA
1970	0	19.5	0	0.9	5.8	26.1	964.4	990.5	2.6	97.4	0.005	0.002	0.007	0.261	0.268	0.03	1.0E-05	2.8E-07	1.1E-05
1971	0	19.2	0	0.9	6.3	26.4	996.2	1022.6	2.6	97.4	0.005	0.002	0.007	0.261	0.268	0.03	1.1E-05	2.8E-07	1.1E-05
1972	0	22.4	0	0.9	9.0	32.3	1029.4	1061.7	3.0	97.0	0.006	0.002	0.008	0.261	0.269	0.03	1.1E-05	3.4E-07	1.1E-05
1973	0	24.2	0	0.9	9.2	34.3	1064.1	1098.4	3.1	96.9	0.006	0.002	0.008	0.261	0.269	0.03	1.1E-05	3.5E-07	1.1E-05
1974	0	23.5	0	0.9	9.8	34.1	1100.1	1134.2	3.0	97.0	0.006	0.002	0.008	0.261	0.269	0.03	1.1E-05	3.5E-07	1.2E-05
1975	0	30.5	0	0.9	10.5	41.9	1137.4	1179.3	3.6	96.4	0.007	0.002	0.010	0.261	0.271	0.04	1.1E-05	4.1E-07	1.2E-05
1976	0	40.0	0	0.9	10.9	51.7	1176.1	1227.8	4.2	95.8	0.009	0.002	0.011	0.261	0.272	0.04	1.1E-05	4.8E-07	1.1E-05
1977	0	41.2	0	0.9	11.1	53.1	1215.7	1268.9	4.2	95.8	0.009	0.002	0.011	0.261	0.272	0.04	1.1E-05	4.7E-07	1.1E-05
1978	0	46.3	0	0.9	12.5	59.7	1256.7	1316.4	4.5	95.5	0.010	0.003	0.012	0.261	0.273	0.05	1.0E-05	4.8E-07	1.1E-05
1979	0	45.6	0	1.0	14.6	61.1	1298.7	1359.9	4.5	95.5	0.009	0.003	0.012	0.261	0.273	0.05	9.5E-06	4.5E-07	1.0E-05
1980	0	48.8	0	1.0	15.8	65.6	1341.3	1406.9	4.7	95.3	0.009	0.003	0.013	0.261	0.274	0.05	8.9E-06	4.4E-07	9.3E-06
1981	0	54.6	0	1.0	14.5	70.0	1384.9	1454.9	4.8	95.2	0.010	0.003	0.013	0.261	0.274	0.05	8.5E-06	4.3E-07	8.9E-06
1982	0	58.9	0	1.0	11.6	71.5	1429.5	1500.9	4.8	95.2	0.011	0.002	0.013	0.261	0.274	0.05	8.6E-06	4.3E-07	9.0E-06
1983	0	68.5	0	1.0	12.5	82.0	1475.4	1557.5	5.3	94.7	0.012	0.002	0.015	0.261	0.276	0.06	8.3E-06	4.6E-07	8.8E-06
1984	0	75.6	0	1.0	12.9	89.4	1523.2	1612.6	5.5	94.5	0.013	0.002	0.015	0.261	0.276	0.06	9.0E-06	5.3E-07	9.6E-06
1985	0	83.5	0	1.0	14.0	98.5	1572.8	1671.3	5.9	94.1	0.014	0.002	0.016	0.261	0.277	0.06	9.1E-06	5.7E-07	9.6E-06
1986	0	94.7	0	1.0	13.2	108.9	1624.7	1733.6	6.3	93.7	0.015	0.002	0.017	0.261	0.278	0.07	8.9E-06	6.0E-07	9.5E-06
1987	0	105.1	0	1.0	14.1	120.1	1679.3	1799.4	6.7	93.3	0.016	0.002	0.019	0.261	0.280	0.07	9.2E-06	6.6E-07	9.9E-06
1988	0	94.2	0	1.0	13.9	109.1	1737.5	1846.5	5.9	94.1	0.014	0.002	0.016	0.261	0.277	0.06	9.5E-06	6.0E-07	1.0E-05
1989	0	NA	0	1.4	NA	NA	1799.1	NA	NA	NA	NA	NA	NA	0.261	NA	NA	1.1E-05	NA	NA
1990	0	NA	0	0.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NOTE: THESE DATA ARE ESTIMATED WITH FOLLOWING ASSUMPTIONS
15% OF APPARENT CONSUMPTION OF ELECTRICITY IS LOST
(STATION'S USES, TRANSMISSION AND DISTRIBUTION LOSSES)
THERMAL GENERATION EFFICIENCY IS 26%
PER CAPITA TRADITIONAL FUELS USE IS 0.9 CUBIC METERS FUELWOOD EQUIVALENT
1 CUBIC METER OF FUELWOOD = 0.29 TOE

TABLE C. ENERGY DATA FOR GRAPHS

YEAR	COMMERCIAL ENERGY COMPONENTS AS % COM.ENERGY FINAL CONSUMPTION METHANE	OIL	ELECTRICITY	COMMERCIAL ENERGY COMPONENTS AS % TOTAL ENERGY FINAL CONSUMPTION METHANE	OIL	ELECTRICITY	COM.ENERGY FINAL CONS. GROWTH RATE (%) 1 PT	3 PT M.A.	5 PT M.A.	TFC GROWTH RATE(%) 1 PT	3 PT M.A.	5 PT M.A.	ENERGY INTENSITY (TOE/RW.FR.) TRAD. ENERGY	COM. ENERGY	TOTAL ENERGY
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	NA	NA	NA	NA	NA	NA
1968	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.2E-05	NA	NA
1969	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.1E-05	NA	NA
1970	3.4	74.6	22.1	0.1	2.0	0.6	NA	NA	NA	NA	NA	NA	1.0E-05	2.8E-07	1.1E-05
1971	3.3	72.8	23.8	0.1	1.9	0.6	1.0	NA	NA	3.2	NA	NA	1.1E-05	2.8E-07	1.1E-05
1972	2.7	69.3	27.9	0.1	2.1	0.8	22.2	9.8	NA	3.8	3.5	NA	1.1E-05	3.4E-07	1.1E-05
1973	2.6	70.5	26.9	0.1	2.2	0.8	6.3	9.3	10.4	3.5	3.5	3.6	1.1E-05	3.5E-07	1.1E-05
1974	2.6	68.8	28.6	0.1	2.1	0.9	-0.6	9.5	14.9	3.3	3.6	3.7	1.1E-05	3.5E-07	1.2E-05
1975	2.1	72.9	25.0	0.1	2.6	0.9	22.9	15.3	11.0	4.0	3.8	3.6	1.1E-05	4.1E-07	1.2E-05
1976	1.7	77.3	21.0	0.1	3.3	0.9	23.4	16.4	12.2	4.1	3.8	3.7	1.1E-05	4.8E-07	1.1E-05
1977	1.7	77.5	20.9	0.1	3.2	0.9	2.7	12.8	12.8	3.3	3.7	3.7	1.1E-05	4.7E-07	1.1E-05
1978	1.5	77.5	21.0	0.1	3.5	1.0	12.3	5.8	9.7	3.7	3.5	3.6	1.0E-05	4.8E-07	1.1E-05
1979	1.6	74.6	23.8	0.1	3.4	1.1	2.5	7.4	6.3	3.3	3.5	3.5	9.5E-06	4.5E-07	1.0E-05
1980	1.5	74.4	24.1	0.1	3.5	1.1	7.4	5.5	6.2	3.5	3.4	3.4	8.9E-06	4.4E-07	9.3E-06
1981	1.4	77.9	20.7	0.1	3.8	1.0	6.7	5.4	6.7	3.4	3.3	3.4	8.5E-06	4.3E-07	8.9E-06
1982	1.4	82.4	16.2	0.1	3.9	0.8	2.0	7.8	8.0	3.2	3.4	3.5	8.6E-06	4.3E-07	9.0E-06
1983	1.2	83.5	15.3	0.1	4.4	0.8	14.8	8.6	8.5	3.8	3.5	3.5	8.3E-06	4.6E-07	8.8E-06
1984	1.1	84.5	14.4	0.1	4.7	0.8	9.0	11.3	9.3	3.5	3.6	3.6	9.0E-06	5.3E-07	9.6E-06
1985	1.0	84.8	14.2	0.1	5.0	0.8	10.2	9.9	11.0	3.6	3.6	3.7	9.1E-06	5.7E-07	9.6E-06
1986	0.9	87.0	12.2	0.1	5.5	0.8	10.6	10.3	6.2	3.7	3.7	3.5	8.9E-06	6.0E-07	9.5E-06
1987	0.8	87.5	11.7	0.1	5.8	0.8	10.3	3.9	NA	3.8	3.4	NA	9.2E-06	6.6E-07	9.9E-06
1988	0.9	86.4	12.7	0.1	5.1	0.8	-9.2	NA	NA	2.6	NA	NA	9.5E-06	6.0E-07	1.0E-05
1989	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.1E-05	NA	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE D. ELECTRICITY DATA INSTALLED CAPACITY (MEGAWATTS)

YEAR	PUBLIC HYDRO	THERMAL	TOTAL	SELFPRODUCERS HYDRO	THERMAL	TOTAL	TOTAL HYDRO	TOTAL THERMAL	TOTAL INSTALLED
1960	NA	NA	NA	NA	NA	NA	NA	NA	NA
1961	NA	NA	NA	NA	NA	NA	NA	NA	NA
1962	7	2	9	0	0	NA	7	2	9
1963	7	2	9	0	0	NA	7	2	9
1964	9	1	10	12	0	12	21	1	22
1965	9	1	10	12	1	13	21	2	23
1966	9	1	10	12	1	13	21	2	23
1967	9	1	10	12	1	13	21	2	23
1968	9	1	10	13	0	13	22	1	23
1969	9	1	10	13	0	13	22	1	23
1970	9	1	10	13	0	13	22	1	23
1971	13	1	14	13	0	13	26	1	27
1972	13	1	14	21	0	21	34	1	35
1973	14	1	15	21	0	21	35	1	36
1974	13	1	14	21	0	21	34	1	35
1975	13	1	14	21	0	21	34	1	35
1976	12	2	14	22	0	22	34	2	36
1977	13	2	15	22	0	22	35	2	37
1978	12	2	14	22	1	23	34	3	37
1979	13	2	15	22	1	23	35	3	38
1980	14	2	16	22	1	23	36	3	39
1981	14	2	16	22	1	23	36	3	39
1982	25	2	27	30	1	31	55	3	58
1983	25	2	27	30	1	31	55	3	58
1984	25	2	27	30	1	31	55	3	58
1985	26	3	29	30	1	31	56	4	60
1986	26	3	29	30	1	31	56	4	60
1987	26	3	29	30	1	31	56	4	60
1988	26	3	29	30	1	31	56	4	60
1989	NA	NA	NA	NA	NA	NA	NA	NA	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA

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

TABLE E. OIL PRODUCT CONSUMPTION (000's METRIC TONS)

YEAR	LPG	RESIDUAL	PETROL	**OTHER**	AVGAS	KEROSINE	DIESEL	OTHER	TOTAL	DIES/PET	% PETROL	%DIESEL	OIL TFC GROWTH RATE %	3 PTS M.A.	OIL INTENSITY (kgOE/GDPrel1985)
1970	0.0	2.0	7.0	1.0	0.0	3.0	6.0	1.0	19.0	0.9	36.8	31.6	NA	NA	0.000
1971	0.0	1.0	7.0	1.0	0.0	3.0	7.0	1.0	19.0	1.0	36.8	36.8	-1.3	NA	0.000
1972	0.0	1.0	8.0	1.0	0.0	4.0	8.0	1.0	22.0	1.0	36.4	36.4	16.4	7.7	0.000
1973	0.0	1.0	9.0	2.0	0.0	4.0	8.0	2.0	24.0	0.9	37.5	33.3	8.1	7.1	0.000
1974	0.0	1.0	9.0	1.0	0.0	4.0	8.0	1.0	23.0	0.9	39.1	34.8	-3.0	11.8	0.000
1975	0.0	1.0	12.0	4.0	0.0	2.0	11.0	4.0	30.0	0.9	40.0	36.7	30.2	19.4	0.000
1976	0.0	1.0	15.0	4.0	0.0	4.0	15.0	4.0	39.0	1.0	38.5	38.5	30.9	21.4	0.000
1977	0.0	1.0	18.0	6.0	0.0	3.0	12.0	6.0	40.0	0.7	45.0	30.0	3.0	15.4	0.000
1978	0.0	3.0	21.0	4.0	0.0	5.0	12.0	4.0	45.0	0.6	46.7	26.7	12.4	4.6	0.000
1979	0.0	3.0	19.0	5.0	0.0	6.0	13.0	5.0	46.0	0.7	41.3	28.3	-1.4	6.0	0.000
1980	0.1	2.5	23.3	1.3	0.2	7.0	14.7	1.2	49.0	0.6	47.6	30.0	7.0	5.8	0.000
1981	0.2	2.7	29.0	1.1	0.3	5.0	16.3	0.9	54.4	0.6	53.3	30.0	11.8	8.9	0.000
1982	0.2	2.8	27.4	1.0	0.3	6.0	19.5	0.8	57.0	0.7	48.1	34.2	7.9	12.0	0.000
1983	0.2	2.3	34.2	4.1	0.4	2.1	22.9	3.9	66.0	0.7	51.8	34.7	16.4	11.5	0.000
1984	0.2	2.4	33.3	6.5	0.3	3.3	27.0	6.3	72.8	0.8	45.7	37.1	10.3	12.4	0.000
1985	0.2	2.4	35.5	5.7	0.3	4.7	31.8	5.5	80.4	0.9	44.2	39.6	10.5	11.4	0.000
1986	0.2	3.9	38.7	6.1	0.4	7.4	35.0	5.9	91.5	0.9	42.3	38.3	13.4	11.6	0.001
1987	0.2	11.3	37.2	5.1	0.5	8.7	39.3	4.9	102.1	1.1	36.4	38.5	10.9	4.7	0.001
1988	0.2	14.0	39.9	1.3	0.6	10.9	25.1	1.1	91.8	0.6	43.5	27.3	-10.3	NA	0.001
1989	0.3	13.6	38.6	1.3	0.3	10.6	25.1	1.0	89.5	0.7	43.1	28.0	NA	NA	NA
1990	0.2	13.5	35.1	1.2	0.2	10.8	23.6	1.0	84.4	0.7	41.6	28.0	NA	NA	NA

DATA OBTAINED FROM: WORLD ENERGY SUPPLY(1950-1974)
RWANDA: ISSUES AND OPTIONS IN THE ENERGY SECTOR (JUNE 1982)
YEARBOOK OF WORLD ENERGY STATISTICS(1981)
ENERGY STATISTICS YEARBOOK(1983)
RWANDA: ISSUES AND OPTIONS IN THE ENERGY SECTOR (JULY 1991)
MINISTRY OF PUBLIC WORKS, ENERGY AND WATER (ENERGY DIRECTORATE)

TABLE F. GDP DATA FOR GRAPHS

YEAR	GDP GROWTH RATE (REAL 1985 PRICES) %/YEAR	3PT MA	5PT MA	RATIO AGRICUL/INDUSTRY 1 PT	3 PT M.A.	PERCENTAGE CONTRIBUTION TO GDP AGRI	IND	MINE & QUARRY	MANU	ELEC,WTR AND GAS	CONSTR	OTHER	RATIO AGRI/MAN 1 PT	% CHANGE OF GDP DEFLATOR 1 PT.	3PT M.A.	ANNUAL CHANGE OF GDP PER CAPITA CURRENT 1 PT	3 PTS M.A.	REAL(1985) 1 PT	3 PTS M.A
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	6.7	NA	65.9	9.8	NA	2.4	NA	NA	24.4	26.9	NA	NA	NA	NA	NA	NA
1968	NA	NA	NA	6.9	6.9	65.3	9.5	NA	4.4	NA	NA	25.2	15.0	NA	NA	NA	NA	NA	NA
1969	12.7	NA	NA	7.0	7.0	65.8	9.4	NA	4.1	NA	NA	24.9	16.1	-2.8	NA	5.0	NA	NA	NA
1970	5.8	6.5	NA	7.2	7.1	61.6	8.6	NA	3.6	NA	NA	29.8	17.2	10.1	2.4	6.3	8.1	9.4	NA
1971	1.1	2.5	4.7	7.0	6.8	61.2	8.7	NA	3.7	NA	NA	30.1	16.4	0.0	3.9	13.0	5.7	2.6	3.3
1972	0.5	1.7	2.3	6.3	6.8	59.6	9.4	NA	4.1	NA	NA	31.0	14.5	1.6	1.8	-2.1	3.2	-2.1	-0.8
1973	3.4	1.6	1.7	7.0	6.6	61.0	8.7	NA	4.1	NA	NA	30.2	14.9	3.9	7.4	-1.2	0.2	-2.7	-1.6
1974	0.7	2.3	2.9	6.4	5.3	59.1	9.2	NA	4.4	NA	NA	31.7	13.6	16.7	33.3	4.0	5.5	0.0	-1.7
1975	2.7	3.5	3.8	2.6	3.9	49.2	19.0	NA	12.3	NA	NA	31.8	4.0	79.2	35.2	13.7	31.9	-2.5	-1.1
1976	7.0	4.9	4.9	2.6	2.5	49.2	18.9	NA	12.3	NA	NA	31.9	4.0	9.6	33.0	78.0	35.0	-0.7	0.1
1977	5.0	7.1	6.8	2.2	2.2	46.5	21.2	NA	14.2	NA	NA	32.3	3.3	10.2	7.8	13.4	34.4	3.5	1.4
1978	9.2	8.0	8.3	1.9	2.2	42.4	22.1	NA	15.6	NA	NA	35.5	2.7	3.6	7.3	12.0	11.6	1.6	3.6
1979	9.9	9.8	8.6	2.6	2.2	49.0	18.7	NA	12.8	NA	NA	32.2	3.8	8.0	4.5	9.5	12.1	5.7	4.5
1980	10.2	9.7	8.0	2.1	2.2	45.8	21.5	NA	15.3	NA	NA	32.6	3.0	1.9	4.7	14.8	11.0	6.4	6.2
1981	8.8	6.9	7.4	2.0	2.0	40.7	20.9	NA	15.7	NA	NA	38.4	2.6	4.3	3.8	8.7	11.2	6.7	6.2
1982	1.7	5.6	4.5	1.8	1.8	39.8	22.1	NA	13.5	NA	NA	38.1	3.0	5.0	3.8	10.0	7.4	5.4	3.5
1983	6.3	1.1	3.0	1.6	1.7	38.2	24.6	NA	15.4	NA	NA	37.2	2.5	2.2	8.2	3.5	6.2	-1.5	2.3
1984	-4.7	1.5	2.3	1.7	1.7	40.8	23.8	0.4	14.0	0.6	5.0	35.3	2.9	17.4	8.5	5.2	5.7	3.0	-2.1
1985	3.0	1.2	1.9	1.8	1.7	41.8	23.2	0.3	13.7	0.5	4.8	35.0	3.0	6.0	5.5	8.4	6.4	-7.7	-1.7
1986	5.2	2.6	0.6	1.6	1.7	37.5	23.7	0.2	15.9	0.6	5.7	38.7	2.4	-6.8	0.2	5.7	3.0	-0.3	-2.0
1987	-0.4	1.6	0.2	1.7	1.7	38.0	22.0	NA	14.4	NA	NA	39.9	2.6	1.3	-0.7	-5.1	-0.6	1.9	-0.7
1988	0.1	-2.4	NA	1.7	1.7	37.9	21.8	NA	14.1	NA	NA	40.3	2.7	3.4	3.2	-2.4	-2.5	-3.6	-1.7
1989	-6.9	NA	NA	1.6	NA	36.8	22.6	NA	14.7	NA	NA	40.6	2.5	4.7	NA	0.0	-2.7	-3.3	-5.7
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-5.8	NA	-10.1	NA

TABLE G. ELECTRICITY DATA / ELECTRICITY PRODUCTION (GWhs)

YEAR	PUBLIC HYDRO	THERMAL	TOTAL	SELF PRODUCERS HYDRO	THERMAL	TOTAL	TOTAL HYDRO	TOTAL THERMAL	TOTAL (GWh)	(000s TOE)	IMP - EXP.	ELEC. % P.A.	TFC GWTH RATE 3 PTS	5 PTS	ELECTRICITY INTENSITY TOE/GDPreal1985	RATIO ELEC GWTH/GDP GWTH 1 PT.	3 PT M.A	ELECTR/ (KWh/CA
1960	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	NA	NA	NA	NA	NA	NA	NA
1961	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	NA	NA	NA	NA	NA	NA	NA
1962	10	0	10	0	0	0	10	0	10	0.9	0	NA	NA	NA	NA	NA	NA	NA
1963	10	1	11	0	0	0	10	1	11	0.9	0	NA	NA	NA	NA	NA	NA	NA
1964	10	1	11	15	0	15	25	1	26	2.2	0	NA	NA	NA	NA	NA	NA	NA
1965	10	1	11	25	0	25	35	1	36	3.1	0	NA	NA	NA	NA	NA	NA	NA
1966	14	1	15	33	0	33	47	1	48	4.1	0	NA	NA	NA	NA	NA	NA	NA
1967	14	1	15	43	0	43	57	1	58	5.0	0	NA	NA	NA	NA	NA	NA	NA
1968	21	1	22	49	0	49	70	1	71	6.1	0	NA	NA	NA	NA	NA	NA	NA
1969	21	1	22	57	0	57	78	1	79	6.8	-2	NA	NA	NA	NA	NA	NA	NA
1970	25	1	26	55	0	55	80	1	81	7.0	-2	NA	NA	NA	6.2E-08	NA	NA	18.1
1971	27	1	28	58	1	59	85	2	87	7.5	-1	9.1	NA	NA	6.7E-08	8.4	NA	19.1
1972	29	1	30	92	1	93	121	2	123	10.6	0	43.3	18.3	NA	9.5E-08	85.6	31.6	26.5
1973	30	2	32	93	1	94	123	3	126	10.9	0	2.4	17.2	13.6	9.4E-08	0.7	31.3	26.3
1974	31	1	32	99	1	100	130	2	132	11.4	1	5.7	5.2	12.5	9.9E-08	7.6	3.7	26.9
1975	39	2	41	100	1	101	139	3	142	12.2	1	7.5	5.6	4.3	1.0E-07	2.8	3.6	27.9
1976	44	2	46	99	1	100	143	3	146	12.6	2	3.6	4.4	6.3	1.0E-07	0.5	1.2	28.0
1977	45	2	47	101	1	102	146	3	149	12.8	2	2.0	6.2	8.5	9.8E-08	0.4	0.8	27.6
1978	46	2	48	103	1	104	149	3	152	13.1	16	12.9	10.4	8.7	1.0E-07	1.4	1.2	30.2
1979	57	7	64	95	1	96	152	8	160	13.8	33	16.4	12.6	6.3	1.1E-07	1.7	1.3	34.0
1980	59	7	66	96	1	97	155	8	163	14.1	45	8.6	5.6	1.9	1.1E-07	0.8	0.5	35.7
1981	59	7	66	96	1	97	155	8	163	14.1	30	-8.2	-6.6	0.9	8.9E-08	-0.9	-4.1	31.8
1982	42	2	44	92	1	93	134	3	137	11.8	18	-20.2	-6.8	-1.8	7.0E-08	-12.2	-4.0	24.5
1983	56	2	58	97	1	98	153	3	156	13.4	13	7.9	-3.1	-1.7	7.1E-08	1.3	-3.9	25.7
1984	65	2	67	95	1	96	160	3	163	14.1	11	2.9	6.6	-1.2	7.6E-08	-0.6	1.2	25.6
1985	55	2	57	109	1	110	164	3	167	14.4	21	8.9	2.1	4.1	8.1E-08	3.0	0.4	27.0
1986	56	2	58	95	2	97	151	4	155	13.4	22	-5.6	3.2	2.3	7.2E-08	-1.1	-4.8	24.7
1987	58	2	60	108	2	110	166	4	170	14.7	19	6.3	-0.2	NA	7.7E-08	-16.3	-10.1	25.4
1988	58	2	60	110	2	112	168	4	172	14.8	15	-1.3	NA	NA	7.6E-08	-13.1	NA	24.2
1989	NA	NA	NA	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	NA

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

TABLE H. COMPLEMENT OF ELECTRICITY DATA (MILLION OF KILOWATTHOURS)

YEAR	PRODUCTION HYDRO	PRODUCTION THERMAL	PRODUCTION TOTAL	IMPORTS	EXPORTS	APPARENT CONSUMPTION	APP.CONS./ CAPITA KWh/CAP.	CONSUMPTION BY CONSUMER CATEGORY (GWh) INDUSTR.	COMMERC.	RESIDENT.	PUBLIC SERVICES	ELECTRO-GAZ	TOTAL
1970	80	1	81	0	2	79	21.4	NA	NA	NA	NA	NA	NA
1971	85	2	87	1	2	86	22.5	NA	NA	NA	NA	NA	NA
1972	121	2	123	1	1	123	31.2	NA	NA	NA	NA	NA	NA
1973	123	3	126	1	1	126	30.9	NA	NA	NA	NA	NA	NA
1974	130	2	132	1	0	133	31.6	NA	NA	NA	NA	NA	NA
1975	139	3	142	1	0	143	32.8	23.1	2.8	4.8	4.0	1.9	36.6
1976	143	3	146	2	0	148	32.8	26.1	2.6	5.3	4.2	2.0	40.2
1977	146	3	149	2	0	151	32.4	27.2	3.0	6.5	5.9	2.1	44.7
1978	149	3	152	16	0	168	34.9	26.7	4.1	7.9	7.1	2.7	48.5
1979	152	8	160	33	0	193	38.8	28.6	4.4	10.6	7.0	1.7	52.3
1980	155	8	163	30	0	193	37.6	30.2	7.2	12.5	6.0	1.4	57.3
1981	155	8	163	30	0	193	36.4	32.5	8.5	14.5	7.2	1.1	63.8
1982	134	3	137	26	8	155	28.3	34.7	13.4	13.5	9.4	2.4	73.4
1983	153	3	156	10	1	165	29.2	34.7	11.3	14.3	12.4	2.6	75.3
1984	160	3	163	11	1	173	29.6	35.8	14.3	17.5	13.2	3.1	83.9
1985	161	3	164	20	3	181	30.0	34.8	14.6	17.7	21.2	4.2	92.5
1986	151	4	155	22	3	174	28.0	35.1	14.3	20.0	22.5	3.2	95.1
1987	166	4	170	19	3	186	28.9	36.5	14.3	23.7	24.1	6.1	104.7
1988	168	4	172	17	2	187	28.1	NA	NA	NA	NA	NA	NA
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

DATA OBTAINED FROM: WORLD ENERGY SUPPLY(1950-1974)
RWANDA: ISSUES AND OPTIONS IN THE ENERGY SECTOR (JUNE 1982)
YEARBOOK OF WORLD ENERGY STATISTICS(1981)
ENERGY STATISTICS YEARBOOK(1983)
RWANDA: ISSUES AND OPTIONS IN THE ENERGY SECTOR (JULY 1991)
ESTIMATIONS

TABLE J. ENERGY COEFFICIENT ENERGY CONS. GROWTH/GDP GROWTH

	OIL		ELECTRICITY		COMMERC. ENERGY		TOTAL ENERGY	
YEAR	1 PT	3 PT	1 PT	3 PTS	1 PT	3 PTS	1 PT	3 PTS
1970	NA	NA	NA	NA	NA	NA	NA	NA
1971	-1.2	NA	8.4	NA	0.9	NA	3.0	NA
1972	32.4	11.2	85.6	31.6	44.0	15.6	7.5	3.8
1973	2.4	10.2	0.7	31.3	1.8	15.0	1.0	4.3
1974	-4.0	3.2	7.6	3.7	-0.8	3.2	4.4	2.3
1975	11.3	3.9	2.8	3.6	8.6	3.7	1.5	2.1
1976	4.4	5.5	0.5	1.2	3.4	4.2	0.6	0.9
1977	0.6	2.1	0.4	0.8	0.5	1.7	0.7	0.6
1978	1.3	0.6	1.4	1.2	1.3	0.7	0.4	0.5
1979	-0.1	0.6	1.7	1.3	0.2	0.8	0.3	0.4
1980	0.7	0.6	0.8	0.5	0.7	0.6	0.3	0.4
1981	1.3	2.3	-0.9	-4.1	0.8	0.9	0.4	0.9
1982	4.7	2.9	-12.2	-4.0	1.2	1.4	1.9	1.0
1983	2.6	1.7	1.3	-3.9	2.4	0.5	0.6	0.6
1984	-2.2	1.3	-0.6	1.2	-1.9	1.3	-0.8	0.4
1985	3.5	1.3	3.0	0.4	3.4	1.2	1.2	0.4
1986	2.6	-7.3	-1.1	-4.8	2.0	-7.0	0.7	-2.6
1987	-28.0	-43.4	-16.3	-10.1	-26.3	-39.2	-9.7	5.9
1988	-104.9	NA	-13.1	NA	-93.3	NA	26.6	NA
1989	NA	NA	NA	NA	NA	NA	NA	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA

FIGURES

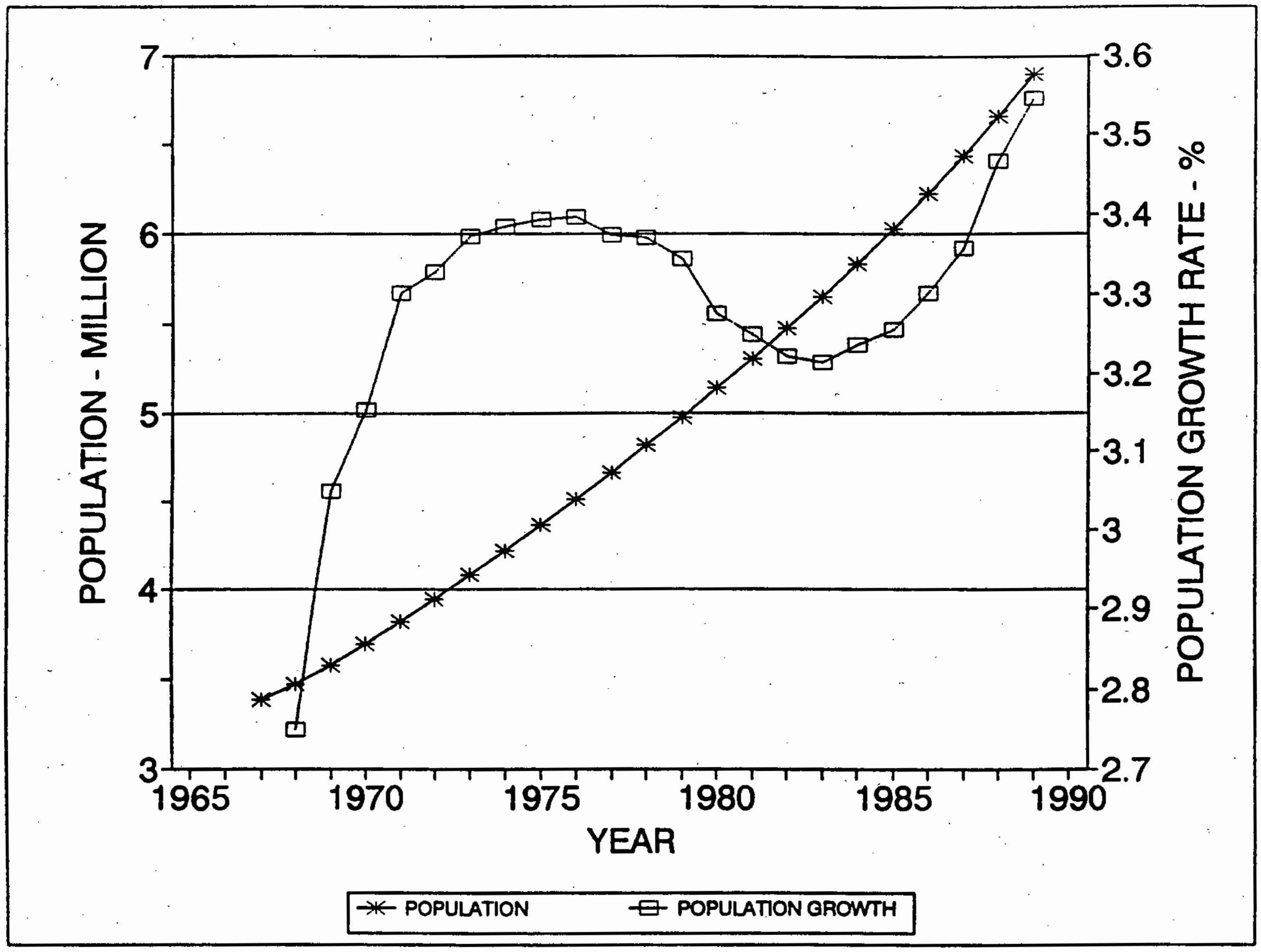


Figure 1. Population and population growth

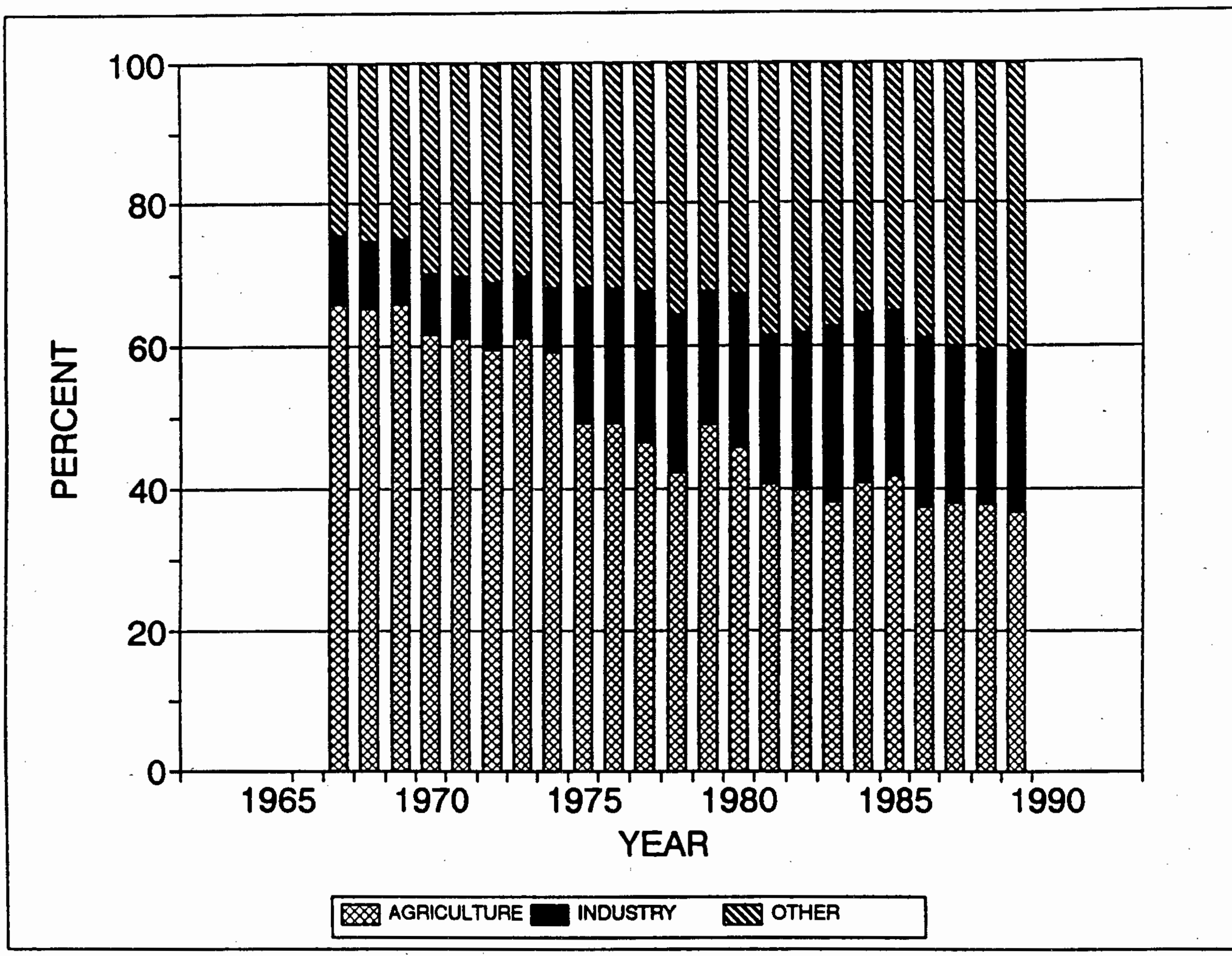


Figure 2. GDP components as percentage of total

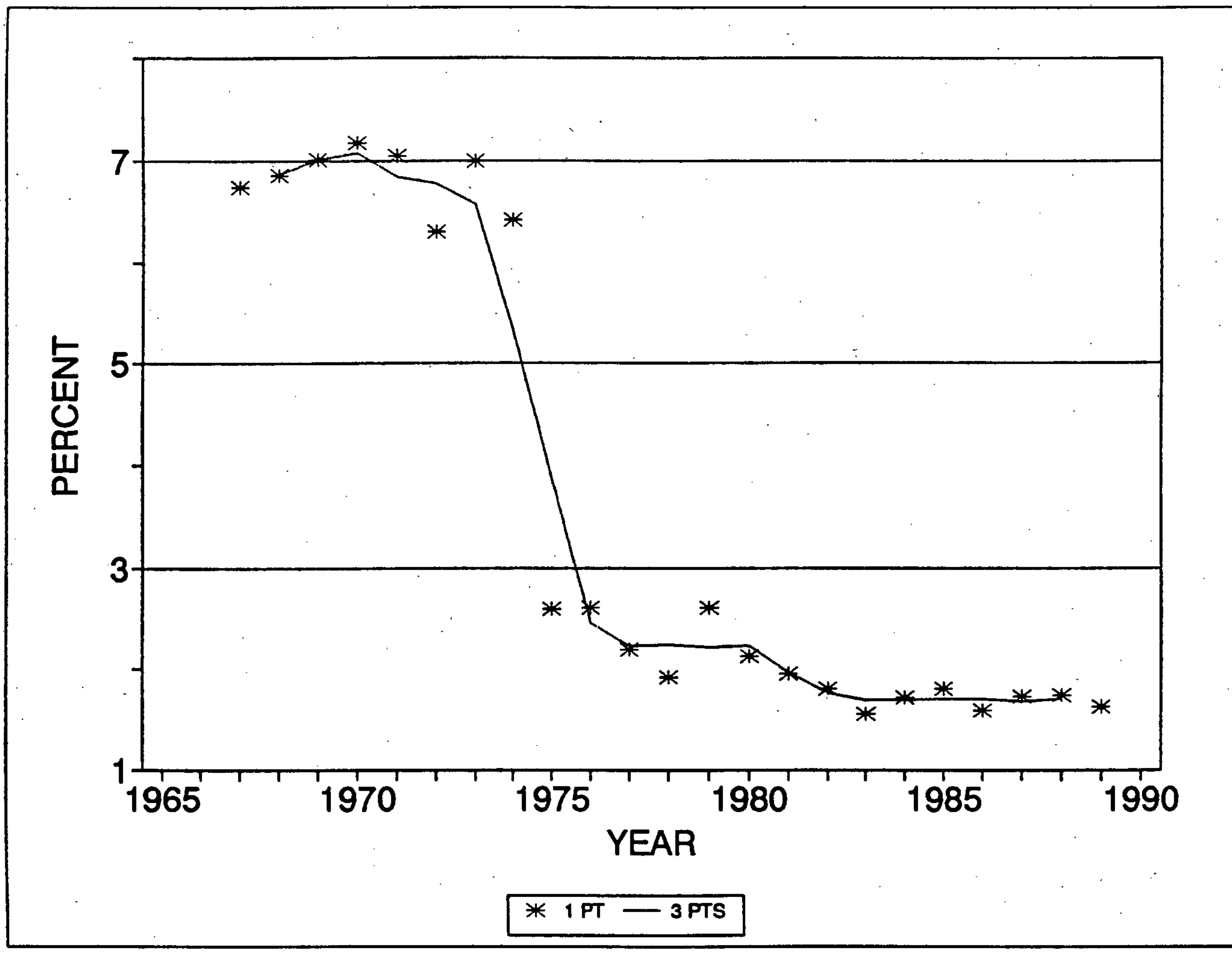


Figure 3. GDP ratio: Agriculture / Industry

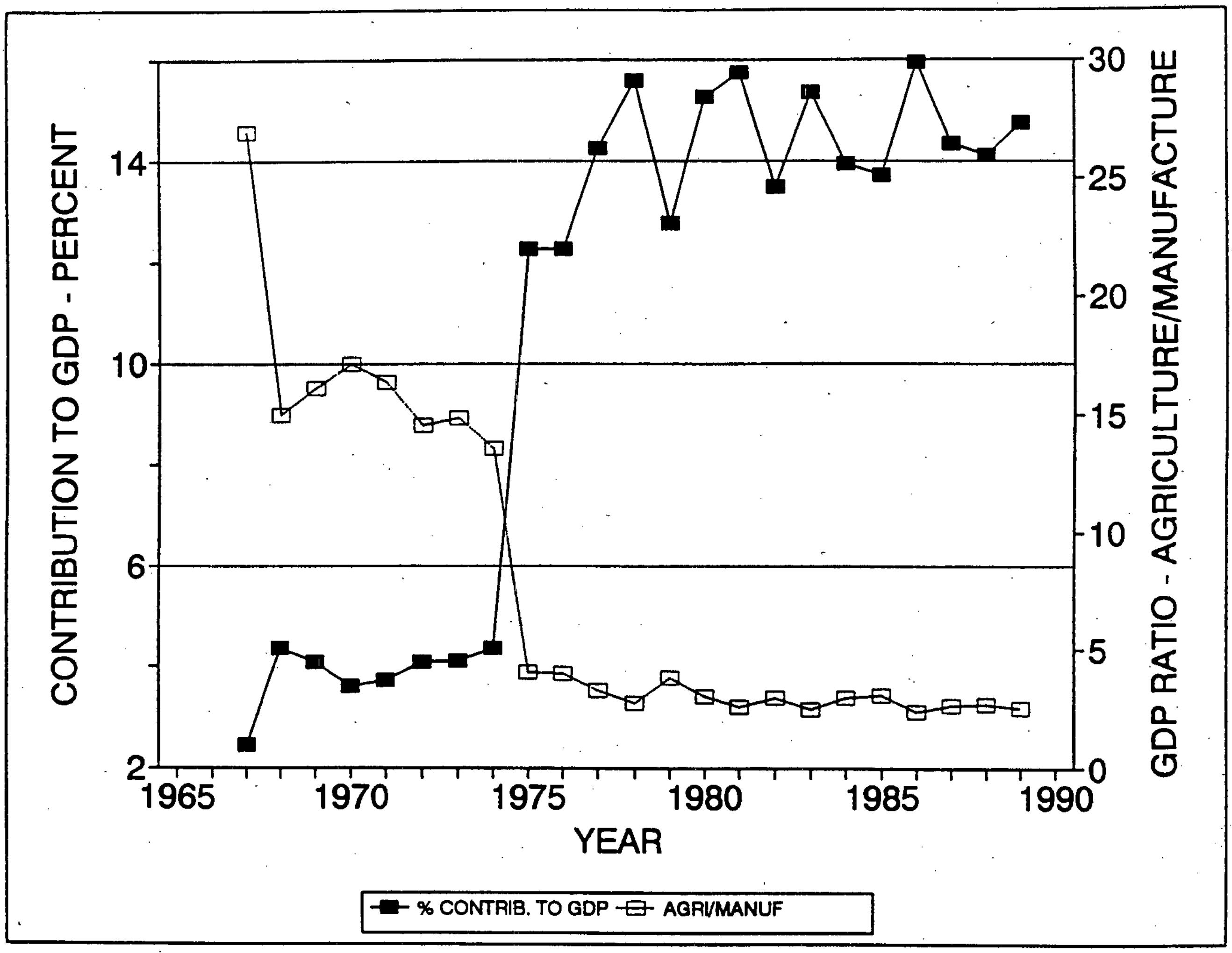


Figure 4. Manufacture: % Contribution to GDP and GDP Ratio

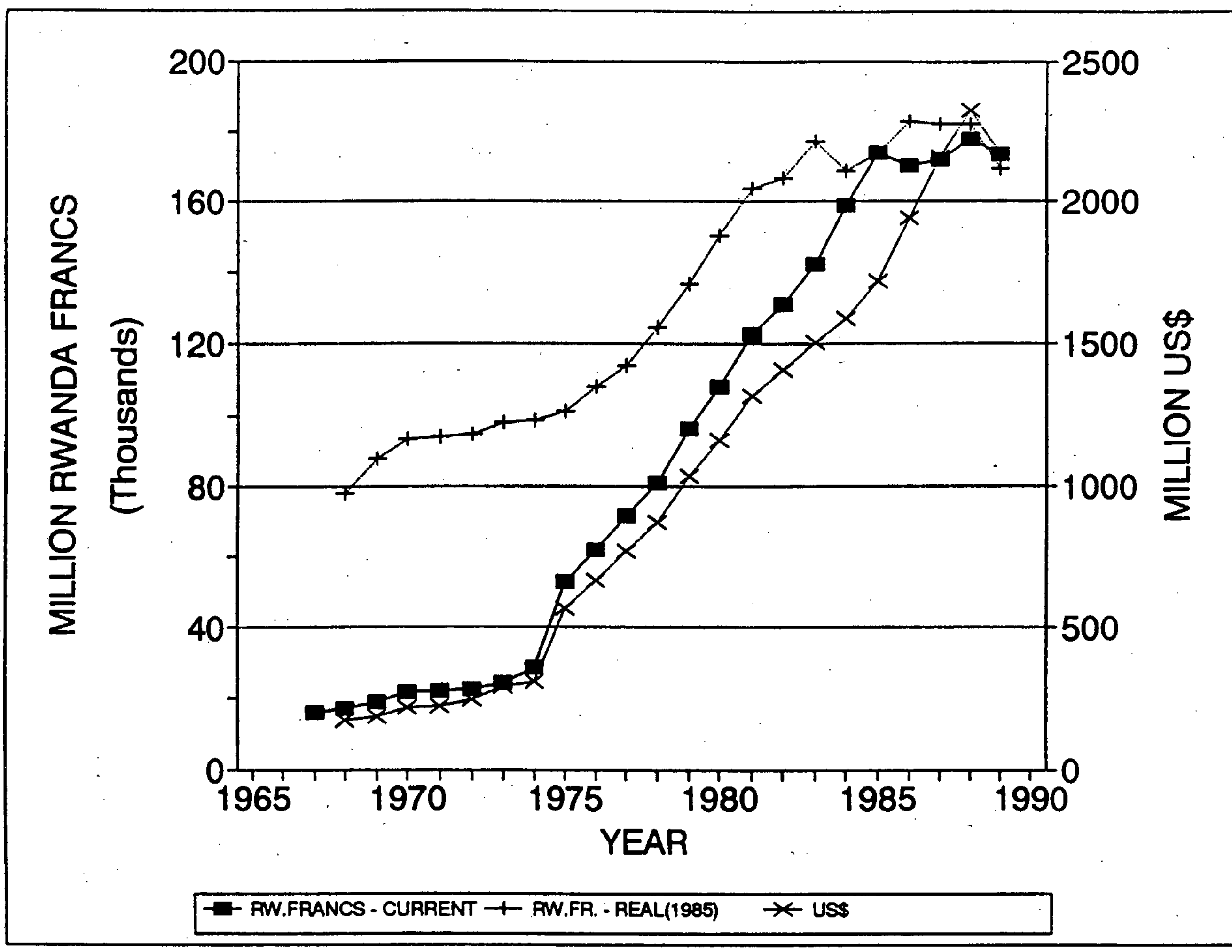


Figure 5. Gross domestic product (market)

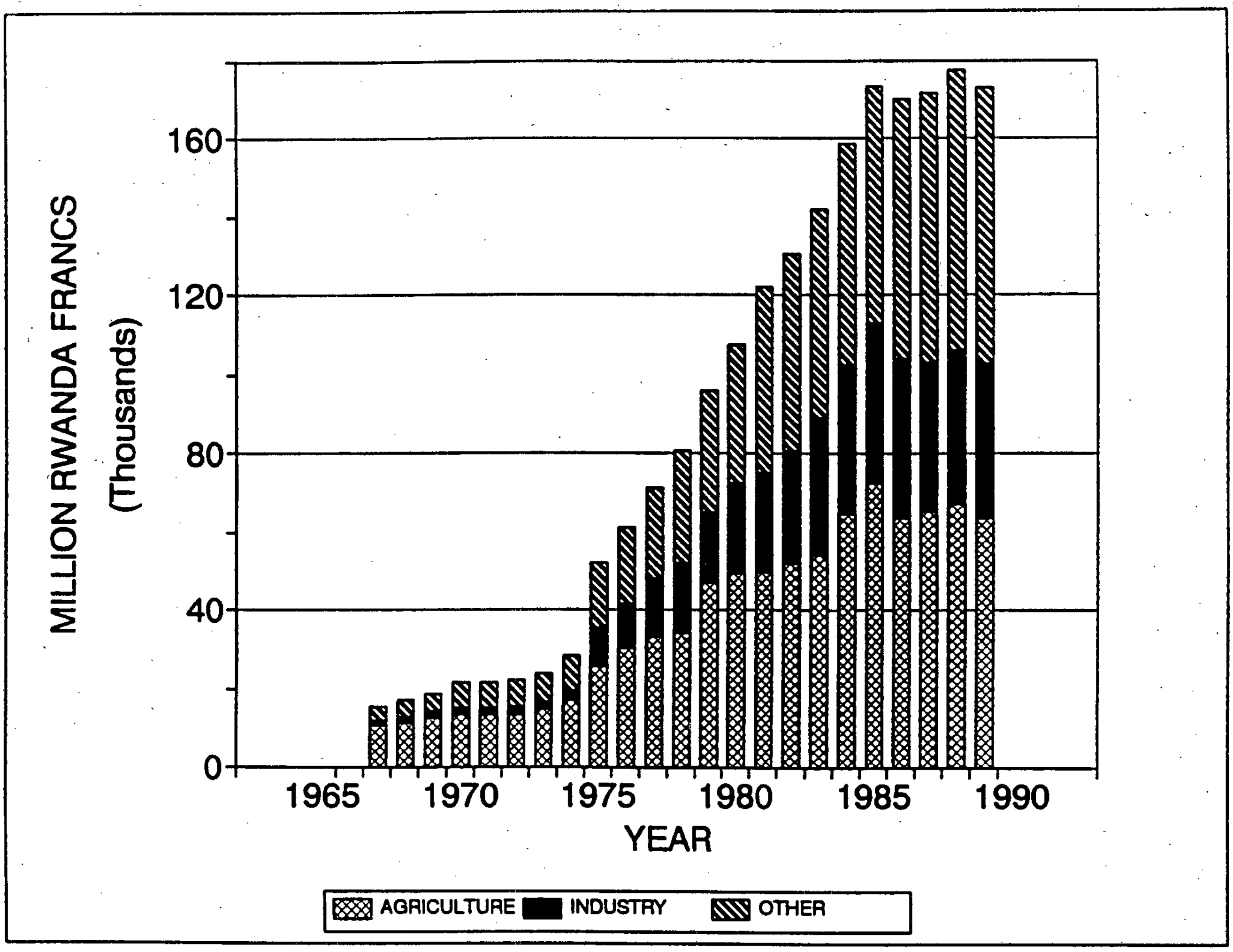


Figure 6. GDP Components (current)

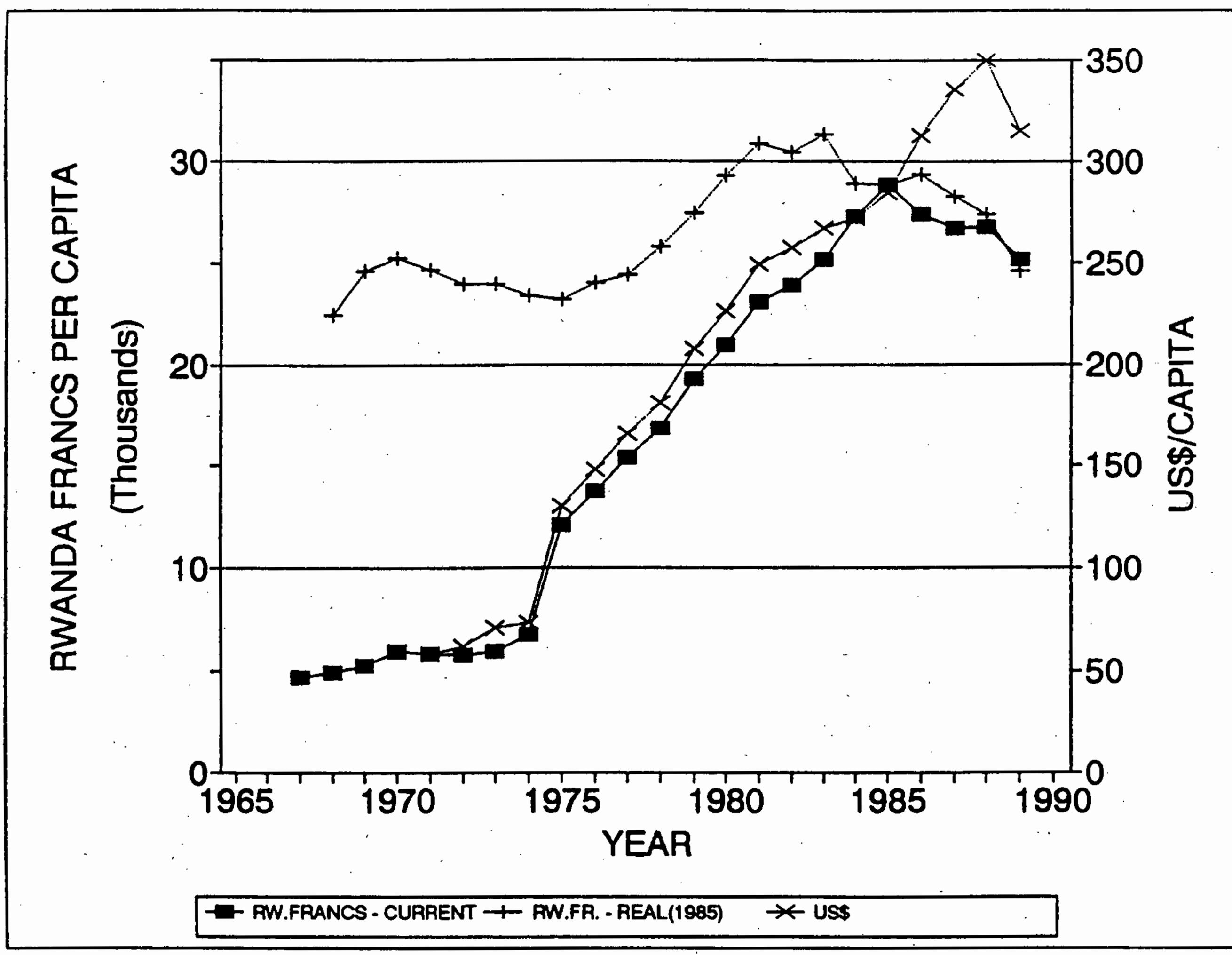


Figure 7. GDP per capita

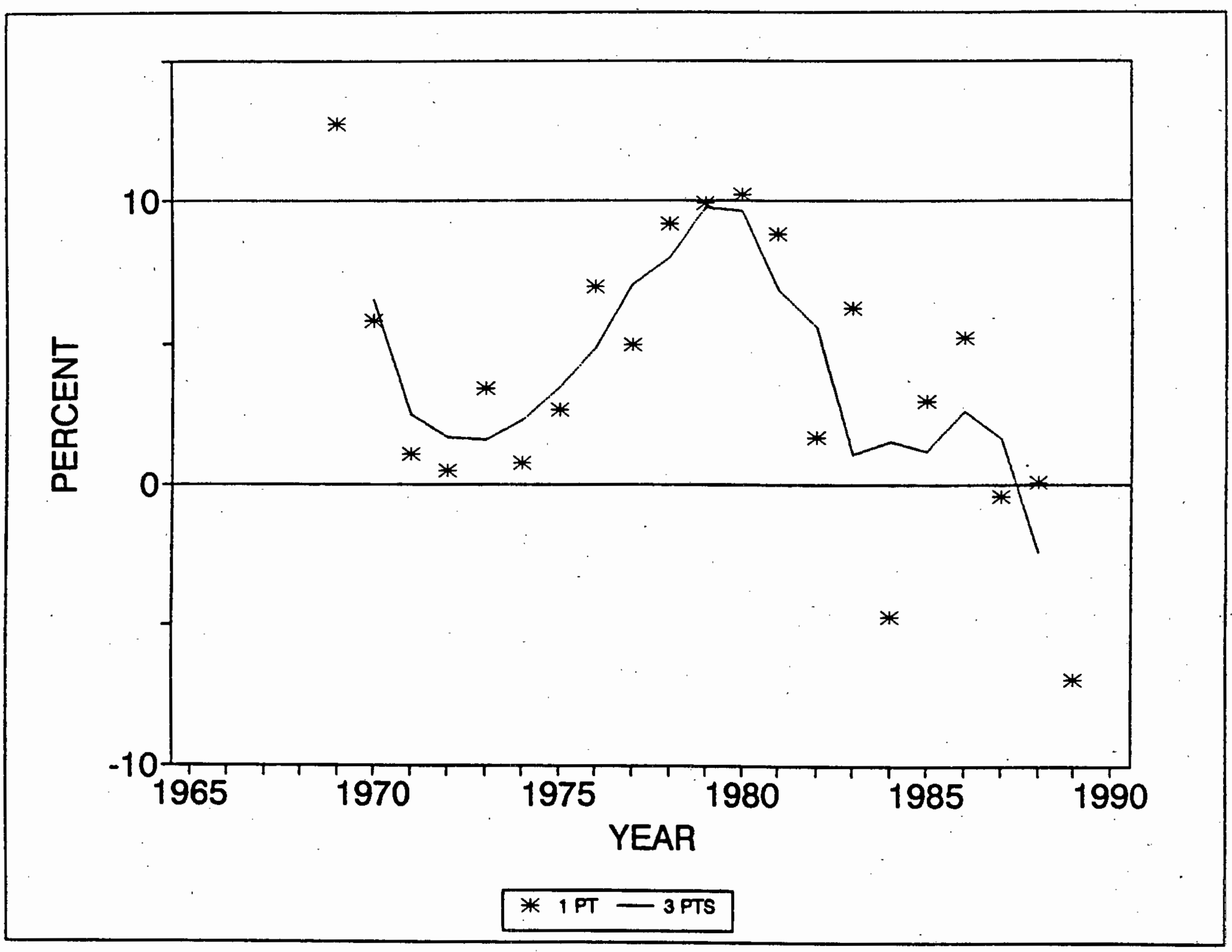


Figure 8. Gross domestic product growth rate: percentage per year (Real 1985)

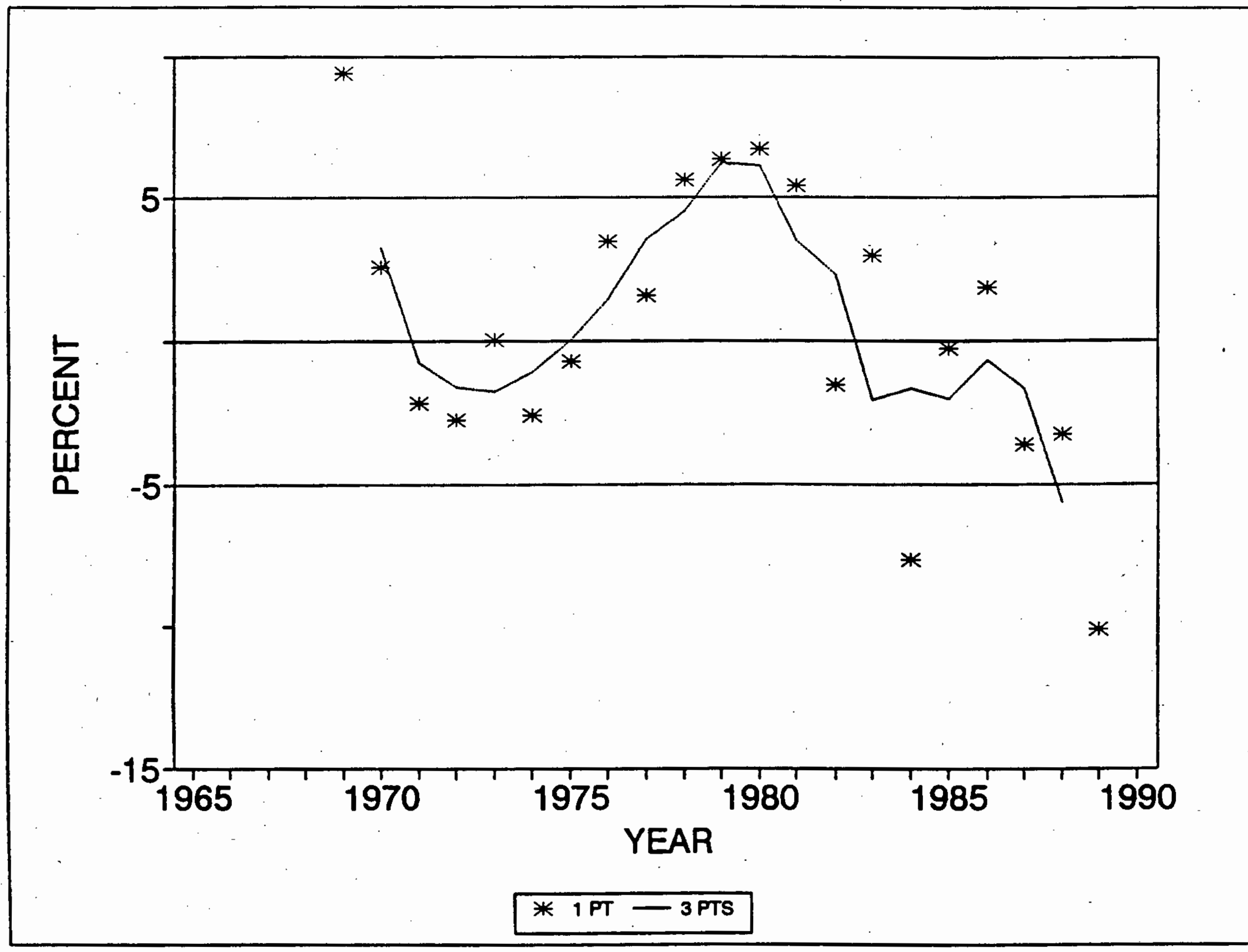


Figure 9. GDP per capita growth rate: percentage / year (Real 1985)

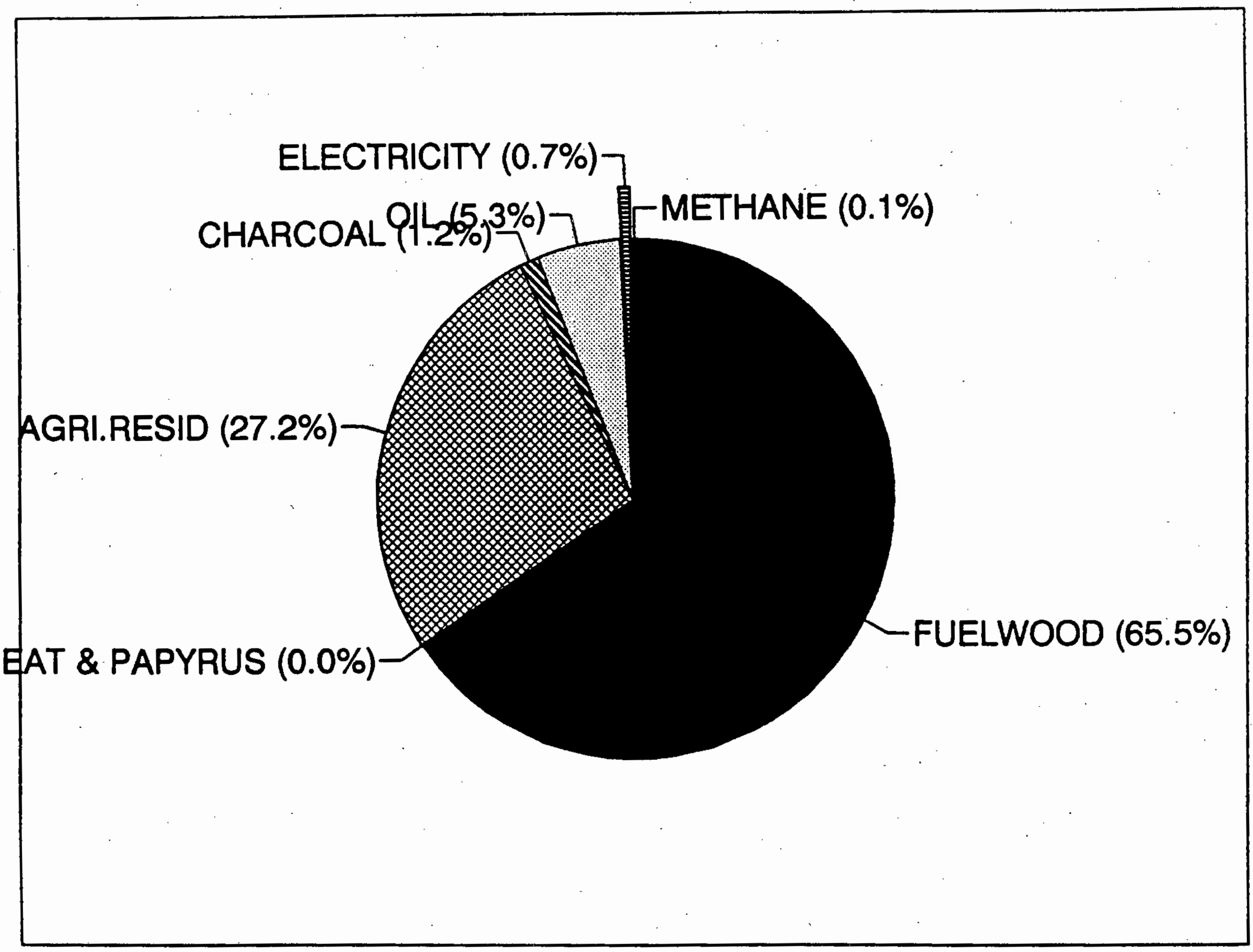


Figure 10. 1989 Energy TFC Balance

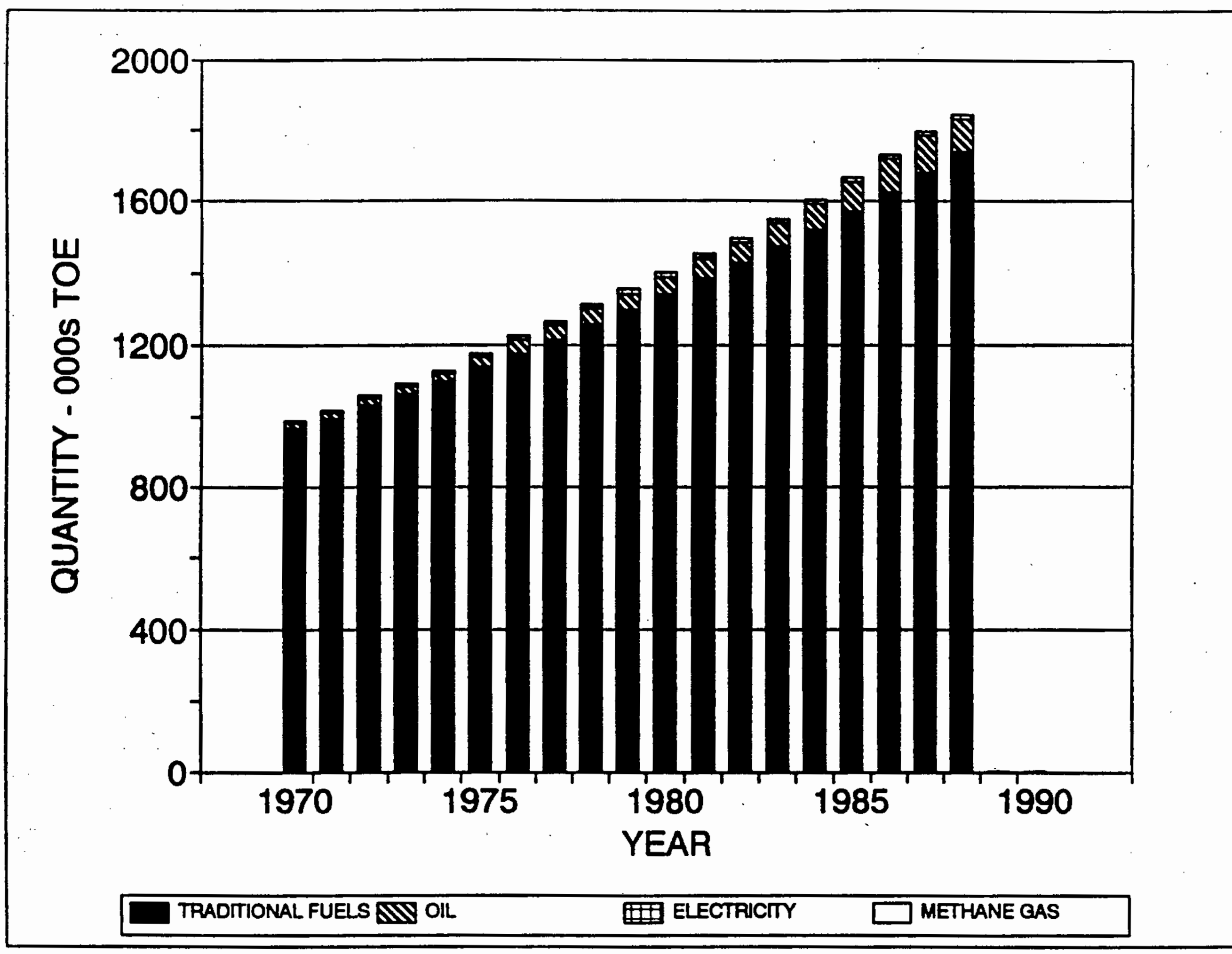


Figure 11. Total final consumption: quantity shares of components

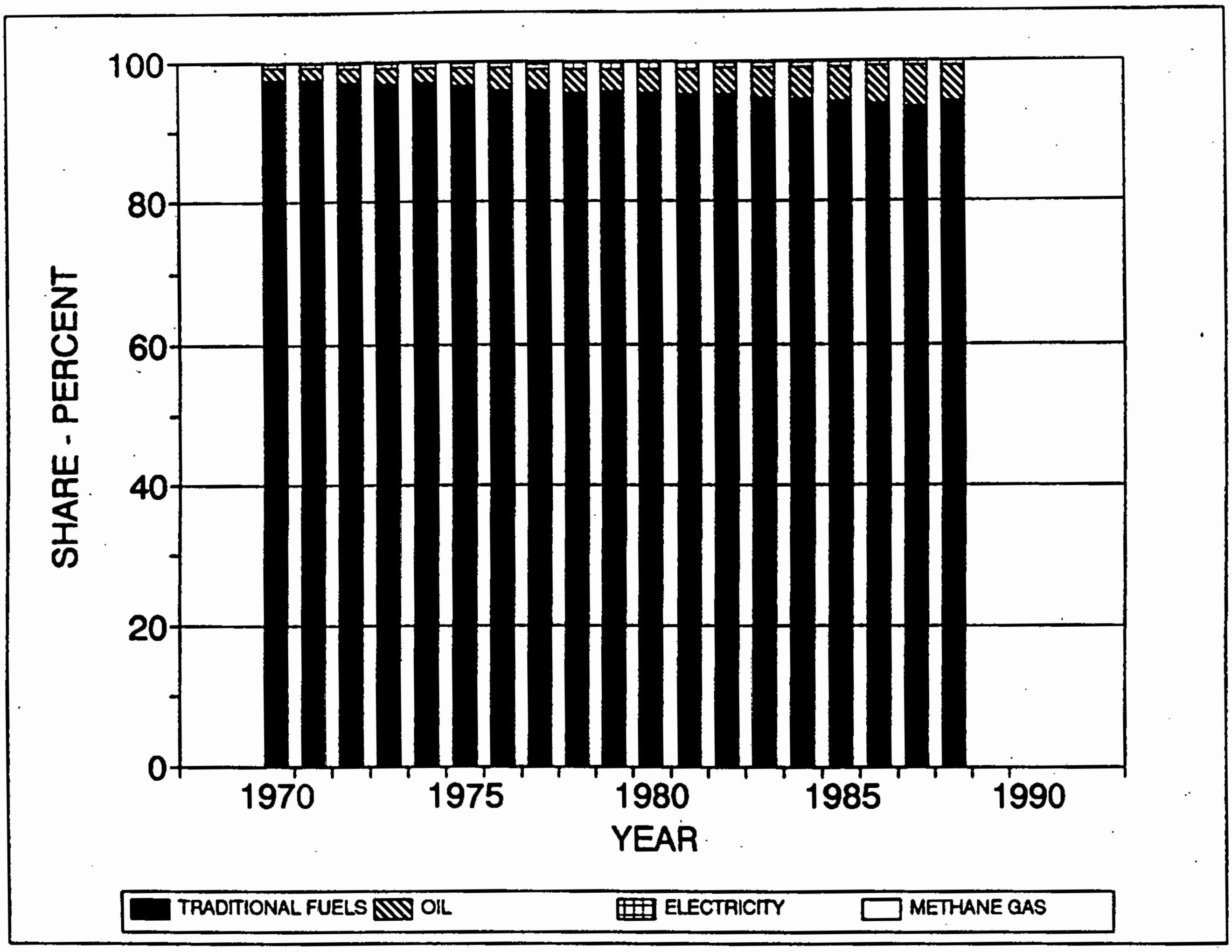


Figure 12. Total final consumption: percentage shares of components

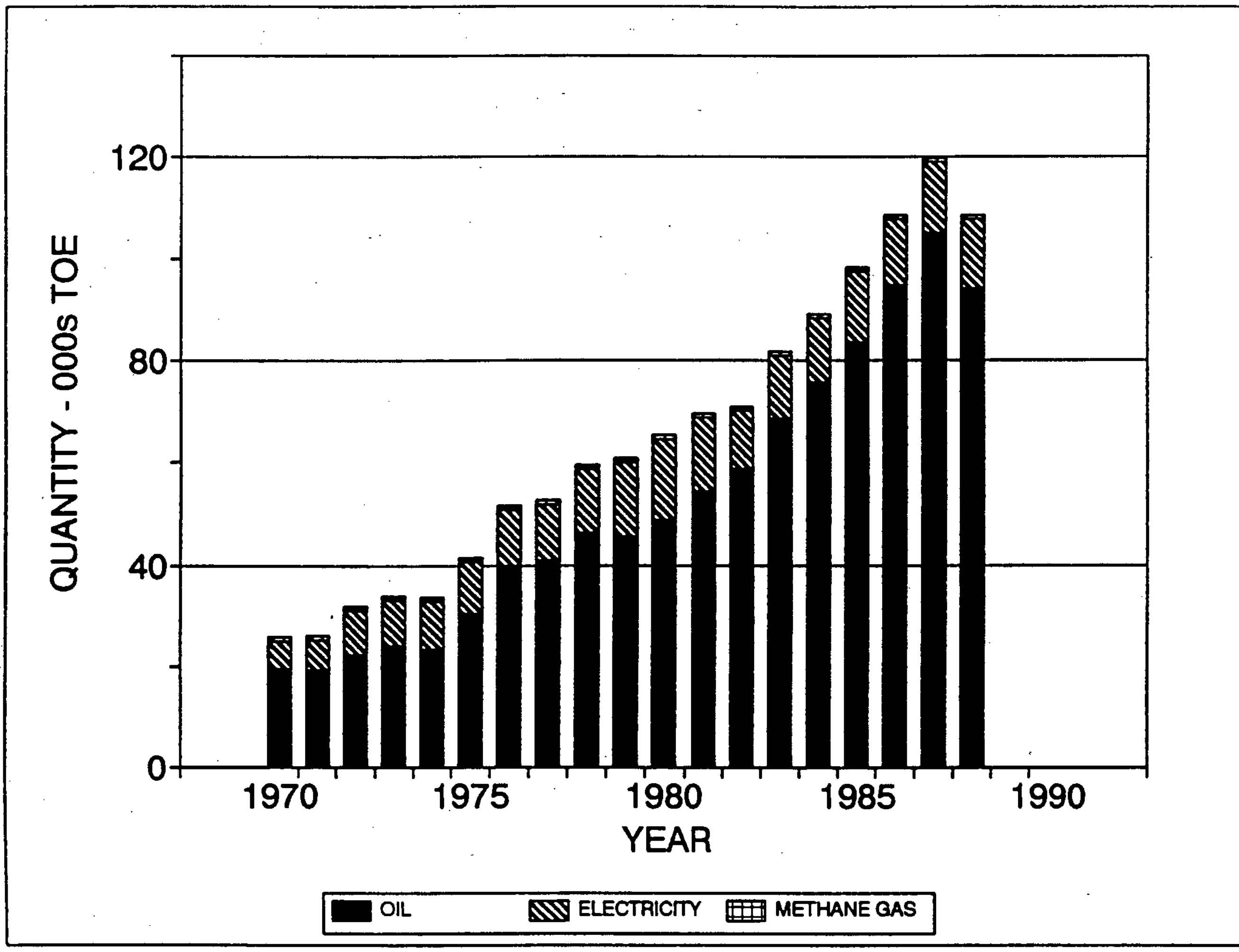


Figure 13. Commercial energy final consumption: quantity shares of components

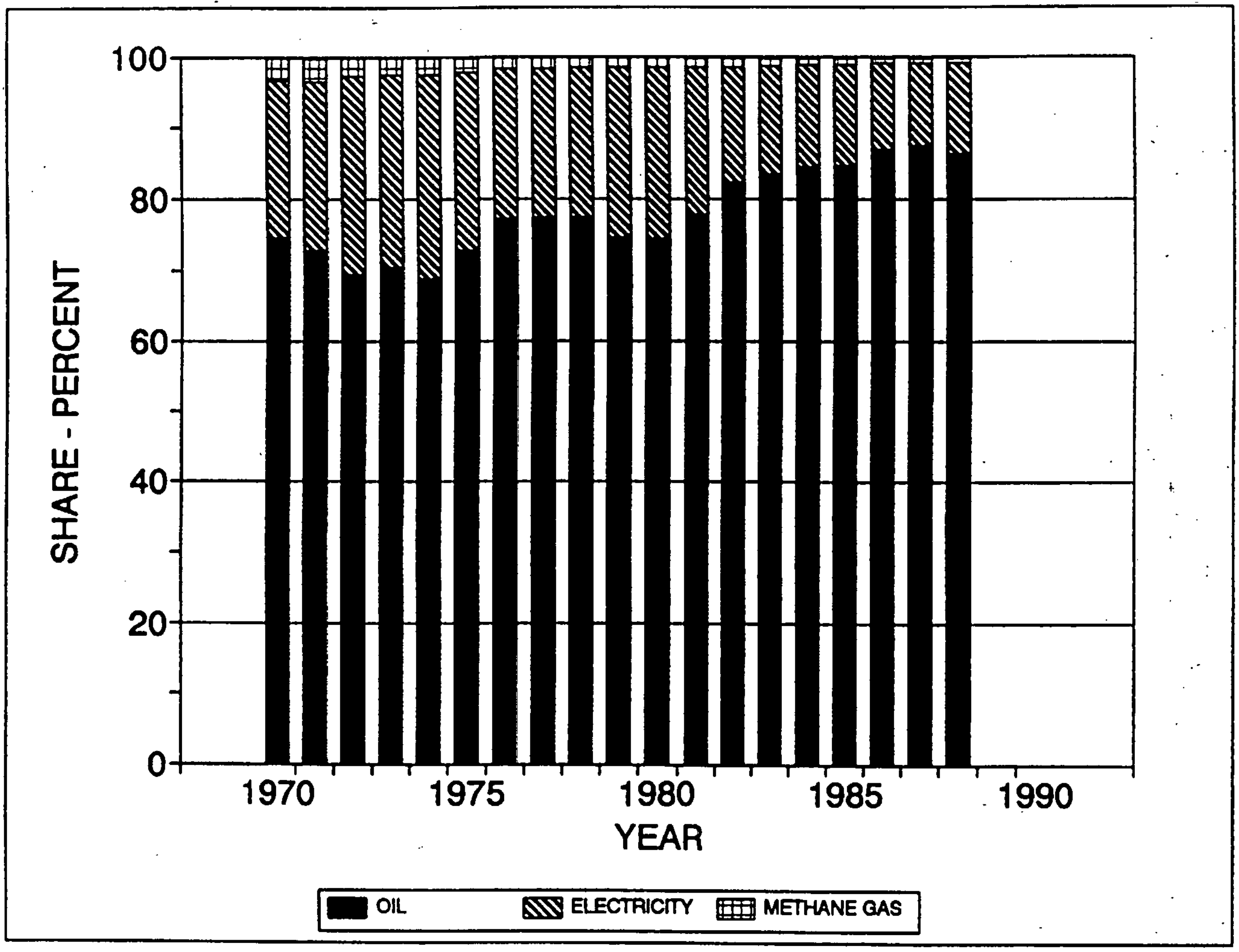


Figure 14. Commercial energy final consumption: percentage shares of components

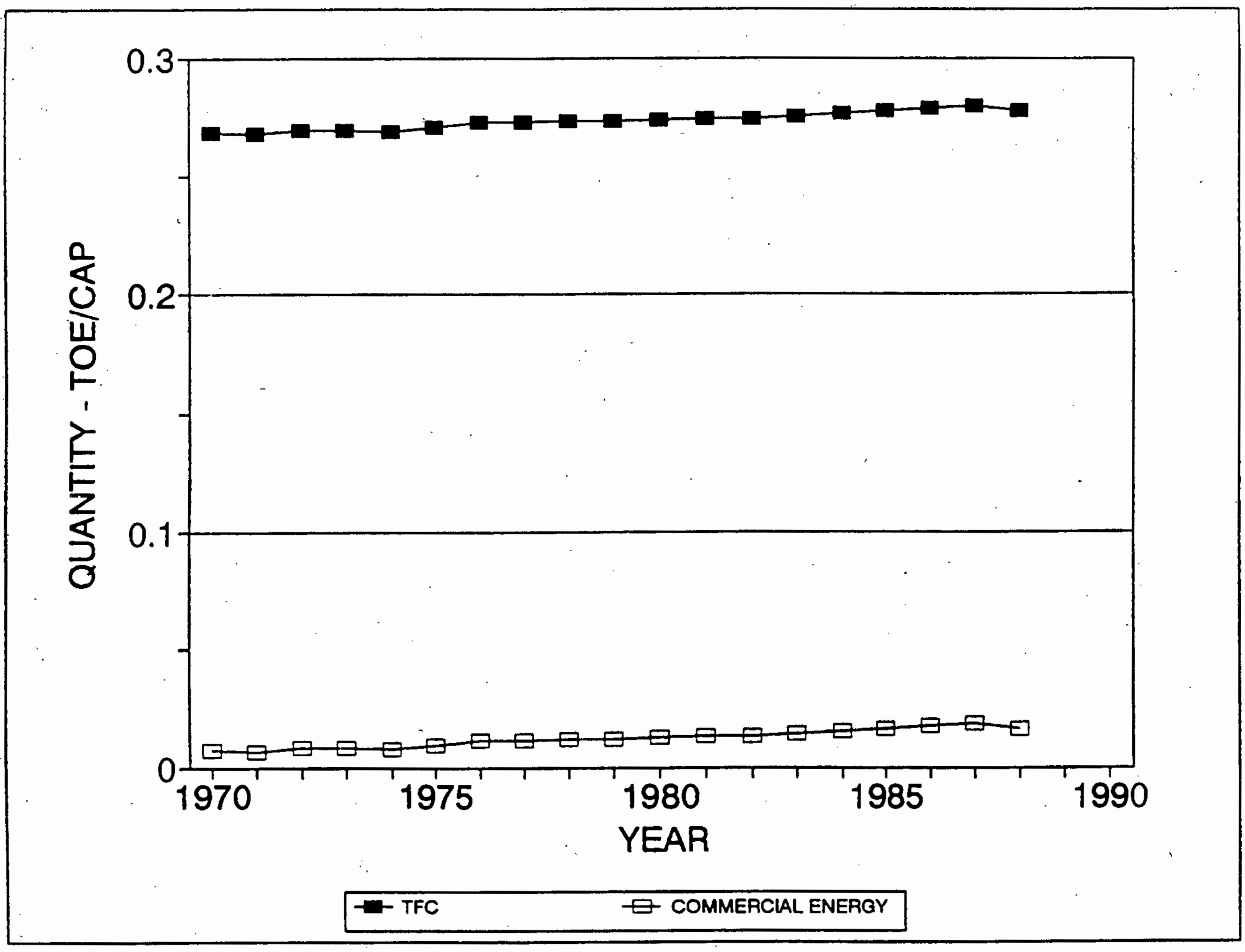


Figure 15. Energy final consumption per capita

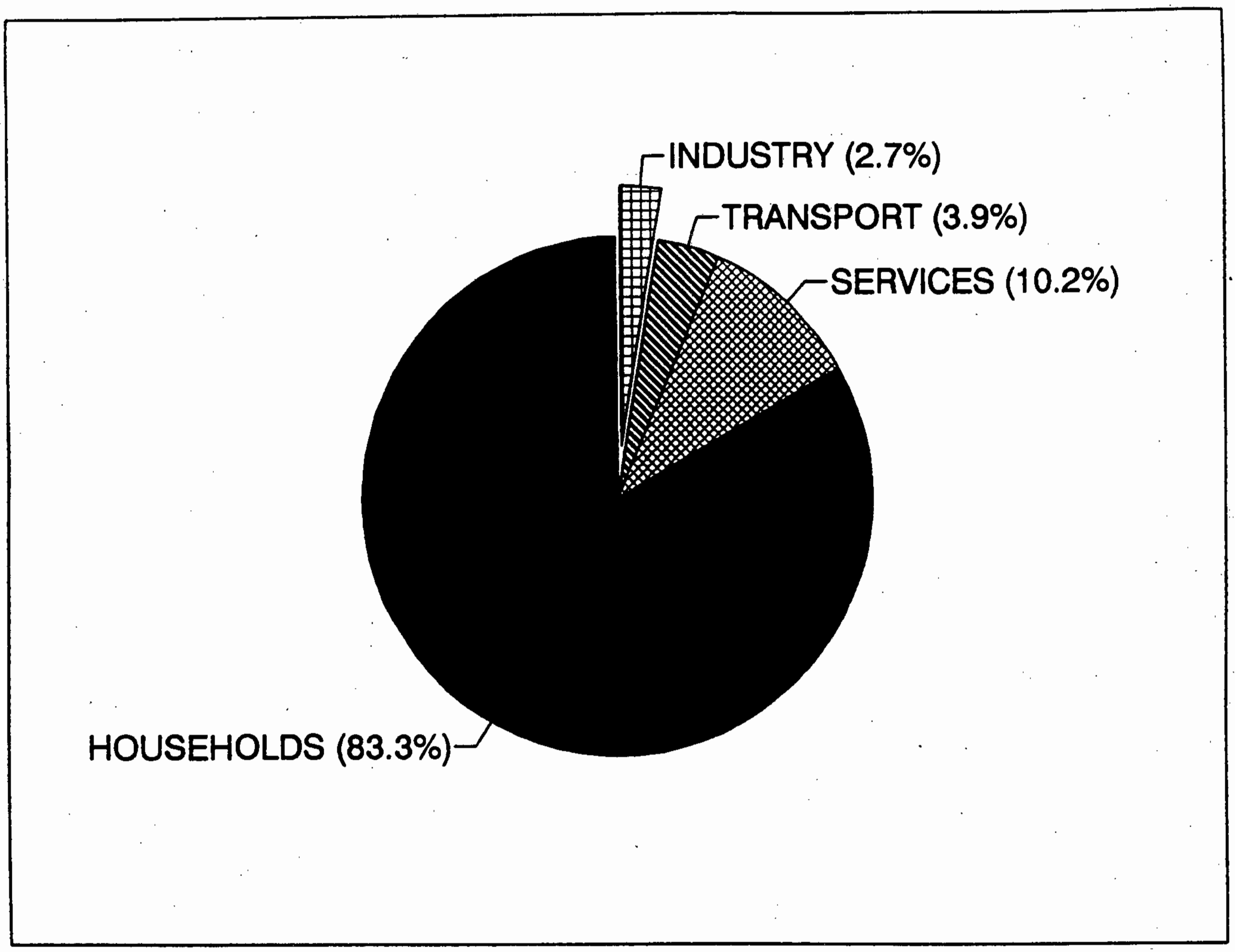


Figure 16. 1989 Energy TFC Balance

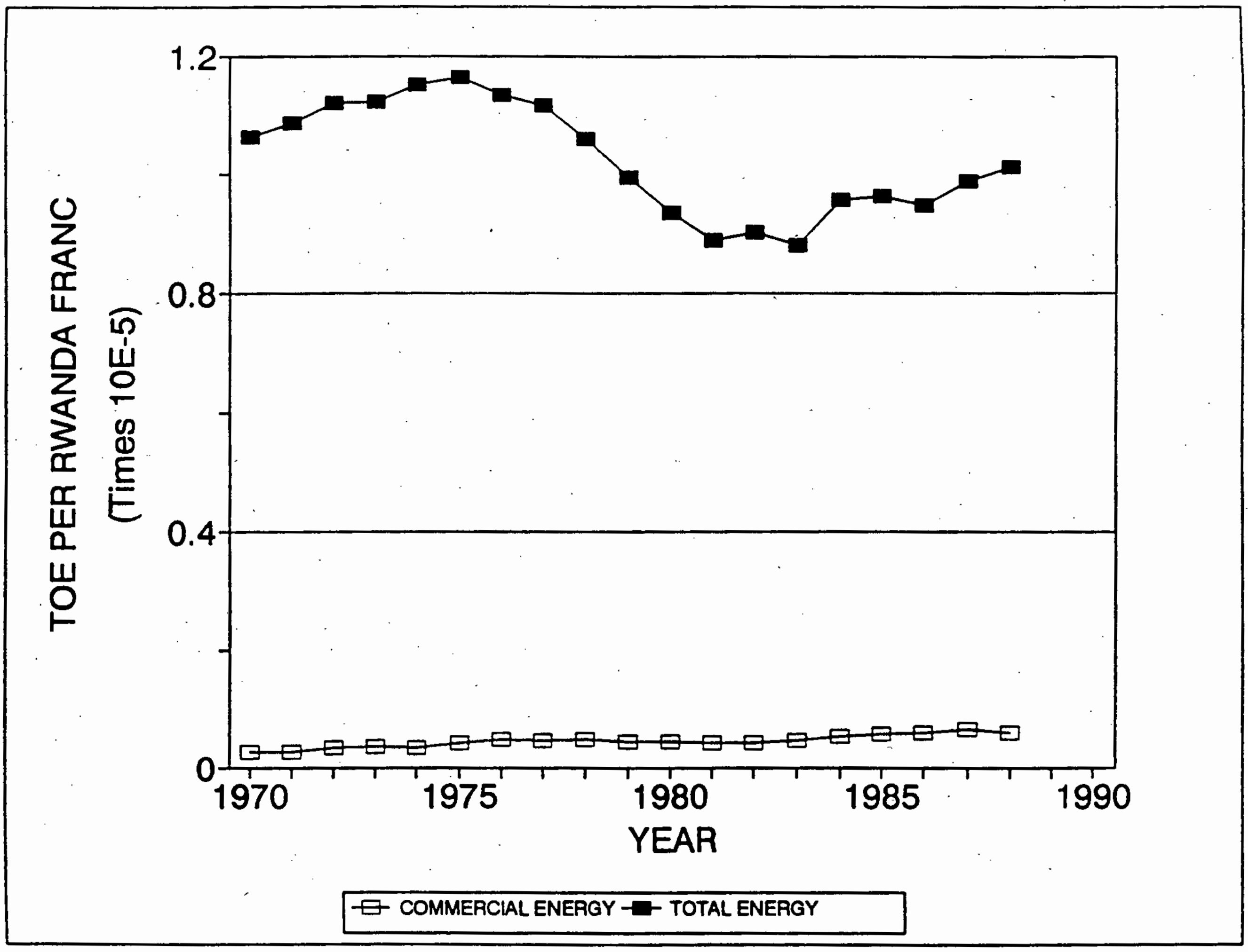


Figure 17. Energy intensity: final consumption / GDP (Real 1985)

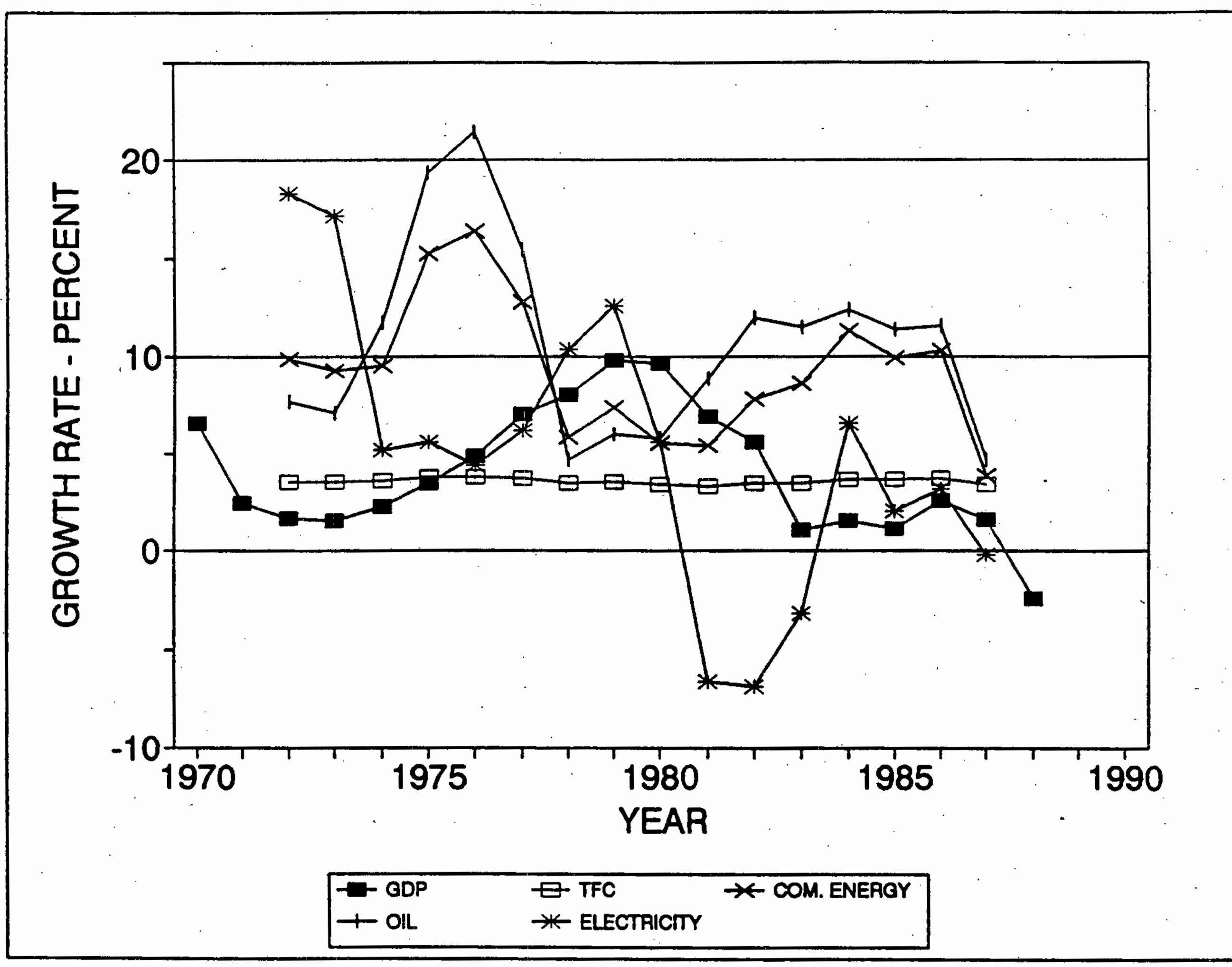


Figure 18. Growth rates (3 pts M.A.)

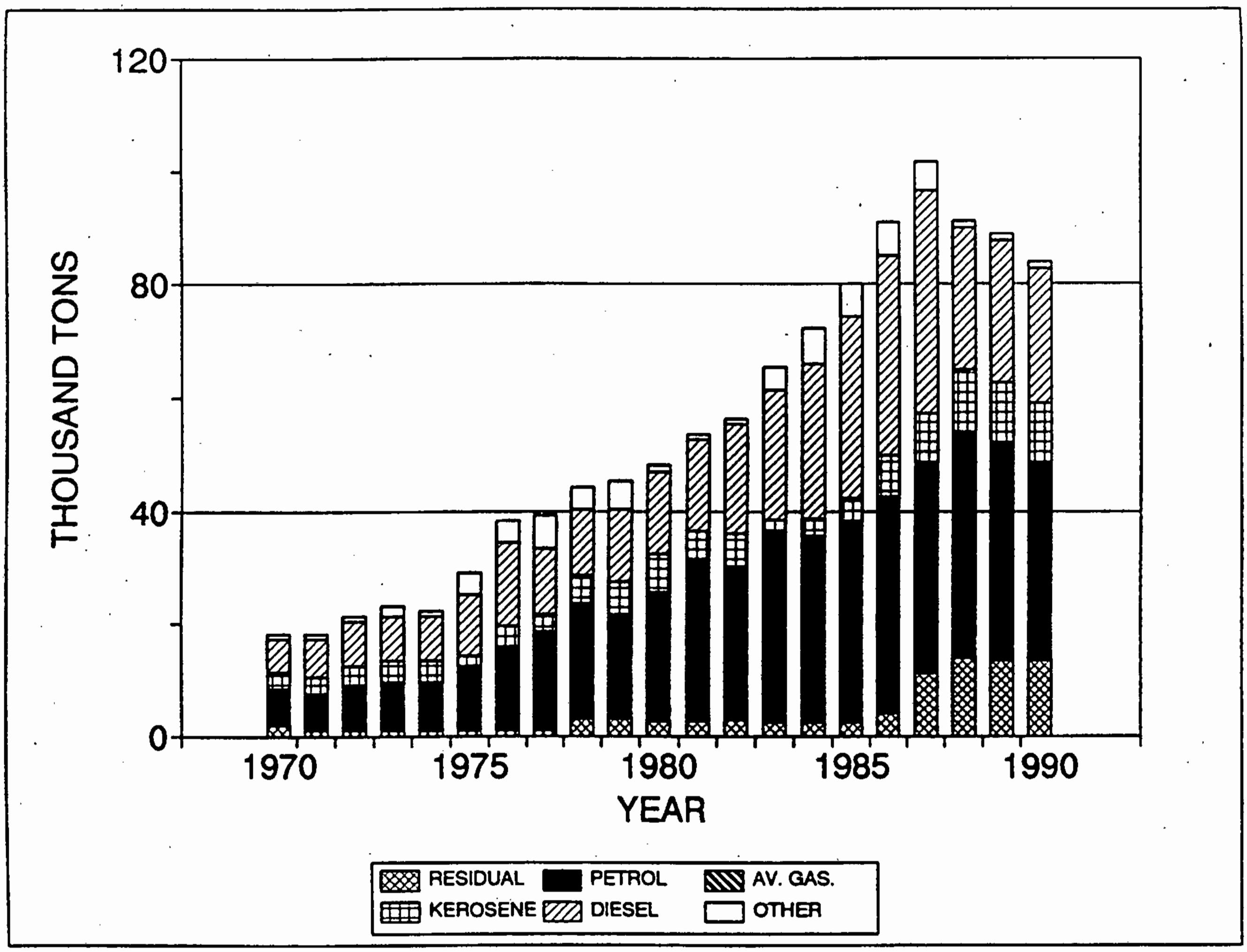


Figure 19. Oil products consumption by type

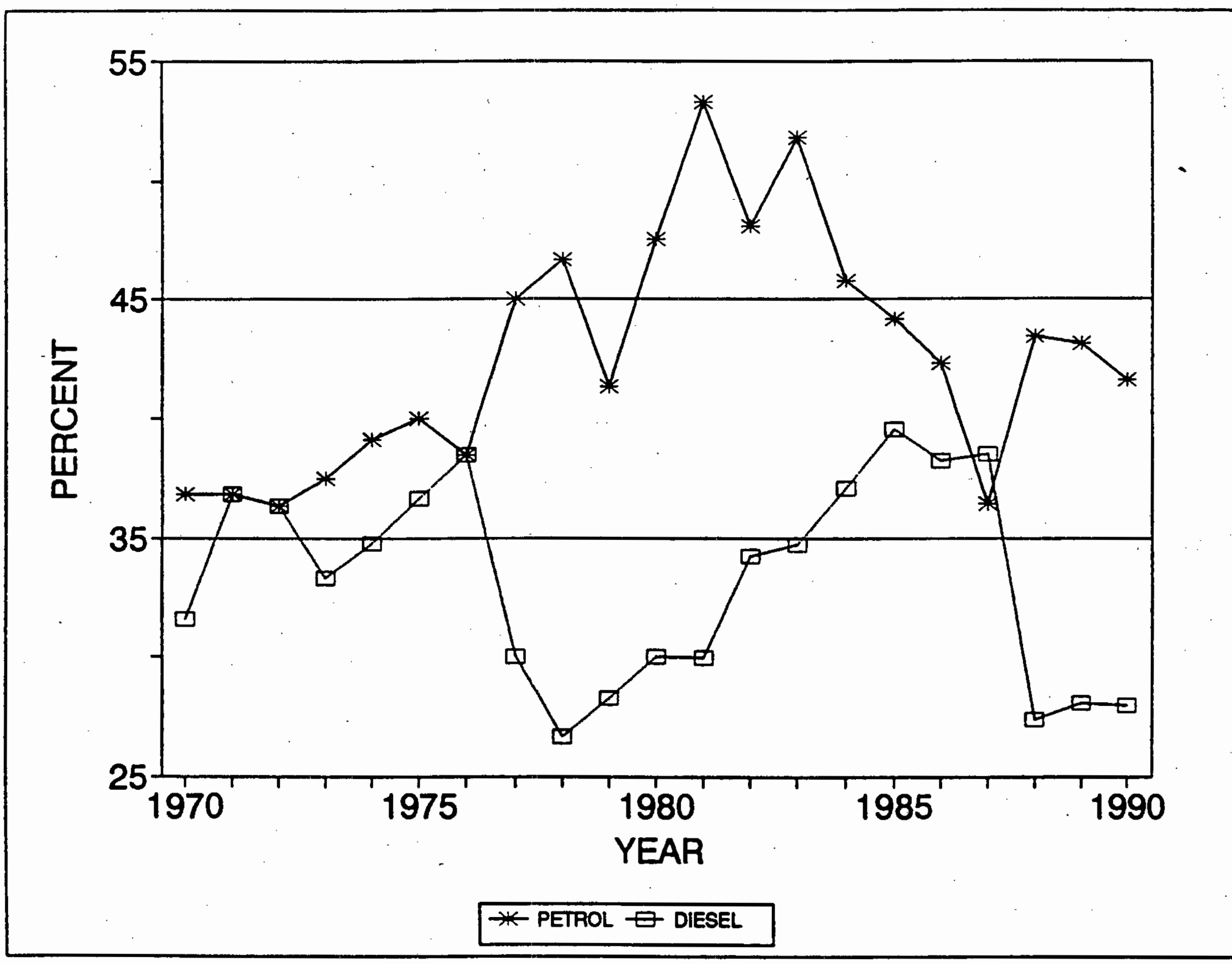


Figure 20. Petrol and diesel as a percent of oil consumption

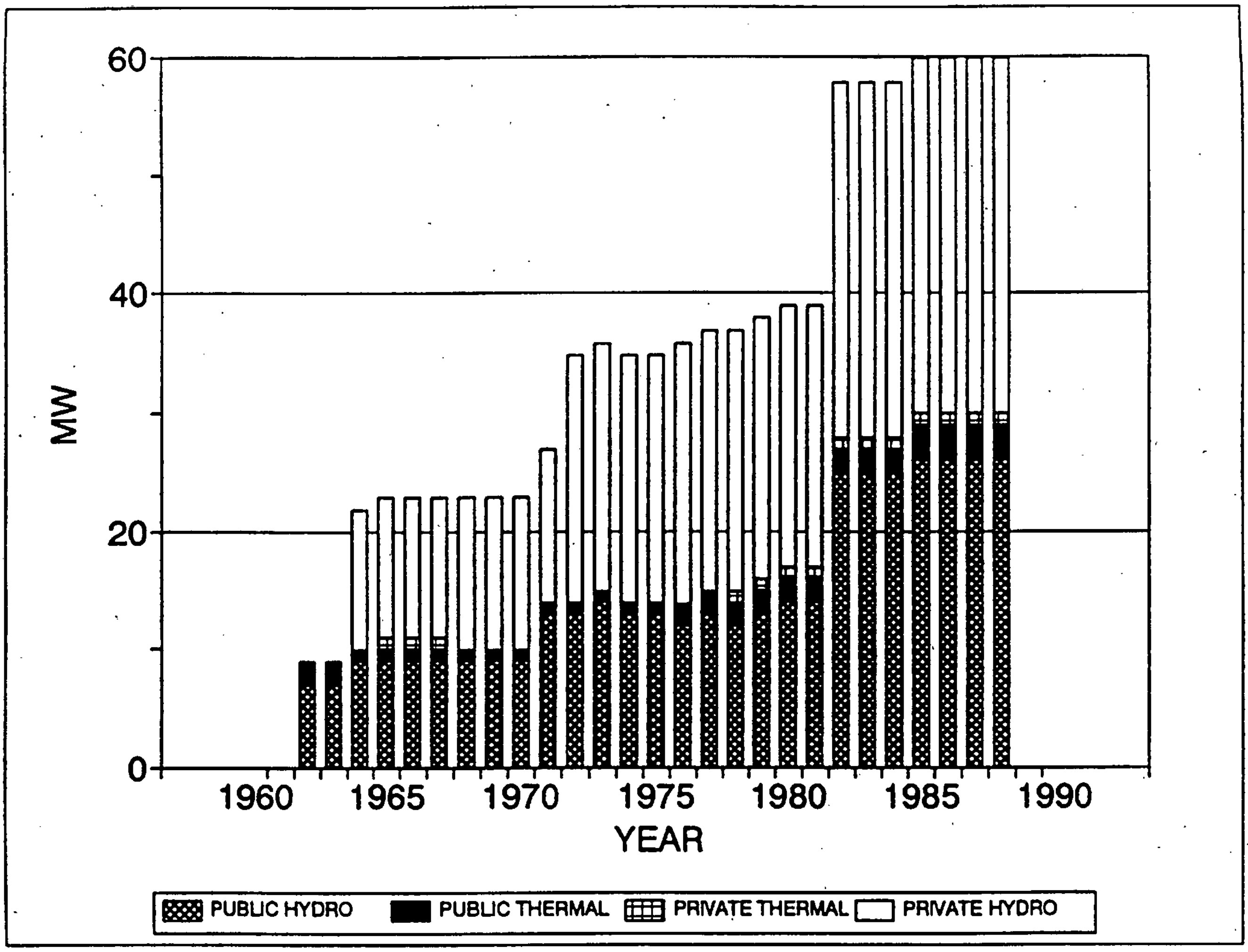


Figure 21. Electrical installed capacity

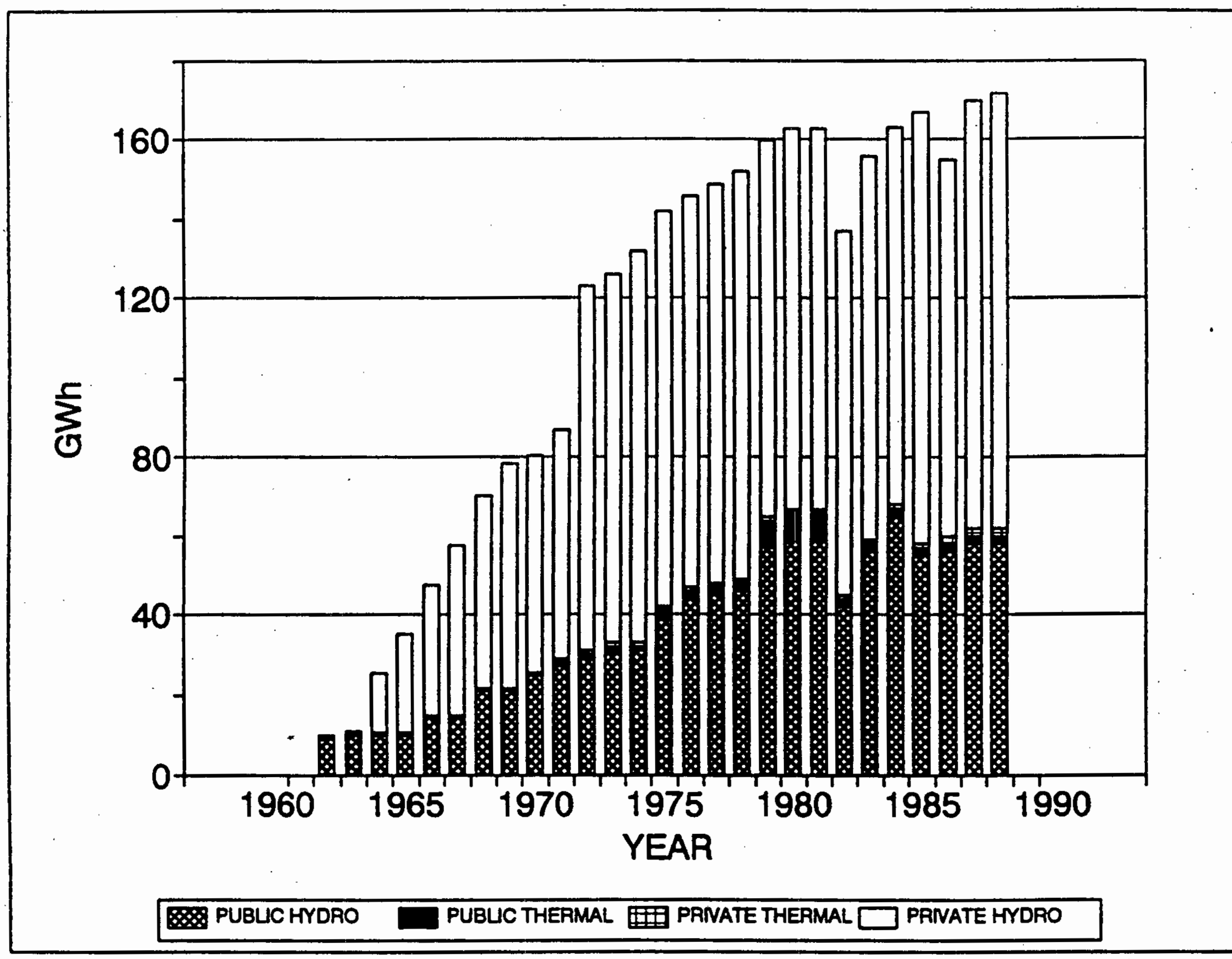


Figure 22. Electricity production

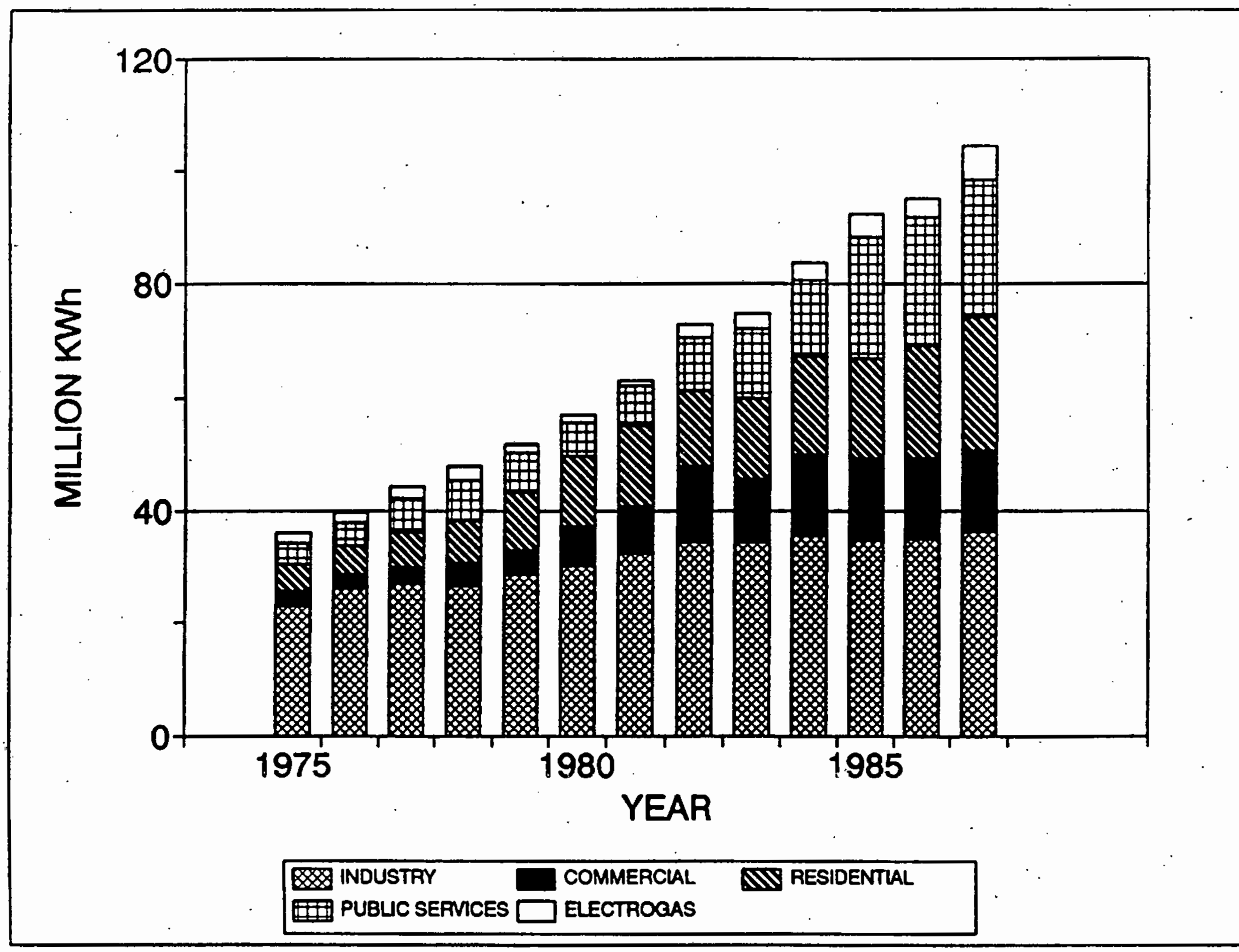
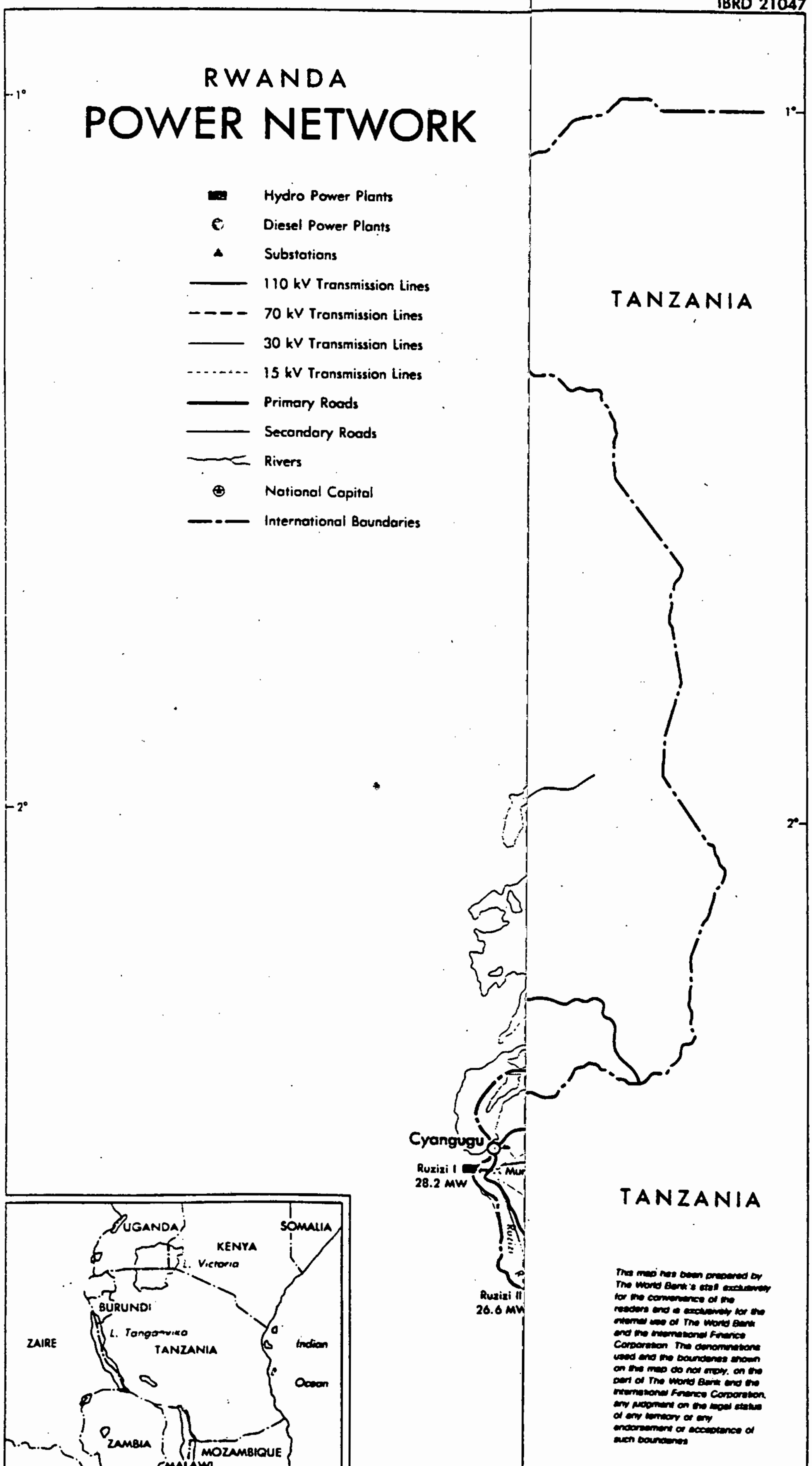


Figure 23. Sectorial distribution of public electricity consumption in Rwanda

MAP

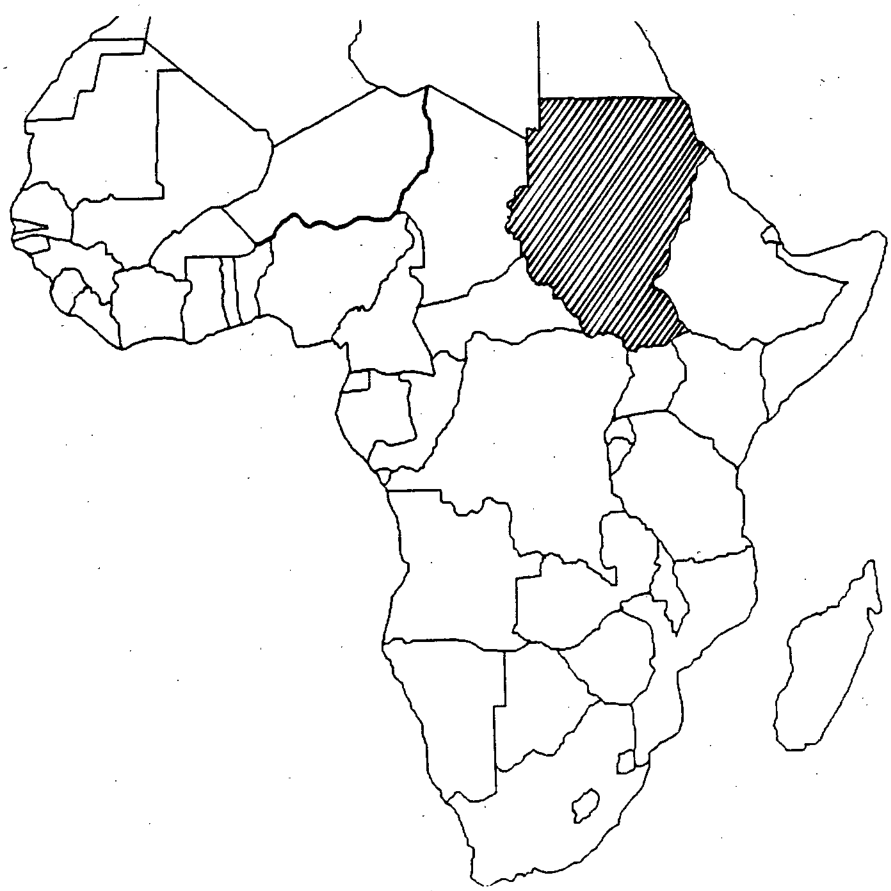
IBRD 21047



MARCH 1989

SUDAN

1. INTRODUCTION



2. COUNTRY PROFILE

2.1 Introduction

The name Sudan comes from 'bilad al Sudan', or Land of the Blacks, a name given to the entire Sub-Saharan belt by medieval Arab geographers. From the 16th century until 1820 the territory was under the influence of the Funj sultanate. In 1820 it came under Turko-Egyptian rule, when Muhammad'Ali Pasha, the ruler of Egypt, launched a campaign of conquest against the land. This unpopular regime was brought to an end in 1885 by the massive Mahdist rebellion which lasted four years.

The publication of work on exploration awakened the European nations' interest in Sudan. In order to safeguard their interests in Egypt by getting rid of other competitors (French, Italian, and Belgian) from the upper reaches of the Nile, the British decided to conquer the Sudan. For diplomatic purposes, the conquest was carried out (between 1896 and 1898) in the name of the Khedive, the Viceroy of Egypt under the Turkish government.

After the reconquest, Sudan became an Anglo-Egyptian colony though a British colonial administration, headed by a governor-general, was installed. In the north this took the form of the Native Administration which encouraged tribalism and indirect rule. In the south a policy was adopted, whose main aim was the detachment of the south from the north in order to facilitate its assimilation into an East Africa under British control. Britain successfully restrained persistent nationalistic fervour in Egypt from spreading across northern Sudan to the south and to other East African possessions. The unpopular Native Administration was gradually changed and transformed into a local and central government system. A union proposal with Egypt was rejected. The Sudanese parliament unanimously passed a declaration of independence on 19 December 1955. This was given approval by both the UK and Egypt at the end of the same month, and the country was proclaimed a sovereign independent republic on 1 January 1956.

Since achieving independence, the Sudan has had seven regimes. The present military regime, led by Lt-Gen. Omar Hassan Ahmad al-Bashir, came to power in a bloodless coup on 30 June 1989. All these regimes have been faced with three main problems: the high dependence on cotton as a cash crop, the problem of southern Sudan's secessionist tendencies that have resulted in civil war, and the search for a permanent constitution acceptable to all sections of the society(1).

Officially considered an Arab country, Sudan is politically divided into Khartoum province, which is centrally administered, and 6 regions. Each region has an elected regional assembly and government. The regions are divided into provinces, of which there are 18 in the country.

2.2 Geographic situation and demography

Situated in the north-eastern part of Africa, the Republic of Sudan, with its 2 505 813 sq.km, commands the largest land area of the continent. It shares borders with Egypt, Libya, Chad, the Central African Republic, Uganda, Kenya, Ethiopia, and in the north-east is the Red Sea.

The population, as given by World Bank estimates, was 23,8 million in 1988(2). Figure 1 shows the population and population growth on a yearly basis for the period 1967 to 1987. The population is very young, with 44,4% under 15 years of age(3). The population is concentrated in the Khartoum province and the Central region. It is estimated that 60% of the land area is occupied by only 11% of the population. The nationwide population density, about 9 per sq.km, is one of the lowest in the world; but average population density reaches 27,3 per sq.km on arable land. At the time of the 1983 census, about 71% of the population resided in rural areas, 18% in urban and semi-urban areas, and the remaining 11% were nomadic.

Ethnically the population is fragmented into 56 groups and 597 subgroups[4]. However, the common basic division of the country is into the Arab north and the black African or Nilotic south. Descendants of former conquerors, the Arabs, dominate national affairs. The south has remained outside the mainstream of Sudanese development. The people in the south, who are either Christian or Animist, have requested a federal form of government since independence. The main Nilotic ethnic groups are the Dinka (41% of the population of the south), the Nuer and the Shilluki. A number of important ethnic and linguistic minorities have retained their identity: the Nubians, the nomadic Beja tribes of the Red Sea littoral and Kassala province, and the Fur people in the west. West African immigrants (mainly from Nigeria and Chad) and pilgrims on their way to or from Mecca form other significant minority groups.

In 1981 the economically active population was estimated to be about 8,6 million, including over 400 000 Africans from neighbouring countries. The labour force was distributed among different economic sectors as follows: agriculture 79%, industry 10%, services 12%. Of the total working force, 56% were adult male, 24,7% adult female and 19,3% children[4]. Some Sudanese find employment as domestic workers and labourers in Egypt and Libya.

2.3 The economy

Figures 2 and 3 give the country's GDP per capita and GDP respectively on a yearly basis over the period 1967-87. The percentage change in these quantities are found in Figs 4 and 5 respectively. With a per capita GDP of about 377 US$ in 1988, Sudan is a low income country. Its economy is overwhelmingly agricultural. Agriculture, which is the source of almost all the country's foreign exchange earnings, accounted until recently for about one-third of GDP. Figure 6 shows the percentage shares of GDP's components.

Agriculture is highly dependent on irrigation. The majority of its labour force is essentially involved in subsistence production. Cotton is the major export crop. Gum arabic (the most important forest product), groundnuts, sesame, sorghum and livestock are also exported. Irrigation land is predominantly in the form of publicly-administered schemes. Of the country's 2 million ha of land under irrigation, about one-half is in Gizera. It is a principal source of crops for export and for home consumption. Small farm projects on the Blue, White and Main Nile Rivers, in New Hafia and Rahad are the other irrigated land schemes.

The rainlands account for almost all output of the staple food grains (sorghum and millet). Meat, milk and some vegetable products are also produced here. The output of rain-fed products is subject to the vagaries of weather. Many parts of the country have been subject to severe droughts in the past, necessitating food relief supplies from the international community. Pastoral activities are also important. They include camel herding in the north and cattle in the savanna belt and in south.

In terms of income generation, the total industrial sector is small, as reflected by the GDP ratio of agriculture/industry shown in Fig. 7. Manufacturing remains small. This is reflected by its 8% contribution to GDP in 1987. Apart from the processing of agricultural commodities such as cotton, oil seeds and sugar, it is mainly limited to the production of textiles and cement. The mining sector is also very small. Gold is extracted from deposits in the Red Sea hills. There have been some exports of chrome ore and further developments of these deposits are taking place. Other known mineral resources are marble, mica, gypsum, iron, and uranium reserves (found on the western borders with Chad and the Central African Republic). However, petroleum activities are expected to become the major mining operation; oil has been discovered in commercial quantities in south-western Sudan. A natural gas reserve has also been found off the coast of Suakin.

After 1970 all the banks were nationalized and 16 large Sudanese and foreign firms confiscated. The government became increasingly involved in industrial activities and public utilities. However, a denationalization move and compensation settlements started later. Trading monopolies were removed from most of the State marketing corporations and a number of non essential industries sold. In order to encourage investment, fiscal guarantees were provided against future nationalization[(4)].

3. ENERGY: GENERAL

3.1 Introduction

The energy situation in Sudan is characterized, as in many other African countries, by a high reliance on traditional fuels. Wood fuel is the most abundant resource. However, its distribution throughout the country does not follow population distribution patterns. Oil products accounted for 17% of the total final consumption in 1981. Electricity (representing about 1% of TFC in 1981) is obtained almost equally from thermal and hydro generation. The major hydro-power potential sites are found along the Nile and its tributaries. However, the development of hydro-power schemes is constrained by irrigation requirements and the low gradient of the rivers.

3.2 Energy institutions

The Ministry of Energy and Mining formulates the overall energy policy and controls the activities of all institutions operating in the sector, public corporations included. The National Energy Administration is its planning agency. The Directorate of Geological and Mineral Resources has a Petroleum Administration division that monitors petroleum activities.

The Ministry of Finance and Planning is also involved in the energy scene. Its representatives are members of the Petroleum Affairs Board which is responsible for petroleum contract negotiations.

Oil companies include Chevron, the Royal Dutch/Shell group, Sun International and Pan Ocean Oil Co. The publicly owned General Petroleum Corporation (GPC) plays a key role in the distribution, allocation (to marketing companies) and pricing of petroleum products. The GPC also assists the government in monitoring petroleum exploration contracts. Another agency, the White Nile Petroleum Corporation, has been formed. It involves Chevron, Royal Dutch/Shell group and Saudi Arabia's Apricorp in a US$ 1000 million pipeline scheme, for the transportation of the crude oil that the country is expected to produce.

The responsibility for the generation and transmission of electricity through the national grids is in the hands of the National Electricity Corporation (NEC).

In the forestry sector the Central Forest Administration formulates the overall forestry policy, evaluates major development projects, and compiles forest inventories. Collection of revenues from the sale of forest products, budgetary controls, land use, forest conservation and utilization, control of desertification, control and direction of land apportionment, and population resettlement are all handled by the Provincial Forest Services.

4. ENERGY RESOURCES

4.1 Fuelwood

Forests are the most abundant energy resource of the country. Covering between 455 000 and 585 000 sq.km, productive forests were thought to bear a stock volume of about 1,99 billion m^3 of wood in the 1980's. The overall stock density was between 22,2 and 28,6 m^3 of wood per hectare of productive forest. However, the actual values ranged from 150 m^3 of wood per hectare in the Mentano Forest in the southern part of the country to less than 1 m^3 of wood per hectare in the desert areas. Of the total growing stock, about 1,28 billion m^3 could be used as firewood and the remainder as building poles and timber(5).

Forest resources are not evenly distributed throughout the country. The north accounts for 33% of the total wood stock volume, while the remaining 67% is found in the south. Within both the northern and southern parts, the distribution between provinces is also uneven. It is estimated that 93% of wood stock volume found in the north is in the two provinces of Southern Darfour and Kordofan, while less than 3% is found the northern province, and the remainder in the other 9 provinces. In the south 63% of the wood stock is located in the two provinces of Bahr el Ghazal and West Equatoria together, and only 3% in the Joglei province.

4.2 Petroleum and natural gas

Potential oil-bearing areas are found in the north-western corner of the country (bordering Egypt, Libya and Chad), along the Red Sea coast and in the area immediately offshore, and in the interior of the country, especially the southern part of the country. Exploration activities started in 1957 and by 1983 more than 80% of available concessions had been allocated. There are many companies involved in exploration activities.

Of the three potential oil areas, the Red Sea coastal zone and the southern part of the country are the most encouraging. There are five known oil fields. They include Abu Jabra in the western province of Kordofan, and Unity-Talih and Igligli in the south. The Abu Jabra field has an estimated yield of 2 thousand barrel per day (bpd). The Unity-Talih and Igligli are the most promising and are estimated to yield 35-45 thousand bpd and 15-20 thousand bpd respectively.

In 1979, Chevron, a subsidiary of the American company Standard Oil, discovered commercial quantities of petroleum in Unity-Talih in south-western Sudan. Chevron's concession area, which in mid-1990 comprised about 100 wells in western Sudan, has around 1000 billion barrels of reserves, of which 270 million barrels are recoverable using present technology. Safety on the oil fields has deteriorated significantly because of increasing attacks by rebel groups of the Southern People's Liberation Army (SPLA) on foreign installations. For this reason, US companies were compelled to suspend all operations in 1984[4]. Under pressure from the government, Chevron planned to resume exploratory drilling in the south in the first half of 1988. However, it was postponed as the civil war had spread into southern Kordofan. A local firm, Concorp, reportedly supported by Iran and the Rumanian state oil company Rompetrol, is said to be extracting oil from two wells leased by Chevron in the Abu Jabra field, and the crude is to be processed at a semi-refinery being build near the site. The Unity-Talih and Igligli fields remain unexploited[11]

According to the Ministry of Energy and Mining, the total confirmed oil reserves in Sudan were estimated to be 2000 million barrels in May 1987, of which 500 million were considered to be recoverable[1].

A natural gas reserve has been discovered in a field off the coast of Suakin, 30 km from Port Sudan. It is estimated to contain 70 million barrels of condensate and 85 000 m^3 of natural gas. The Swiss-based Pan Ocean Oil Company has undertaken to develop this resource.

Chevron, the Royal Dutch/Shell group and other concession holders have suspended their oil exploration in the south. Sun International, which began exploratory drilling in its Nile Block in November 1989, is the only international company actively involved in exploration activities. However, following a 3-year World Bank study on Sudan's hydrocarbon potential, other companies, such as Amoco and Conoco, have expressed interest in drilling in unallocated areas near the Libyan border[6].

4.3 Hydro-electricity

A complete inventory of hydro-electric resources is not available. However, the country is estimated to have a capacity of some 2700 MW, with a maximum annual production of 19 000 GWh. About 2000 MW can be exploited at costs competitive with other sources and with acceptable social and environmental impacts[7]. Large-scale development depends on the Nile River and its major tributaries (Atbara, Bahr el Ghazal, Sabat).

The main constraints to the harnessing of the country's hydro-power potential are the low gradient of its rivers and irrigation requirements. In fact, the success of agriculture is largely dependent on irrigation, and water release patterns are to a great extent modelled by irrigation needs, as is the case in the existing hydro-electric plants. Furthermore, most of the country is a vast plain, resulting in the low gradient of its rivers. This requires long, but low head dams with large reservoirs to ensure water availability for irrigation during the dry season.

4.4 Other energy sources

4.4.1 Solar and wind energy:

Average solar insolation is very high and ranges between 436 W/m^2 (or 6,9 GJ/m^2) per annum in the south to 639 W/m^2 (or 10,1 GJ/m^2) per annum in the north. This large solar energy potential, with which the country is endowed due to its geographical position, will remain largely unexploited until appropriate technologies are affordable.

Wind energy potential is located mainly on the Red Sea coastline and in the desert areas of the north. As with solar energy, wind power is unlikely to be exploited on a large scale in the foreseeable future. Its potential use is for the pumping of irrigation water on agricultural land in the north, where the average wind power density is more than 150 W/m^2. Wind power density is estimated to be between 285 and 380 W/m^2 in the Khartoum area, and more than 400 W/m^2 in Dongola. Wind power density decreases from north to south.

4.4.2 Molasses and bagasse:

There is a significant potential for ethanol production from molasses in the country. At full output, all the sugar mills together are able to produce 266 600 tons of molasses per year. With this quantity of molasses, the potential for ethanol production is estimated at 45 000 million tons/year. Considerations are under way to substitute part of the gasoline consumption with ethanol produced from the sugar mills' molasses(5).

5. ENERGY SUPPLY AND DEMAND

5.1 General

The main energy form in Sudan is traditional fuels, mainly in the form of fuelwood. Figures 8 and 9 show the estimated contribution of the various forms of energy in terms of magnitude and percentage respectively, relative to the total final consumption during the period 1971-88. Households are the largest energy-consuming sector, followed by transport and industry, as shown in Fig. 10 which gives the sectorial breakdown of the 1981 total final consumption (TFC). The TFC of energy on a per capita basis is shown in Fig. 11. The TFC per capita averaged 450 kgoe in the 1970's and at the beginning of the 1980's. However, there was a significant decrease after 1985, following the increasing shortage of traditional fuels.

Commercial energy consumption remains small compared to that of traditional fuels. It is satisfied mainly by imported oil and a small percentage by electricity. The quantity and percentage shares of these components are given in Figs 12 and 13 respectively. Transport is the biggest commercial energy-consuming sector, followed by industry and agriculture. This is illustrated in Fig. 14.

Figure 15 shows the growth rates of GDP, commercial energy final consumption and electricity final consumption, which display similar trends. However, the electricity growth rate follows the trends in GDP growth more closely. As oil forms the bulk of commercial energy, its growth rate must be close to that of commercial energy.

Because of the high reliance on traditional fuels, total energy intensity is six times higher than commercial energy intensity, as can be seen in Fig. 16. As the greater proportion of total energy is used in the household sector, the total energy intensity does not reflect the efficiency of energy in the generation of GDP. Commercial energy intensity, which gives a better description of energy in the economy, is low, reflecting the absence of an energy-intensive productive sector. In Fig. 17 the energy intensity in various sectors of the economy is shown. As can be seen, a Sudanese pound generated by industry requires far more energy than one generated in agriculture or in all the remaining sectors together. This neglects the use of manpower in agriculture, especially in the rainlands. As transport's contribution to GDP is not listed separately, it is difficult to know its energy intensity. However, one can guess that it is high as it is the greatest consumer of oil.

Energy losses are very important. It takes 6 tons of dried fuelwood to produce one ton of charcoal. Losses of lesser magnitude than those found in the production of charcoal are also found in the petroleum refining industry.

5.2 Fuelwood and other traditional energy

Traditional fuels play an important role in the energy scene, as reflected by its percentage share in the total final consumption shown in Fig. 9. This important role is likely to remain even after commercial resources have been developed.

Domestic resources cannot provide a sustainable supply. They are heavily strained by the increasing demand for fuelwood due to population growth and demand for wood poles. The extension of agricultural land to feed the growing population results in additional losses to the growing wood stock. In the 1980's annual wood requirements were estimated at 75,8 million m^3, including 3,4 million m^3 due to mechanized farming scheme losses. The allowable annual cut represented only about 58% of this amount. Important cuts were made every year to meet the demand. This resulted in a progressive reduction of the total stock volume and the annual allowable cut for the coming years. A sharp decline in the quantity of traditional fuels was noted after 1985 and is highlighted in Fig. 8.

The present supply and consumption pattern is leading to serious depletion and scarcity in some parts of the country. The problem is aggravated by the deep contrast between the population and fuelwood distributions. Although 78% of the total population are situated in the north, it has only 33% of the total growing stock. This gives an available growing stock of 50 m^3 of roundwood per capita and an annual allowable cut of 1 m^3 of roundwood per capita. The south, which accounts for the remainder of both population and growing stock, has, per capita, 322 m^3 available growing stock and 7 m^3 annual allowable cut(5).

There are however large variations in resource distribution in the north as well as in the south. The northern part of the country cannot provide a sustainable supply of wood, adequate to meet consumer requirements for firewood and charcoal. Forests around towns like Khartoum and Juba have been largely depleted. With increasing fuelwood scarcity, supply necessitates long and costly haulage of fuels. Opportunity to utilize agricultural residues exists in agricultural areas such as the central region (formed by the province of Gezira, the White Nile and the Blue Nile). This could help to alleviate woodfuels scarcity in these areas.

All forest lands in Sudan are State-owned. They are managed by provincial forest services.

5.3 Petroleum products

Petroleum requirements of Sudan are met partly by the domestic processing of imported crude oil and partly by the direct import of refined products. The consumption of oil products is shown in Fig. 18. Diesel, residual fuel and petrol are the most important products with respect to quantity consumed. Figure 19 shows the percentage share of diesel and petrol in relation to total oil products consumption.

Before the exploitation of local resources, all crude oil had been imported. Figure 20 gives crude oil consumption for the period 1965-88. Because the refinery output pattern does not follow the domestic product consumption pattern, large quantities of excess fuel oil (between 0,2 and 0,3 million metric tons per annum in the 1980's) are exported each year. However, export trends have probably been decreasing as larger quantities of fuel oil are being utilized for power generation to meet increasing electricity demand(5). Production of petroleum products from local refineries is shown in Fig. 21. The government is planning to build a second refinery.

The major consumers of petroleum products are the transport and industrial sectors. The sectoral breakdown of oil final consumption is shown Fig. 22. In 1988 the consumption of oil in the refinery industry was equivalent to 4% of oil final consumption.

The General Petroleum Corporation (GPC) has the monopoly right to import petroleum products (both crude oil and refined products). It owns and operates the pipeline from Port Sudan to Khartoum. There is a complex system for the allocation of petroleum products. Co-ordinated by the Monthly Planning Committee, it starts with the collection of data from regional governors and from consumers respectively. Some consumers, who earn foreign exchange or who are able to pay directly in foreign exchange, are allowed to import products through the oil marketing companies. But these imports are handled by the GPC through its channels on behalf of the marketing companies.

The Port Sudan refinery gets its crude from GPC. After the processing operation, it returns the refined products to GPC. Because of the lack of regular supplies of crude, the refinery has never operated at its rated capacity of 1,2 million m^3. Even if it did, some imports would still be required. A pipeline between Chevron's Unity-Talih oil fields and the Red Sea terminal is proposed to satisfy the envisaged exploitation of local oil reserves. This oil export pipeline will be owned by the White Nile Petroleum Corporation (WNPC) and serve as a common carrier for any oil discovered by exploration companies. Talks have also started on the possible construction of the pipeline from Sudan's oil fields crossing the Central African Republic to a point on the Atlantic coast(1). However, there is speculation that the WNPC is to go into liquidation.

There are four marketing companies in the country. As their market share is determined by the allocation of petroleum products to them by the GPC, competition between marketing companies remains small. It is limited to their sales to large industrial and agricultural consumers.

There has been a significant shift in the transport of petroleum products from the Port Sudan refinery to the rest of the country. The share in weight carried by the railways declined from 90% in 1973 to 38,6% in 1982. Pipeline, road and river took 31,7%, 28,2%, 1,5% respectively of the total traffic weight in 1982. The national storage capacity was about 60 days of 1981 consumption in 1982. However, a large imbalance in the storage capacity between provinces exists. The Red Sea province, which accounted for 20% of the 1981 consumption, had more than half of the country's oil storage.

5.4 Electricity

The organization of the power supply in Sudan has been regionalized since May 1982. The National Electricity Corporation (NEC) supplies power in bulk to regional electricity organizations. It builds and manages the power facilities of the national grids and the Khartoum distribution area. It provides the regional organizations with consultancy, training and technical services on a commercial basis, and establishes technical standards for electricity installations and operations in order to ensure uniformity throughout the country(5).

In 1988 Sudan had 0,6% of the installed capacity of Africa, amounting to 450 MW, of which 225 MW were thermal[8]. Figure 23 gives the installed capacity of the country over the period 1971-88. In 1988 public supply (936 GWh) provided about 88% of Sudan's total consumption (1061 GWh or 0,4% of the continent's consumption).

The deficit was privately generated, mainly by individual enterprises to meet their own requirements. Of the total electricity consumed, 544 GWh were thermally generated. This reflects the importance of thermal generation in the country. Figure 24 shows the production of electricity in the country between 1971 and 1988.

The public supply corporation, NEC, operated an electric generating capacity of 360 MW in 1988, of which 225 MW was hydro-electricity. The remainder was thermally generated. However, the reliable output is probably less than this because of problems such as age, shortage of spare parts, major overhauls, siltation of the dams, and fluctuations in river levels. Public supply problems resulting in frequent power cuts have led to a major growth in private generation by households and companies in main urban areas. Electricity consumption per capita, as given by the United Nations' 1988 Energy Statistics Yearbook, was 45 kWh in 1988.

Access to electricity is very limited. In 1982 only 8% of the total population had access to public supply. Sectorially, industrial and residential customers remain the largest users of electricity. Figure 31 shows the sectorial breakdown of electricity final consumption in percentage terms. Electricity consumption patterns in Sudan are highly irregular. Khartoum and the central region account for 87% of the total consumption and the south and west only 2%. This situation explains the reason for the growth in private generation.

NEC's operational activities are divided into 9 geographical regions, mostly served by isolated diesel systems. Only the Blue Nile Grid and the Port Sudan (eastern) area are interconnected and are the most important[9].

The Blue Nile Grid (BNG) is the largest system, as depicted in Fig. 32. In 1985 it accounted for approximately 83% of the public generating capacity and served about 85% of public supply customers. Centered on the Roseires and Sennar hydro-electric schemes, it also has a large thermal generation capacity (steam, gas turbine and diesel). The BNG's generating capacity was almost doubled with the completion of the IDA's Power-III electricity project in 1986. A new 60 MW thermal power station at Khartoum North began operating in May 1985. Extension work for an additional 40 MW has started at the Burri thermal power station. In 1988 work was due to begin on the first of the two 40-60 MW units at Khartoum North, under the revised Power-V programme. The Roseires dam's capacity was raised by 84 MW to 250 MW after the installation of new turbines. Initial renovation work at the Sennar dam was close to completion in mid-1990[1].

The Port Sudan area, the largest center of population outside Khartoum province, has the second largest electricity system in the country. It is the largest load centre outside the BNG. Installed capacity in Port Sudan in 1982 was only 11 MW. With the construction of a new power station, a capacity of 30 MW was expected to be added before the end of 1984. Private industrial generation meets the major part of the demand in the area.

The remainder of NEC's capacity is located in isolated systems. With the completion of thermal units at Dongala, El Fasher, Sendi and Wau, these isolated systems together had, in 1983, an installed capacity of 71 MW, of which only 13 MW were hydro. This highlights the great imbalance in the electricity distribution system in the country. However, efforts are being made to redress the situation. Work is underway to build new stations at Karina and Nyala, and to complete the long-delayed Juba power station, under the IDA's Power-II project. Work to expand the power stations at Kassala and Khashm el Girba was due to be completed by early 1990. The thermal power plant expansion programme was given 1330 million Yen by Japan in September 1988.

The demand is expected to double before the year 2000. In order to meet the growing electricity needs, in 1983 the government began to seek finance for the Power-IV programme. Largely thermal based, this scheme had to cover the growth in demand up to 1990. Revised and scaled down, the programme now aims at the rehabilitation of the existing network to bring it up to designed capacity, and the expansion of the Burri and the Khartoum North stations. The government is also planning to build a 1000 MW hydro-electric station at Meroe on the Main Nile in the north[1]. Potential for other hydropower schemes exists at Rumela (20 MW), Burdana, Sabaloka (120 MW), Shereik (240 MW), Shirri Island (450 MW), and Dal (600 MW).

In Sudan hydro-electricity schemes are also used for flow regulation and irrigation purposes. In this regard, reservoirs are found at Sennar and Roseires on the Blue Nile, Khashm el Girba on the Atbara, and Jebel Aulia on the White Nile. Sudan is engaged in the construction of the Jonglei canal, linking the vast Sudd swampland in southern Sudan to the confluence of the Sobat River and the White Nile. The canal is intended to reduce water losses by evaporation and to speed the flow of the Nile. It is a joint venture with Egypt which needs more water for irrigation to meet the food requirements of its fast growing population. The project was suspended in 1983 following attacks by rebel groups of the SPLA on construction camps. One-third of the work remains to be done.

The Nile waters are very important to the national security of Egypt and Sudan. Unfortunately, the sources of these waters are beyond their control. In the past both countries feared political blackmail from Ethiopia, which was considering the building of a dam on Lake Tana, the source of the Blue Nile, in order to irrigate plains east of the Sudan frontier. Ethiopian resettlement schemes on highlands drained by the Blue Nile were thought to yield heavy loads of sediment which could threaten to diminish the capacity of the Roseries dam[9].

5.5 Other

The use of energy supply sources other than petroleum, power and forestry is very limited. If harnessed, molasses, bagasse, solar and wind energy can at best make a marginal contribution to the total energy supply in the future. Their potential uses are water heating (solar), irrigation pumping (wind), ethanol production (molasses) and power generation (bagasse).

6. PRICING

Pricing of petroleum products is controlled by the government through the General Petroleum Corporation. In the 1980's the prices of petroleum products were held below full delivery cost. Subsidization ranged from 15 to 54% at the end of 1980. Fuel oil was sold at 50% of its value, diesel 43%, gas oil 10% and kerosene 19%. Successive attempts at increasing prices did not give the expected results as the local currency was either overvalued or depreciated. With respect to the protection of forest resources and the lower income groups, subsidization of kerosene was considered.

In order to recover the cost of electricity supply, the NEC has undertaken the implementation of major tariff increases since 1983. In 1987 the average revenue was 8,87 US cts/kWh. The energy charge per kWh was 11,13 US cts for residential consumers, 10,93 US cts for commercial consumers, and 7,12 US cts for small and large industry[10].

Data on fuelwood prices are not available. However, fuelwood costs are increasing due to scarcity and transport over long distances, especially in less endowed resource areas.

7. DISCUSSION

Although important, forest resources are not evenly distributed in the country and do not follow population distribution patterns. There is a high reliance on woodfuels. Deforestation is taking place and woodfuels are becoming scarce.

Hydro-electric potential is important on the Nile and its tributaries. The Nile waters are also important in irrigated agricultural schemes. Some projects are underway to increase the country's generating capacity. The exploitation of important hydro-schemes is linked to the capability of the government to secure foreign financing.

Prospects for gas and oil exploitation are also good. The oil deposits already discovered in the south have not yet been exploited as a result of the civil war in that part of the country. If they are exploited, known reserves can free the country from oil imports for over a decade.

Oil and electricity pricing policies do not cover costs. Measures should be taken in order to ensure efficient energy supply.

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TABLES

TABLE A. ECONOMIC INDICATORS

CURRENCY: SUDANESE POUNDS

MILLIONS OF NATIONAL CURRENCY UNLESS INDICATED

YEAR	POPUL. MILLIONS	POPUL. GROWTH RATE (%)	GROSS DOMESTIC PRODUCT AT MARKET COST: AGRICULTURE	INDUSTRY: TOTAL INDUSTRY	INDUSTRY: MINING QUARRY	INDUSTRY: MANUFACTURE	INDUSTRY: ELEC, WTR, GAS	INDUSTRY: CONSTRUCT	OTHER SERVICES + TAXES	TOTAL	GDP DEFLATOR	GDP AT 1985 PRICES MARKET	GDP/CAPITA CURRENT	GDP/CAPITA REAL 1985	EXCHANGE RATE SUDANESE POUNDS PER US$	GDP IN US$ (MILL) CURRENT PRICE MARKET	GDP IN US$ (MILL) AT 1985 PRICE MARKET	GDP PER CAPITA US$/CAP	GDP PER CAPITA US$(1985)/CAPITA
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	13.08	NA	190	80	NA	40	NA	NA	266	536	5.6	9571	41	732	0.35	1531	4161	117	318
1968	13.19	NA	200	85	NA	42	NA	NA	298	583	5.9	9881	44	749	0.35	1666	4296	126	326
1969	13.51	2.4	180	83	NA	43	NA	NA	322	585	6.1	9527	43	705	0.35	1671	4142	124	307
1970	13.86	2.6	264	91	NA	49	NA	NA	346	701	6.8	10245	51	739	0.35	2003	4455	145	321
1971	14.24	2.8	294	92	NA	51	NA	NA	375	761	7.0	10844	53	761	0.35	2174	4715	153	331
1972	14.65	2.9	324	98	NA	52	NA	NA	410	832	7.9	10539	57	719	0.35	2377	4582	162	313
1973	15.08	2.9	342	106	NA	55	NA	NA	449	897	9.1	9833	59	652	0.35	2563	4275	170	283
1974	15.54	3.0	512	153	NA	71	NA	NA	581	1246	11.6	10761	80	693	0.35	3560	4679	229	301
1975	16.01	3.1	580	185	NA	96	NA	NA	746	1511	12.5	12131	94	758	0.35	4317	5274	270	329
1976	16.51	3.1	623	230	NA	109	NA	NA	995	1848	13.0	14235	112	862	0.35	5280	6189	320	375
1977	17.02	3.1	817	271	NA	132	NA	NA	1252	2340	14.2	16467	137	968	0.35	6686	7159	393	421
1978	17.55	3.1	1043	306	NA	148	NA	NA	1534	2883	17.7	16270	164	927	0.38	7587	7074	432	403
1979	18.10	3.2	1089	374	NA	202	NA	NA	1791	3254	22.3	14605	180	807	0.43	7567	6350	418	351
1980	18.68	3.2	1232	492	NA	249	NA	NA	2248	3972	27.0	14702	213	787	0.50	7944	6392	425	342
1981	19.28	3.2	1446	659	NA	359	NA	NA	2875	4980	33.2	15019	258	779	0.56	8893	6530	461	339
1982	19.89	3.2	2567	917	NA	459	NA	NA	3556	7040	41.8	16861	354	848	0.95	7411	7331	373	368
1983	20.53	3.2	3106	1334	NA	637	NA	NA	5152	9592	55.6	17247	467	840	1.30	7378	7499	359	365
1984	21.17	3.1	3569	1696	NA	868	NA	NA	6542	11807	72.1	16375	558	774	1.30	9082	7119	429	336
1985	21.82	3.1	4202	2342	NA	1236	NA	NA	8813	15357	100.0	15357	704	704	2.30	6677	6677	306	306
1986	22.48	3.0	7747	3331	NA	1867	NA	NA	11992	23070	137.0	16837	1026	749	2.50	9228	7321	411	326
1987	23.13	2.9	9987	4398	NA	2505	NA	NA	15502	29887	175.4	17036	1292	737	3.00	9962	7407	431	320
1988	23.78	2.8	11826	6110	NA	3396	NA	NA	22355	40291	241.1	16715	1695	703	4.50	8954	7267	377	306
1989	24.42	2.7	25537	10334	NA	5784	NA	NA	37694	73565	409.8	17950	3012	735	4.50	16348	7805	669	320
1990	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 B. ENERGY BREAKDOWN

YEAR	TOTAL FINAL CONSUMPTION (000s TOE): COMMERCIAL FORMS OF ENERGY COAL	OIL	HYDRO	GAS	ELECT	TOTAL	TRADIT. ENERGY	TOTAL ENERGY (COM + TRAD)	ENERGY FORMS AS % OF TFC COM. ENERG	TRADIT. ENERGY	ENERGY FORMS PER CAPITA (TOE/CAPITA): OIL	ELECT	COM. ENERGY	TRAD. ENERGY	TOTAL ENERGY	RATIO COM ENERGY/ TRAD.ENERGY	FINAL CONSUMPTION OF OIL IN OIL REFINERIES 000s TO	% OF OIL TFC
1970	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1971	0.0	745.7	0	0	30.3	776.0	5729	6505.0	11.9	88.1	0.052	0.002	0.055	0.402	0.457	0.14	67.9	9.1
1972	0.0	725.3	0	0	32.9	758.2	5902	6660.2	11.4	88.6	0.050	0.002	0.052	0.403	0.455	0.13	80.1	11.0
1973	0.0	790.4	0	0	40.3	830.7	6075	6905.7	12.0	88.0	0.052	0.003	0.055	0.403	0.458	0.14	104.2	13.2
1974	0.0	670.9	0	0	48.2	719.1	6264	6983.1	10.3	89.7	0.043	0.003	0.046	0.403	0.449	0.11	102.8	15.3
1975	0.0	722.3	0	0	51.4	773.7	6455	7228.7	10.7	89.3	0.045	0.003	0.048	0.403	0.451	0.12	98.9	13.7
1976	0.0	794.4	0	0	53.9	848.3	6507	7355.3	11.5	88.5	0.048	0.003	0.051	0.395	0.446	0.13	73.3	9.2
1977	0.0	847.5	0	0	56.9	904.4	6665	7569.4	11.9	88.1	0.050	0.003	0.053	0.392	0.445	0.14	81.7	9.6
1978	0.0	839.0	0	0	61.2	900.2	6879	7779.2	11.6	88.4	0.048	0.003	0.051	0.392	0.444	0.13	62.9	7.5
1979	0.0	896.6	0	0	61.8	958.4	7022	7980.4	12.0	88.0	0.050	0.003	0.053	0.388	0.441	0.14	56.3	6.3
1980	0.7	947.8	0	0	67.9	1016.4	7228	8244.4	12.3	87.7	0.051	0.004	0.054	0.387	0.441	0.14	50.2	5.3
1981	0.7	1006.7	0	0	78.3	1085.7	7424	8509.7	12.8	87.2	0.052	0.004	0.056	0.385	0.441	0.15	80.6	8.0
1982	0.7	1016.6	0	0	83.7	1101.0	7612	8713.0	12.6	87.4	0.051	0.004	0.055	0.383	0.438	0.14	42.7	4.2
1983	0.0	1091.9	0	0	85.7	1177.6	7861	9038.6	13.0	87.0	0.053	0.004	0.057	0.382	0.440	0.15	39.8	3.6
1984	0.0	1039.5	0	0	89.9	1129.4	8023	9152.4	12.3	87.7	0.049	0.004	0.053	0.379	0.432	0.14	43.0	4.1
1985	0.0	1154.4	0	0	93.7	1248.1	8200	9448.1	13.2	86.8	0.053	0.004	0.057	0.376	0.433	0.15	42.4	3.7
1986	0.0	1211.9	0	0	85.4	1297.3	4575	5872.3	22.1	77.9	0.054	0.004	0.058	0.204	0.261	0.28	48.3	3.8
1987	0.0	1355.5	0	0	91.6	1447.1	4686	6133.1	23.6	76.4	0.059	0.004	0.063	0.203	0.265	0.31	57.5	4.2
1988	0.0	1446.1	0	0	91.2	1537.3	4862	6399.3	24.0	76.0	0.061	0.004	0.065	0.204	0.269	0.32	52.4	3.6
1989	NA	NA	NA	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	NA

DATA OBTAINED FROM: IEA WORLD ENERGY STATISTICS AND BALANCES (1971-1988)

TABLE C. SECTORIAL DISTRIBUTION OF COMMERCIAL ENERGY FINAL CONSUMPTION (000'S TOE)

YEAR	COAL		OIL						ELECTRICITY						TOTAL					TOTAL
	IND	TOTAL	IND	TRANS	AGRI	RESID.	OTHER	TOTAL	IND	TRAN	AGRI	RESID.	OTHER	TOTAL	IND	TRANS	AGRI	RESID.	OTHER	TOTAL
1970	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1971	0.0	0.0	157.3	397.9	51.8	104.8	33.9	745.7	17.7	0.0	3.1	5.0	4.5	30.3	175.0	397.9	54.9	109.8	38.4	776.0
1972	0.0	0.0	161.1	403.0	57.0	68.4	35.8	725.3	19.0	0.0	3.4	5.6	4.9	32.9	180.1	403.0	60.4	74.0	40.7	758.2
1973	0.0	0.0	185.4	422.1	64.2	81.9	36.8	790.4	20.1	0.0	3.8	8.6	7.8	40.3	205.5	422.1	68.0	90.5	44.7	830.8
1974	0.0	0.0	171.3	351.6	73.5	34.7	39.8	670.9	21.7	0.0	3.6	12.0	10.9	48.2	193.0	351.6	77.1	46.7	50.8	719.2
1975	0.0	0.0	205.1	362.1	75.6	37.9	41.6	722.3	24.1	0.0	2.7	13.0	11.6	51.4	229.2	362.1	78.3	50.9	53.2	773.7
1976	0.0	0.0	214.8	416.7	78.7	34.8	49.4	794.4	26.7	0.0	2.0	12.7	12.5	53.9	241.5	416.7	80.7	47.5	62.0	848.4
1977	0.0	0.0	224.8	441.1	95.3	35.9	50.4	847.5	28.6	0.0	2.0	13.3	13.0	56.9	253.4	441.1	97.3	49.2	63.5	904.5
1978	0.0	0.0	218.2	443.7	105.6	28.6	42.9	839.0	31.0	0.0	1.9	14.4	13.9	61.2	249.2	443.7	107.5	43.0	56.8	900.2
1979	0.0	0.0	231.8	481.0	111.9	21.2	50.7	896.6	29.6	0.0	3.2	14.7	14.3	61.8	261.4	481.0	115.1	35.9	65.0	958.4
1980	0.7	0.7	243.6	527.3	119.1	23.4	34.4	947.8	34.8	0.0	3.3	15.1	14.7	67.9	279.1	527.3	122.4	38.5	49.0	1016.3
1981	0.7	0.7	253.5	561.9	127.4	26.6	37.3	1006.7	43.8	0.0	2.3	16.3	15.9	78.3	298.0	561.9	129.7	42.9	53.1	1085.6
1982	0.7	0.7	271.0	552.4	136.7	16.2	40.3	1016.6	46.8	0.0	2.5	17.4	17.0	83.7	318.5	552.4	139.2	33.6	57.2	1100.9
1983	0.0	0.0	292.2	586.0	147.0	22.5	44.2	1091.9	48.0	0.0	2.5	17.8	17.4	85.7	340.2	586.0	149.5	40.3	61.7	1177.7
1984	0.0	0.0	283.0	549.9	136.7	23.7	46.2	1039.5	50.3	0.0	2.6	18.9	18.1	89.9	333.3	549.9	139.3	42.6	64.3	1129.4
1985	0.0	0.0	328.7	601.2	157.4	23.8	43.3	1154.4	52.5	0.0	2.6	19.8	18.8	93.7	381.2	601.2	160.0	43.6	62.1	1248.1
1986	0.0	0.0	327.5	652.2	167.7	26.8	37.7	1211.9	47.8	0.0	2.6	19.8	15.2	85.4	375.3	652.2	170.3	46.6	52.9	1297.3
1987	0.0	0.0	486.5	633.0	155.3	37.4	43.3	1355.5	52.6	0.0	2.6	20.6	15.8	91.6	539.1	633.0	157.9	58.0	59.1	1447.1
1988	0.0	0.0	515.6	690.4	155.3	38.6	46.2	1446.1	52.5	0.0	2.6	20.6	15.5	91.2	568.1	690.4	157.9	59.2	61.8	1537.4
1989	NA	NA	NA	NA	NA	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	NA	NA	NA

TABLE D. SECTORIAL DISTRIBUTION OF COMMERCIAL ENERGY FINAL CONSUMPTION AS A PERCENTAGE OF TOTAL

YEAR	COAL		OIL						ELEC						TOTAL					
	IND	TOTAL	IND	TRANS	AGRI	RESID.	OTHER	TOTAL	IND	TRANS	AGRI	RESID.	OTHER	TOTAL	IND	TRANS	AGRI	RESID.	OTHER	TOTAL
1970	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1971	0.0	0.0	21.1	53.4	6.9	14.1	4.5	100	58.4	0.0	10.2	16.5	14.9	100	22.6	51.3	7.1	14.1	4.9	100
1972	0.0	0.0	22.2	55.6	7.9	9.4	4.9	100	57.8	0.0	10.3	17.0	14.9	100	23.8	53.2	8.0	9.8	5.4	100
1973	0.0	0.0	23.5	53.4	8.1	10.4	4.7	100	49.9	0.0	9.4	21.3	19.4	100	24.7	50.8	8.2	10.9	5.4	100
1974	0.0	0.0	25.5	52.4	11.0	5.2	5.9	100	45.0	0.0	7.5	24.9	22.6	100	26.8	48.9	10.7	6.5	7.1	100
1975	0.0	0.0	28.4	50.1	10.5	5.2	5.8	100	46.9	0.0	5.3	25.3	22.6	100	29.6	46.8	10.1	6.6	6.9	100
1976	0.0	0.0	27.0	52.5	9.9	4.4	6.2	100	49.5	0.0	3.7	23.6	23.2	100	28.5	49.1	9.5	5.6	7.3	100
1977	0.0	0.0	26.5	52.0	11.2	4.2	5.9	100	50.3	0.0	3.5	23.4	22.8	100	28.0	48.8	10.8	5.4	7.0	100
1978	0.0	0.0	26.0	52.9	12.6	3.4	5.1	100	50.7	0.0	3.1	23.5	22.7	100	27.7	49.3	11.9	4.8	6.3	100
1979	0.0	0.0	25.9	53.6	12.5	2.4	5.7	100	47.9	0.0	5.2	23.8	23.1	100	27.3	50.2	12.0	3.7	6.8	100
1980	0.0	0.0	25.7	55.6	12.6	2.5	3.6	100	51.3	0.0	4.9	22.2	21.6	100	27.5	51.9	12.0	3.8	4.8	100
1981	0.0	0.0	25.2	55.8	12.7	2.6	3.7	100	55.9	0.0	2.9	20.8	20.3	100	27.5	51.8	11.9	4.0	4.9	100
1982	0.0	0.0	26.7	54.3	13.4	1.6	4.0	100	55.9	0.0	3.0	20.8	20.3	100	28.9	50.2	12.6	3.1	5.2	100
1983	0.0	0.0	26.8	53.7	13.5	2.1	4.0	100	56.0	0.0	2.9	20.8	20.3	100	28.9	49.8	12.7	3.4	5.2	100
1984	0.0	0.0	27.2	52.9	13.2	2.3	4.4	100	56.0	0.0	2.9	21.0	20.1	100	29.5	48.7	12.3	3.8	5.7	100
1985	0.0	0.0	28.5	52.1	13.6	2.1	3.8	100	56.0	0.0	2.8	21.1	20.1	100	30.5	48.2	12.8	3.5	5.0	100
1986	0.0	0.0	27.0	53.8	13.8	2.2	3.1	100	56.0	0.0	3.0	23.2	17.8	100	28.9	50.3	13.1	3.6	4.1	100
1987	0.0	0.0	35.9	46.7	11.5	2.8	3.2	100	57.4	0.0	2.8	22.5	17.2	100	37.3	43.7	10.9	4.0	4.1	100
1988	0.0	0.0	35.7	47.7	10.7	2.7	3.2	100	57.6	0.0	2.9	22.6	17.0	100	37.0	44.9	10.3	3.9	4.0	100
1989	NA	NA	NA	NA	NA	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	NA	NA	NA

TABLE E. ENERGY DATA FOR GRAPHS

YEAR	COMPONENTS AS PERCENTAGE OF COM.ENERGY FINAL CONSUMPTION			COMPONENTS AS PERCENTAGE OF TOTAL FINAL CONSUMPTION			COM.TFC GROWTH RATE			TFC GROWTH RATE			ENERGY INTENSITY (TOE/SUDANESE POUND) COMMERCIAL ENERGY INTENSITY				TFC
	COAL	OIL	ELECTRICITY	COAL	OIL	ELECTRICITY	%	3 PT M.A.	5 PT M.A.	%	3 PT M.A.	5 PT M.A.	TOTAL	INDUSTRY	AGRICULT	OTHER	INTENSITY
1970	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1971	0.0	96.1	3.9	0.0	11.5	0.5	NA	NA	NA	NA	NA	NA	7.2E-05	1.3E-04	1.3E-05	1.0E-04	6.0E-04
1972	0.0	95.7	4.3	0.0	10.9	0.5	-2.3	NA	NA	2.4	NA	NA	7.2E-05	1.5E-04	1.5E-05	1.0E-04	6.3E-04
1973	0.0	95.1	4.9	0.0	11.4	0.6	9.6	-2.1	NA	3.7	2.4	NA	8.4E-05	1.8E-04	1.8E-05	1.1E-04	7.0E-04
1974	0.0	93.3	6.7	0.0	9.6	0.7	-13.4	1.2	2.2	1.1	2.8	2.5	6.7E-05	1.5E-04	1.7E-05	9.0E-05	6.5E-04
1975	0.0	93.4	6.6	0.0	10.0	0.7	7.6	1.3	4.0	3.5	2.1	2.6	6.4E-05	1.5E-04	1.7E-05	7.8E-05	6.0E-04
1976	0.0	93.6	6.4	0.0	10.8	0.7	9.6	7.9	2.0	1.8	2.7	2.4	6.0E-05	1.4E-04	1.7E-05	6.9E-05	5.2E-04
1977	0.0	93.7	6.3	0.0	11.2	0.8	6.6	5.3	6.0	2.9	2.5	2.7	5.5E-05	1.3E-04	1.7E-05	6.3E-05	4.6E-04
1978	0.0	93.2	6.8	0.0	10.8	0.8	-0.5	4.2	5.7	2.8	2.8	2.7	5.5E-05	1.4E-04	1.8E-05	6.3E-05	4.8E-04
1979	0.0	93.6	6.4	0.0	11.2	0.8	6.5	4.0	5.1	2.6	2.9	3.0	6.6E-05	1.6E-04	2.4E-05	7.2E-05	5.5E-04
1980	0.1	93.3	6.7	0.0	11.5	0.8	6.1	6.4	4.1	3.3	3.0	2.9	6.9E-05	1.5E-04	2.7E-05	7.4E-05	5.6E-04
1981	0.1	92.7	7.2	0.0	11.8	0.9	6.8	4.8	5.5	3.2	3.0	3.0	7.2E-05	1.5E-04	3.0E-05	7.6E-05	5.7E-04
1982	0.1	92.3	7.6	0.0	11.7	1.0	1.4	5.1	3.4	2.4	3.1	2.8	6.5E-05	1.5E-04	2.3E-05	7.6E-05	5.2E-04
1983	0.0	92.7	7.3	0.0	12.1	0.9	7.0	1.4	4.3	3.7	2.5	2.8	6.8E-05	1.4E-04	2.7E-05	7.4E-05	5.2E-04
1984	0.0	92.0	8.0	0.0	11.4	1.0	-4.1	4.5	3.7	1.3	2.7	-5.4	6.9E-05	1.4E-04	2.8E-05	7.2E-05	5.6E-04
1985	0.0	92.5	7.5	0.0	12.2	1.0	10.5	3.5	5.8	3.2	-11.1	-5.0	8.1E-05	1.6E-04	3.8E-05	8.0E-05	6.2E-04
1986	0.0	93.4	6.6	0.0	20.6	1.5	3.9	8.7	5.6	-37.8	-10.1	-4.9	7.7E-05	1.5E-04	3.0E-05	8.6E-05	3.5E-04
1987	0.0	93.7	6.3	0.0	22.1	1.5	11.5	7.2	NA	4.4	-9.7	NA	8.5E-05	2.2E-04	2.8E-05	8.5E-05	3.6E-04
1988	0.0	94.1	5.9	0.0	22.6	1.4	6.2	NA	NA	4.3	NA	NA	9.2E-05	2.2E-04	3.2E-05	8.7E-05	3.8E-04
1989	NA	NA	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 F. ELECTRICITY DATA INSTALLED CAPACITY (MEGAWATTS)

YEAR	PUBLIC			SELFPRODUCERS					
	HYD	THERMA	TOTAL	HYDRO	THERM	TOTAL	TOTAL HYDRO	TOTAL THERMAL	TOTAL INSTALLED
1950	0	9	9	0	0	0	0	9	9
1951	0	11	11	0	0	0	0	11	11
1952	0	11	11	0	0	0	0	11	11
1953	0	14	14	0	0	0	0	14	14
1954	0	15	15	0	0	0	0	15	15
1955	0	18	18	0	0	0	0	18	18
1956	0	29	29	0	0	0	0	29	29
1957	0	31	31	0	0	0	0	31	31
1958	0	31	31	0	0	0	0	31	31
1959	0	44	44	0	0	0	0	44	44
1960	0	44	44	0	0	0	0	44	44
1961	0	51	51	0	0	0	0	51	51
1962	2	61	63	0	0	0	2	61	63
1963	11	59	70	0	0	0	11	59	70
1964	11	59	70	0	0	0	11	59	70
1965	16	60	76	0	0	0	16	60	76
1966	26	65	91	0	0	0	26	65	91
1967	27	65	92	0	0	0	27	65	92
1968	27	70	97	0	0	0	27	70	97
1969	27	104	131	0	0	0	27	104	131
1970	30	87	117	0	0	0	30	87	117
1971	27	85	112	0	0	0	27	85	112
1972	29	85	114	0	0	0	29	85	114
1973	105	90	195	0	0	0	105	90	195
1974	105	90	195	0	0	0	105	90	195
1975	105	105	210	0	32	32	105	137	242
1976	105	105	210	0	33	33	105	138	243
1977	110	105	215	0	34	34	110	139	249
1978	110	115	225	0	35	35	110	150	260
1979	147	115	262	0	35	35	147	150	297
1980	147	115	262	0	40	40	147	155	302
1981	147	125	272	0	40	40	147	165	312
1982	148	125	273	0	50	50	148	175	323
1983	178	125	303	0	65	65	178	190	368
1984	185	125	310	0	80	80	185	205	390
1985	225	125	350	0	100	100	225	225	450
1986	225	125	350	0	100	100	225	225	450
1987	225	125	350	0	100	100	225	225	450
1988	225	125	350	0	100	100	225	225	450
1989	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE G. OIL PRODUCT CONSUMPTION (000's METRIC TONS)

YEAR	NGL/LPG	RESIDUAL	PETROL	AVGAS	KEROSINE	DIESEL	OTHE	TOTA	DIES/PET	% PETRO	%DIESEL	OIL TFC GROWTH RATE 1 PT	3 PTS M.A.
1970	3	517	180	14	122	562	35	1433	3.1	12.6	39.2	NA	NA
1971	3	608	186	17	121	583	35	1553	3.1	12.0	37.5	NA	NA
1972	3	700	183	20	108	604	52	1670	3.3	11.0	36.2	-2.7	NA
1973	5	790	241	24	93	684	69	1906	2.8	12.6	35.9	9.0	-3.0
1974	6	549	219	20	75	632	51	1552	2.9	14.1	40.7	-15.1	0.5
1975	6	307	149	17	56	580	32	1147	3.9	13.0	50.6	7.7	0.8
1976	6	300	148	15	47	560	34	1110	3.8	13.3	50.5	10.0	8.1
1977	7	290	148	10	40	540	36	1071	3.6	13.8	50.4	6.7	5.2
1978	8	281	147	5	33	518	38	1030	3.5	14.3	50.3	-1.0	4.2
1979	7	310	149	4	36	515	44	1065	3.5	14.0	48.4	6.9	3.9
1980	8	325	157	4	40	520	48	1102	3.3	14.2	47.2	5.7	6.3
1981	8	325	152	4	40	535	48	1112	3.5	13.7	48.1	6.2	4.3
1982	9	555	195	2	39	555	44	1399	2.8	13.9	39.7	1.0	4.9
1983	8	513	187	2	38	513	40	1301	2.7	14.4	39.4	7.4	1.2
1984	8	531	198	2	36	531	38	1344	2.7	14.7	39.5	-4.8	4.6
1985	8	293	194	6	48	340	77	966	1.8	20.1	35.2	11.1	3.7
1986	9	300	190	2	51	349	84	985	1.8	19.3	35.4	5.0	9.3
1987	10	295	184	7	51	347	81	975	1.9	18.9	35.6	11.8	7.8
1988	10	302	187	8	52	335	83	977	1.8	19.1	34.3	6.7	NA
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

DATA OBTAINED FROM: WORLD ENERGY SUPPLIES (1954-1973)
YEARBOOK OF WORLD ENERGY STATISTICS (1981)
ENERGY STATISTICS YEARBOOKS (1983, 1985, 1988)
ESTIMATIONS

TABLE H. GDP DATA FOR GRAPHS

YEAR	GDP GROWTH RATE (REAL 1985 PRICES) %/YEAR	3PT MA	5PT MA	AGRICULTURE/ INDUSTRY 1 PT	3 PT M.A.	% CONTRIBUTION TO GDP AGRI	IND	MINE QUARRY	MANU	ELEC,WTR GAS	CONSTR	OTHER	AGRI/MANU	% OF CHANGE GDP DEFLATOR 1 PT	3PT M.A.	ANNUAL CHANGE OF GDP/CAP CURRENT %	3 PT M.A.	REAL %	3 PT M.A.
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	2.4	NA	35.4	14.9	NA	7.5	NA	NA	49.6	4.8	NA	NA	NA	NA	NA	NA
1968	3.2	NA	NA	2.4	2.3	34.3	14.6	NA	7.2	NA	NA	51.1	4.8	5.4	NA	7.9	NA	2.4	NA
1969	-3.6	2.4	NA	2.2	2.5	30.8	14.2	NA	7.4	NA	NA	55.0	4.2	4.1	7.0	-2.0	7.6	-5.9	0.5
1970	7.5	3.3	2.0	2.9	2.8	37.7	13.0	NA	7.0	NA	NA	49.4	5.4	11.4	6.0	16.8	6.8	4.8	0.6
1971	5.8	3.5	0.1	3.2	3.1	38.6	12.1	NA	6.7	NA	NA	49.3	5.8	2.6	8.8	5.6	9.6	3.0	0.8
1972	-2.8	-1.2	2.7	3.3	3.2	38.9	11.8	NA	6.3	NA	NA	49.3	6.2	12.5	10.2	6.3	5.5	-5.5	-4.0
1973	-6.7	-0.0	3.7	3.2	3.3	38.1	11.8	NA	6.1	NA	NA	50.1	6.2	15.6	18.3	4.7	15.3	-9.4	-2.9
1974	9.4	5.2	6.0	3.3	3.2	41.1	12.3	NA	5.7	NA	NA	46.6	7.2	26.9	16.7	34.8	19.1	6.2	2.1
1975	12.7	13.2	9.7	3.1	3.1	38.4	12.2	NA	6.4	NA	NA	49.4	6.0	7.6	12.9	17.7	23.7	9.4	9.8
1976	17.3	15.3	10.8	2.7	3.0	33.7	12.4	NA	5.9	NA	NA	53.8	5.7	4.2	7.1	18.6	19.7	13.8	11.8
1977	15.7	10.6	6.9	3.0	3.0	34.9	11.6	NA	5.6	NA	NA	53.5	6.2	9.5	12.8	22.8	20.3	12.2	7.3
1978	-1.2	1.4	4.5	3.4	3.1	36.2	10.6	NA	5.1	NA	NA	53.2	7.0	24.7	20.0	19.5	17.2	-4.2	-1.7
1979	-10.2	-3.6	1.4	2.9	2.9	33.5	11.5	NA	6.2	NA	NA	55.0	5.4	25.7	23.9	9.4	15.7	-13.0	-6.5
1980	0.7	-2.5	0.7	2.5	2.5	31.0	12.4	NA	6.3	NA	NA	56.6	4.9	21.3	23.2	18.3	16.4	-2.4	-5.5
1981	2.2	5.0	1.4	2.2	2.5	29.0	13.2	NA	7.2	NA	NA	57.7	4.0	22.7	23.3	21.5	25.6	-1.0	1.8
1982	12.3	5.6	2.5	2.8	2.4	36.5	13.0	NA	6.5	NA	NA	50.5	5.6	25.9	27.3	37.0	30.2	8.8	2.3
1983	2.3	3.2	1.1	2.3	2.4	32.4	13.9	NA	6.6	NA	NA	53.7	4.9	33.2	29.6	32.1	29.5	-0.8	-0.0
1984	-5.1	-3.0	2.6	2.1	2.1	30.2	14.4	NA	7.4	NA	NA	55.4	4.1	29.7	33.8	19.3	25.9	-7.9	-5.9
1985	-6.2	-0.5	0.4	1.8	2.1	27.4	15.3	NA	8.0	NA	NA	57.4	3.4	38.7	35.1	26.2	30.5	-9.0	-3.5
1986	9.6	1.5	-0.5	2.3	2.1	33.6	14.4	NA	8.1	NA	NA	52.0	4.1	37.0	34.6	45.9	32.6	6.5	-1.4
1987	1.2	3.0	2.0	2.3	2.2	33.4	14.7	NA	8.4	NA	NA	51.9	4.0	28.0	34.2	25.9	34.3	-1.7	0.1
1988	-1.9	2.2	NA	1.9	2.2	29.4	15.2	NA	8.4	NA	NA	55.5	3.5	37.4	45.2	31.1	44.9	-4.6	-0.6
1989	7.4	NA	NA	2.5	NA	34.7	14.0	NA	7.9	NA	NA	51.2	4.4	70.0	NA	77.8	NA	4.6	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE I. CRUDE OIL (000'S METRIC TONS)

YEAR	PRODUCT	EXPORT	IMPORT	CONSUMPTION
1964	0	0	125	125
1965	0	0	600	600
1966	0	0	820	820
1967	0	0	860	860
1968	0	0	640	640
1969	0	0	640	640
1970	0	0	850	829
1971	0	0	955	954
1972	0	0	1060	1079
1973	0	0	1165	1204
1974	0	0	1065	1104
1975	0	0	1149	1137
1976	0	0	1150	1124
1977	0	0	1240	1210
1978	0	0	1022	1028
1979	0	0	1050	1040
1980	0	0	1100	1085
1981	0	0	1150	1130
1982	0	0	1150	1100
1983	0	0	1175	1120
1984	0	0	1150	1110
1985	0	0	1095	1085
1986	0	0	1010	1007
1987	0	0	1015	1010
1988	0	0	1023	1013
1989	NA	NA	NA	NA
1990	NA	NA	NA	NA

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

TABLE J. ELECTRICITY DATA / ELECTRICITY PRODUCTION (GWhs)

YEAR	PUBLIC HYDR	PUBLIC THERMA	PUBLIC TOTAL	SELF PRODUCERS HYDRO	SELF PRODUCERS THERMAL	SELF PRODUCERS TOTAL	TOTAL HYDRO	TOTAL THERMAL	TOTAL	TOTAL (000s TOE)	ELEC. TFC GROWTH RATE % PA	ELEC. TFC GROWTH RATE 3PT MA	ELEC. TFC GROWTH RATE 5PT MA	ELEC INTENSITY TOE/GDP REL 1985	RATIO ELEC GWTH/GDP G 1PT	RATIO ELEC GWTH/GDP G 3PT M.A.	TFC ELEC/CAP kWh/CAP
1950	0	20	20	0	0	0	0	20	20	1.7	NA	NA	NA	NA	NA	NA	NA
1951	0	23	23	0	0	0	0	23	23	2.0	NA	NA	NA	NA	NA	NA	NA
1952	0	27	27	0	0	0	0	27	27	2.3	NA	NA	NA	NA	NA	NA	NA
1953	0	32	32	0	0	0	0	32	32	2.8	NA	NA	NA	NA	NA	NA	NA
1954	0	36	36	0	0	0	0	36	36	3.1	NA	NA	NA	NA	NA	NA	NA
1955	0	45	45	0	0	0	0	45	45	3.9	NA	NA	NA	NA	NA	NA	NA
1956	0	49	49	0	0	0	0	49	49	4.2	NA	NA	NA	NA	NA	NA	NA
1957	0	60	60	0	0	0	0	60	60	5.2	NA	NA	NA	NA	NA	NA	NA
1958	0	67	67	0	0	0	0	67	67	5.8	NA	NA	NA	NA	NA	NA	NA
1959	0	84	84	0	0	0	0	84	84	7.2	NA	NA	NA	NA	NA	NA	NA
1960	0	94	94	0	0	0	0	94	94	8.1	NA	NA	NA	NA	NA	NA	NA
1961	0	103	103	0	0	0	0	103	103	8.9	NA	NA	NA	NA	NA	NA	NA
1962	3	129	132	0	0	0	3	129	132	11.4	NA	NA	NA	NA	NA	NA	NA
1963	25	138	163	0	0	0	25	138	163	14.1	NA	NA	NA	NA	NA	NA	NA
1964	26	141	167	0	0	0	26	141	167	14.4	NA	NA	NA	NA	NA	NA	NA
1965	30	144	174	0	0	0	30	144	174	15.0	NA	NA	NA	NA	NA	NA	NA
1966	80	182	262	0	0	0	80	182	262	22.6	NA	NA	NA	NA	NA	NA	NA
1967	100	218	318	0	0	0	100	218	318	27.4	NA	NA	NA	NA	NA	NA	NA
1968	105	229	334	0	0	0	105	229	334	28.8	NA	NA	NA	NA	NA	NA	NA
1969	150	378	528	0	0	0	150	378	528	45.5	NA	NA	NA	NA	NA	NA	NA
1970	100	292	392	0	0	0	100	292	392	33.8	NA	NA	NA	NA	NA	NA	NA
1971	90	169	259	0	0	0	90	169	259	22.3	NA	NA	NA	2.7987E-06	NA	NA	25
1972	100	200	300	0	0	0	100	200	300	25.9	8.6	NA	NA	3.1002E-06	-4.3	NA	26
1973	200	300	500	0	0	0	200	300	500	43.1	22.5	16.9	NA	4.1333E-06	-2.8	-1.7	31
1974	270	310	580	0	0	0	270	310	580	50.0	19.6	16.2	12.4	4.4873E-06	1.9	-0.1	36
1975	290	320	610	0	80	80	290	400	690	59.5	6.6	10.4	11.8	4.2522E-06	0.5	0.9	37
1976	390	330	720	0	85	85	390	415	805	69.4	4.9	5.7	8.8	3.7625E-06	0.3	0.4	38
1977	440	370	810	0	90	90	440	460	900	77.6	5.6	6.0	5.1	3.4529E-06	0.4	-1.5	39
1978	450	405	855	0	95	95	450	500	950	81.9	7.6	4.7	5.8	3.7701E-06	-5.1	-1.6	40
1979	500	400	900	0	95	95	500	495	995	85.8	1.0	6.1	7.9	4.2466E-06	-0.1	1.3	40
1980	500	400	900	0	100	100	500	500	1000	86.2	9.9	8.7	8.1	4.6156E-06	9.1	5.6	42
1981	500	400	900	0	100	100	500	500	1000	86.2	15.3	10.7	7.1	5.2200E-06	7.8	5.8	47
1982	510	400	910	0	100	100	510	500	1010	87.1	6.9	8.2	7.9	4.9530E-06	0.5	3.2	49
1983	510	400	910	0	100	100	510	500	1010	87.1	2.4	4.7	6.7	4.9676E-06	1.1	0.2	48
1984	512	410	922	0	110	110	512	520	1032	89.0	4.9	3.8	1.9	5.4822E-06	-1.0	-0.2	49
1985	515	410	925	0	115	115	515	525	1040	89.7	4.2	0.1	2.0	6.1015E-06	-0.7	-0.8	50
1986	517	415	932	0	120	120	517	535	1052	90.7	-8.9	0.9	1.4	4.9387E-06	-0.7	1.4	44
1987	516	416	932	0	123	123	516	539.	1055	90.9	7.3	-0.7	NA	5.2277E-06	5.5	1.7	46
1988	517	419	936	0	125	125	517	544	1061	91.5	-0.4	NA	NA	5.2983E-06	0.2	NA	44

TABLE K. PRODUCTION OF ENERGY PRODUCTS FROM REFINERIES (QUANTITIES IN THOUSAND METRIC TONS)

YEAR	AV GAS	PETROL	JET FUELS	KEROSE	DIESEL	RESIDUAL	LPG	TOTAL
1970	2	90	61	21	234	283	2	693
1971	2	96	72	20	275	377	2	844
1972	2	100	83	19	315	470	2	991
1973	2	106	94	18	356	564	2	1142
1974	2	103	71	27	402	424	2	1031
1975	4	100	47	36	447	283	3	920
1976	2	113	43	33	466	290	4	951
1977	3	126	38	29	486	285	4	971
1978	3	139	34	26	505	281	5	993
1979	2	140	38	28	500	310	4	1022
1980	2	145	25	26	498	267	5	968
1981	2	145	27	28	510	280	5	997
1982	2	150	32	18	530	310	7	1049
1983	2	147	30	16	490	295	6	986
1984	2	148	30	15	510	298	7	1010
1985	2	110	72	17	313	313	4	831
1986	2	105	78	16	323	320	4	848
1987	3	112	75	17	325	295	5	832
1988	4	110	73	17	312	297	5	818
1989	NA	NA	NA	NA	NA	NA	NA	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA

DATA OBTAINED FROM: YEARBOOK OF WORLD ENERGY STATISTICS (1981)
ENERGY STATISTICS YEARBOOKS (1983, 1985, 1988)
ESTIMATIONS

TABLE L. FINAL ENERGY CONSUMPTION (1981) (000's TOE)

	FUELWOOD	CHARCOAL	BIOMASS	ELECTRIC.	PETROLEUM	TOTAL	SHARE (%)
AGRICULTURE	0	0	0	7	98	105	1.7
INDUSTRY	75	0	100	22	161	358	5.8
TRANSPORT	0	0	0	0	674	674	10.9
HOUSEHOLDS	2591	1686	426	23	55	4781	77.1
PUBLIC/OTHER	85	92	0	8	45	230	3.7
TOTAL	2751	1778	526	60	1088	6203	100.0
SHARE (%)	44.3	28.7	8.5	1.0	17.5	100.0	

DATA OBTAINED FROM: SUDAN: ISSUES AND OPTIONS IN THE ENERGY SECTOR

TABLE M. NEC'S ELECTRICITY GENERATION AND MAXIMUM DEMAND IN THE BNG FROM 1972 TO 1981

YEAR	ELECTRICITY GENERATION (GWhs) BNG	ISOLATED SYSTEMS	TOTAL NEC	MAXIMUM DEMAND IN THE BNG (MW)
1972	379	NA	NA	74.0
1973	418	NA	NA	81.6
1974	452	NA	NA	86.0
1975	489	100	589	93.6
1976	528	104	632	96.0
1977	576	106	682	104.0
1978	667	111	778	126.0
1979	742	112	854	136.9
1980	819	113	932	144.7
1981	841	124	965	157.8

DATA OBTAINED FROM: SUDAN: ISSUES AND OPTIONS IN THE ENERGY SECTOR

FIGURES

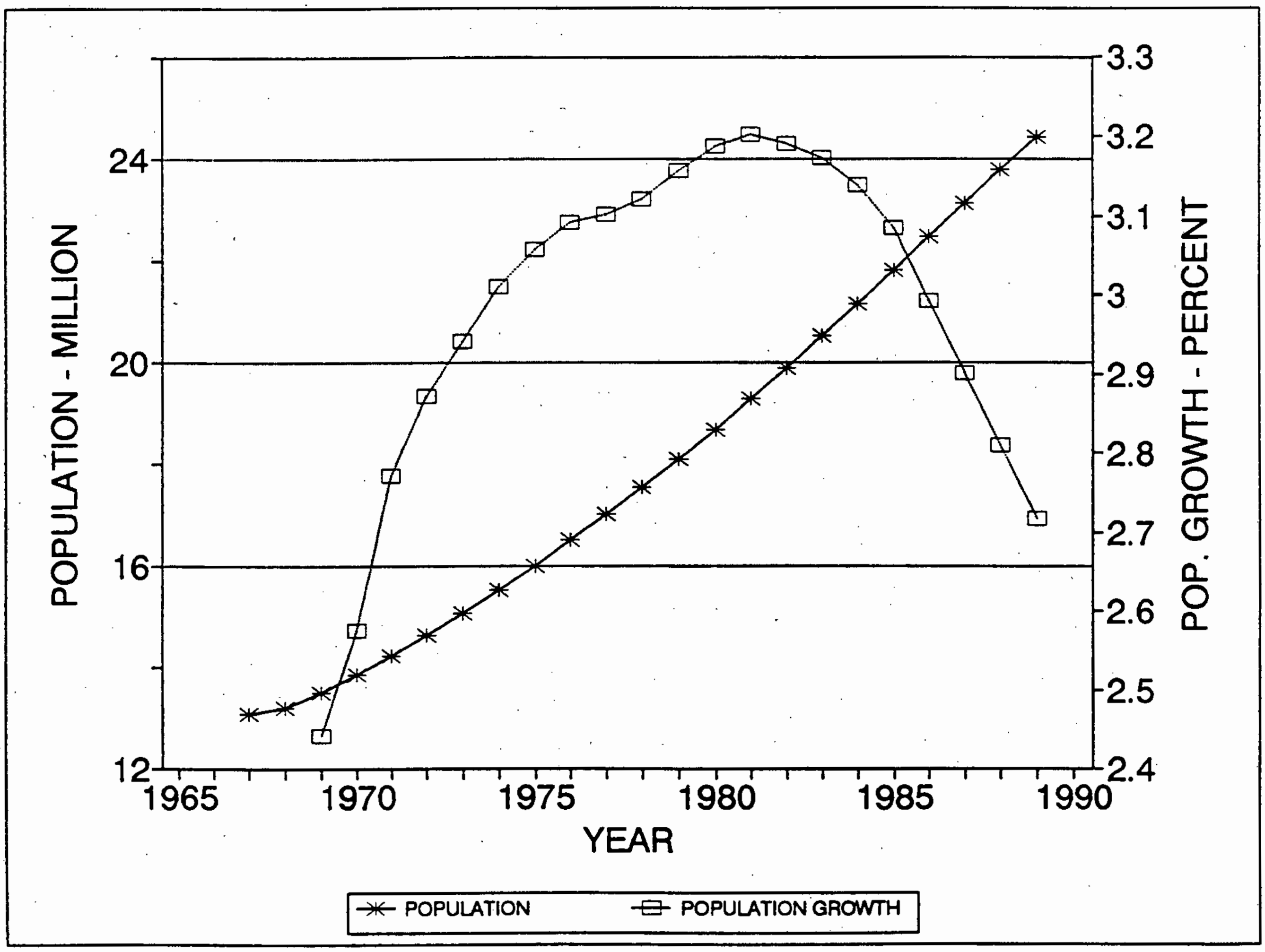


Figure 1. Population and population growth

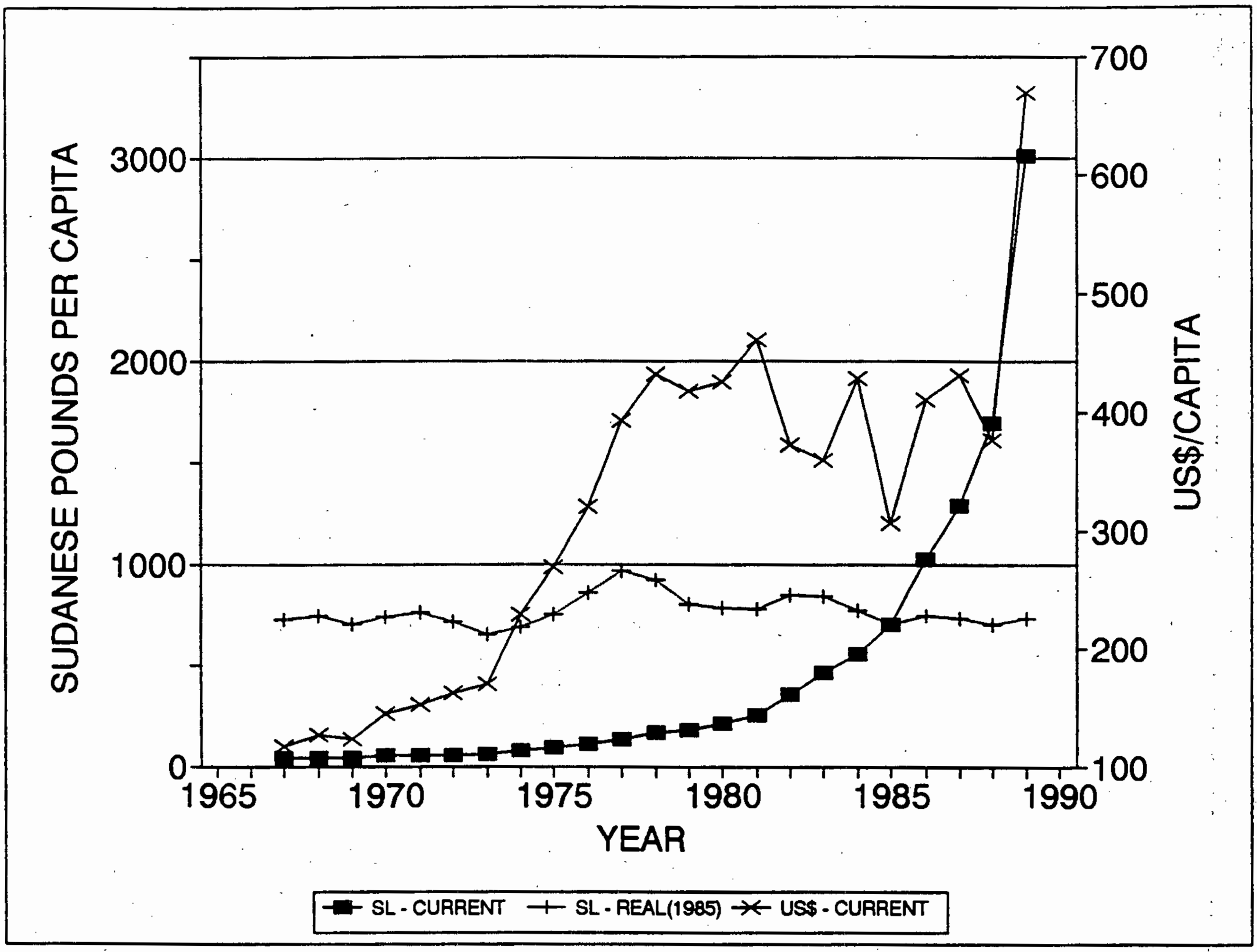


Figure 2. GDP per capita

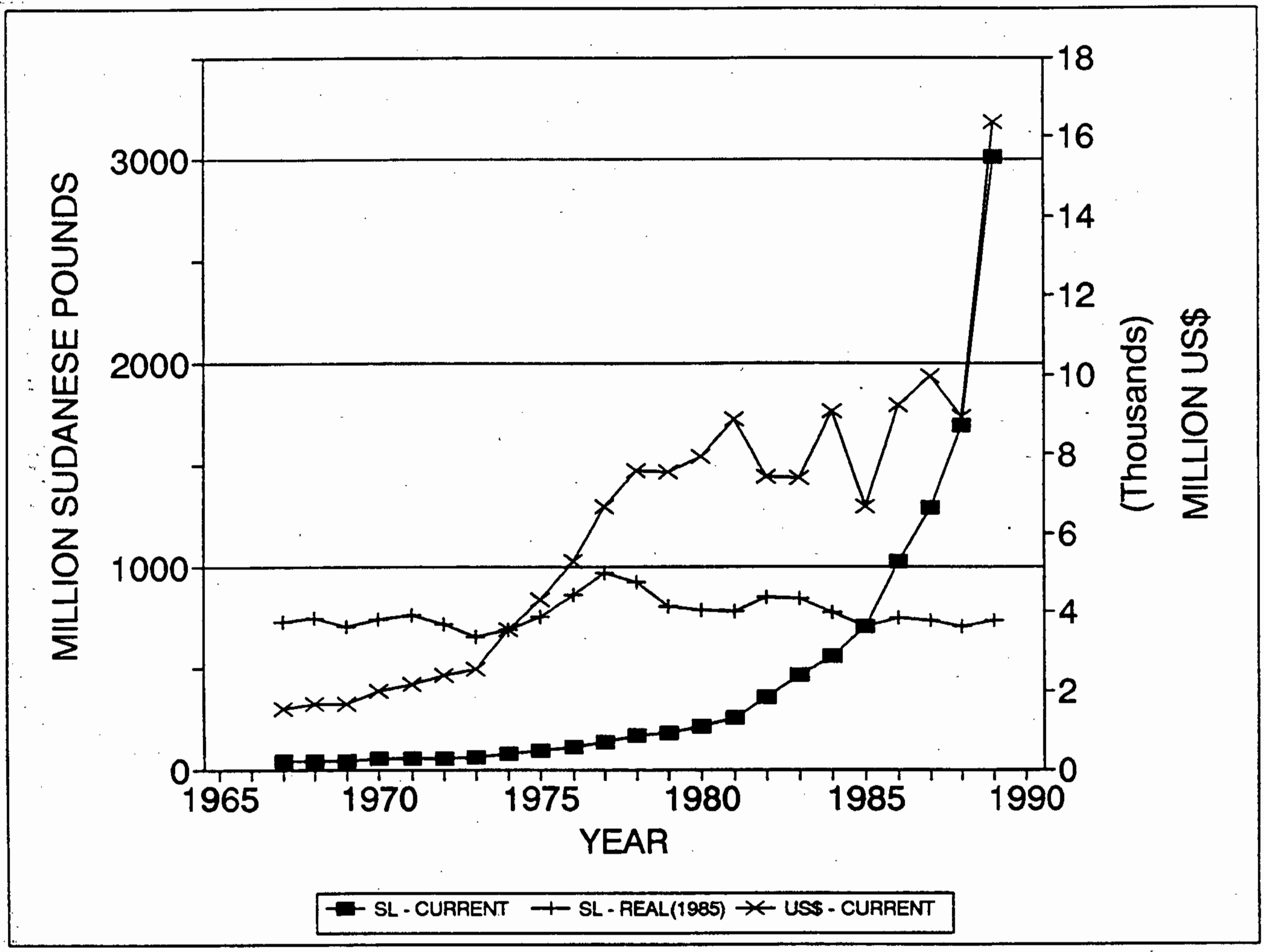


Figure 3. Gross domestic product (market)

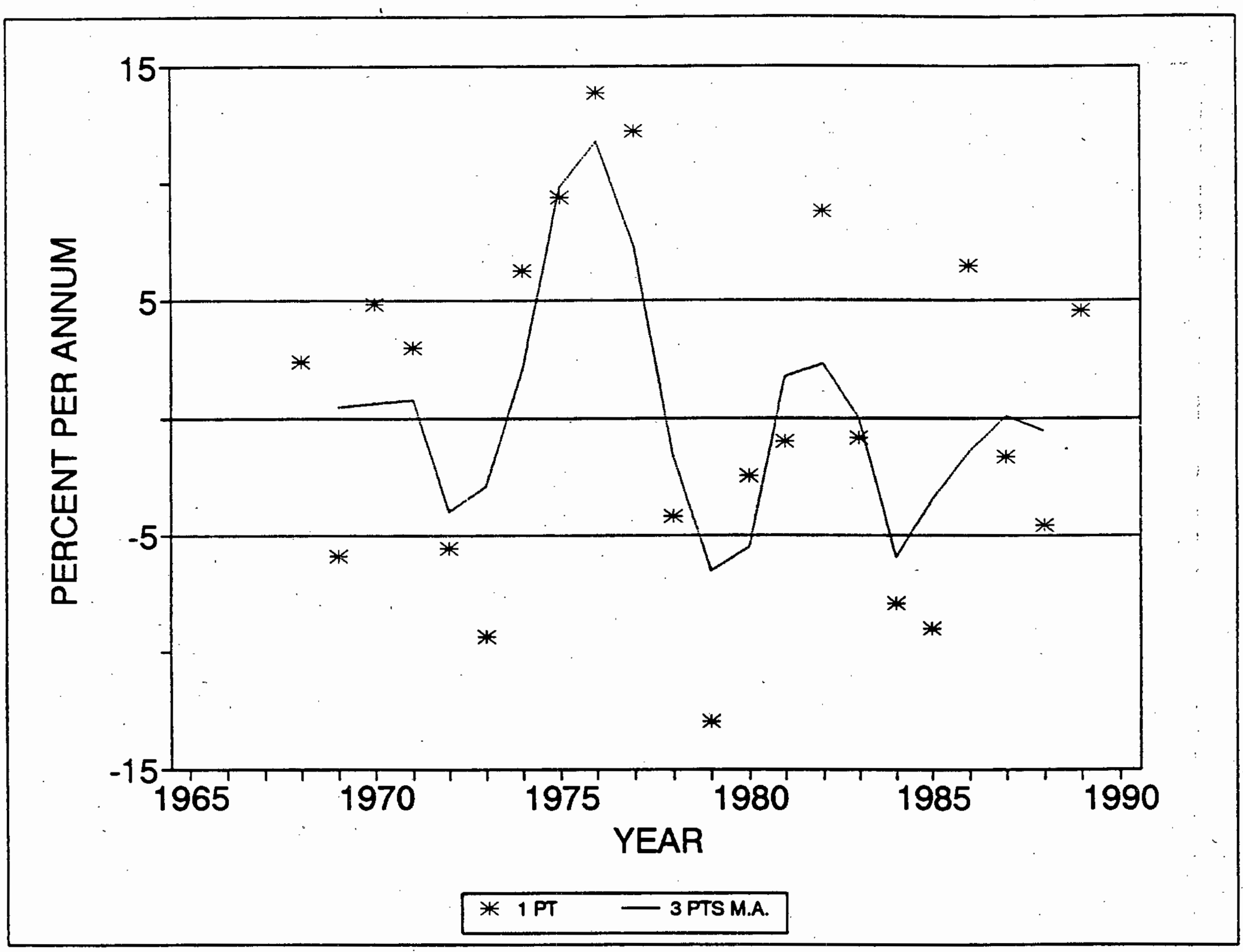


Figure 4. GDP per capita growth rate: percentage / year (Real 1985)

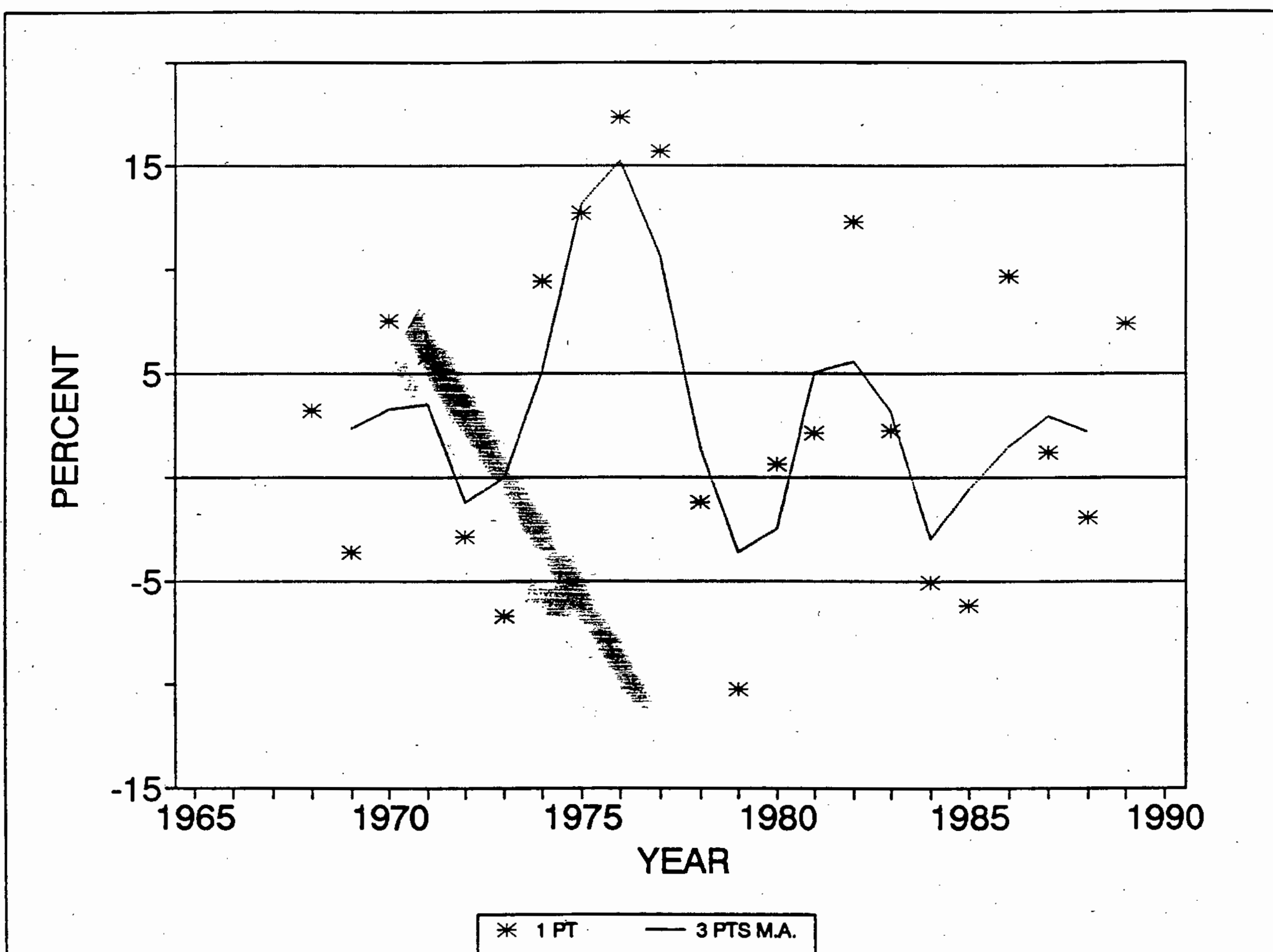


Figure 5. Gross domestic product growth rate: percentage per year (Real 1985)

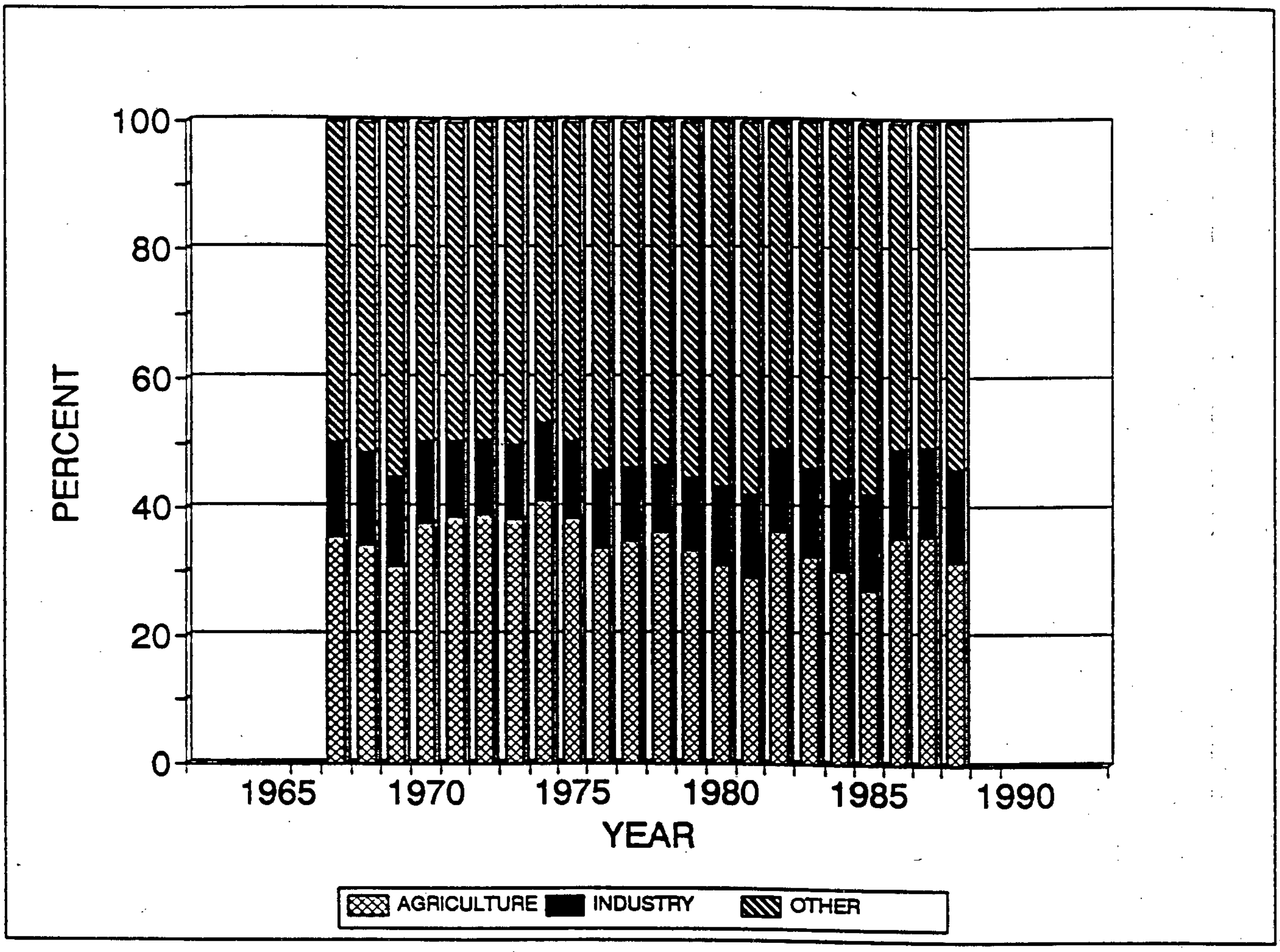


Figure 6. GDP components as percentage of total

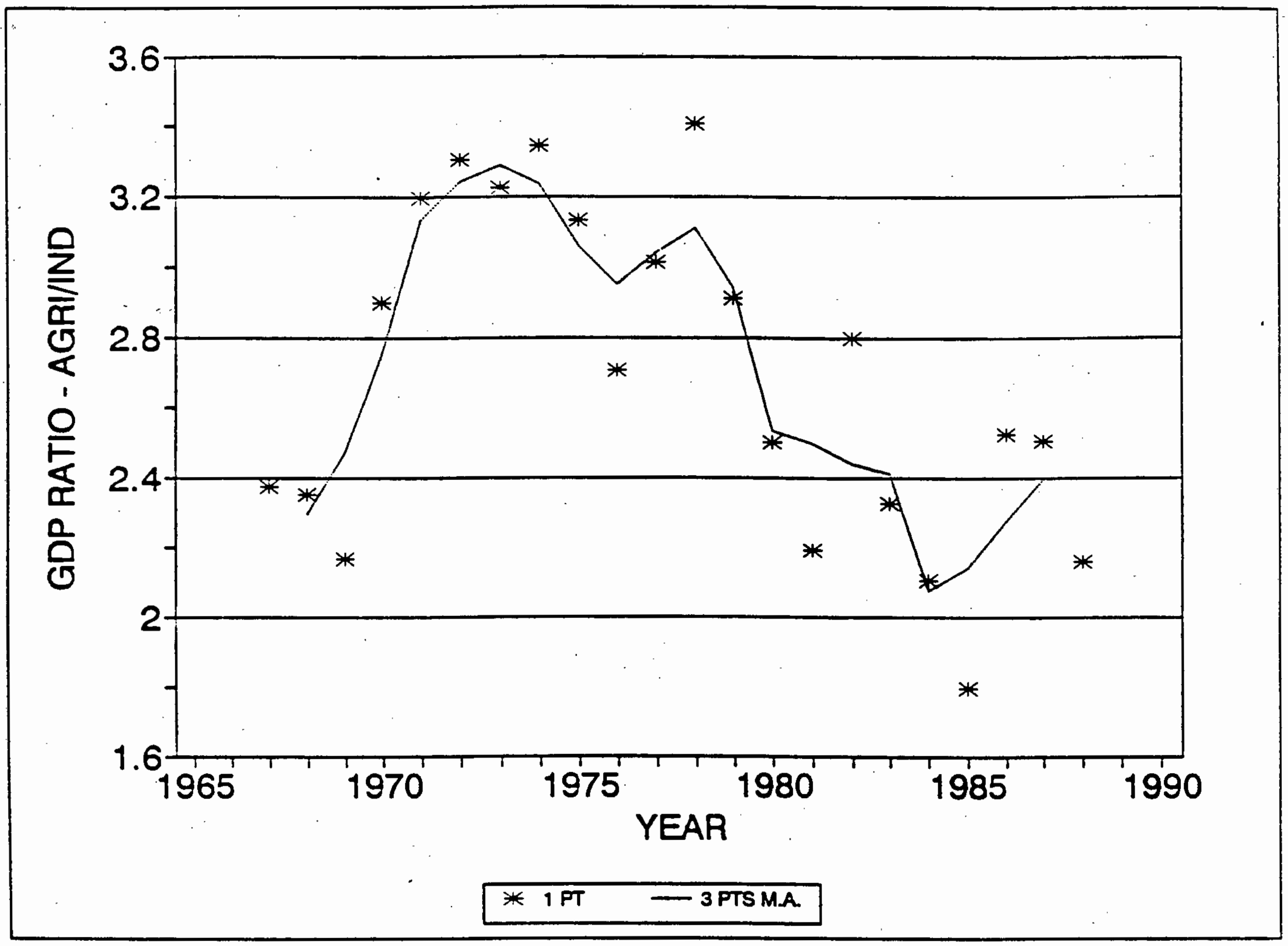


Figure 7. GDP ratio: Agriculture / Industry

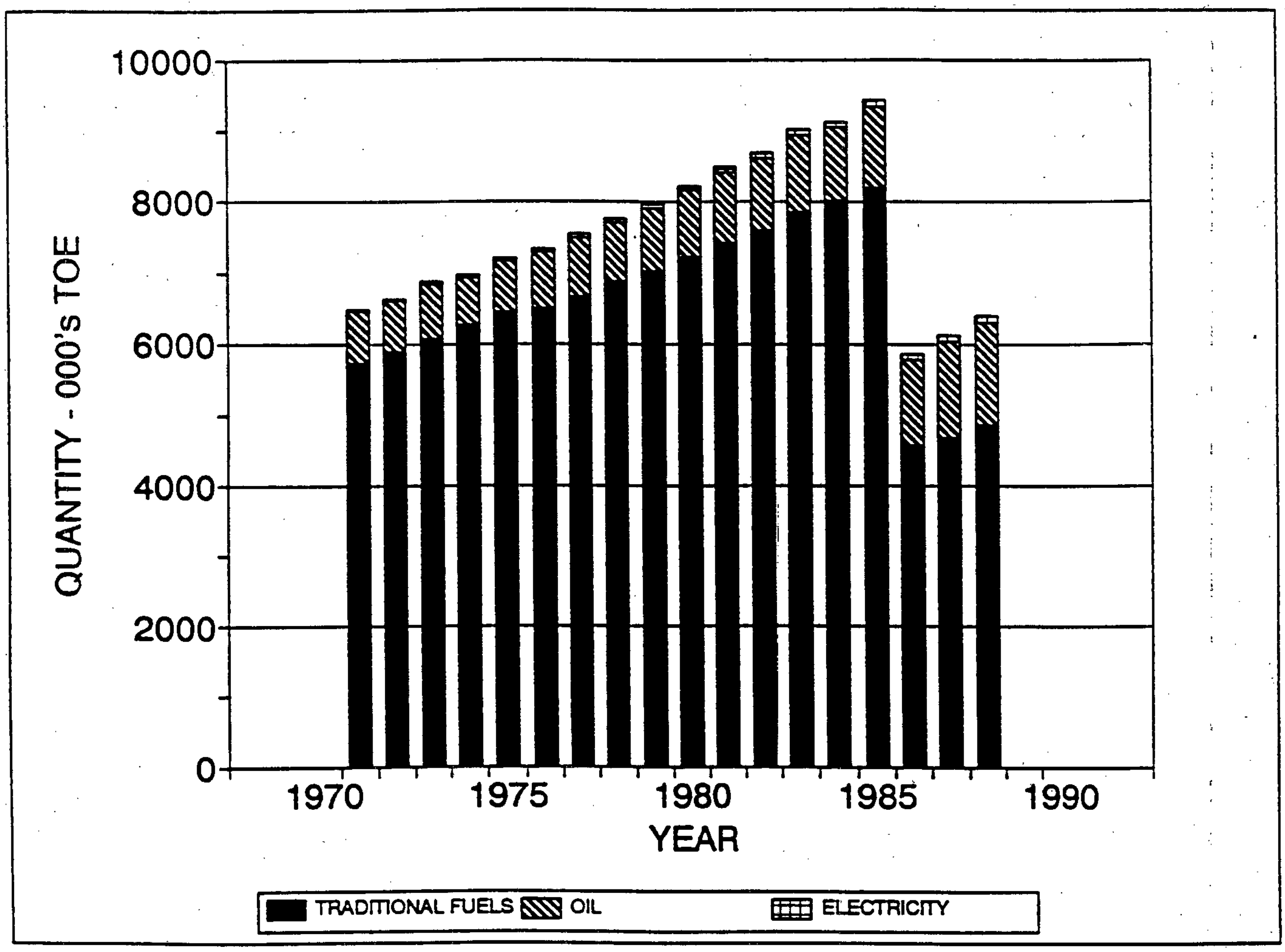


Figure 8. Total final consumption: quantity shares of components

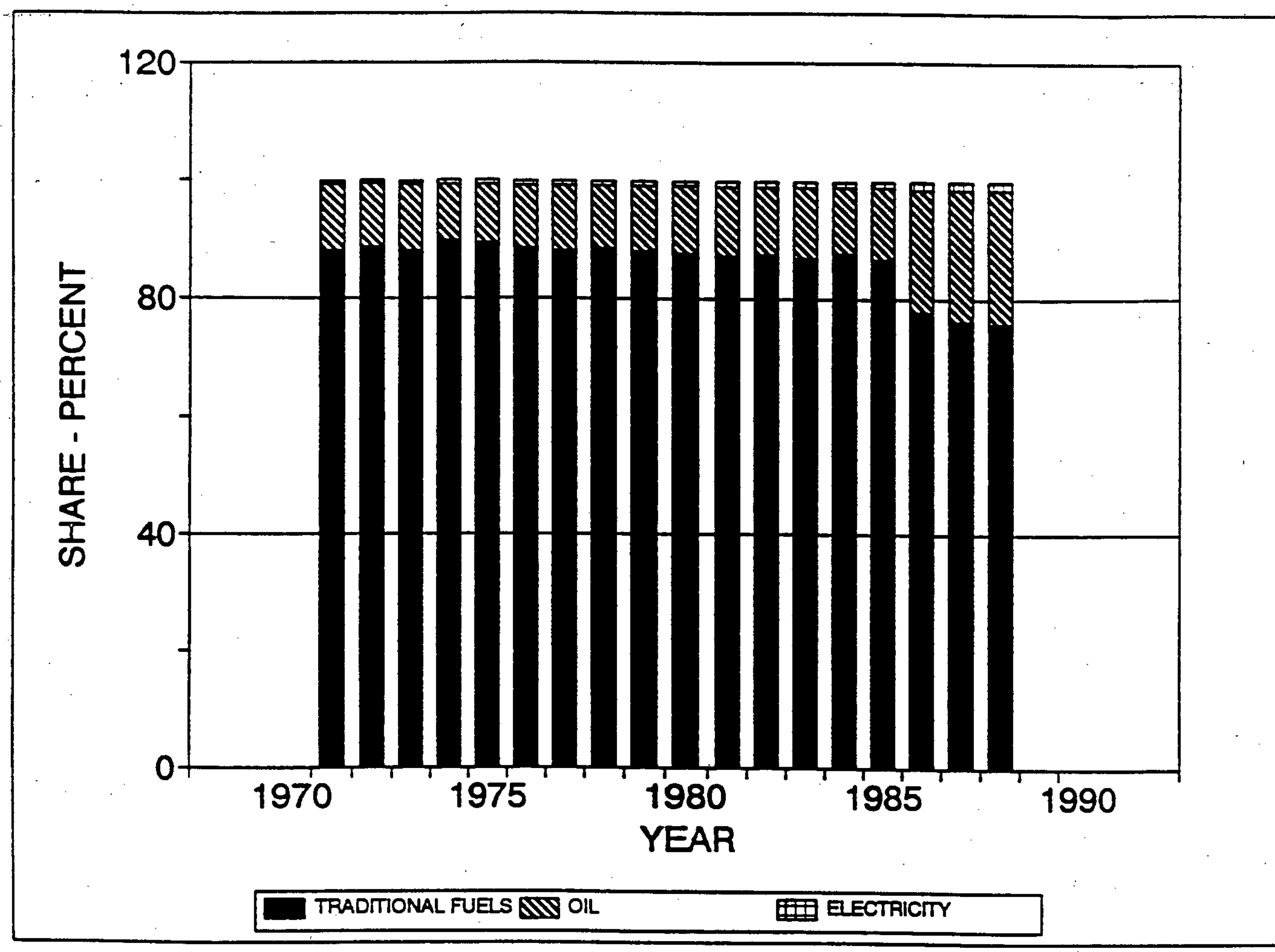


Figure 9. Total final consumption: percentage shares of components

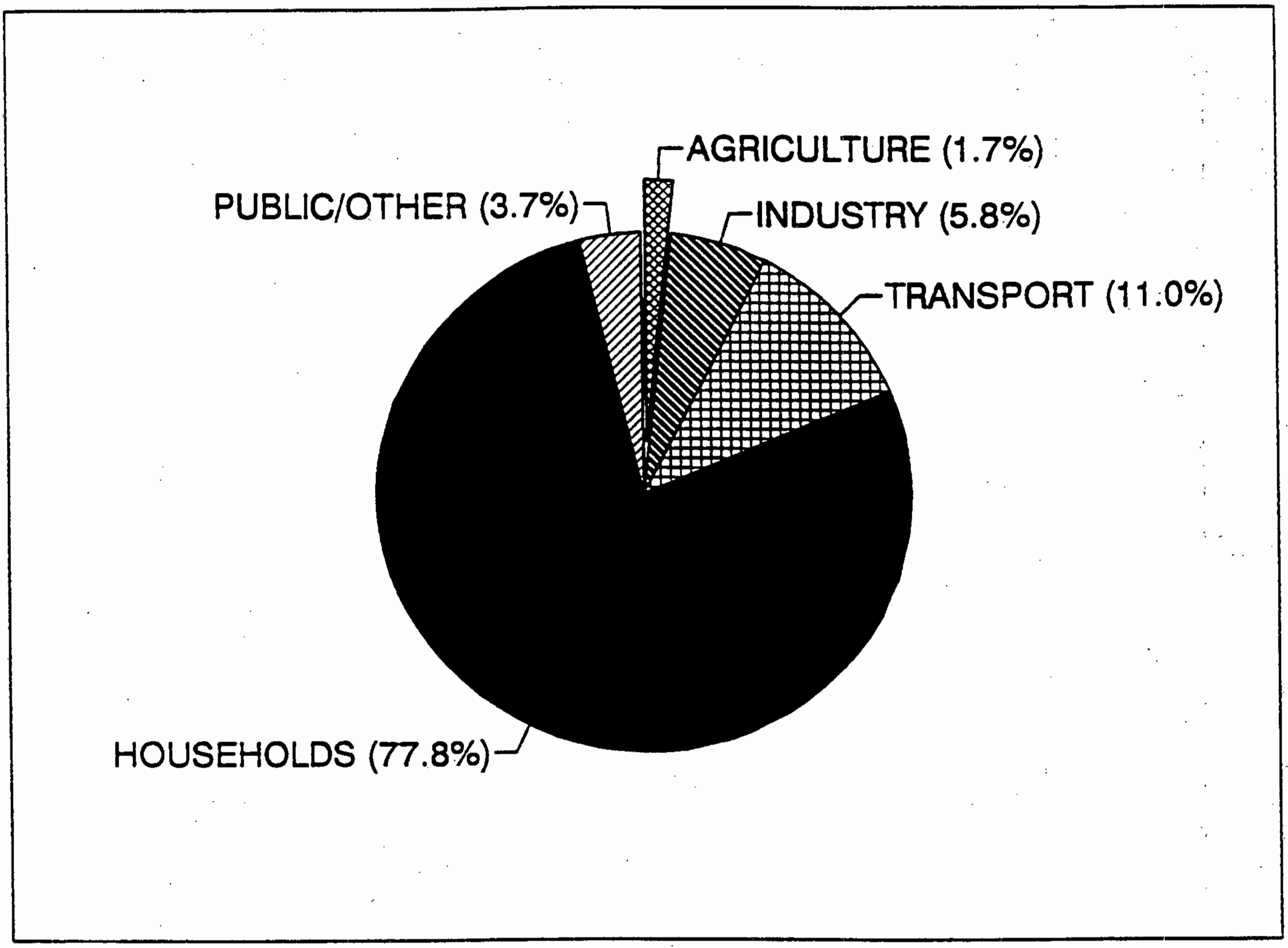


Figure 10. Total final consumption (Trad. + Com.): Breakdown of 1981

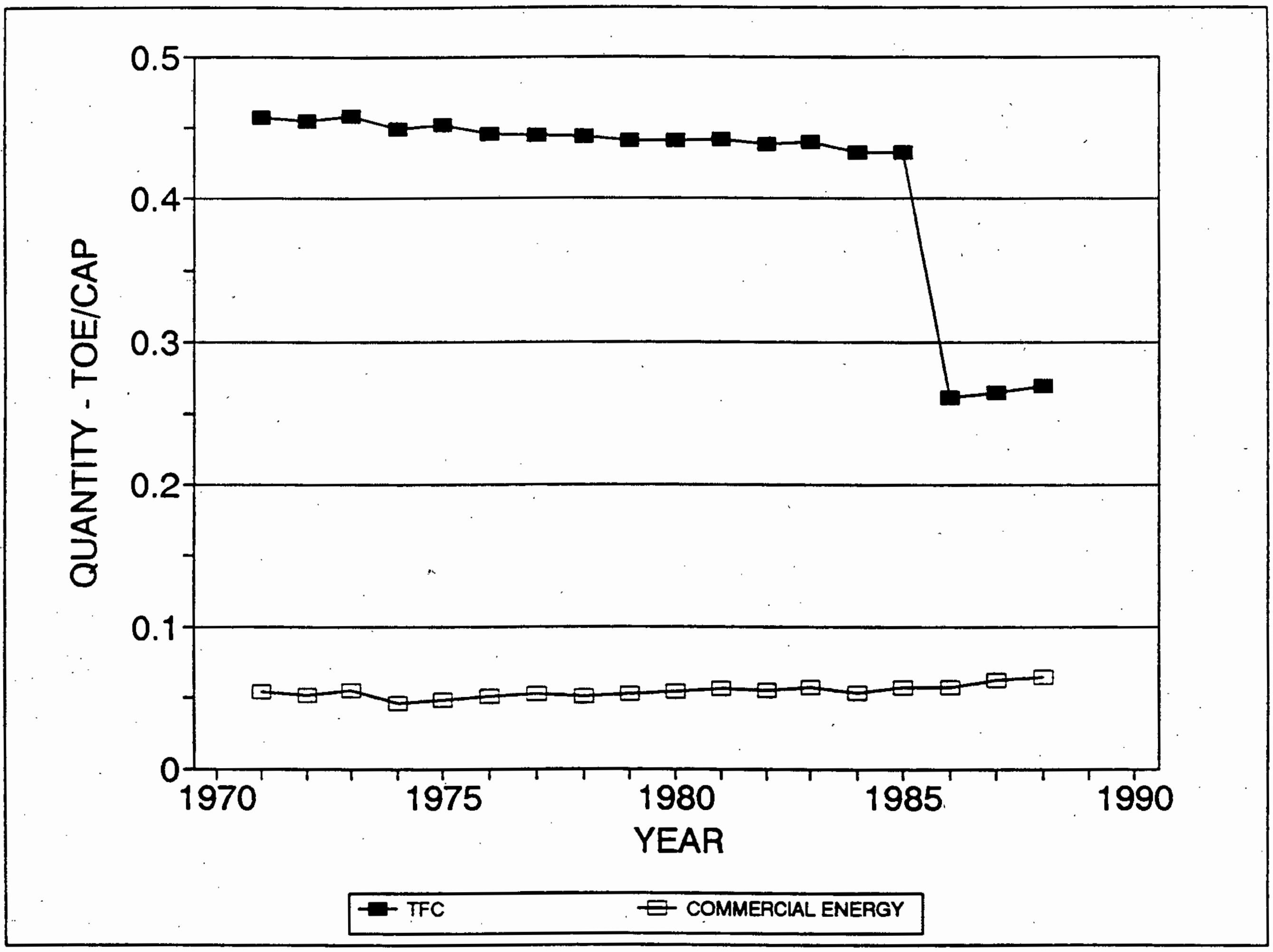


Figure 11. Energy final consumption per capita

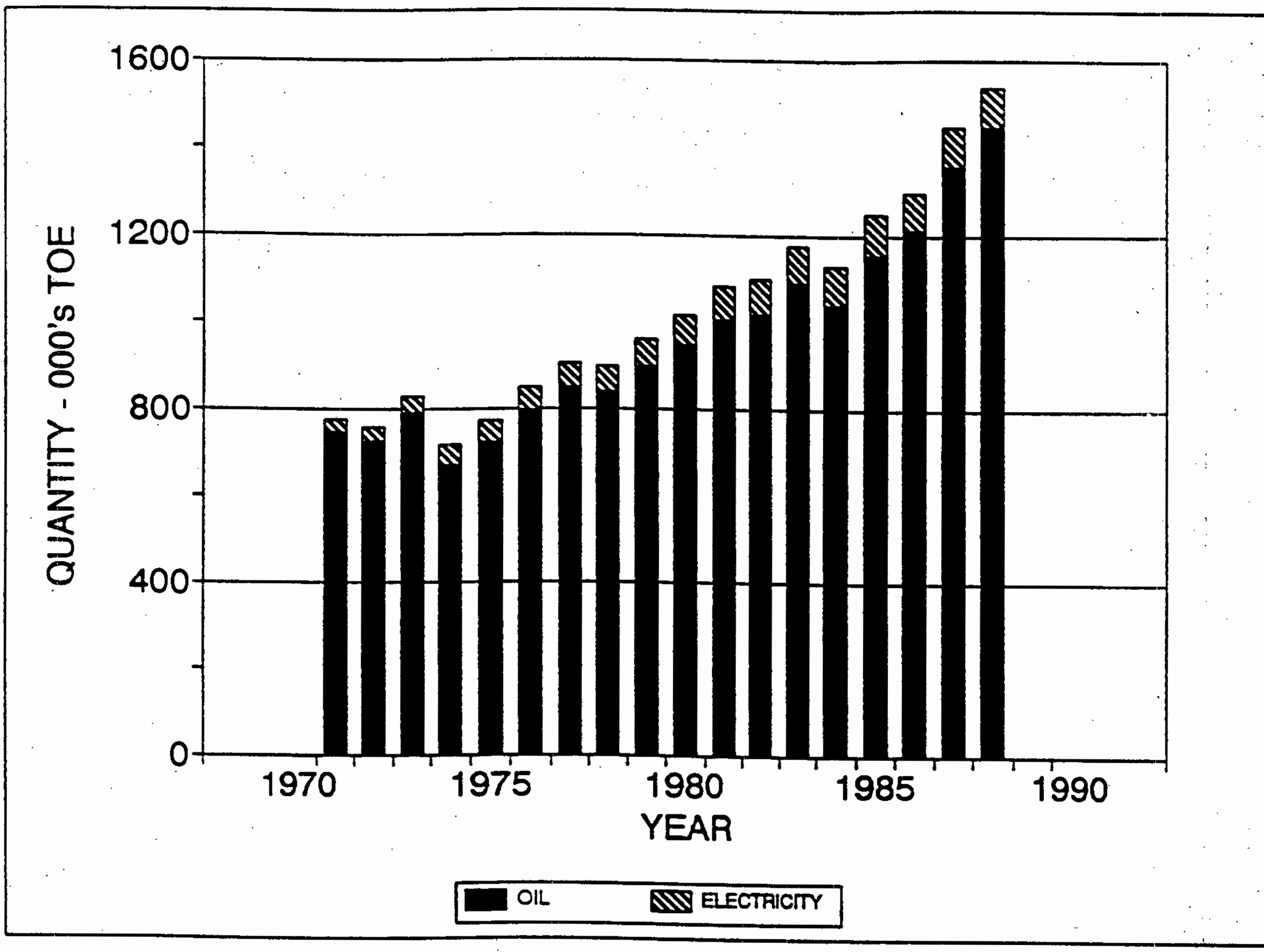


Figure 12. Commercial energy final consumption: quantity shares of components

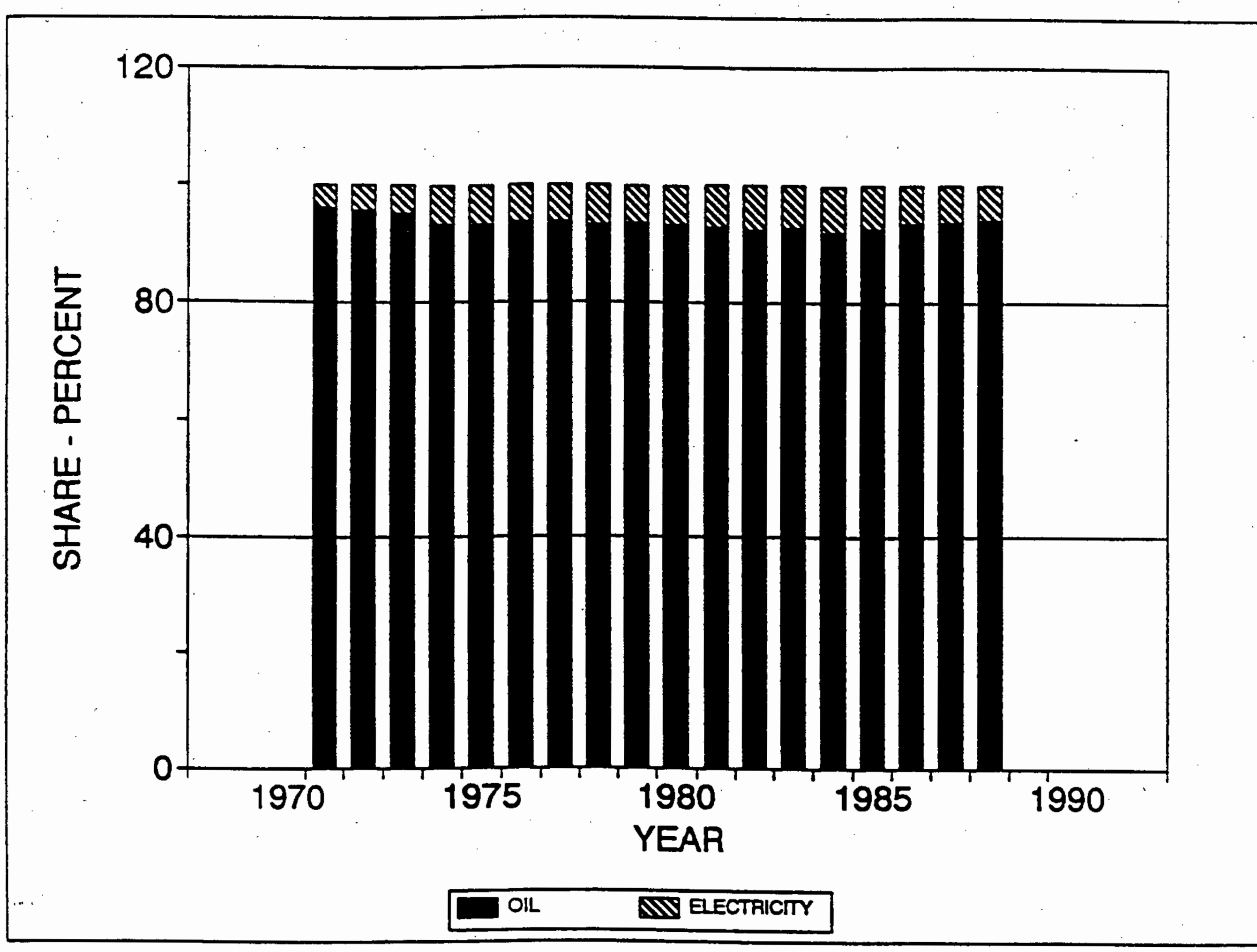


Figure 13. Commercial energy final consumption: percentage shares of components

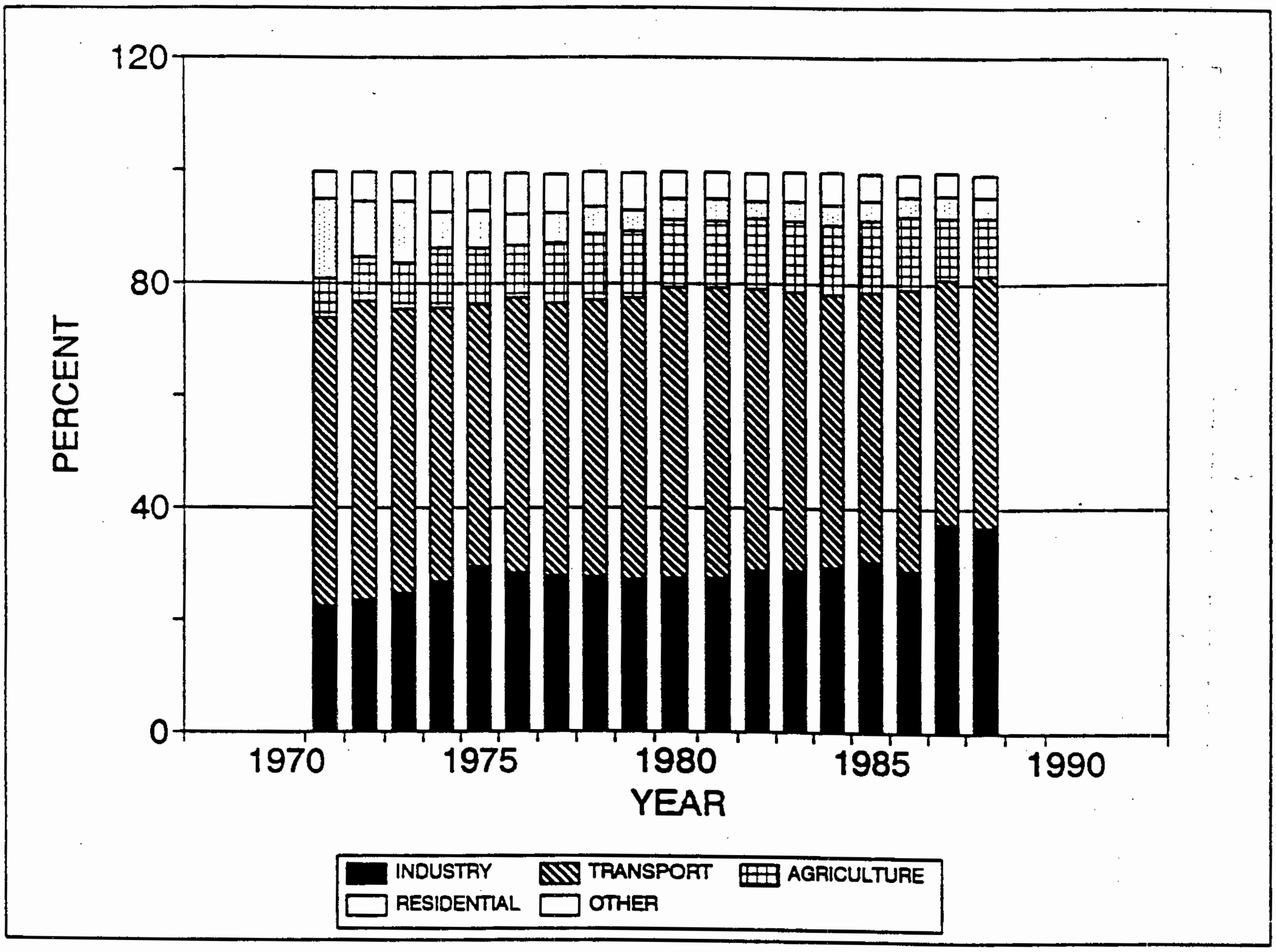


Figure 14. Commercial energy final consumption: Sectorial breakdown (%)

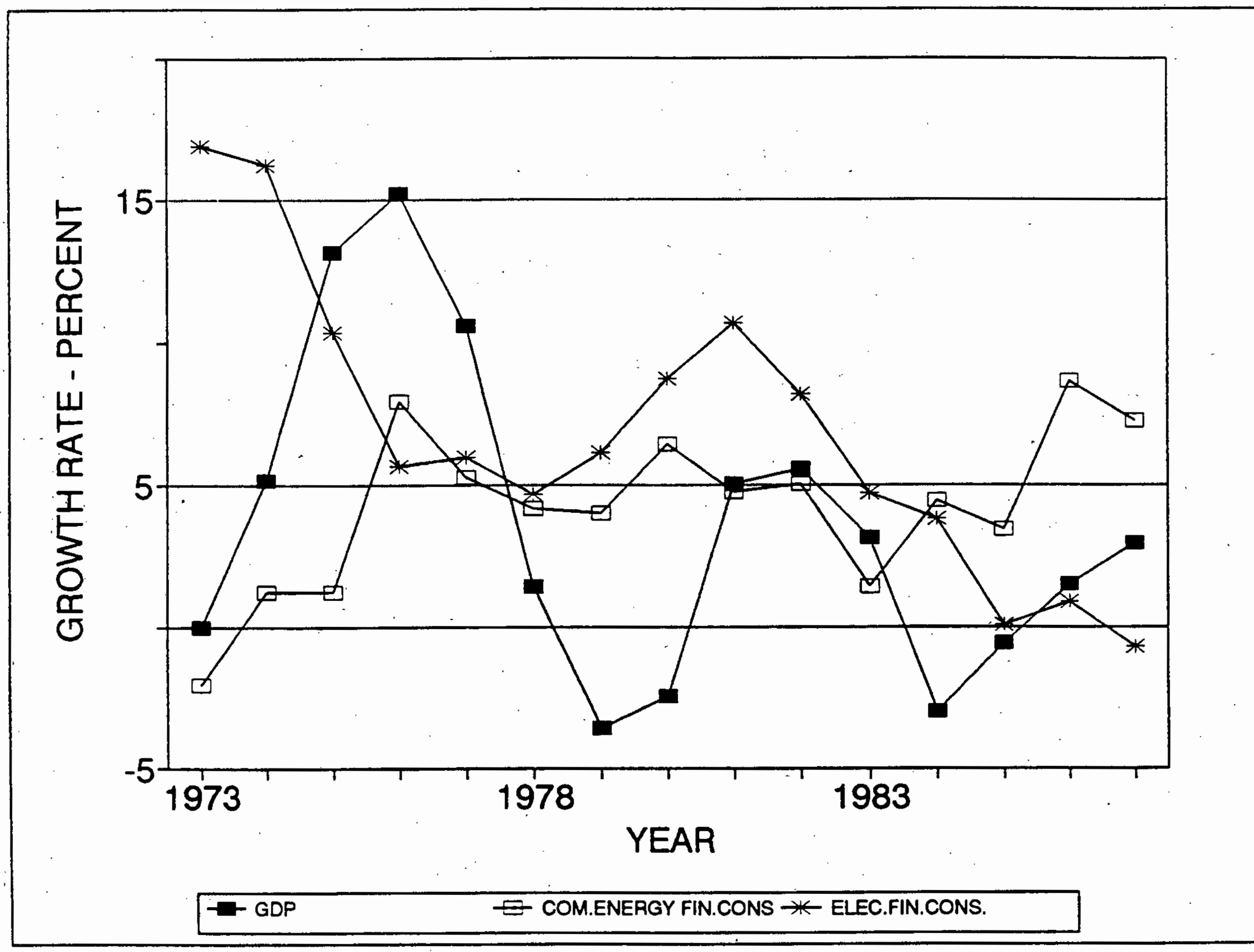


Figure 15. Growth rates (3 pts M.A.)

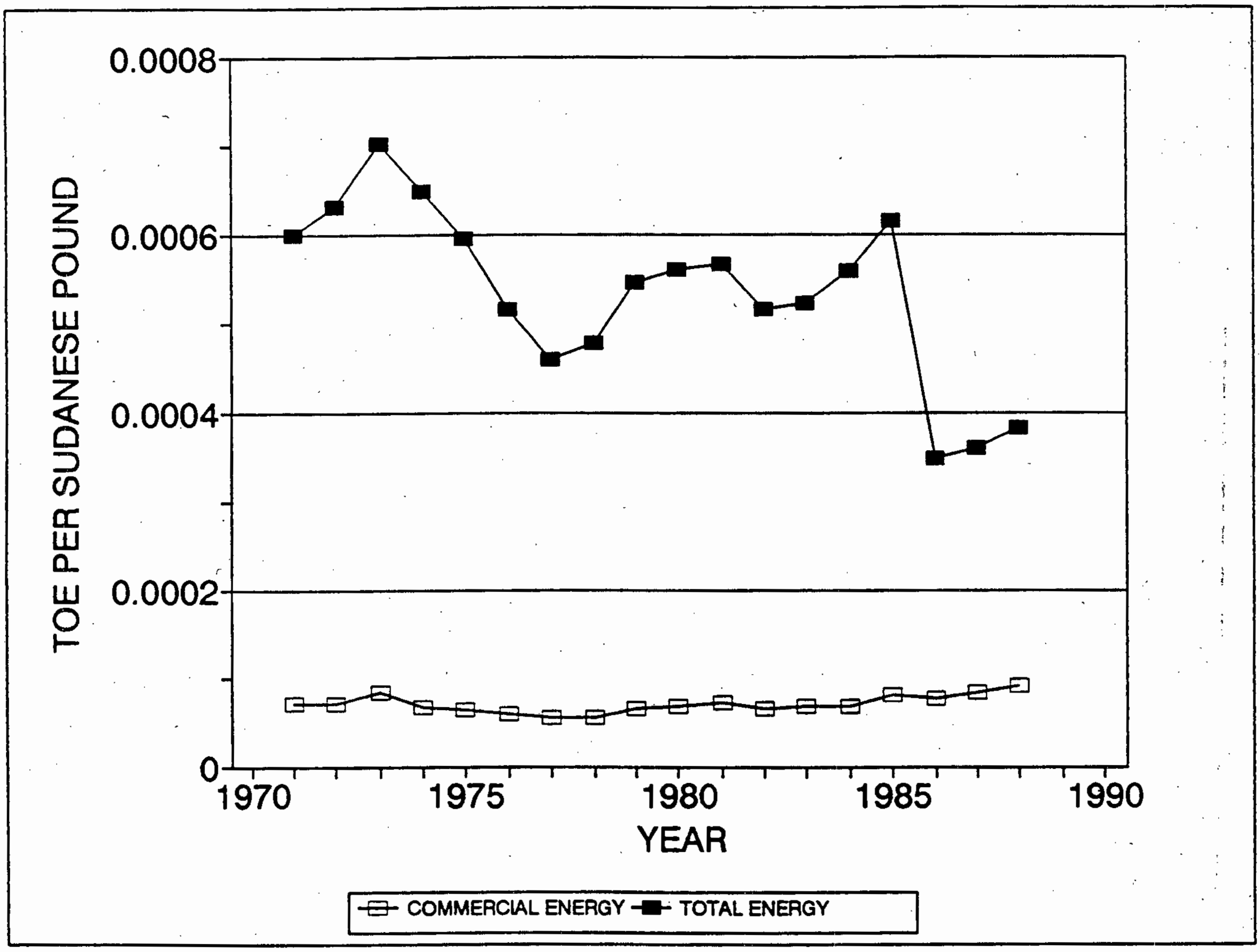


Figure 16. Energy intensity: final consumption / GDP (Real 1985)

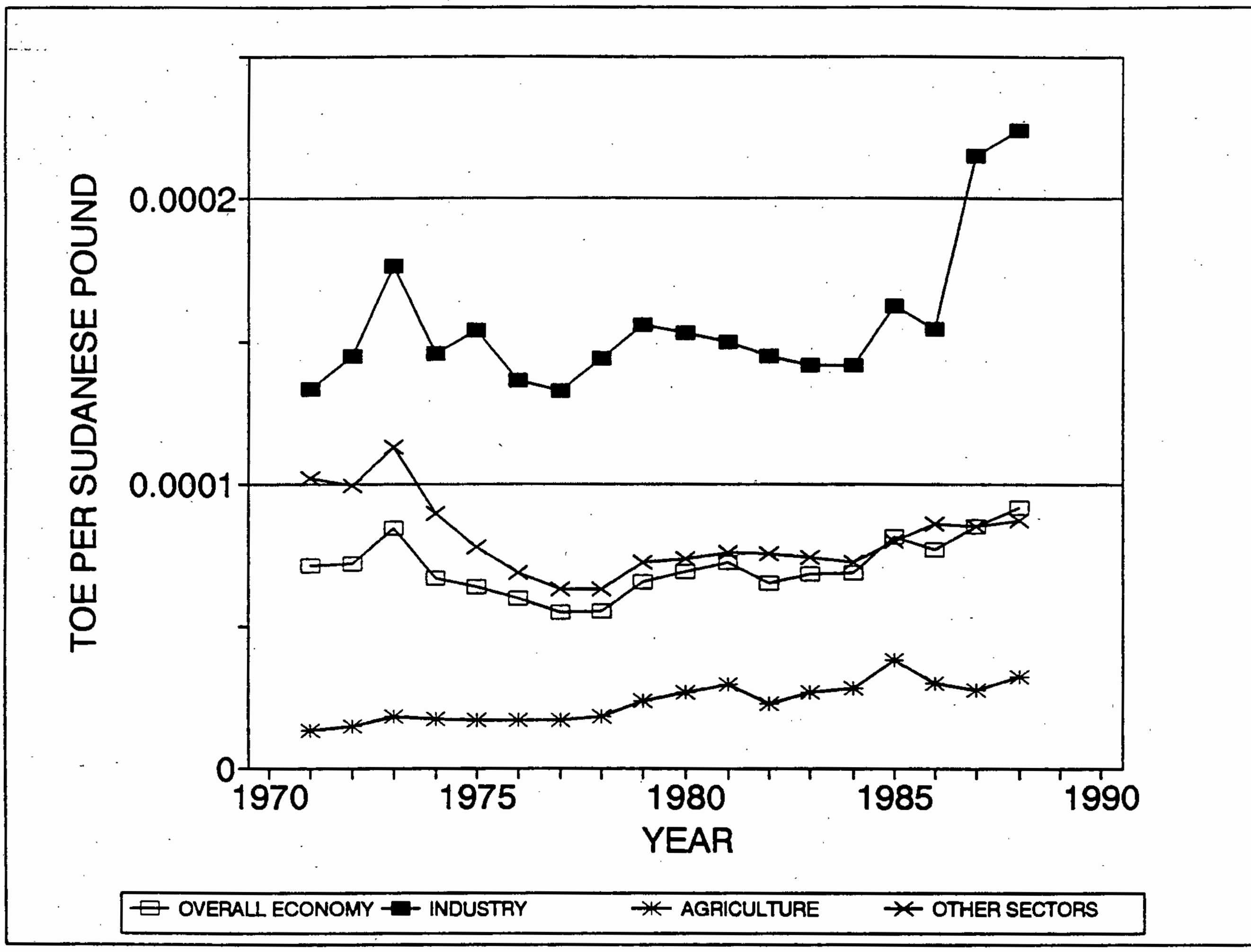


Figure 17. Commercial energy intensity: commercial energy final consumption / GDP (Real 1985)

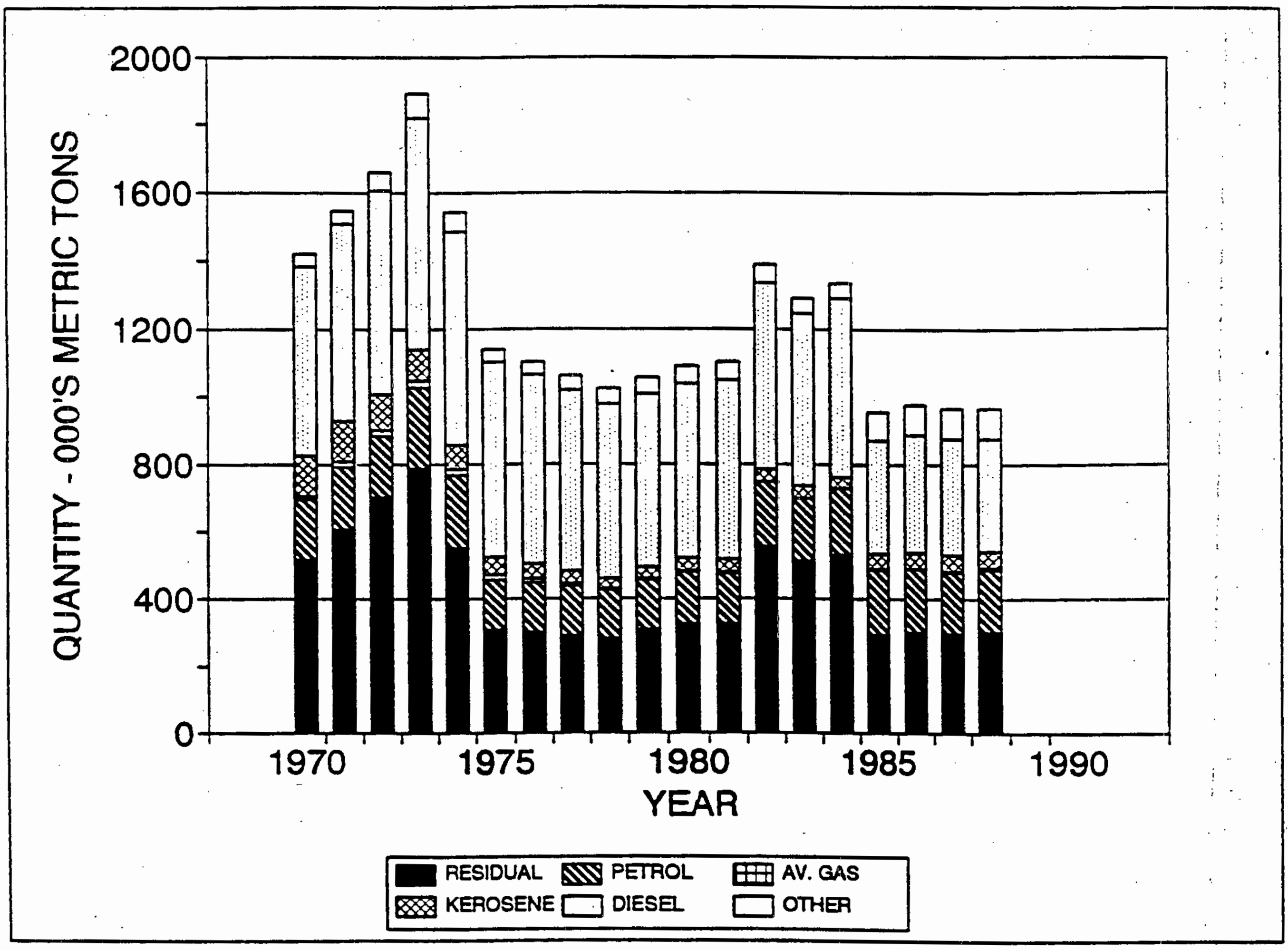


Figure 18. Oil products consumption

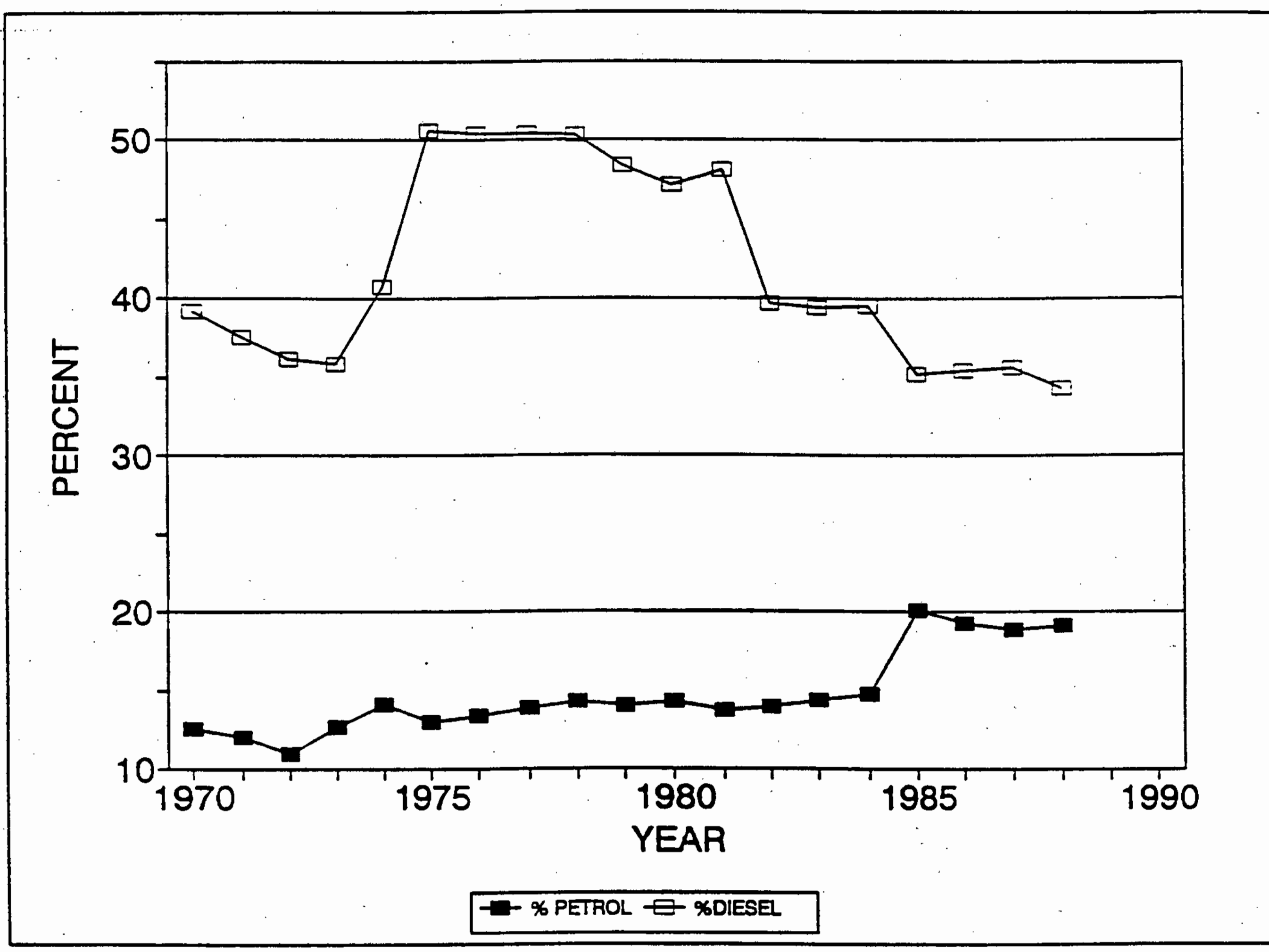


Figure 19. Petrol and diesel as a percent of oil consumption

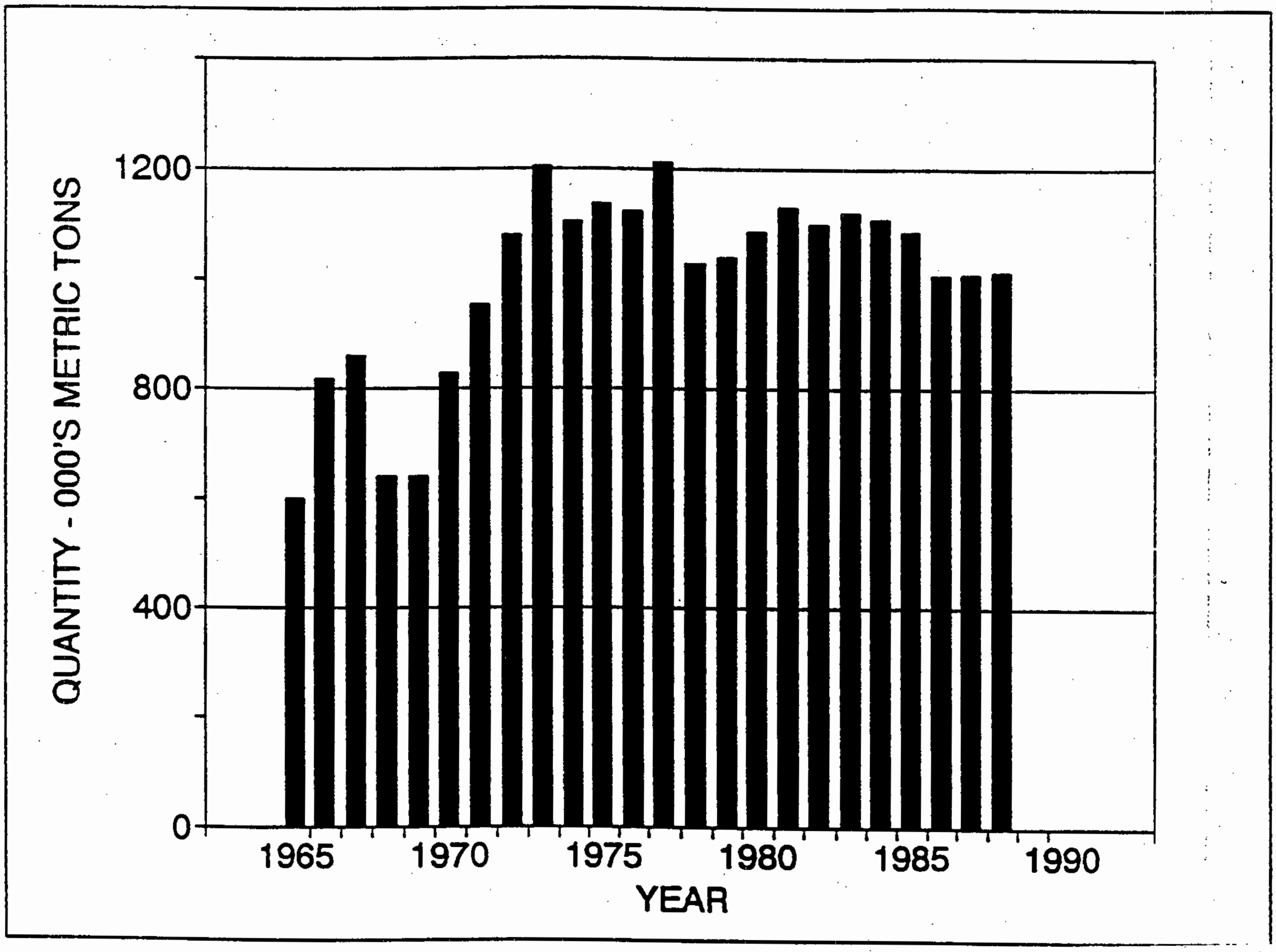


Figure 20. Crude oil consumption

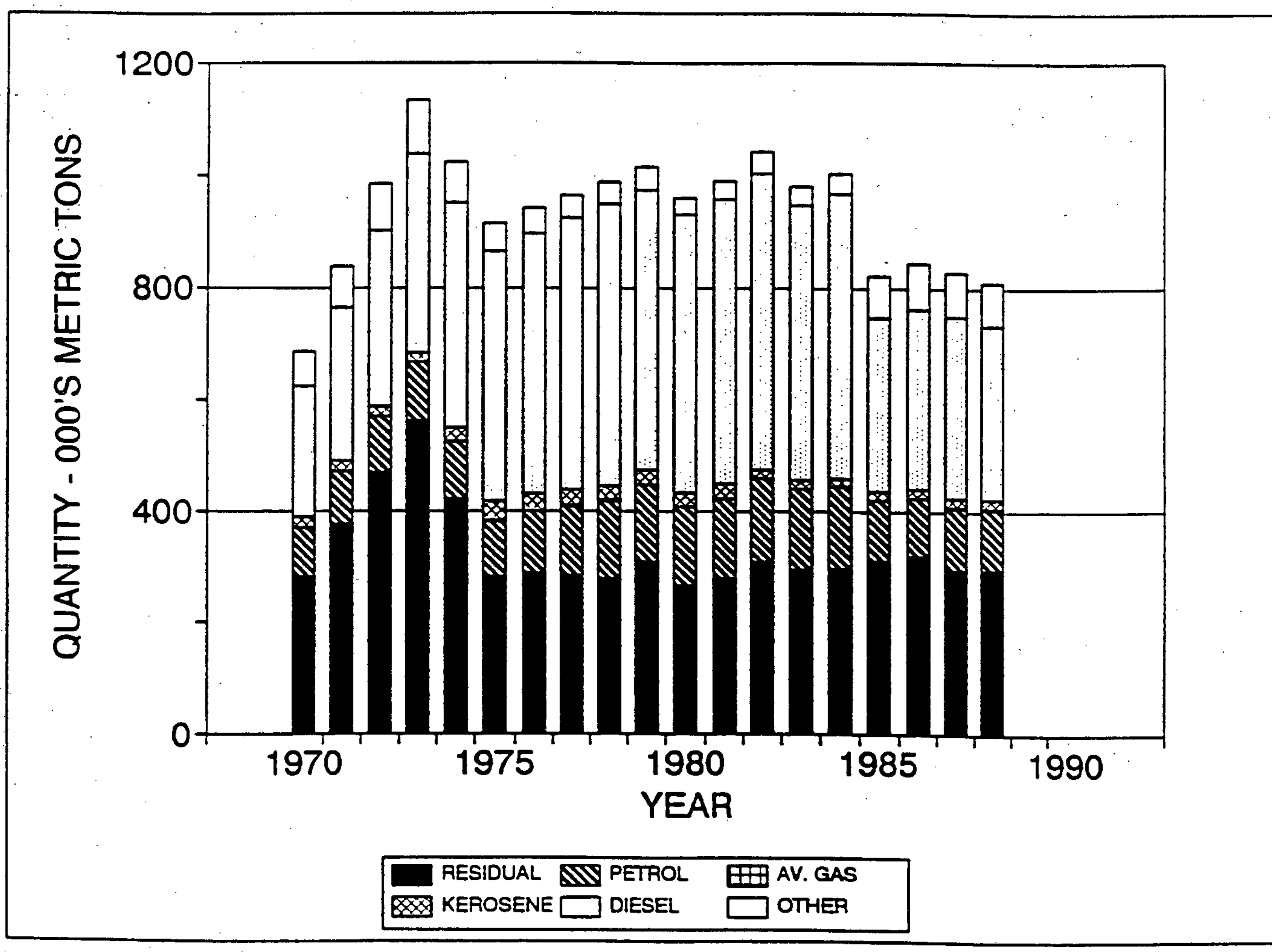


Figure 21. Production of oil energy products from refineries

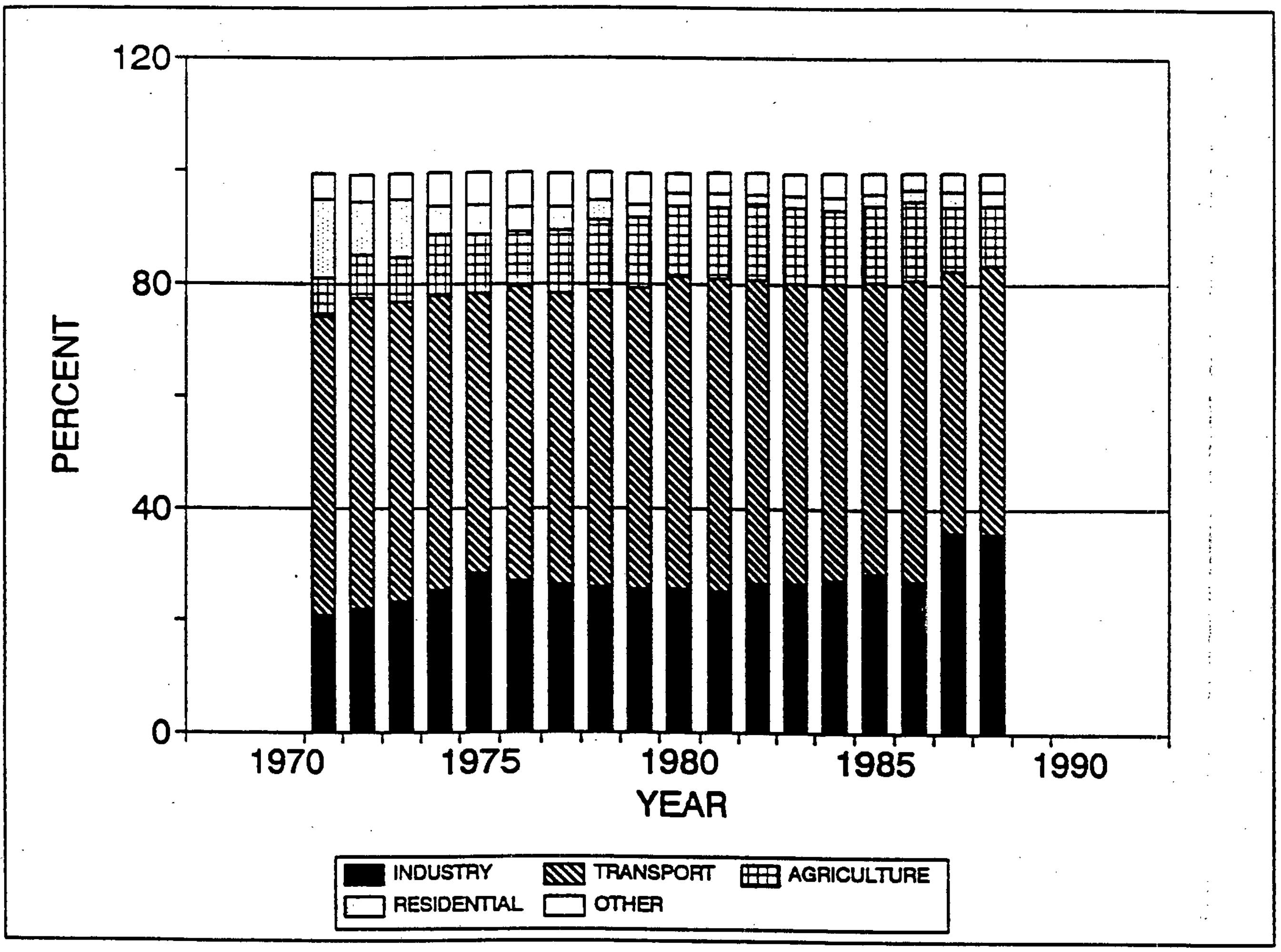


Figure 22. Oil final consumption sectorial breakdown (%)

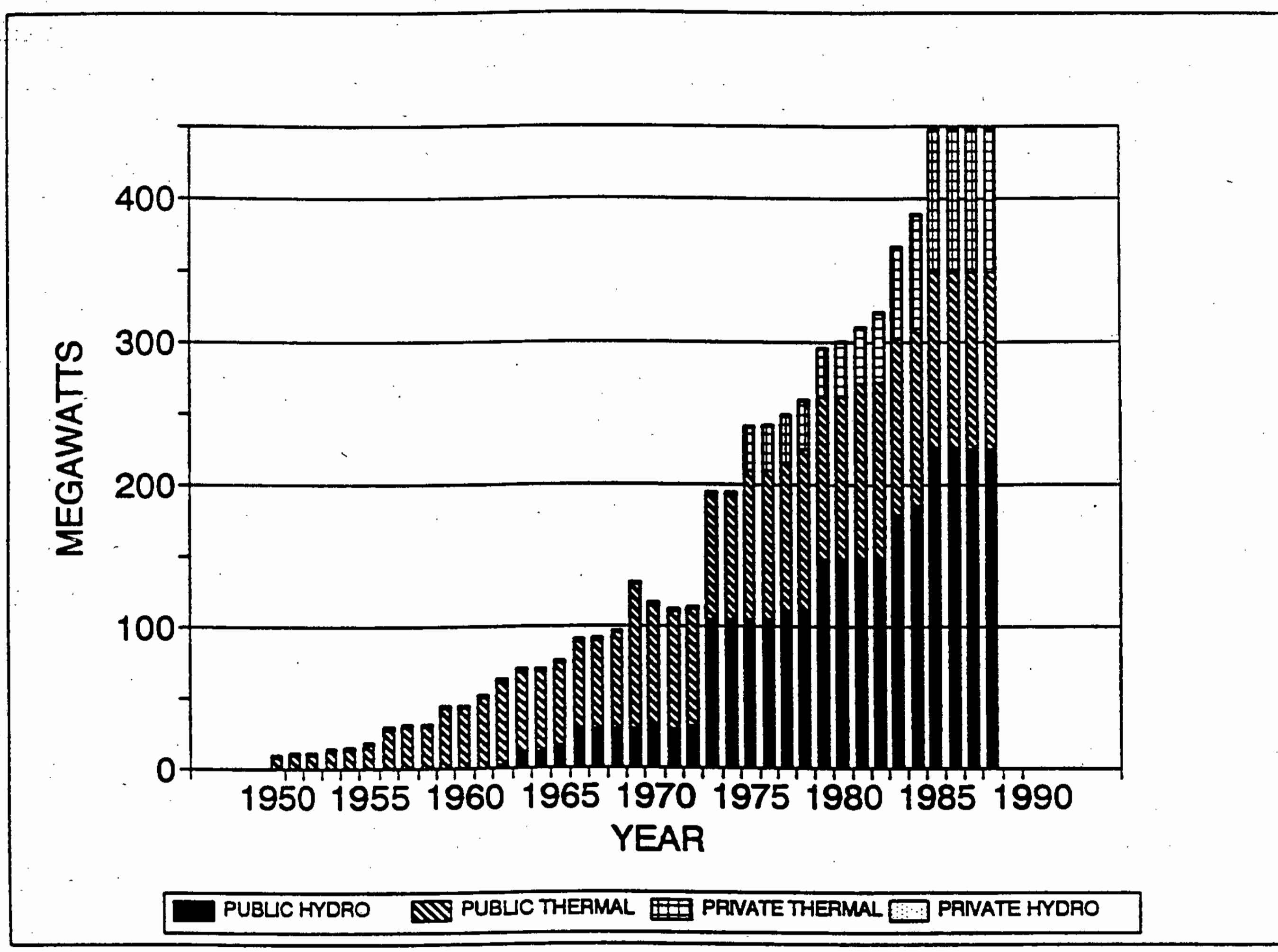


Figure 23. Electrical installed capacity

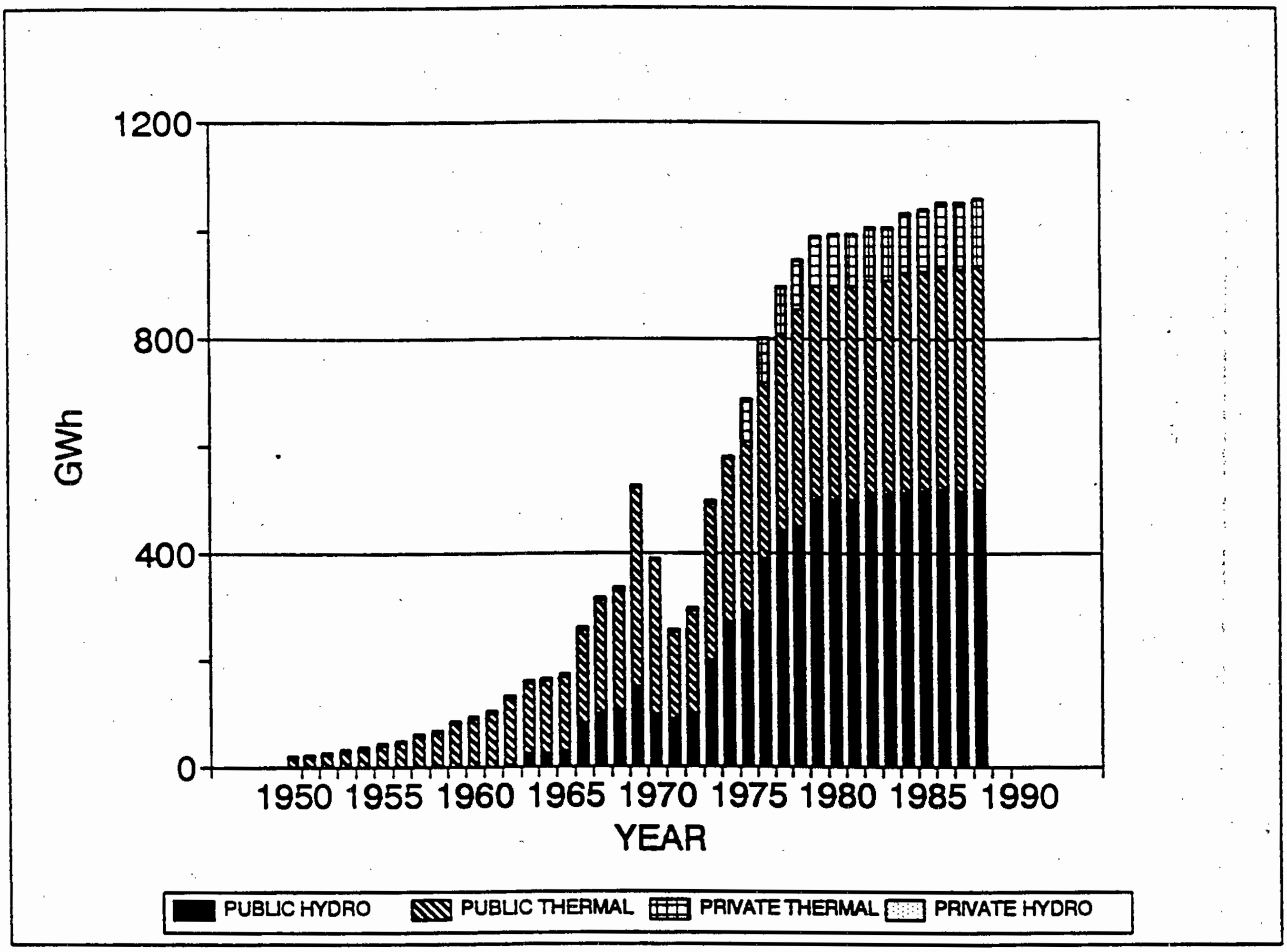


Figure 24. Electricity production

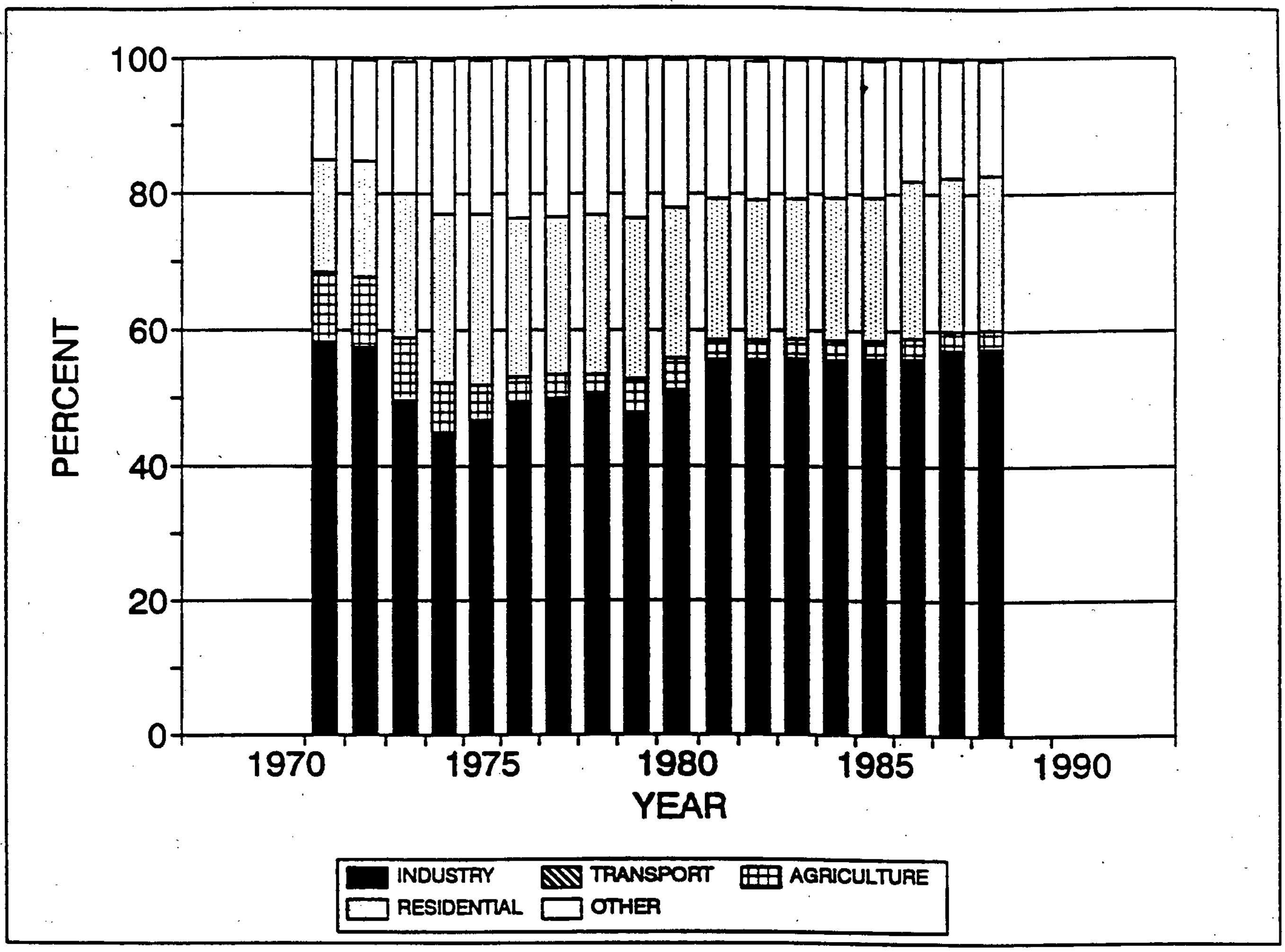


Figure 25. Electricity final consumption: Sectorial breakdown (%)

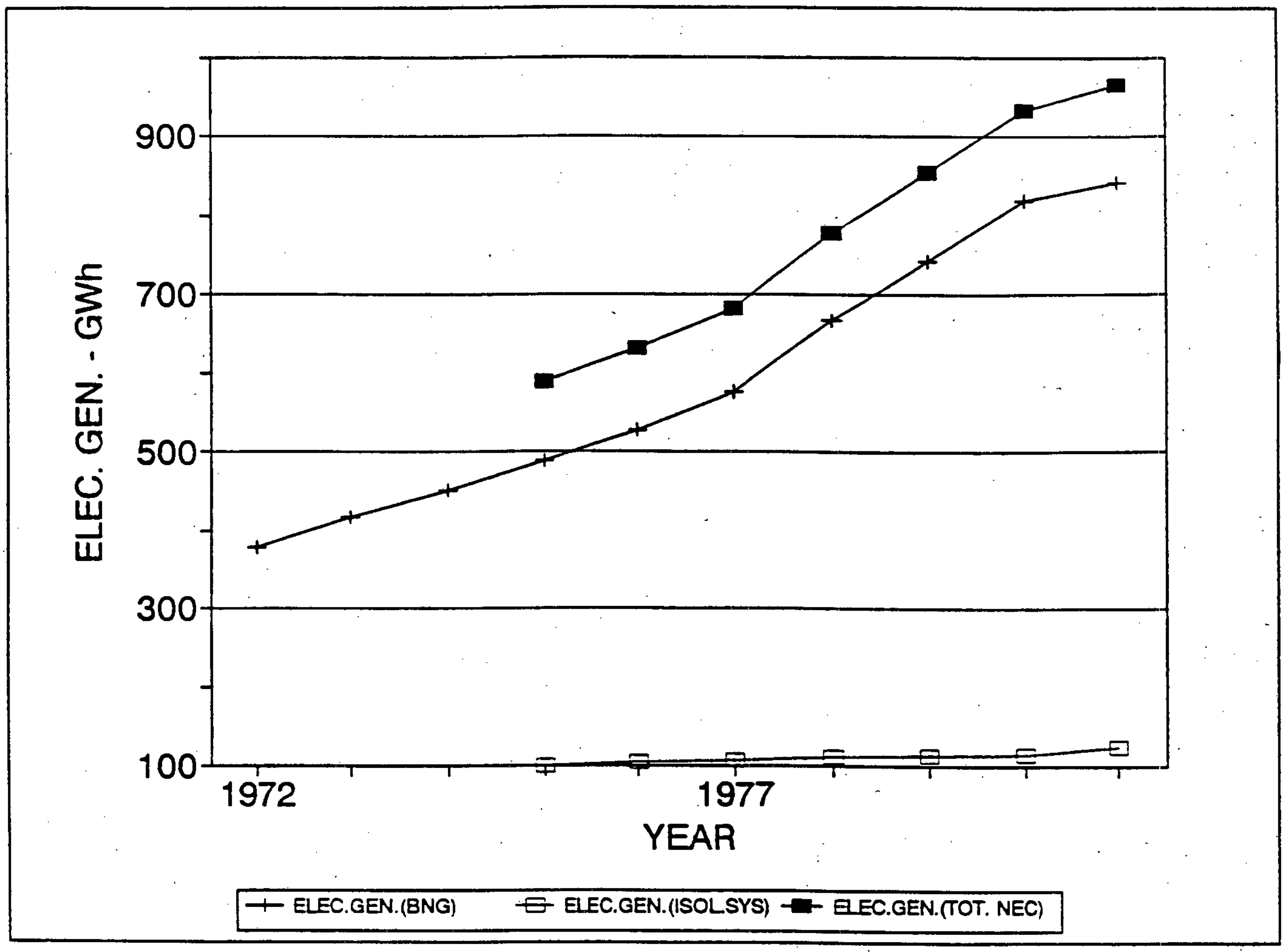
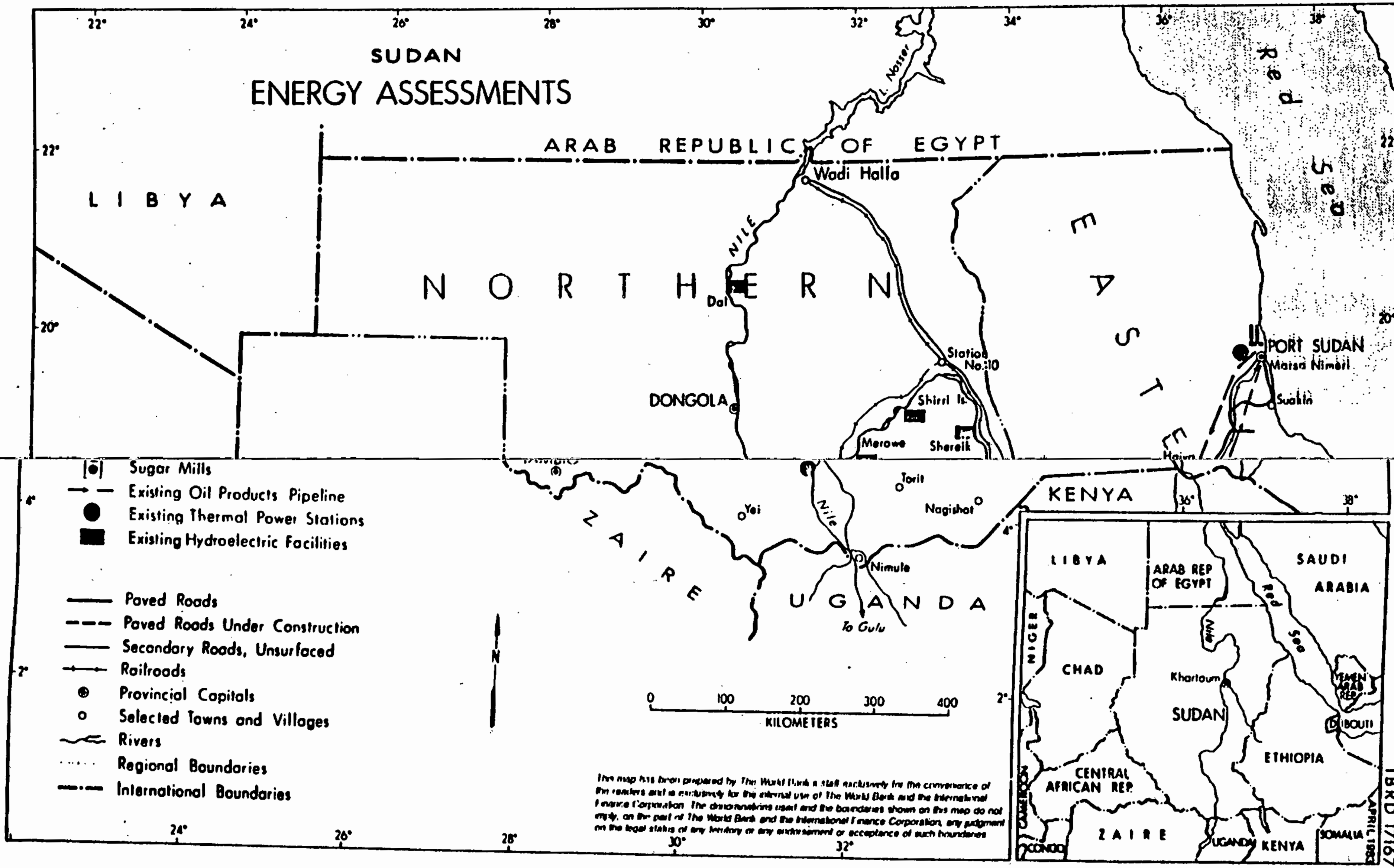


Figure 26. NEC's electricity generation and maximum demand

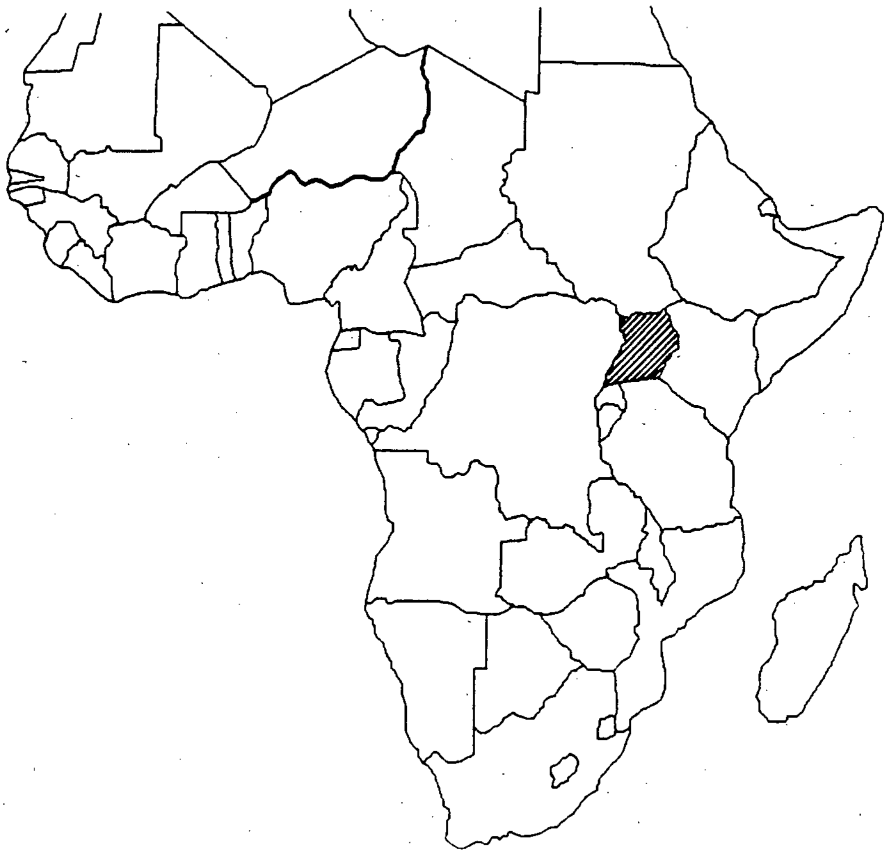
MAP



This map has been prepared by The World Bank's staff exclusively for the convenience of the readers and is exclusively for the internal use of The World Bank and the International Finance Corporation. The denominations used and the boundaries shown on this map do not imply, on the part of The World Bank and the International Finance Corporation, any judgment on the legal status of any territory or any endorsement or acceptance of such boundaries.

UGANDA

1. INTRODUCTION



2. COUNTRY PROFILE

2.1 Introduction

Uganda is made up of ancient kingdoms, of which Buganda was the dominant one. It was brought under British administration in 1888 by the Imperial British East Africa Company. Its various kingdoms were declared protectorates between 1894 and 1916. The powerful province of Buganda was recognized as a native kingdom under its kabaka (king). In return for this privileged position of semi-independence, the British used the Baganda leadership to extend British control over the territory.

In 1961 the country was granted an internal self-government with federal status for Buganda. A coalition of two parties, the Uganda People's Council (UPC) and the Kabaka Yekka (YK), formed the government under the leadership of Dr Milton Obote. Buganda's king, Mutesa II, was appointed future president of the country. This took effect in the following year when Uganda became a republic. The country became a fully independent member of the Commonwealth on 9 October 1962, after nearly 70 years of British rule. In 1966 Obote deposed the president, suspended the 1962 constitution and transferred all the executive powers to himself. The new constitution, finalized on 8 September 1967, established a unitary republic and abolished all traditional rulers and legislatures. National elections were postponed until 1971.

General Idi Amin, the army commander, seized power from Dr Obote early in 1971. His dictatorial rule, which lasted eight years, shattered both the economy and the political cohesion of the country. British companies were nationalized without compensation. Nearly all of the 45 000[(1)] Asians, many of them strongly involved in commerce and industry, were expelled. Bloody purges, successive factional quarrels, political murders and disappearances were common. As many as 300 000[(1)] of his opponents were reported killed. Meanwhile, Ugandan exiles formed the Ugandan National Liberation Front (UNLF), led by Dr Yusuf Lule. Following risings and military intervention by Tanzanian troops, assisted by UNLF members, Amin was overthrown in 1979.

The post-Amin period has been marked by political instability. Yusuf Lule's and Godfrey Binaissa's governments were short-lived. Following elections in 1980, Dr Obote became president, but he was ousted on 27 July 1985 by elements of the Military Commission (military arm of the UNLF). The military coup was led by senior officers, primarily from the Acholi ethnic group. An Interim Military Government (IMG) was installed. General Tito Okello Lutwa, formerly chief of the defence forces, became head of state and chairman of the Military Council. The IMG attempted to negotiate a power-sharing agreement with the National Resistance Movement (whose military arm, the National Resistance Army (NRA), was led by Yoweri Museveni). A peace accord was signed between the IMG and the NRA under the chairmanship of President Daniel Arap Moi of Kenya on 17 December 1985. However, the NRA drove out Tito Okello by early 1986 and installed its leader Museveni as president.

2.2 Geographical situation and demography

Uganda is a land-locked country in East-Central Africa, straddling the equator. It has a total land area of 241 139 km^2, including 44 081 km^2 of water and swamp. It shares its international borders with 5 neighbours: Sudan to the north, Kenya to the east, Tanzania and Rwanda to the south, and Zaire to the west.

The population was estimated at 16,2 million in 1988[2]. Figure 1 gives the population and the population growth on a yearly basis over the period 1967-88. The overall population density is 67 per square kilometer. The most populated areas are the central plateau north and west of Lake Victoria and the slopes of Mount Elgon. Elsewhere, settlement is sparse. The population is very young with 47% under the age of 15. The average life expectancy between 1985 and 1990 was 51 years. The literacy levels were 45% among adult females and 70% among adult males in 1985[3]. The labour force totalled 5,7 million in 1985, of which 83% were involved in agriculture, 6% in industry, and 11% in services[4]. With the high incidence of the Acquired Immunodeficiency Syndrome (AIDS), it is likely that present population patterns will be seriously affected.

The population is overwhelmingly rural, with only 14% living in urban areas. One-third of the urban population is concentrated in Kampala. The urban population is increasing rapidly at a rate estimated to be 7,3% per annum. The population consists of approximately 40 tribes grouped into four large language categories: the Bantu-speakers (two-thirds of the population, mainly in the centre and the south); Western Nilotic (15%); Eastern Nilotic (12%), and Central Sudanic (5%)[4].

2.3 Economy

Uganda has a free-market economy in which the private sector is dominant. In terms of income it is not a rich country. Its GDP and GDP per capita are given in Figs 2 and 3 respectively. The economic activity is concentrated in the "fertile crescent" extending to the west from Lake Victoria. This productive belt includes Kampala the capital, the main industrial centre of Jinja, and the coffee/banana growing areas of the Buganda region[5].

The economy was once one of the strongest and most promising in Sub-Saharan Africa. The economic war declared by Idi Amin with its hasty nationalizations, prolonged mismanagement, and sustained neglect destroyed it. The political instability brought about by the successive changes of the post-Amin governments never allowed the economy to recover. As can be seen in Figs 4 and 5, the growth rates of GDP and GDP per capita have shown significant declines. The decline reached its maximum in 1979 with the disruption related to Amin's downfall. GDP and GDP per capita grew after 1980, but declined again due to the civil war in the country. Agricultural production began to recover with the relative peace within the country achieved since the assumption of power by Museveni.

The quantity and percentage shares of the various economic sectors in the GDP are given by Figs 6 and 7 respectively. The economy is dominated by agriculture which accounts for about 95% of the country's export earnings and 55% of the GDP, and provides more than 65% of government revenue[6]. Coffee (mainly Robusta) is the major cash crop, followed by cotton (4,1% of total export earnings in 1985), tea, and tobacco. The principal food crops are plantains, cassava, sweet potatoes, finger millet, sorghum, maize, beans, and groundnuts. The prevalence of the tsetse fly in over 30% of the land surface is the major obstacle to the extension of cultivation and herding.

The industrial sector is small in terms of income generation, as reflected by the GDP ratio agriculture/industry (see Fig. 8). In the past, it made a valuable contribution towards supplying the domestic market with basic goods and produced a surplus for exportation. The main industries are the processing of cotton, coffee, tea, sugar, tobacco, edible oils and dairy products, grain milling, brewing, vehicle assembly, and the manufacture of textiles, steel, metal products, cement, soap, shoes, animal feeds, fertilizers, paints and matches.

The industrial sector was estimated to be operating at only 15% of its capacity in the late 1980's. Rehabilitation of the sector is very slow. The government claimed in August 1987 that more than 20 major industries were operating at above 30% capacity and several were operating at more than 50%[6]. According to estimates by the World Bank, industrial output increased by 1,4% per annum during 1980-87, by 16% in 1987, and by 25% in 1988. Manufacturing decreased by an average annual rate of 0,9% during 1980-87[6]. As shown in Fig. 9, the manufacturing sector's contribution to GDP decreased significantly during Amin's rule (1971-79) and during the civil war (1984-85). It amounted to about 4,8% in 1988.

Mining operations are very limited. The main mineral resource is copper, but the only known deposit at Kilembe is reaching exhaustion and may not be commercially exploitable after the 1980's. There are two known phosphate deposits in the vicinity of Tororo with proven resources of more than 18 million tons. Extraction of small quantities of tungsten, tin and gold, which were mined until the 1970's, has been resumed.

In November 1986, Museveni's government signed an agreement with Lonrho to construct an oil pipeline from the Kenyan border to Kampala and to participate in the marketing of Ugandan coffee and cotton.

Plans to revive the East African Community (EAC) after 15 years of collapse are underway. This economic union, including Uganda, Kenya and Tanzania, was founded on 6 June 1967 and operated successfully under the umbrella of the colonial East African Services Organisation (EASCO) which was established in 1947. The EAC was severely strained following the Tanzanian backing of Obote who had been overthrown by Idi Amin. It collapsed completely in 1977 as a result of more internal squabbles.

3. ENERGY: GENERAL

3.1 Introduction

The energy sector is marked by the predominant use of fuelwoods, on which more than 92% of the population rely completely for all their energy requirements. Petroleum products represent a small proportion of the final energy and account for at least 50% of the total foreign exchange used for imports. Total electricity production is not very large. In 1988 about 599 GWh[7] were generated, of which 110 GWh were exported to Kenya.

Trends in the energy sector have followed economic development. The energy sector has been seriously mismanaged, a process which started under Idi Amin. As a result, the level of commercial energy consumption is low. The country has many interesting energy resources, including hydro-power, geothermal, solar, and wind energy.

3.2 Institutions

The main players in the energy scene are the Ministry of Energy, the Forestry Department, the Uganda Electricity Board (UEB), the Geological Survey and Mines Department, and the oil companies.

In order to assume a broader responsibility in the energy sector, the present government replaced the energy department of the Ministry of Power, Transport and Communication (MPTC) with a Ministry of Energy. Part of its mandate overlaps that of the Ministry of Environmental Protection.

The Forestry Department, under the Ministry of Agriculture and Forestry, is responsible for preserving and managing the existing forests. It also aims at increasing reserves and promoting efficiency in the use of forest products and promoting environmental conservation. Its Forest Research Institute provides training courses in charcoal-making and wood preservation.

The Geological Survey and Mines Department (GSMD) operates under the Ministry of Minerals and Water resources. Prospecting for and mining of all minerals, petroleum and geothermal resources are its responsibility.

The Uganda Electricity Board (UEB) is responsible for the production, transmission and distribution of the public electricity supply in Uganda.

There are many local non-governmental organisations (NGO) involved in the woodfuels sub-sector, such as Usika Crafts, Joint Energy and Environment Projects (JEEP), Black Power Ltd, Wildlife Clubs of Uganda, Boy Scouts of Uganda, etc. The energy institutional structure of the country is weak and poorly co-ordinated. The present administration is trying to correct these shortcomings. A non-government agency known as the Uganda National Energy Development Organization (UNEDO) has been created with government support. UNEDO is expected to address the need to study the energy problems in a more systematic way, to fill the technical manpower gap in the Ministry of Energy, and to streamline the operational bottlenecks of the organisations involved in energy sector activities(8).

4. ENERGY RESOURCES

4.1 Traditional fuels

In 1983 forests and woodlands were estimated to cover 6 million hectares or 25% of the country's total area. The growing stock was estimated at roughly 450 million tons, providing a sustainable yield of 14,1 million tons per year(5). The high dependence on woodfuels, the high conversion losses in charcoal-making, and the conversion of available land to agriculture are seriously eroding the wood resource. Uncontrolled deforestation has inflicted severe depletion in some parts of the country. In some cases reserves of firewood have been created by industries. Eucalyptus trees have been planted by some tobacco farmers (in the Arua District for example), but reforestation efforts remain generally insufficient.

The very high potential of agricultural residue remains largely unexploited. In 1980 only 1,2 million tons of the 4,1 million tons of crop residue were used as fuel; dung and crop residue provided 110 000 TOE. Each year 374 000 tons of coffee husks are produced, 40% of which serves as manure on banana plantations. A small part is used to fire brick kilns and the rest is wasted. Bagasse is also used in some sugar mill boilers.

4.2 Coal, petroleum and gas

The country produces neither coal nor gas. It has no proven petroleum resources, although there are signs that the western Rift Valley may contain some, particularly in Lake Mobutu Sese Seko (formerly Lake Albert). Uganda needs the co-operation of its neighbours to enhance exploration work: Zaire for the western portion of the Rift Valley, and Tanzania and Kenya for the southern Rift Valley and Lake Victoria. However, political instability has prevented any progress in petroleum exploration. In 1987 the present administration initiated a Petroleum Exploration Promotion Project overseen by the National Mining Corporation. It also signed an agreement, in 1990, with Zaire for the joint exploration and exploitation of petroleum reserves beneath Lakes Albert and Edward.

4.3 Hydro-electricity

The national hydro-power potential is estimated at 2000 MW, with a firm generation capability of 10 000 GWh per year, concentrated on the Victoria Nile. Up to now only 150 MW of this abundant potential has been exploited. The major sites with hydro-electric potential are given in Table 1.

The main source of electricity in the country is the Owen Falls Dam, with an installed capacity of 150 MW. This dam is expected to be modernized and its capacity expanded to 210 MW. In spite of strong environmental objections, the government is planning to build a second dam at the Murchison Falls site.

4.4 Other energy sources

4.4.1 Geothermal energy

The country's geothermal potential, estimated at 450 MW in 1971, has not yet been exploited. The three potential sites are located in western Uganda. They are the Kitwe volcanic field to the south, the Buranga field in the foothills of the Ruwenzori

Table 1. Major potential hydro-electric sites(5)

SITES	POTENTIAL CAPACITY (MW)	GENERATION CAPACITY (GWh/year)
Between Lake Victoria and Lake Kioga:		
(a) Owen Falls (uprated)	210	981
(b) Bujagali	180	915
(c) Busowoko	160	840
(d) Kalagala	115	585
Between Lake Kyoga and Lake Albert (Mobutu):		
(e) Kamdini	230	527
(f) Ayago	540	2900
(g) Kabalega or Murchison Falls	520	3300
Some rivers:		
(h) Nyakizumba	12	55
(i) Muzuzi and Kiumi	2,5	5

Mountains, and the Kibiro field in the northern part of the Rift Valley near Lake Albert. The Kitwe field is the most interesting due to its location near a transmission line and a projected salt industry.

4.4.2 Solar and wind energy

Solar energy potential is abundant but has not been exploited. The Commonwealth Science Council Projects in Uganda have experimented with solar crop drying (coffee and cereals), but information has not been widely disseminated. Solar cookers have not been accepted by housewives because their use is intermittent. There is no detail about the wind energy potential; an assessment is needed to locate areas that need wind pumps and can support them.

4.4.3 Peat and papyrus

Substantial peat and papyrus deposits are found around Lake Kyoga in central Uganda. Their exploitation is questionable because they are located far from potential consumers.

4.4.4 Biogas

Biogas potential has not been exploited though its development can be justified in isolated areas. With a national cattle population estimated at 4 million, digesters could potentially be used to help meet the cooking and heating needs for at least 3 million families on large farms[8].

4.4.5 Alcohol

Alcohol can be produced from sugar cane, primarily for blending into gasoline. This option needs careful assessment as sugar is used as food and more arable land would be diverted to grow sugar cane.

5. ENERGY SUPPLY AND DEMAND

5.1 General

Figures 10 and 11 give the quantity and percentage shares of various energy forms in the estimated total final consumption on a yearly basis over the period 1965-88. They show that the energy consumed is predominantly in the form of traditional fuels (fuelwoods, charcoal, crop residues and dung). In general, firewood and charcoal account for 92% and 4%[8] of energy consumption respectively, petroleum, electricity and other forms meet the remaining 4% of energy demand.

Commercial fuels are petroleum products and electricity. Their quantity and percentage shares in the final consumption of commercial energy are given in Figs 12 and 13. However, woodfuels are also widely used for commercial purposes, accounting for 71% of commercial use of energy in the 1980's[5]. As shown in Fig. 14, final energy consumption per capita is around 0,35 TOE, of which only 0,02 TOE is strictly commercial (excluding the commercial use of woodfuels)[5]. The level of commercial energy consumption is low, reflecting the long and significant economic decline, particularly notable in the industrial and transport sectors, and the preponderance of subsistence farming. However, this level remains comparable to estimates for other low-income countries in Sub-Saharan Africa.

The energy intensity in the economy is shown in Fig. 15. The strictly commercial energy intensity is low. This is due on one hand to the significant commercial use of woodfuels, and on the other to the large share of agriculture, where manpower is often used, in GDP generation. Fig. 16 gives the growth rates of GDP, oil, and electricity. The commercial fuels growth rates follow closely the GDP pattern. The declines are significant during the periods 1970-79 and 1984-85, corresponding to the Amin regime and the civil disorder. According to available estimates, commercial energy consumption (including the commercial use of woodfuels) grew by 6,9% during 1965-70, -2,5% during 1970-75, -4,1% during 1975-80 and -2,1% during 1980-82[(5)].

Energy supply is a pressing problem for the country. The rate of consumption of woodfuels exceeds the overall rate of natural growth. It is estimated that between 1980 and 1985 the total energy demand (the bulk of which is in the form of woodfuels) had an average growth rate of 5,3%. However, this was accompanied by a net growth of 2,3% in woodfuel resources, resulting in a net depletion of resources[(8)].

Sectorially, households account for 80% of the total energy consumption, commerce 12%, industry 5%, passenger transport and other 3%[(8)].

5.2 Fuelwood

The estimated shares of traditional fuels in the total final consumption for the period 1965-88 are shown in Figs 10 and 11. Energy consumption data reveal a high dependence on woodfuels, which has led to an imbalance in the supply and demand patterns. For instance, in 1983 woodfuels consumption was estimated at 13,6 million tons or 25% above the 10,9 million tons projected sustainable yield. The uncontrolled depletion of wood reserves, presently estimated at about 17% above the sustainable yield per annum, has led to severe deforestation in some parts of the country[(8)]. There is a growing scarcity of wood supply, and there has been a partial shift to dung and agricultural residues. Crop residues and dung are reported to have provided 110 000 TOE[(5)] of energy in 1980.

The woodfuels crisis is serious. Reforestation efforts are weak, except for some large-scale tree (eucalyptus) plantings by certain institutions such as British

American Tobacco Ltd in the west Nile region (Arua district). Conservation and efficiency improvement projects have been carried out in the tobacco industry through the use of improved tobacco curing barns. They are expected to be expanded to the brick and tile industry, tea-drying and fish-smoking. Wood stoves and charcoal burners with improved efficiency have been introduced by the Commonwealth Science Council Projects in Uganda. However, they were not replicated on a wider scale. Unless alternative sources of energy and more efficient devices are provided on a larger scale, tree plantings and conservation of existing woodfuel reserves cannot play an important role in the solution to the present crisis.

The fuelwood and charcoal market is formal in urban areas. Most fuelwood consumed in rural areas is not marketed and is gathered by the consumers themselves. It is estimated that 77% of fuelwood consumed in Uganda in 1980 was not marketed.

5.3 Petroleum

The supply of petroleum is entirely dependent on imports, either from the Middle East through the Mombasa refinery or refined products purchased directly on the Kenyan market. Imports from the Middle East started in 1983 and now represent about 50% of petroleum requirements.

Figure 17 gives the consumption of petroleum products for the period 1965-85. Due to the economic decline of the 1970's, petroleum imports, which reached a peak of 431 000 tons in 1970, fell to 250 000 tons/year in 1978-80. Oil consumption has been about 230 000 tons in 1987. The bulk of imports is in the form of petrol and diesel. Their percentage shares are shown in Fig. 18. Due to the low pricing of petroleum products, smuggling operations to neighbouring countries is very active and consumption is probably lower than the above figures. In 1980 up to 40% of packed kerosene imports were smuggled in to Rwanda and Zaire and 20% of auto-diesel imports went back to Kenya[5].

Sectorial distribution of oil consumption is shown in Fig. 19. In general, transport accounts for 69% of the total consumption, mainly in the form of petrol and diesel, households (17%), aviation (9%), and industry (5%)[8]. Distribution and consumption of petroleum products are concentrated around Kampala (60% of all gasoline and auto-diesel sales) and Jinja (80% of fuel oil sales)[5].

Oil products are imported and marketed by six companies working on the basis of fixed market shares which are as follows: Shell 30%, Total 19%, Agip 14%, Caltex 14%, Esso 15%, and Mobil 8%. The Ugandan government is a 50% shareholder in each of the first three companies. Shell, Esso and Caltex have a right to use refinery facilities at Mombasa by virtue of their parent companies' participation in the Refining Processing Agreement, and the remaining three when the refinery has unused capacity for white products.

This agreement brings some disadvantages for Uganda, such as the high unit cost of the Mombasa refinery (five times greater than that of the major international refining centres in 1982), and the obligation to use the Mombasa-Nairobi pipeline (commissioned in 1978) for the transportation of white products. Permission of the refinery operators (who also operate the pipeline) has to be obtained prior to the importation of white products; they used to charge a refinery loss fee before making the pipeline available. In the early 1980's there were interruptions in the refining operations, and hence to supplies to Uganda. Due to the lack of foreign exchange, Kenya was not able to buy the minimum quantity of crude oil required to maintain continuity of the refinery operations[5].

Transportation costs add approximately 20% of the value of the products at the Mombasa refinery. Most white oil products are transported from Mombasa to Nairobi by the 485 km pipeline and on to Kampala by road tankers, along a 670 km route through Malaba on the Ugandan border. The estimated transport cost, including transport losses, was about 80 US$/ton in mid-1982. Black petroleum products are generally transported on road tankers from Mombasa to Malaba at a cost estimated at 74 US$/ton in 1982. Less than 10% of all petroleum products are transported by the 1040 km railroad from Mombasa to Malaba. Railroad, however, offers the most economic transport option, 60 US$/ton for white products and 46 US$/ton for black products in 1982. Transport charges are levied on foreign exchange[5].

The country is completely dependent on the Kenya supply route. To minimize possible supply interruption, the government and oil companies have been developing an alternative supply route (of about 1600 km to Kampala) through Tanzania and have started the maintenance of a stockpile. The Tanzanian route runs from Dar-es-Salaam to Mwanza by railroad and on to Jinja by lake ferry through Lake Victoria. It must be mentioned that the Tanzanian railroad is already currently used to transport petroleum products to Rwanda and Burundi. However, the Tanzania Railway Corporation has difficulties in maintaining a reliable service. The service is affected by the shortage of railroad capacity, maintenance and managerial problems. In 1982 the stockpile level was kept at the equivalent of one month's consumption. Oil companies had an available storage capacity of 29 606 thousand litres, and the government built two strategic storage facilities with a total capacity of 10 million litres.

5.4 Electricity

Figures 20 and 21 give the electrical installed capacity and the electricity production respectively on a yearly basis for the period 1955-88. The bulk of electricity used in Uganda comes from the public sector and is hydro-generated. The private sector, mainly industries, owns and operates small hydro and diesel stations.

The main asset of the State-owned Uganda Electricity Board (UEB) is the Owen Falls hydro-electric station located at Jinja just downstream from the source of the Victoria Nile. Commissioned in 1953, it reached its present installed capacity of 150 MW (10 x 15 MW) in 1968. However, due to the lack of a general overhaul of all units since installation, the reliable output is estimated at 105 MW. One of the ten units is usually held as reserve. Plans for rehabilitating and uprating the Owen Falls Power station are under way. This modernization project is expected to cost 80 million US$. It also includes the expansion of the station's capacity to 210 MW by increasing the generation capacity of each unit from 15 MW to 20 MW. The first phase, to raise capacity to 172 MW, was given permission to proceed in 1986 and is due to be completed in 1993. Funds for the project are provided by the British Government, the Commonwealth Development Corporation (CDC) and the International Development Association (IDA), which account for 28,8 million US$[6]. The remaining public facilities are a 1 MW hydro station at Kabale (already closed) and nine small diesel-driven electricity generating stations of about 4,4 MW.

Uganda has electricity export contracts with Kenya and Tanzania. In the initial agreement, signed for 50 years in 1955, Uganda agreed to provide 45 MW of firm power to Kenya. This was reduced to 30 MW in 1964 and Kenya was committed to maintaining a minimum load factor of 90%. During 1981 the maximum Kenyan demand was 30 MW during the day and 75 MW at night[5]. Sales to Kenya are shown in Fig. 22 which gives the public sector electricity sales and losses. In 1982 Uganda agreed to make available 15 MW (126 GWh/year) to north-western Tanzania through a transmission line still to be built.

Sectorial distribution of domestic sales are shown in Fig. 23. Industry is the largest consumer, followed by the residential sector. Few people have access to electricity, only 3% of the total population in 1982 or about 8% of the people living in areas covered by the grid. Of the 93 156 electricity connections by the end of 1981, 71% were domestic consumers. Transmission is carried out by very long 132 kV and 66 kV lines which cross unpopulated areas. The distribution in towns is mainly by 33 kV and 11 kV lines. The transmission network extends from the Owen Falls power station to the southern part of country (Jinja, Kampala, Mpigi), to the west (Masaka), and to the east (Tororo). At the Tororo substation the grid is connected to the Kenyan transmission system and to another line running towards the north up to Lira.

In order to meet the growing demand, the government is planning to build a 480 MW hydro-electric station at Kabalega or Murchison Falls on the Victoria Nile. This second dam, estimated to cost between 500 and 700 million US$[6], is also intended to service the development of northern Uganda and enhance prospects for power exports. However, as it is located within the Kabalega National Park boundaries, it is likely to cause environmental damage such as interference with the animal life and with the general ecology of the park.

6. PRICING

The price of petroleum products is controlled by the government. Retail prices for premium and regular gasoline, kerosene and auto-diesel are set by the government, whereas the prices of fuel oil, jet fuel and lubricants are set by oil companies after discussion with the government. Significant increases in prices of oil products were introduced in the 1980's in order to discourage smuggling. The over-valuation of local currency, the cross-subsidization of products at the Mombasa refinery and the differences in effective taxes have led to distortions in retail prices. Taxes on oil products provide a major contribution to government revenue. Foreign exchange for the importation of petroleum is obtained from the government according to an agreement with the oil companies and allocated on the basis of the market share of each company. This is controlled by an independent audit.

In the early 1980's there was a cross-subsidization of prices of electricity for each consumer category nationwide, irrespective of the supply cost. Tariff levels were substantially below the long-run marginal cost. In order to promote the consumption of electricity, the pricing structure had regressive incremental rates for both energy and demand charge. Nowadays, as the policy trend is to increase power generation capacity in order to meet growing demand, such a pricing practice is questionable. The average electricity sales revenue in 1987 was 2,87 US cts/kwh[9].

Prices for woodfuels are not officially controlled and therefore tend to reflect economic cost. Higher transport and distribution costs are noted in the woodfuels market. These are inflated by abnormal supply conditions such as security bottlenecks, steady depletion of the most accessible and economic forests, and sometimes the "hijacking" of fuelwood and charcoal in transit to Kampala. This situation has led to significant price increases. Retail prices are substantially lower for non-household users who can purchase directly from the Forestry Department and do their own cutting and transport.

7. DISCUSSION

Uganda is stabilizing after years of internal strife which destroyed the economy and energy infrastructure. Consequently, the country will continue to rely on traditional fuels for the bulk of its energy needs. The rate of fuelwood depletion on a national level is important. Serious measures have been taken in order to encourage reforestation, improve efficiency in utilisation and production, educate people on woodfuels saving, and protect the environment.

The upgrading of power facilities is receiving significant attention. Hydro resources are important and the country is planning to increase its generating capacity so that it can export more power to neighbouring countries such as Kenya.

In order to ensure an efficient energy supply, sound economic pricing, leading to cost recovery, is required in both the oil and electricity sub-sectors. Woodfuel prices should include an allowance for reforestation.

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TABLES

TABLE A. ECONOMIC INDICATORS

CURRENCY: NEW UGANDA SHILLINGS

MILLIONS OF NATIONAL CURRENCY UNLESS INDICATED

YEAR	POPUL. (MILLIONS)	POPUL. GROWTH RATE (%)	GROSS DOMESTIC PRODUCT AT MARKET COST: AGRICULTURE	INDUSTRY: TOTAL INDUSTRY	INDUSTRY: MINING QUARRY	INDUSTRY: MANUFACTURE	INDUSTRY: ELEC,WTR AND GAS	INDUSTRY: CONSTRUCTION	OTHER SERVICES + TAXES	TOTAL	GDP DEFLATOR	GDP AT 1985 MARKET PRICES	GDP/CAPITA CURRENT	GDP/CAPITA REAL 1985	EXCHANGE RATE UGANDA SHILLING PER US$	GDP IN US$(MILL) CURRENT PRICE	GDP IN US$(MILL) AT 1985 MARKET PRICE	GDP PER CAPITA US$/CAP	GDP PER CAPITA US$(1985)/CAPITA
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	8.77	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1968	9.12	3.9	33	9	NA	6	NA	NA	32	74	0.3	21765	8	2387	0.05	1480	3239	162	355
1969	9.45	3.6	38	11	NA	7	NA	NA	34	83	0.3	23851	9	2525	0.05	1660	3549	176	376
1970	9.76	3.3	46	12	NA	8	NA	NA	37	95	0.4	24485	10	2509	0.05	1900	3644	195	373
1971	10.04	2.8	55	12	NA	8	NA	NA	41	108	0.4	24828	11	2474	0.05	2160	3695	215	368
1972	10.31	2.7	58	11	NA	8	NA	NA	44	113	0.4	25167	11	2442	0.05	2260	3745	219	363
1973	10.57	2.6	71	11	NA	8	NA	NA	48	130	0.5	25540	12	2416	0.06	2167	3801	205	360
1974	10.84	2.5	89	16	NA	11	NA	NA	55	160	0.6	25682	15	2370	0.07	2286	3822	211	353
1975	11.11	2.5	150	17	NA	13	NA	NA	58	225	0.9	24324	20	2190	0.09	2500	3620	225	326
1976	11.38	2.5	176	18	NA	15	NA	NA	71	265	1.1	24859	23	2184	0.10	2650	3699	233	325
1977	11.67	2.5	366	35	NA	29	NA	NA	143	544	2.3	23936	47	2051	0.17	3200	3562	274	305
1978	11.98	2.6	410	28	NA	24	NA	NA	154	592	2.3	26048	49	2175	0.23	2574	3876	215	324
1979	12.30	2.7	558	35	NA	31	NA	NA	289	882	4.5	19404	72	1578	0.40	2205	2888	179	235
1980	12.64	2.8	893	56	NA	53	NA	NA	318	1267	6.1	20905	100	1654	0.73	1736	3111	137	246
1981	13.00	2.9	1472	66	NA	45	NA	NA	960	2498	11.4	21982	192	1691	1.57	1591	3271	122	252
1982	13.38	3.0	2070	189	NA	155	NA	NA	1480	3739	15.9	23502	279	1756	2.14	1747	3497	131	261
1983	13.79	3.0	3380	252	NA	192	NA	NA	2264	5896	22.7	25942	428	1881	2.69	2192	3860	159	280
1984	14.22	3.1	5109	399	NA	254	NA	NA	3944	9452	39.4	23994	665	1687	3.60	2626	3570	185	251
1985	14.68	3.2	14625	808	NA	518	NA	NA	8135	23568	100.0	23568	1605	1605	6.72	3507	3507	239	239
1986	15.16	3.3	35955	2138	NA	1655	NA	NA	16412	54505	234.1	23284	3594	1535	14.00	3893	3465	257	228
1987	15.68	3.4	122294	10159	NA	6734	NA	NA	54074	186527	757.6	24622	11900	1571	42.84	4354	3664	278	234
1988	16.21	3.4	330052	37037	NA	22630	NA	NA	152873	519962	1990.9	26117	32075	1611	106.14	4899	3886	302	240
1989	16.77	3.5	666217	71546	NA	40840	NA	NA	313603	1051366	3785.6	27773	62686	1656	223.09	4713	4133	281	246
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

DATA OBTAINED FROM: WORLD BANK WORLD TABLES (1989-1990, 91 EDITIONS)

TABLE B. ENERGY BREAKDOWN

YEAR	TOTAL FINAL CONSUMPTION (000s TOE): COMMERCIAL FORMS OF ENERGY — COMMERCIAL FORMS OF ENERGY: COA	OIL	HYDR	GAS	ELEC	TOTAL	TRAD. ENERGY	TOTAL ENERGY (TRAD + COM)	ENERGY FORMS AS % OF TFC: COM. ENERG	TRAD. ENERGY	ENERGY FORMS PER CAPITA (TOE/CAP): OIL	ELECT	COM. ENERG	TRAD. ENERGY	TOTAL ENERG	RATIO COM.ENERGY/ TRAD.ENERGY
1965	0	199.3	0	0	31.2	230.5	3489.0	3719.5	6.2	93.8	NA	NA	NA	NA	NA	0.07
1966	0	234.1	0	0	35.5	269.6	3561.0	3830.6	7.0	93.0	NA	NA	NA	NA	NA	0.08
1967	0	253.8	0	0	37.4	291.2	3623.0	3914.2	7.4	92.6	0.03	0.004	0.03	0.41	0.45	0.08
1968	0	307.3	0	0	40.6	347.9	3638.0	3985.9	8.7	91.3	0.03	0.004	0.04	0.40	0.44	0.10
1969	0	367.9	0	0	41.6	409.5	3703.0	4112.5	10.0	90.0	0.04	0.004	0.04	0.39	0.44	0.11
1970	0	440.5	0	0	38.9	479.4	3763.0	4242.4	11.3	88.7	0.05	0.004	0.05	0.39	0.43	0.13
1971	0	401.3	0	0	42.1	443.4	3814.0	4257.4	10.4	89.6	0.04	0.004	0.04	0.38	0.42	0.12
1972	0	390.7	0	0	41.2	431.9	3864.0	4295.9	10.1	89.9	0.04	0.004	0.04	0.37	0.42	0.11
1973	0	352.9	0	0	37.4	390.3	3911.0	4301.3	9.1	90.9	0.03	0.004	0.04	0.37	0.41	0.10
1974	0	365.0	0	0	37.3	402.4	3955.0	4357.4	9.2	90.8	0.03	0.003	0.04	0.37	0.40	0.10
1975	0	348.4	0	0	35.9	384.3	3988.0	4372.3	8.8	91.2	0.03	0.003	0.03	0.36	0.39	0.10
1976	0	296.6	0	0	32.8	329.4	4030.0	4359.4	7.6	92.4	0.03	0.003	0.03	0.35	0.38	0.08
1977	0	300.1	0	0	31.6	331.6	4062.0	4393.6	7.5	92.5	0.03	0.003	0.03	0.35	0.38	0.08
1978	0	244.8	0	0	31.3	276.1	4096.0	4372.1	6.3	93.7	0.02	0.003	0.02	0.34	0.37	0.07
1979	0	210.7	0	0	22.5	233.3	4132.0	4365.3	5.3	94.7	0.02	0.002	0.02	0.34	0.35	0.06
1980	0	254.1	0	0	22.8	276.9	4222.0	4498.9	6.2	93.8	0.02	0.002	0.02	0.33	0.36	0.07
1981	0	157.0	0	0	27.2	184.3	4250.7	4434.9	4.2	95.8	0.01	0.002	0.01	0.33	0.34	0.04
1982	0	159.6	0	0	27.4	187.1	4376.2	4563.3	4.1	95.9	0.01	0.002	0.01	0.33	0.34	0.04
1983	0	216.4	0	0	30.6	247.0	4509.7	4756.6	5.2	94.8	0.02	0.002	0.02	0.33	0.34	0.05
1984	0	215.2	0	0	30.6	245.8	4650.9	4896.7	5.0	95.0	0.02	0.002	0.02	0.33	0.34	0.05
1985	0	228.3	0	0	29.4	257.6	4800.4	5058.0	5.1	94.9	0.02	0.002	0.02	0.33	0.34	0.05
1986	0	237.3	0	0	28.9	266.2	4957.6	5223.9	5.1	94.9	0.02	0.002	0.02	0.33	0.34	0.05
1987	0	238.0	0	0	31.3	269.3	5122.8	5392.1	5.0	95.0	0.02	0.002	0.02	0.33	0.34	0.05
1988	0	285.1	0	0	35.4	320.5	5295.8	5616.2	5.7	94.3	0.02	0.002	0.02	0.33	0.35	0.06
1989	0	NA	0	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1990	0	NA	0	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

DATA ESTIMATED

TABLE C. ENERGY DATA FOR GRAPHS

YEAR	COMMERCIAL ENERGY COMPONENTS AS % OF COM.ENERGY. FIN. CONS. COAL	OIL	ELECTRICITY	COMMERCIAL ENERGY COMPONENTS AS PERCENTAGE OF TFC COAL	OIL	ELECTRICITY	COM. ENERGY FIN. CONS. GROWTH RATE 1 PT	3 PTS	5 PTS	TOTAL FINAL CONSUMPTION GROWTH RATE 1 PT	3 PTS	5 PTS	ENERGY INTENSITY (TOE/NEW UG.SHILLING) TRAD. ENERGY	COM. ENERGY	TOTAL ENERGY
1965	0	86.5	13.5	0	5.4	0.8	NA	NA	NA	NA	NA	NA	NA	NA	NA
1966	0	86.8	13.2	0	6.1	0.9	17.0	NA	NA	3.0	NA	NA	NA	NA	NA
1967	0	87.2	12.8	0	6.5	1.0	8.0	14.8	NA	2.2	2.3	NA	NA	NA	NA
1968	0	88.3	11.7	0	7.7	1.0	19.5	15.1	15.8	1.8	2.4	2.7	1.7E-04	1.6E-05	1.8E-04
1969	0	89.8	10.2	0	8.9	1.0	17.7	18.1	10.9	3.2	2.7	2.1	1.6E-04	1.7E-05	1.7E-04
1970	0	91.9	8.1	0	10.4	0.9	17.1	9.1	8.8	3.2	2.2	1.9	1.5E-04	2.0E-05	1.7E-04
1971	0	90.5	9.5	0	9.4	1.0	-7.5	2.3	3.0	0.4	1.5	1.5	1.5E-04	1.8E-05	1.7E-04
1972	0	90.5	9.5	0	9.1	1.0	-2.6	-6.6	0.1	0.9	0.5	1.2	1.5E-04	1.7E-05	1.7E-04
1973	0	90.4	9.6	0	8.2	0.9	-9.6	-3.0	-4.2	0.1	0.8	0.6	1.5E-04	1.5E-05	1.7E-04
1974	0	90.7	9.3	0	8.4	0.9	3.1	-3.7	-5.6	1.3	0.6	0.5	1.5E-04	1.6E-05	1.7E-04
1975	0	90.7	9.3	0	8.0	0.8	-4.5	-5.2	-4.9	0.3	0.5	0.5	1.6E-04	1.6E-05	1.8E-04
1976	0	90.1	9.9	0	6.8	0.8	-14.3	-6.0	-6.3	-0.3	0.3	0.3	1.6E-04	1.3E-05	1.8E-04
1977	0	90.5	9.5	0	6.8	0.7	0.7	-10.1	-10.1	0.8	0.0	0.0	1.7E-04	1.4E-05	1.8E-04
1978	0	88.7	11.3	0	5.6	0.7	-16.7	-10.5	-5.4	-0.5	0.0	0.6	1.6E-04	1.1E-05	1.7E-04
1979	0	90.3	9.7	0	4.8	0.5	-15.5	-4.5	-9.3	-0.2	0.8	0.4	2.1E-04	1.2E-05	2.2E-04
1980	0	91.8	8.2	0	5.6	0.5	18.7	-10.1	-9.1	3.1	0.5	0.8	2.0E-04	1.3E-05	2.2E-04
1981	0	85.2	14.8	0	3.5	0.6	-33.5	-4.4	0.7	-1.4	1.5	1.7	1.9E-04	8.4E-06	2.0E-04
1982	0	85.3	14.7	0	3.5	0.6	1.5	0.0	3.7	2.9	1.9	2.3	1.9E-04	8.0E-06	1.9E-04
1983	0	87.6	12.4	0	4.5	0.6	32.0	11.0	0.9	4.2	3.4	2.4	1.7E-04	9.5E-06	1.8E-04
1984	0	87.6	12.4	0	4.4	0.6	-0.5	12.1	8.2	2.9	3.5	3.3	1.9E-04	1.0E-05	2.0E-04
1985	0	88.6	11.4	0	4.5	0.6	4.8	2.6	8.2	3.3	3.2	3.4	2.0E-04	1.1E-05	2.1E-04
1986	0	89.1	10.9	0	4.5	0.6	3.3	3.1	5.6	3.3	3.3	3.4	2.1E-04	1.1E-05	2.2E-04
1987	0	88.4	11.6	0	4.4	0.6	1.2	7.8	NA	3.3	3.6	NA	2.1E-04	1.1E-05	2.2E-04
1988	0	89.0	11.0	0	5.1	0.6	19.0	NA	NA	4.2	NA	NA	2.0E-04	1.2E-05	2.2E-04
1989	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.0E-04	NA	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE D. ELECTRICITY DATA INSTALLED CAPACITY (MEGAWATTS)

YEA	PUBLIC HYDRO	THERMA	TOTAL	SELF PRODUCERS HYDR	THERMAL	TOTAL	TOTAL HYDRO	TOTAL THERMAL	TOTAL INSTALLED
1955	60	18	78	0	0	0	60	18	78
1956	60	14	74	0	0	0	60	14	74
1957	90	12	102	0	0	0	90	12	102
1958	106	11	117	0	0	0	106	11	117
1959	121	11	132	0	12	12	121	23	144
1960	121	11	132	0	12	12	121	23	144
1961	121	11	132	0	13	13	121	24	145
1962	122	11	133	0	13	13	122	24	146
1963	122	11	133	0	14	14	122	25	147
1964	122	12	134	0	17	17	122	29	151
1965	122	12	134	0	18	18	122	30	152
1966	135	12	147	0	18	18	135	30	165
1967	135	12	147	0	20	20	135	32	167
1968	150	4	154	0	20	20	150	24	174
1969	150	4	154	0	20	20	150	24	174
1970	151	4	155	5	2	7	156	6	162
1971	150	4	154	5	2	7	155	6	161
1972	150	4	154	5	2	7	155	6	161
1973	151	4	155	5	2	7	156	6	162
1974	151	5	156	5	2	7	156	7	163
1975	151	5	156	5	2	7	156	7	163
1976	151	5	156	5	2	7	156	7	163
1977	151	5	156	5	2	7	156	7	163
1978	151	5	156	5	2	7	156	7	163
1979	151	5	156	5	2	7	156	7	163
1980	151	5	156	5	2	7	156	7	163
1981	151	5	156	5	2	7	156	7	163
1982	151	5	156	5	2	7	156	7	163
1983	151	5	156	5	2	7	156	7	163
1984	151	5	156	5	2	7	156	7	163
1985	150	5	155	5	2	7	155	7	162
1986	150	5	155	5	2	7	155	7	162
1987	150	5	155	5	2	7	155	7	162
1988	150	5	155	5	2	7	155	7	162
1989	NA	NA	NA	NA	NA	NA	NA	NA	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA

DATA OBTAINED FROM: WORLD ENERGY SUPPLIES(1950-1974)
WORLD ENERGY SUPPLIES(1973-1978)
YEARBOOK OF WORLD ENERGY STATISTICS(1981)
UGANDA: ISSUES AND OPTIONS IN THE ENERGY SECTOR

TABLE E. OIL PRODUCT CONSUMPTION (000's METRIC TONS)

YEA	LPG	RESIDUA	PETRO	AVIAT. FUELS	KEROSE	DIESEL	TOTAL	DIESEL PETROL	% PETRO	% DIESEL	SECTORIAL DISTRIBUTION DOMESTI	INDUST	TRANSPORT	OIL TFC GROWTH RATE 1 PT	3 PTS
1965	0.5	15	78	25.0	25	58	201.5	0.7	38.7	28.8	25.5	23.0	153.0	NA	NA
1966	1.0	14	83	32.0	30	66	226.0	0.8	36.7	29.2	31.0	23.0	172.0	17.5	NA
1967	1.0	16	86	45.0	28	69	245.0	0.8	35.1	28.2	29.0	26.0	190.0	8.4	15.7
1968	1.5	31	97	51.0	34	83	297.5	0.9	32.6	27.9	35.5	44.0	218.0	21.1	16.4
1969	2.0	64	103	68.0	35	86	358.0	0.8	28.8	24.0	37.0	64.0	257.0	19.7	20.2
1970	2.0	100	115	76.0	39	98	430.0	0.9	26.7	22.8	41.0	101.0	288.0	19.7	10.2
1971	4.0	70	108	78.0	35	95	390.0	0.9	27.7	24.4	39.0	82.0	269.0	-8.9	2.7
1972	2.5	68	113	69.0	36	91	379.5	0.8	29.8	24.0	38.5	78.0	263.0	-2.6	-7.1
1973	3.0	69	109	38.0	41	84	344.0	0.8	31.7	24.4	44.0	77.0	223.0	-9.7	-3.0
1974	3.0	76	116	39.0	42	80	356.0	0.7	32.6	22.5	45.0	83.0	228.0	3.5	-3.6
1975	3.0	59	113	36.5	46	81	338.5	0.7	33.4	23.9	49.0	66.0	223.5	-4.6	-5.3
1976	3.0	56	89	24.0	56	61	289.0	0.7	30.8	21.1	59.0	61.0	169.0	-14.9	-6.1
1977	2.0	60	95	20.0	52	64	293.0	0.7	32.4	21.8	54.0	65.0	174.0	1.2	-10.7
1978	1.5	36	90	11.0	38	62	238.5	0.7	37.7	26.0	39.5	39.0	160.0	-18.4	-10.4
1979	1.0	52	59	5.0	40	50	207.0	0.8	28.5	24.2	41.0	53.0	113.0	-13.9	-3.9
1980	1.0	24	86	13.0	48	74	246.0	0.9	35.0	30.1	49.0	25.0	172.0	20.6	-10.5
1981	1.0	19	47	15.0	23	48	153.0	1.0	30.7	31.4	24.0	20.0	109.0	-38.2	-5.3
1982	0.0	16	44	17.0	29	50	156.0	1.1	28.2	32.1	29.0	17.0	110.0	1.6	-0.3
1983	0.0	32	79	10.0	32	58	211.0	0.7	37.4	27.5	32.0	34.2	144.8	35.6	12.2
1984	0.0	33	77	10.0	33	57	210.0	0.7	36.7	27.1	33.0	35.3	141.7	-0.5	13.7
1985	0.0	34	79	10.0	33	65	221.0	0.8	35.7	29.4	33.0	36.4	151.6	6.1	3.2
1986	0.0	8	74	27.0	30	80	219.0	1.1	33.8	36.5	30.0	38.0	151.0	4.0	3.4
1987	0.0	4	74	31.0	30	94	233.0	1.3	31.8	40.3	30.0	40.0	163.0	0.3	8.0
1988	0.0	12	82	32.0	41	100	267.0	1.2	30.7	37.5	41.0	45.0	181.0	19.8	NA
1989	NA	NA	NA	35.0	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

DATA OBTAINED FROM: UGANDA: ISSUES AND OPTIONS IN THE ENERGY SECTOR
ENERGY STATISTICS YEARBOOKS (1985, 1988)

TABLE F. GDP DATA FOR GRAPHS

YEAR	GDP GROWTH RATE (REAL 1985) %/YEAR	GDP GROWTH RATE (REAL 1985) 3PT MA	GDP GROWTH RATE (REAL 1985) 5PT MA	RATIO AGRICUL/INDUSTRY 1 PT	RATIO AGRICUL/INDUSTRY 3 PT M.A.	PERCENTAGE CONTRIBUTION TO GDP AGRI	IND	MINE QUARRY	MANU	ELEC,WTR GAS	CONSTR	OTHER	RATIO AGRI/MANU	PERCENTAGE CHANGE OF GDP DEFLATOR 1 PT	PERCENTAGE CHANGE OF GDP DEFLATOR 3PT MA	ANNUAL CHANGE OF GDP PER CAPITA CURRENT 1 PT	CURRENT 3 PT M.A.	REAL (AT 1985 M.P 1 PT	REAL (AT 1985 M.P 3 PT M.
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	3.7	NA	44.6	12.2	NA	8.1	NA	NA	43.2	5.5	NA	NA	NA	NA	NA	NA
1969	9.6	NA	NA	3.5	3.7	45.8	13.3	NA	8.4	NA	NA	41.0	5.4	2.4	NA	8.3	NA	5.8	NA
1970	2.7	4.5	NA	3.8	4.0	48.4	12.6	NA	8.4	NA	NA	38.9	5.8	11.5	8.7	10.8	9.9	-0.6	1.2
1971	1.4	1.8	3.3	4.6	4.6	50.9	11.1	NA	7.4	NA	NA	38.0	6.9	12.1	8.9	10.5	7.7	-1.4	-1.1
1972	1.4	1.4	1.5	5.3	5.4	51.3	9.7	NA	7.1	NA	NA	38.9	7.3	3.2	9.6	1.9	8.2	-1.3	-1.2
1973	1.5	1.1	-0.1	6.5	5.8	54.6	8.5	NA	6.2	NA	NA	36.9	8.9	13.4	13.0	12.2	11.4	-1.1	-1.4
1974	0.6	-1.1	0.1	5.6	6.9	55.6	10.0	NA	6.9	NA	NA	34.4	8.1	22.4	28.1	20.1	23.1	-1.9	-3.5
1975	-5.3	-0.8	-1.0	8.8	8.1	66.7	7.6	NA	5.8	NA	NA	25.8	11.5	48.5	28.7	37.2	24.1	-7.6	-3.3
1976	2.2	-2.3	0.5	9.8	9.7	66.4	6.8	NA	5.7	NA	NA	26.8	11.7	15.2	59.0	14.9	50.8	-0.3	-4.7
1977	-3.7	2.4	-4.7	10.5	11.6	67.3	6.4	NA	5.3	NA	NA	26.3	12.6	113.2	42.8	100.2	40.4	-6.1	-0.1
1978	8.8	-6.8	-2.1	14.6	13.7	69.3	4.7	NA	4.1	NA	NA	26.0	17.1	0.0	71.1	6.1	50.5	6.1	-9.2
1979	-25.5	-3.0	-1.5	15.9	15.5	63.3	4.0	NA	3.5	NA	NA	32.8	18.0	100.0	44.4	45.1	30.3	-27.5	-5.5
1980	7.7	-4.2	0.6	15.9	18.1	70.5	4.4	NA	4.2	NA	NA	25.1	16.8	33.3	73.6	39.8	58.9	4.8	-6.8
1981	5.2	6.6	0.9	22.3	16.4	58.9	2.6	NA	1.8	NA	NA	38.4	32.7	87.5	53.6	91.7	58.9	2.2	3.6
1982	6.9	7.5	4.5	11.0	15.6	55.4	5.1	NA	4.1	NA	NA	39.6	13.4	40.0	56.8	45.4	63.4	3.8	4.4
1983	10.4	3.3	2.6	13.4	12.4	57.3	4.3	NA	3.3	NA	NA	38.4	17.6	42.9	52.1	53.0	51.3	7.1	0.2
1984	-7.5	0.4	1.4	12.8	14.8	54.1	4.2	NA	2.7	NA	NA	41.7	20.1	73.3	90.0	55.4	83.3	-10.3	-2.7
1985	-1.8	-3.5	1.1	18.1	15.9	62.1	3.4	NA	2.2	NA	NA	34.5	28.2	153.8	120.4	141.6	107.0	-4.8	-6.5
1986	-1.2	0.9	0.3	16.8	15.7	66.0	3.9	NA	3.0	NA	NA	30.1	21.7	134.1	170.5	123.9	165.5	-4.4	-2.3
1987	5.7	3.5	3.0	12.0	12.6	65.6	5.4	NA	3.6	NA	NA	29.0	18.2	223.6	173.5	231.1	174.8	2.3	0.2
1988	6.1	6.1	NA	8.9	10.1	63.5	7.1	NA	4.4	NA	NA	29.4	14.6	162.8	158.9	169.5	165.3	2.6	2.5
1989	6.3	NA	NA	9.3	NA	63.4	6.8	NA	3.9	NA	NA	29.8	16.3	90.1	NA	95.4	NA	2.8	NA
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE G. ELECTRICITY DATA AND PRODUCTION (GWHS)

YEAR	PUBLIC HYDRO	THERMAL	TOTAL	SELF PRODUCERS HYDRO	THERMA	TOTAL	TOTAL HYDRO	TOTAL THERM	TOTAL	(000's TOE)	ELEC. TFC GWTH RATE % P.A.	3 PTS	5 PTS	ELEC. INTENSITY TOE/GDPreal1985	RATIO ELEC GWTH/GDP 1 PT	3PTS	ELEC/CAPITA KWh/CAP.
1955	79	1	80	0	0	0	79	1	80	6.9	NA	NA	NA	NA	NA	NA	NA
1956	95	0	95	0	0	0	95	0	95	8.2	NA	NA	NA	NA	NA	NA	NA
1957	148	1	149	0	0	0	148	1	149	12.8	NA	NA	NA	NA	NA	NA	NA
1958	278	1	279	0	0	0	278	1	279	24.1	NA	NA	NA	NA	NA	NA	NA
1959	346	0	346	0	24	24	346	24	370	31.9	NA	NA	NA	NA	NA	NA	NA
1960	396	0	396	0	24	24	396	24	420	36.2	NA	NA	NA	NA	NA	NA	NA
1961	435	0	435	0	35	35	435	35	470	40.5	NA	NA	NA	NA	NA	NA	NA
1962	452	1	453	0	37	37	452	38	490	42.2	NA	NA	NA	NA	NA	NA	NA
1963	496	1	497	0	32	32	496	33	529	45.6	NA	NA	NA	NA	NA	NA	NA
1964	521	0	521	0	34	34	521	34	555	47.8	NA	NA	NA	NA	NA	NA	NA
1965	570	1	571	0	35	35	570	36	606	52.2	NA	NA	NA	NA	NA	NA	NA
1966	662	2	664	35	7	42	697	9	706	60.9	13.8	NA	NA	NA	NA	NA	NA
1967	701	2	703	35	8	43	738	10	746	64.3	5.3	9.2	NA	NA	NA	NA	49.4
1968	727	3	730	35	8	43	762	11	773	66.6	6.5	5.5	4.8	1.8638E-06	NA	NA	51.6
1969	726	4	730	35	8	43	761	12	773	66.6	2.6	1.6	3.6	1.7442E-06	0.3	NA	51.1
1970	730	4	734	35	8	43	765	12	777	67.0	-6.4	1.4	2.1	1.5898E-06	-2.4	1.2	48.3
1971	813	3	816	35	9	44	848	12	860	74.1	8.2	-0.1	-1.4	1.6958E-06	5.8	0.8	48.7
1972	797	5	802	35	8	41	832	11	843	72.7	-2.2	-1.1	-2.0	1.6368E-06	-1.6	-0.7	46.4
1973	788	5	793	35	6	41	823	11	834	71.9	-9.2	-3.9	-1.5	1.4644E-06	-8.2	-2.7	41.0
1974	780	5	785	35	6	41	815	11	826	71.2	-0.2	-4.4	-4.8	1.4529E-06	-0.4	-2.0	39.9
1975	722	5	727	35	5	40	757	10	767	66.1	-3.9	-4.3	-5.1	1.4743E-06	0.7	-1.2	37.5
1976	668	4	672	35	5	40	703	9	712	61.4	-8.7	-5.4	-3.5	1.3178E-06	-3.9	-1.8	33.4
1977	683	5	688	35	5	40	718	10	728	62.8	-3.7	-4.4	-9.0	1.2461E-06	-2.2	-2.0	31.4
1978	625	5	630	35	5	40	660	10	670	57.8	-0.8	-10.8	-8.0	1.3257E-06	0.1	-0.1	30.3
1979	462	2	464	25	5	30	487	7	494	42.8	-28.0	-9.2	-2.4	1.1312E-06	1.8	0.8	21.3
1980	634	3	637	25	5	30	659	8	667	57.5	1.1	-2.4	-1.5	1.2069E-06	-0.2	1.2	20.9
1981	513	4	517	30	3	33	543	7	550	47.4	19.5	7.1	1.0	1.3177E-06	2.1	0.5	24.3
1982	564	5	569	34	4	38	598	9	607	52.3	0.7	10.8	6.6	1.3525E-06	-0.4	1.8	23.8
1983	610	5	615	31	4	35	641	9	650	56.0	11.5	4.1	5.5	1.4552E-06	3.2	0.9	25.7
1984	615	5	620	32	4	36	647	9	656	56.6	0.1	2.5	1.3	1.6197E-06	-0.0	0.9	25.0
1985	625	2	627	10	2	12	635	4	639	55.1	-4.0	-1.9	2.8	1.4589E-06	-0.6	-0.8	23.2
1986	635	2	637	12	2	14	647	4	651	56.1	-1.6	0.9	3.2	1.4226E-06	-1.9	-0.5	22.1
1987	610	1	611	8	1	9	618	2	620	53.4	8.4	6.6	NA	1.4220E-06	1.0	0.3	23.2
1988	564	2	566	31	2	33	595	4	599	51.6	13.0	NA	NA	1.5013E-06	1.8	NA	25.3
1989	NA	NA	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

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

TABLE H. COMPLEMENT OF ELECTRICITY DATA (MILLION KILOWATT HOURS)

	PUBLIC		SALES IN		SELF PRODUCERS			PUBLIC & SELF PRODUCERS PRODUCTION			TOTAL	SALES IN UGANDA SECTORIAL DISTRIBUTION		
	PRODU	LOSSES	UGANDA	KENYA	PRODUCT	LOSSES	CONSUMPT	HYDRO	THERMA	TOTAL	CONSUMPTION	RESID.	INDUSTR	OTHER
1965	571	48	332	191	35	5	30	570	36	606	362	51	247	34
1966	664	85	376	203	42	6	36	697	9	706	412	61	280	35
1967	703	64	397	242	43	6	37	736	10	746	434	58	293	46
1968	730	72	434	224	43	6	37	762	11	773	471	63	319	52
1969	730	66	446	218	43	6	37	761	12	773	483	69	323	54
1970	734	72	415	247	43	6	37	765	12	777	452	74	277	64
1971	816	71	451	294	44	7	37	848	12	860	488	89	287	75
1972	802	76	443	283	41	6	35	832	11	843	478	82	284	77
1973	793	91	399	303	41	6	35	823	11	834	434	76	253	70
1974	785	91	398	296	41	6	35	815	11	826	433	83	244	71
1975	727	84	382	261	40	6	34	757	10	767	416	89	223	70
1976	672	89	346	237	40	6	34	703	9	712	380	91	191	64
1977	688	84	332	272	40	6	34	718	10	728	366	95	175	62
1978	630	84	329	217	40	6	34	660	10	670	363	105	159	65
1979	464	70	236	158	30	5	26	487	7	494	262	87	99	50
1980	637	109	239	289	30	5	26	659	8	667	265	89	100	50
1981	517	50	288	179	33	5	28	543	7	550	316	137	74	77
1982	569	70	286	213	38	6	32	598	9	607	318	126	99	61
1983	615	80	325	210	35	5	30	641	9	650	355	NA	NA	NA
1984	620	81	324	215	36	5	31	647	9	656	355	NA	NA	NA
1985	627	82	330	215	12	2	10	635	4	639	341	NA	NA	NA
1986	637	83	323	231	14	2	12	647	4	651	335	NA	NA	NA
1987	611	79	356	176	9	1	8	618	2	620	363	NA	NA	NA
1988	566	74	382	110	33	5	28	595	4	599	410	NA	NA	NA
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 ON SALES OBTAINE : UGANDA ISSUES AND OPTIONS IN THE ENERGY SECTOR
ESTIMATIONS, WITH LOSSES BEING ESTIMATED AT
13% (AVERAGE FOR THE PERIOD 1965-81) FOR THE PUBLIC SECTOR
15% FOR THE PRIVATE SECTOR

FIGURES

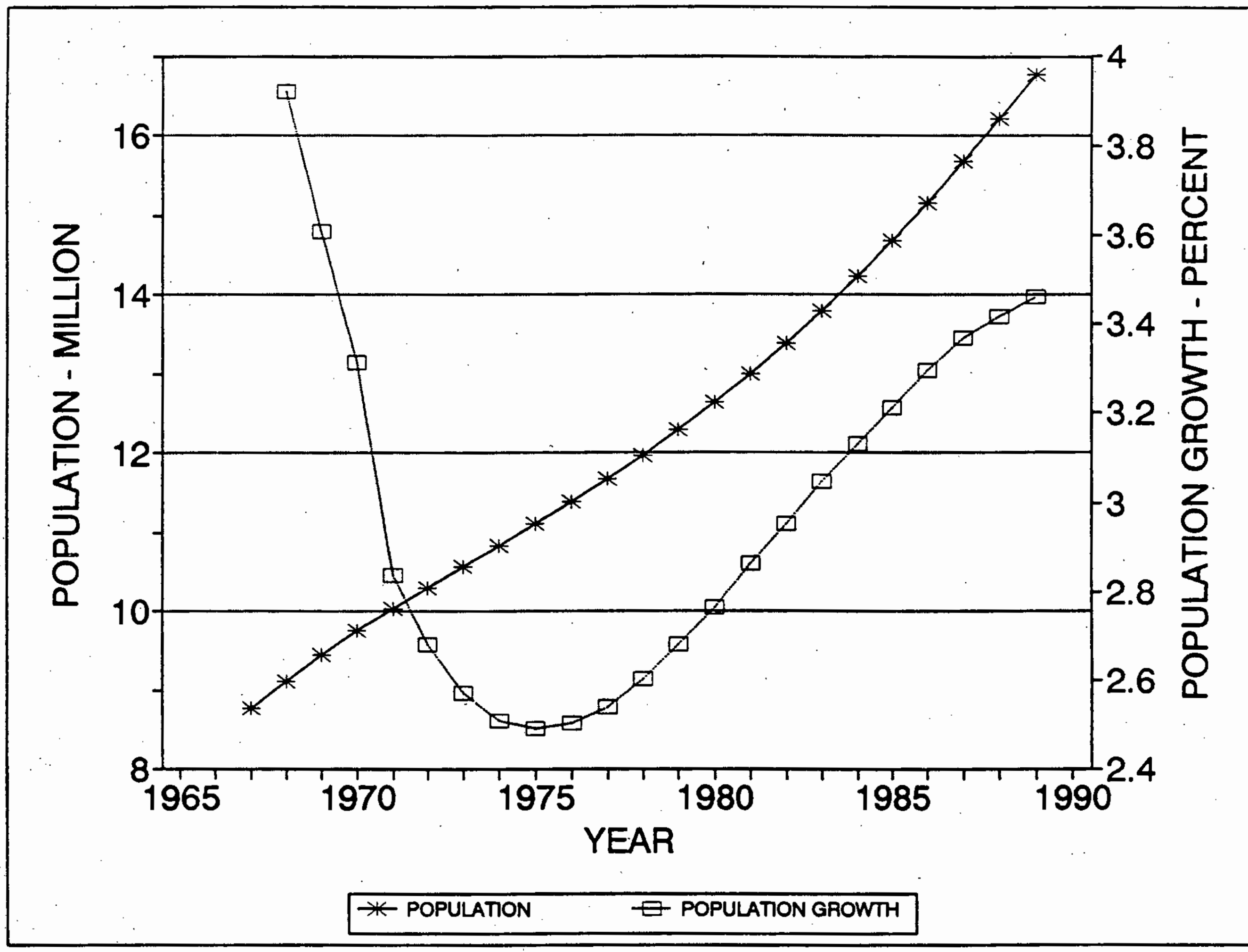

Figure 1. Population and population growth

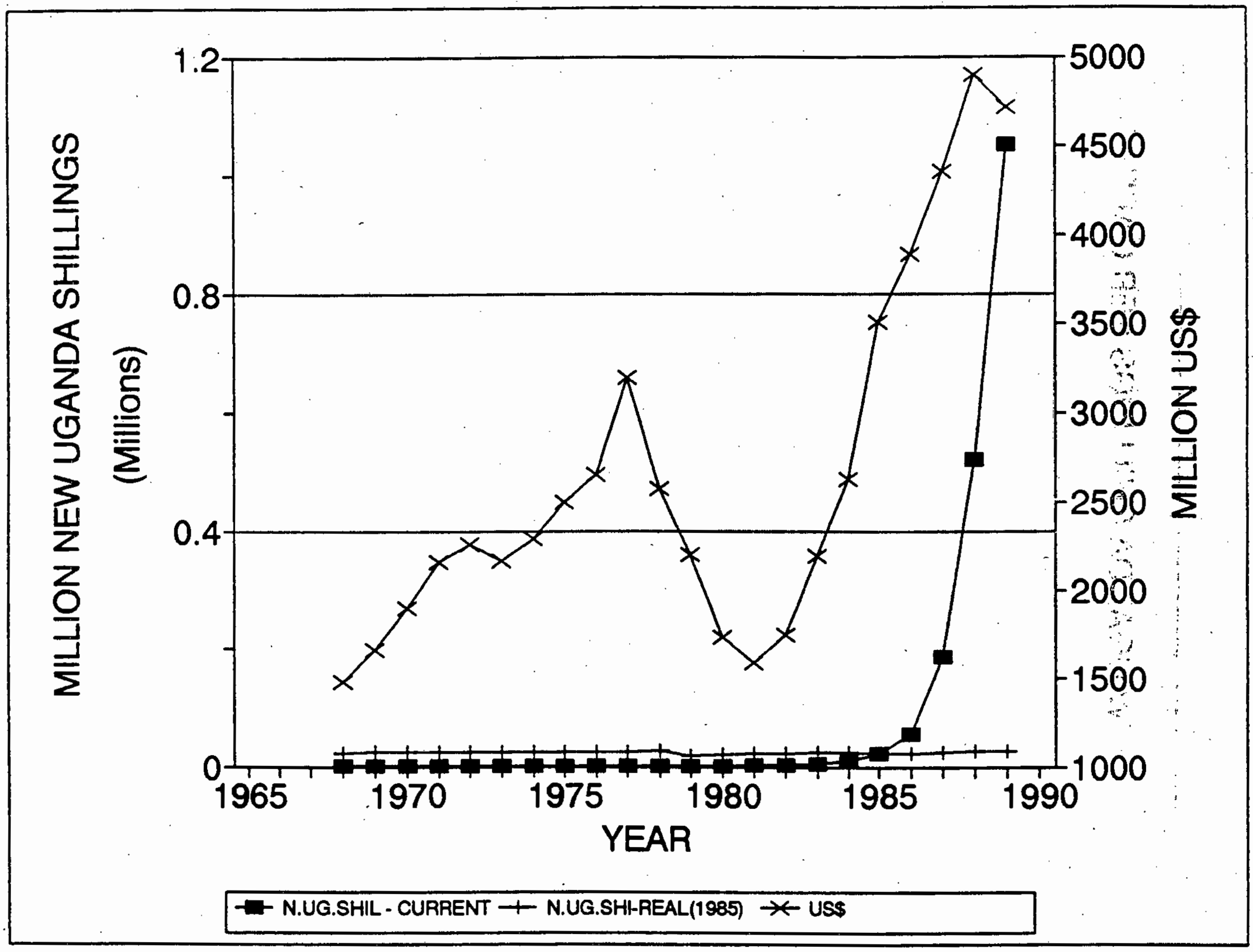

Figure 2. Gross domestic product (market)

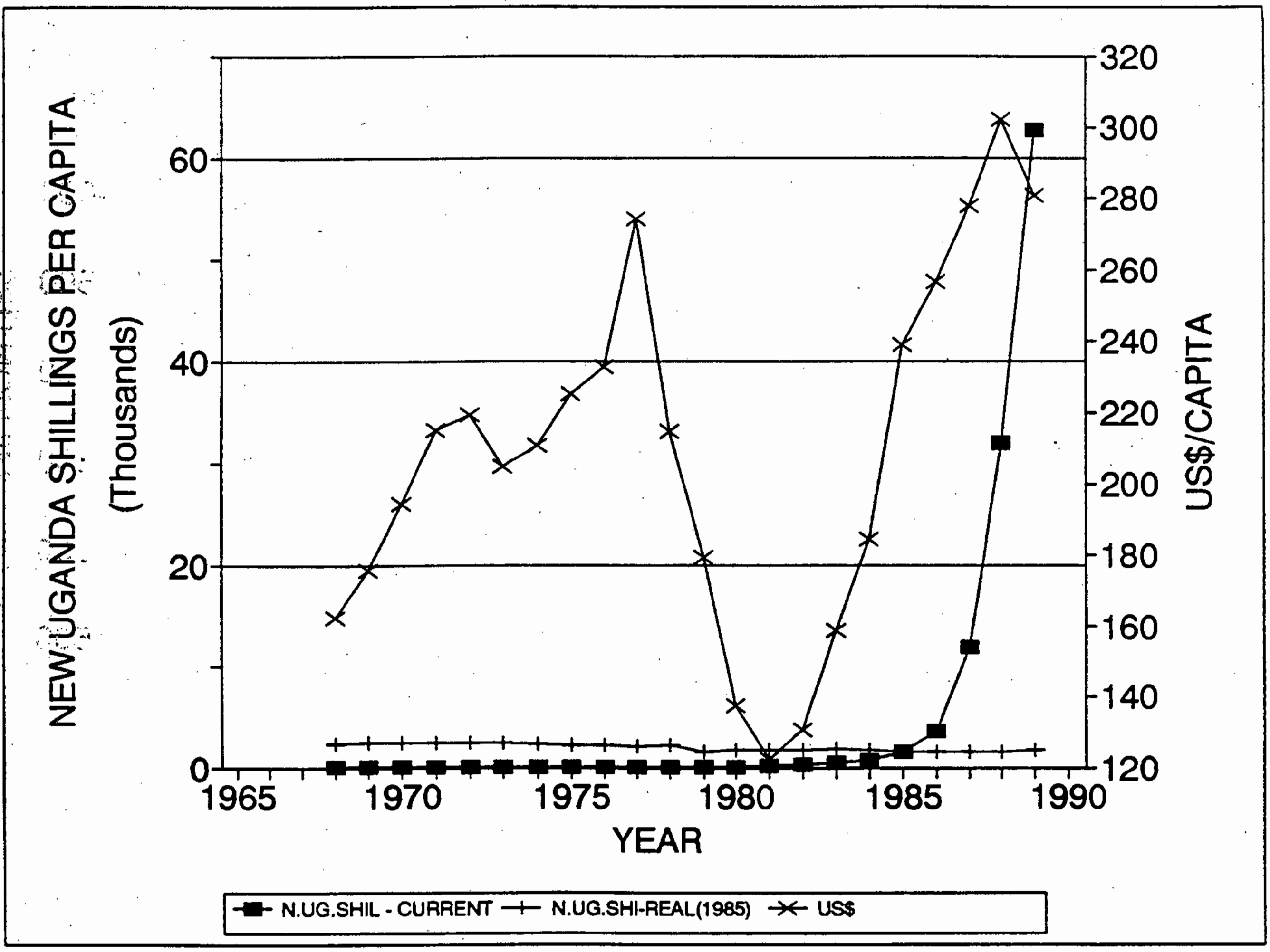

Figure 3. GDP per capita

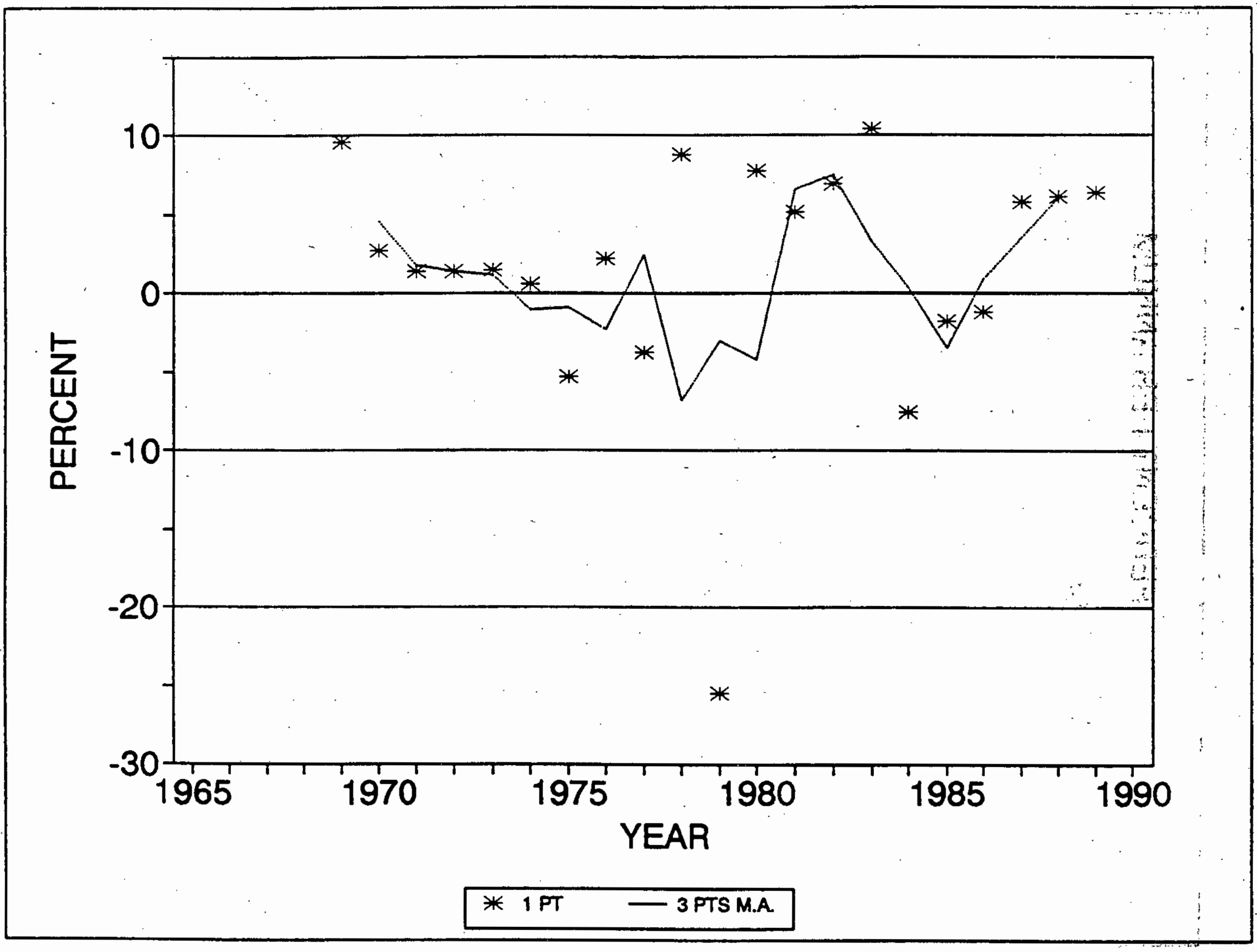

Figure 4. Gross domestic product growth rate: percentage per year (Real 1985)

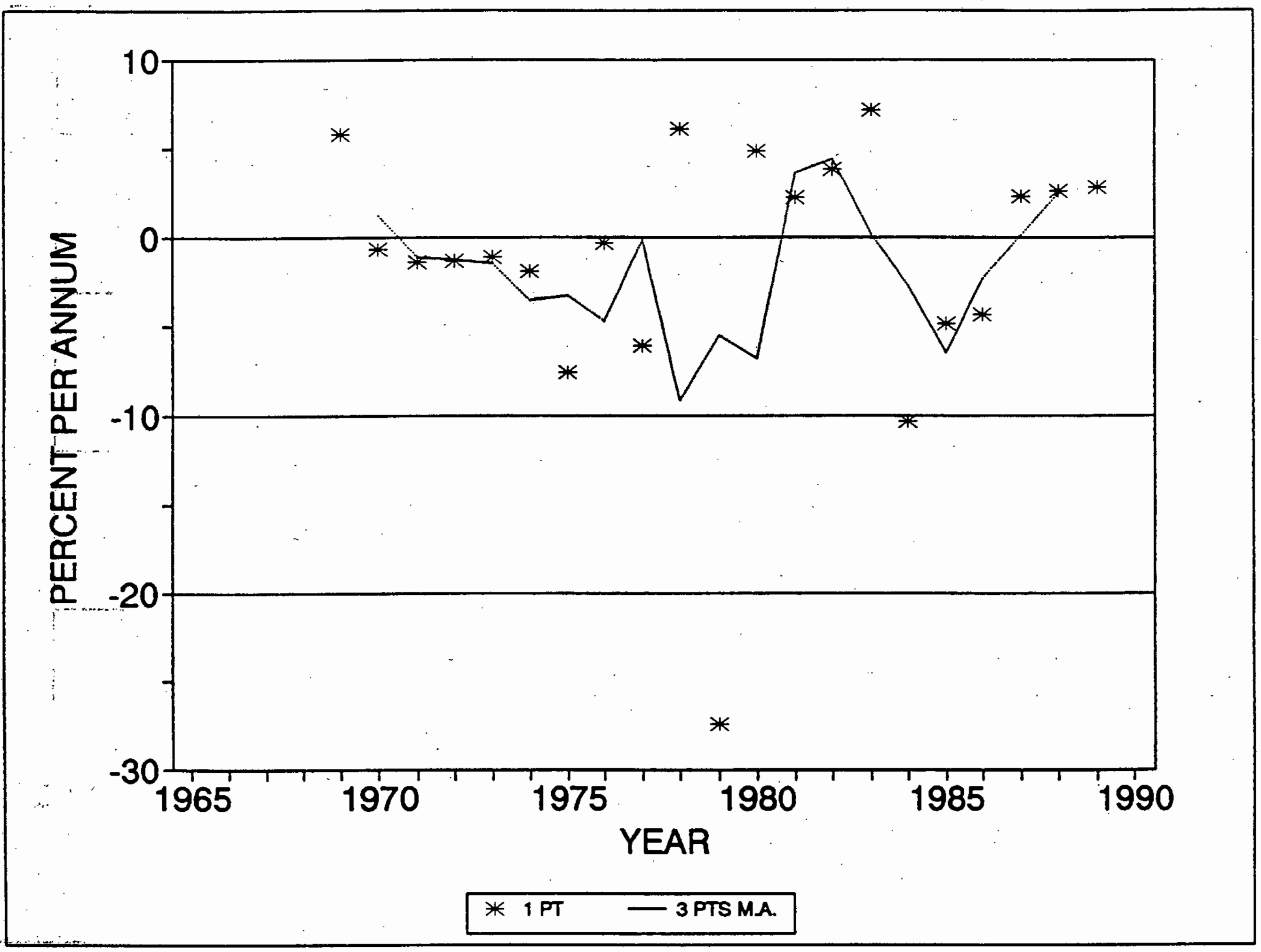

Figure 5. GDP per capita growth rate: percentage / year (Real 1985)

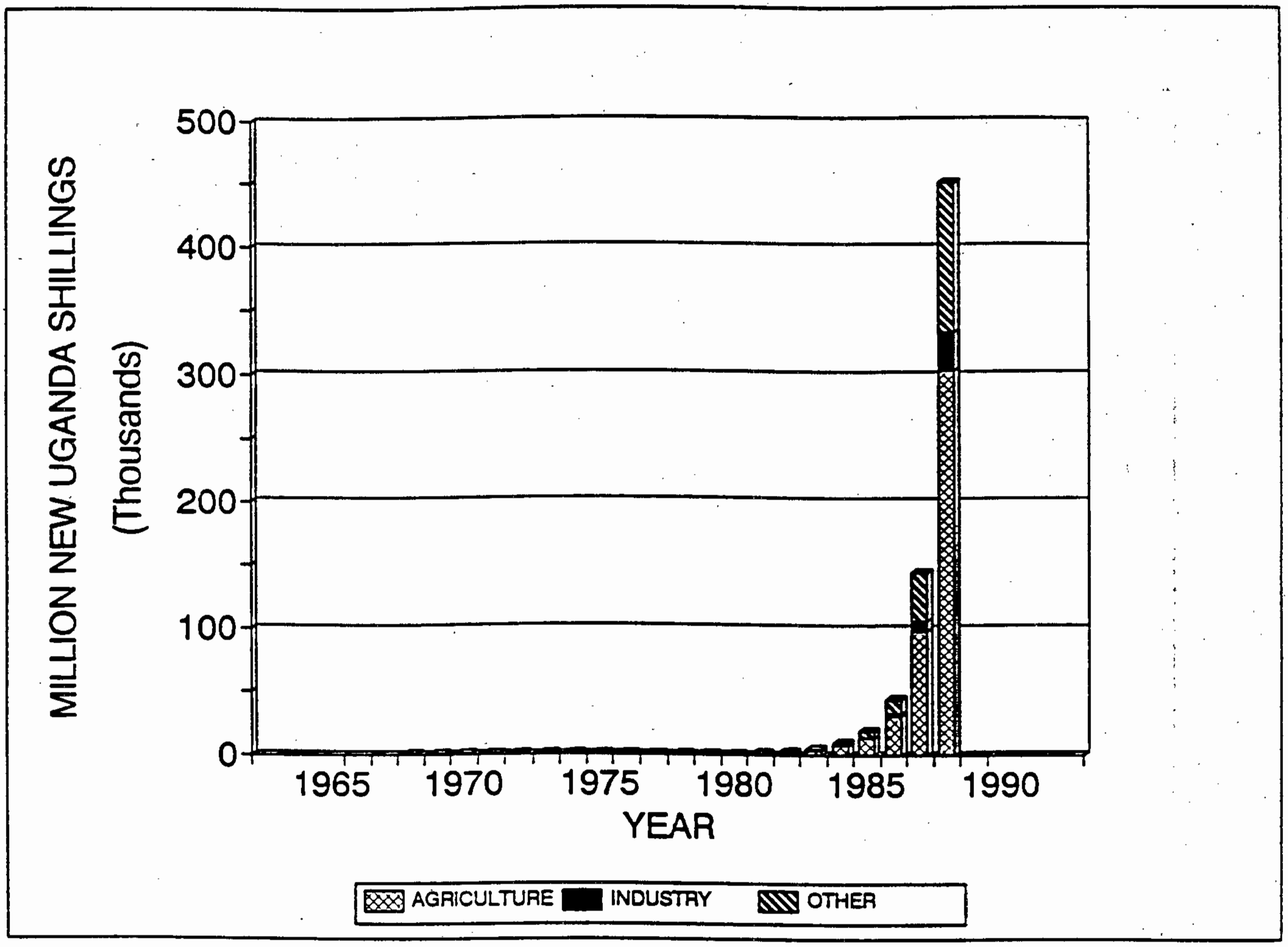

Figure 6. GDP components (Current)

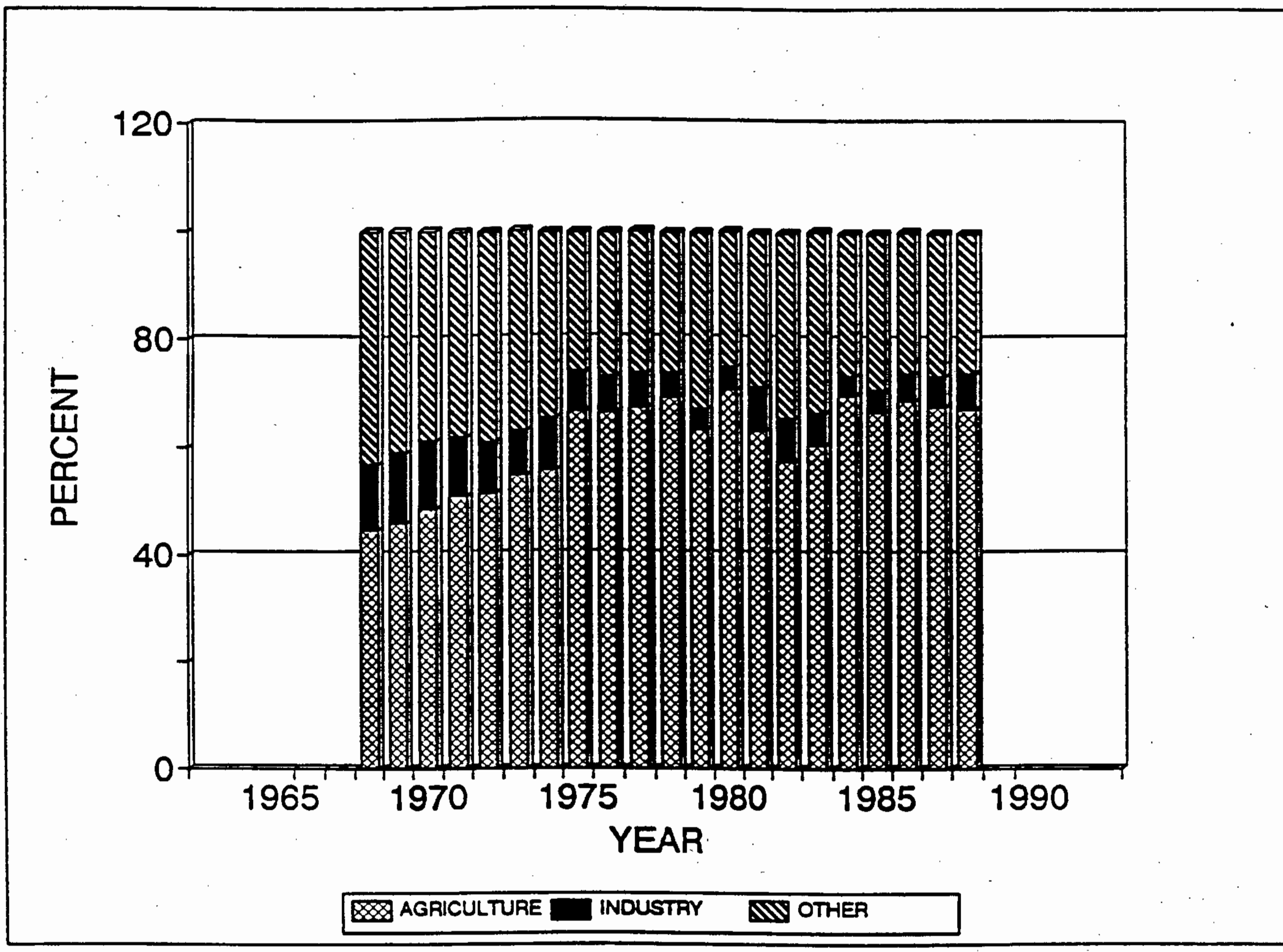

Figure 7. GDP components as percentage of total

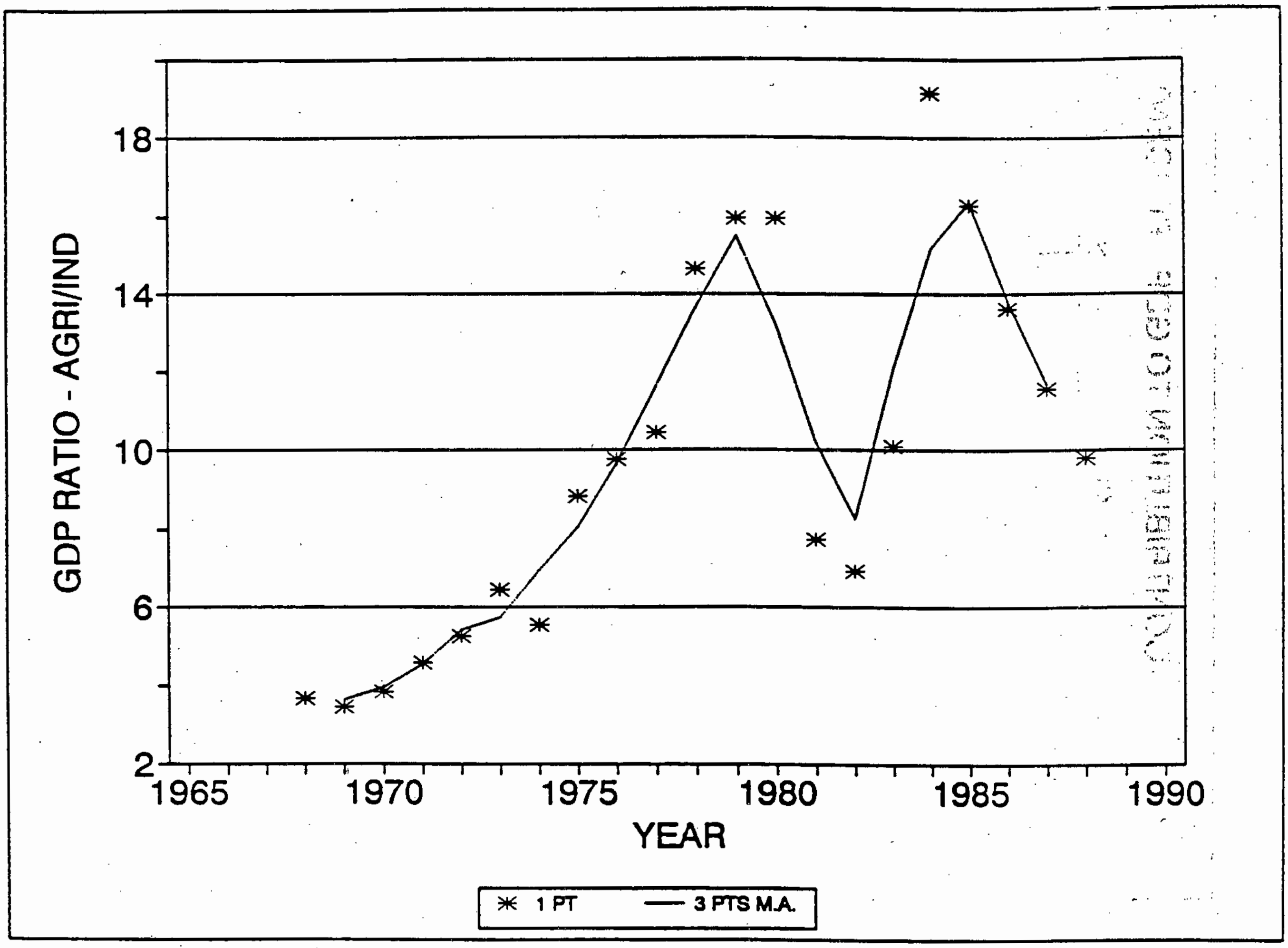

Figure 8. GDP ratio: Agriculture / Industry

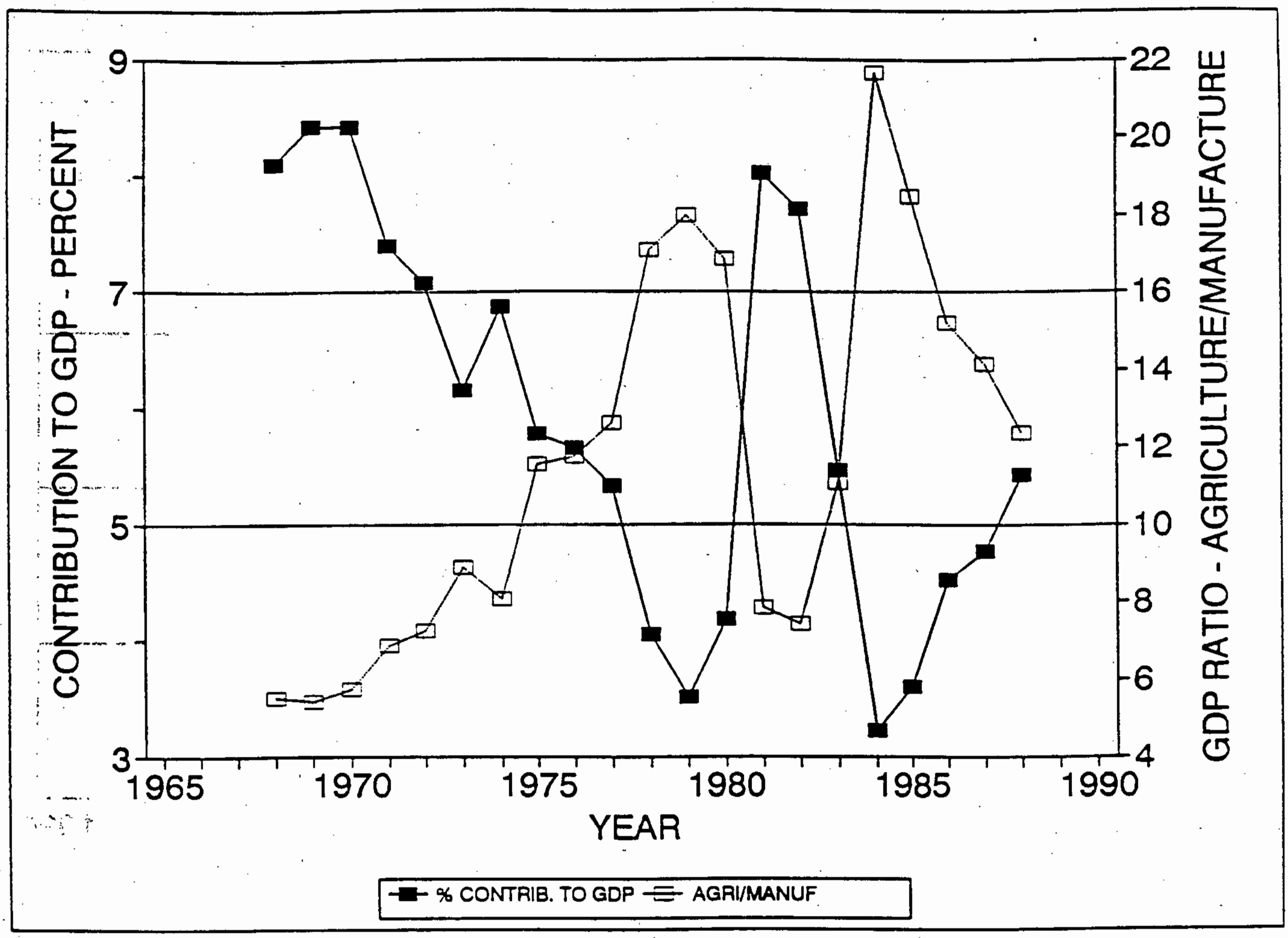

Figure 9. Manufacture: percentage contribution to GDP and GDP ratio

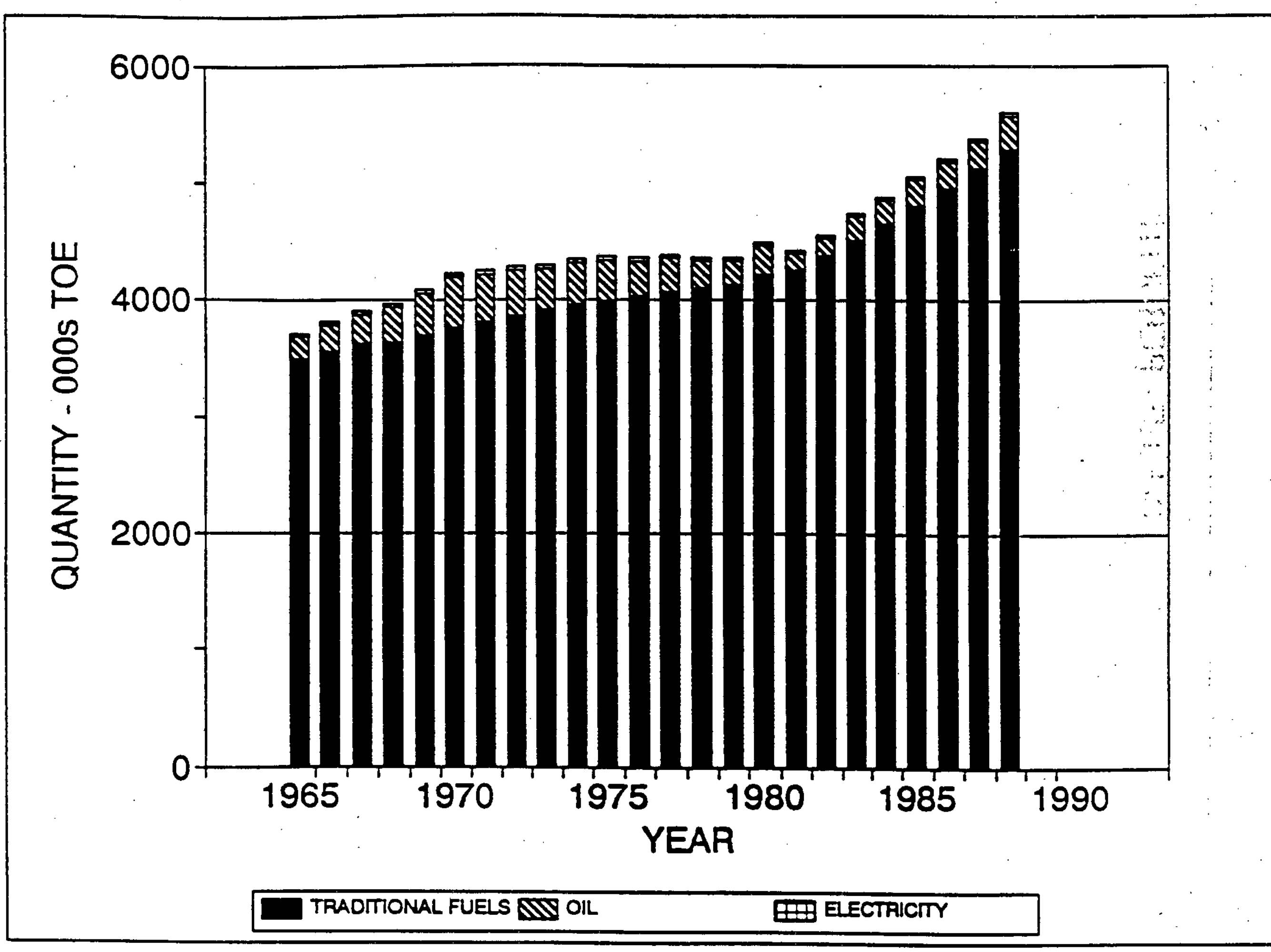

Figure 10. Total final consumption: quantity shares of components

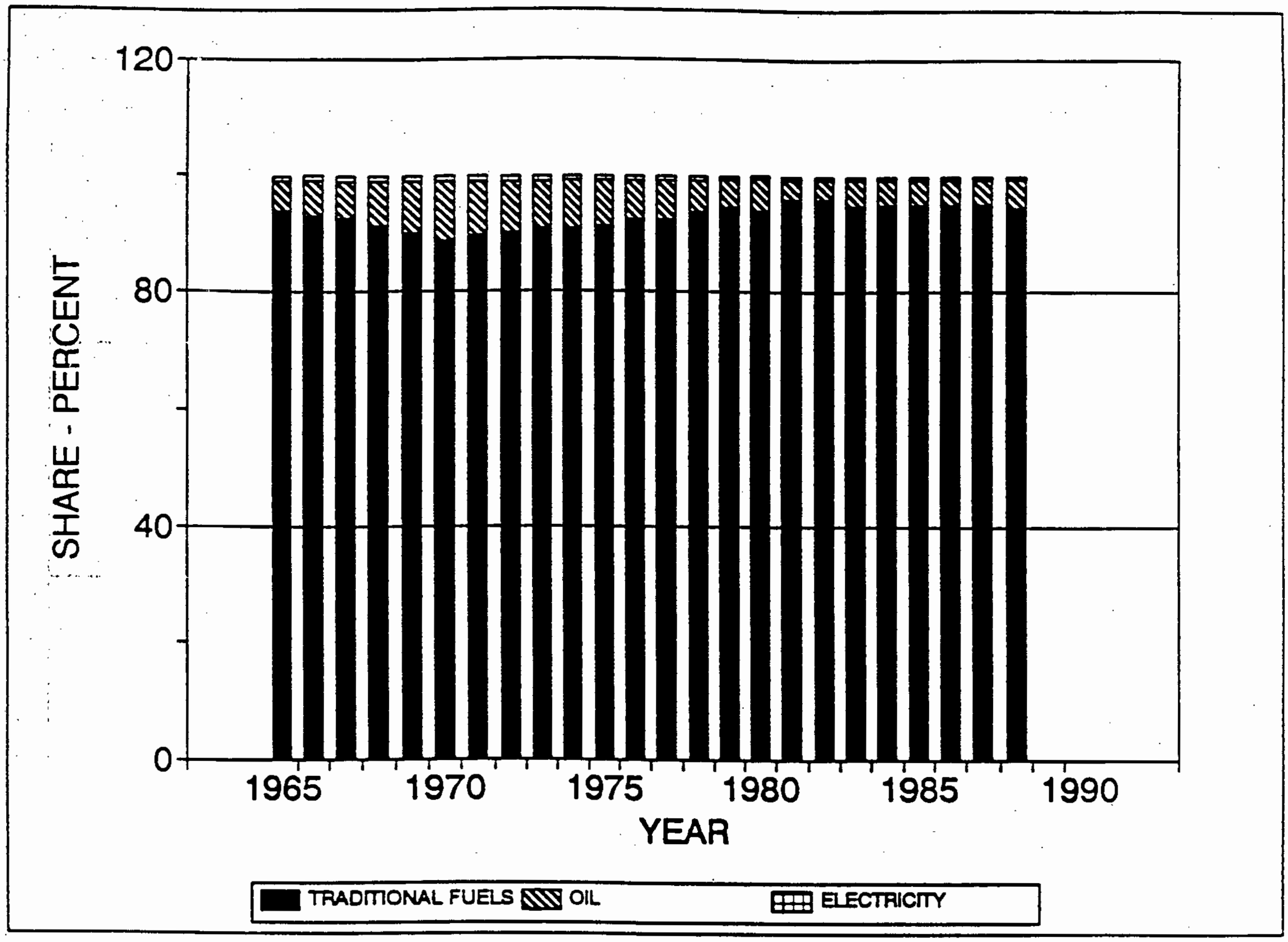

Figure 11. Total final consumption: percentage shares of components

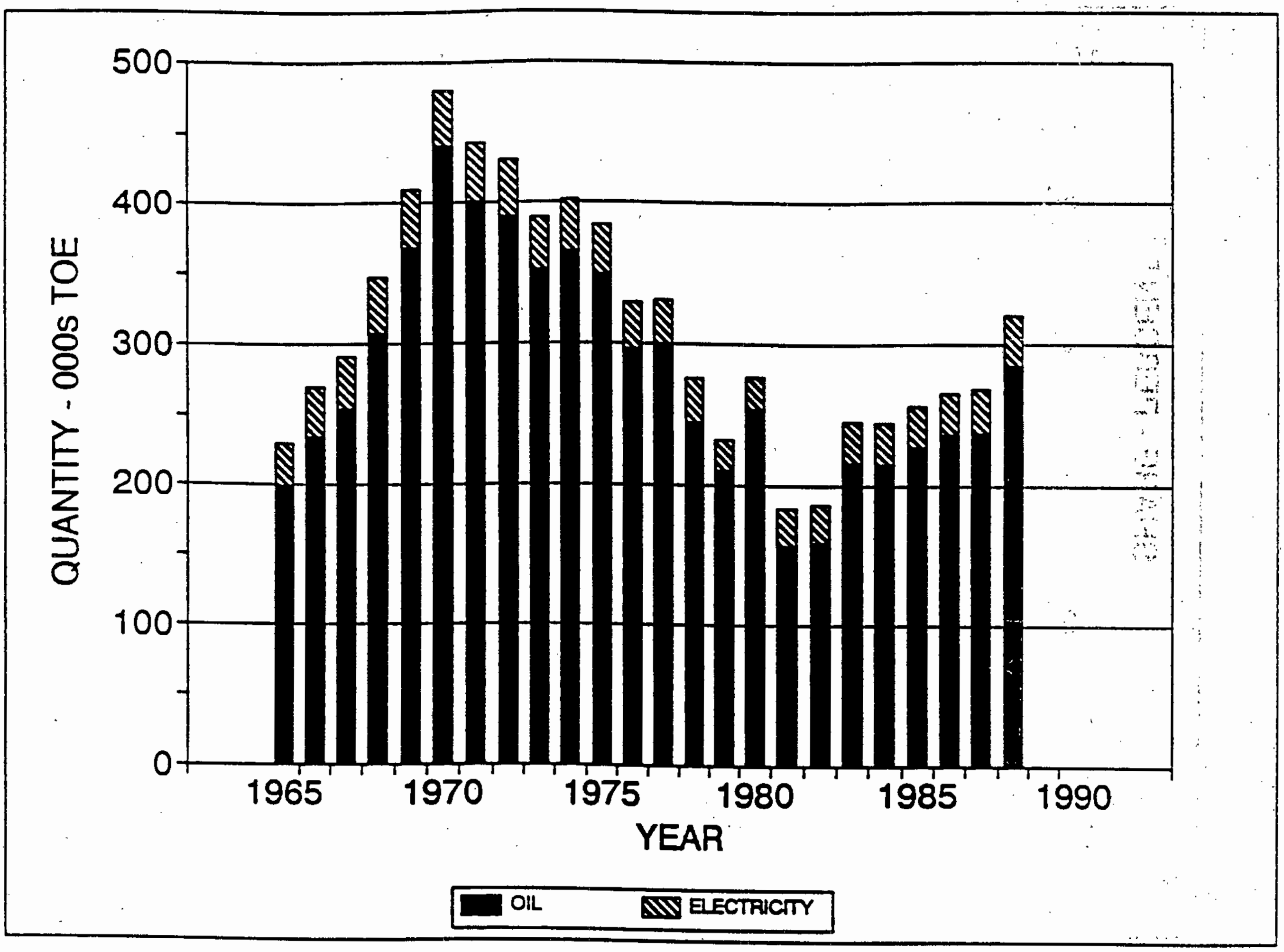

Figure 12. Commercial energy final consumption: quantity shares of components

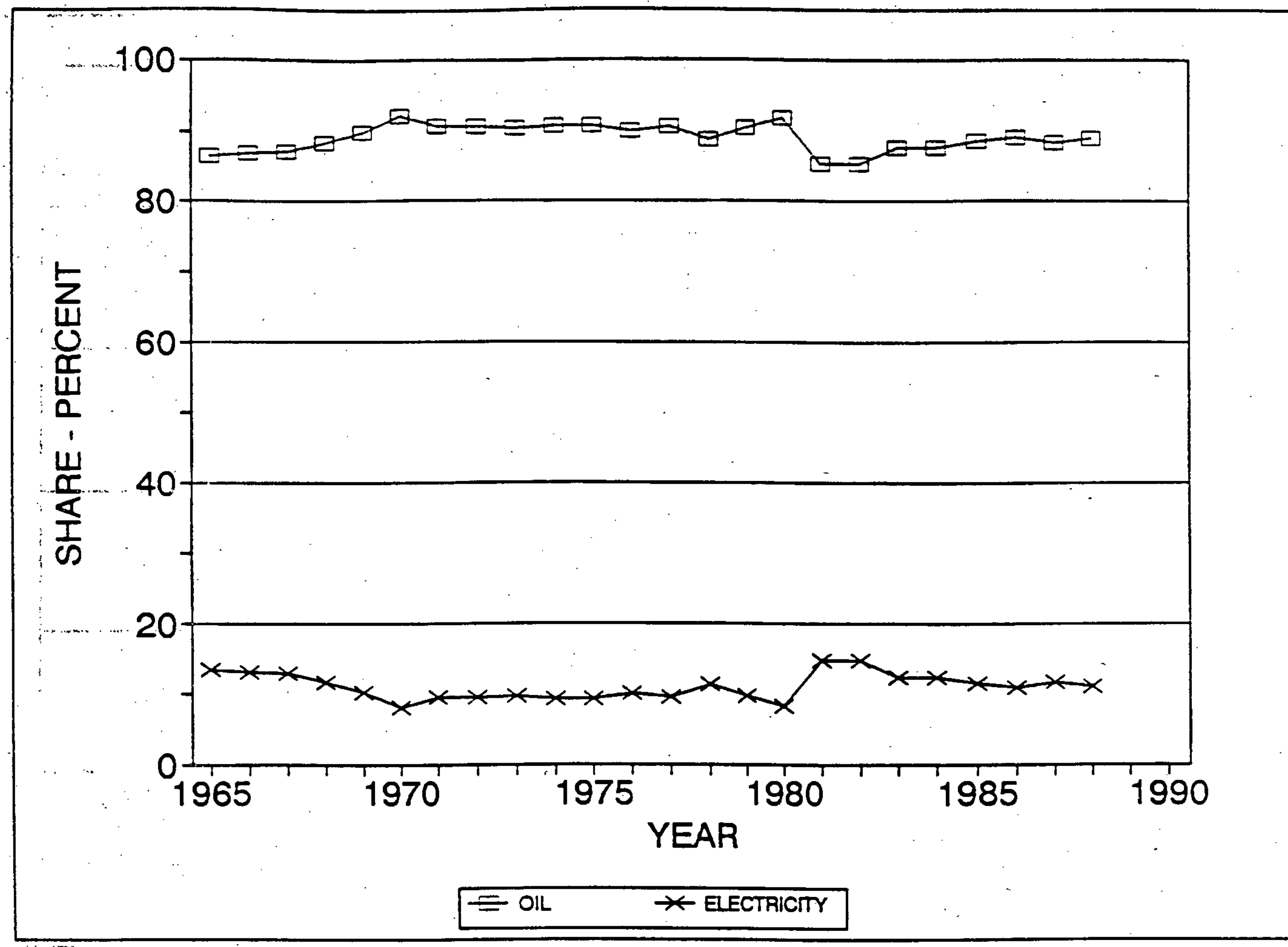

Figure 13. Commercial energy final consumption: percentage shares of components

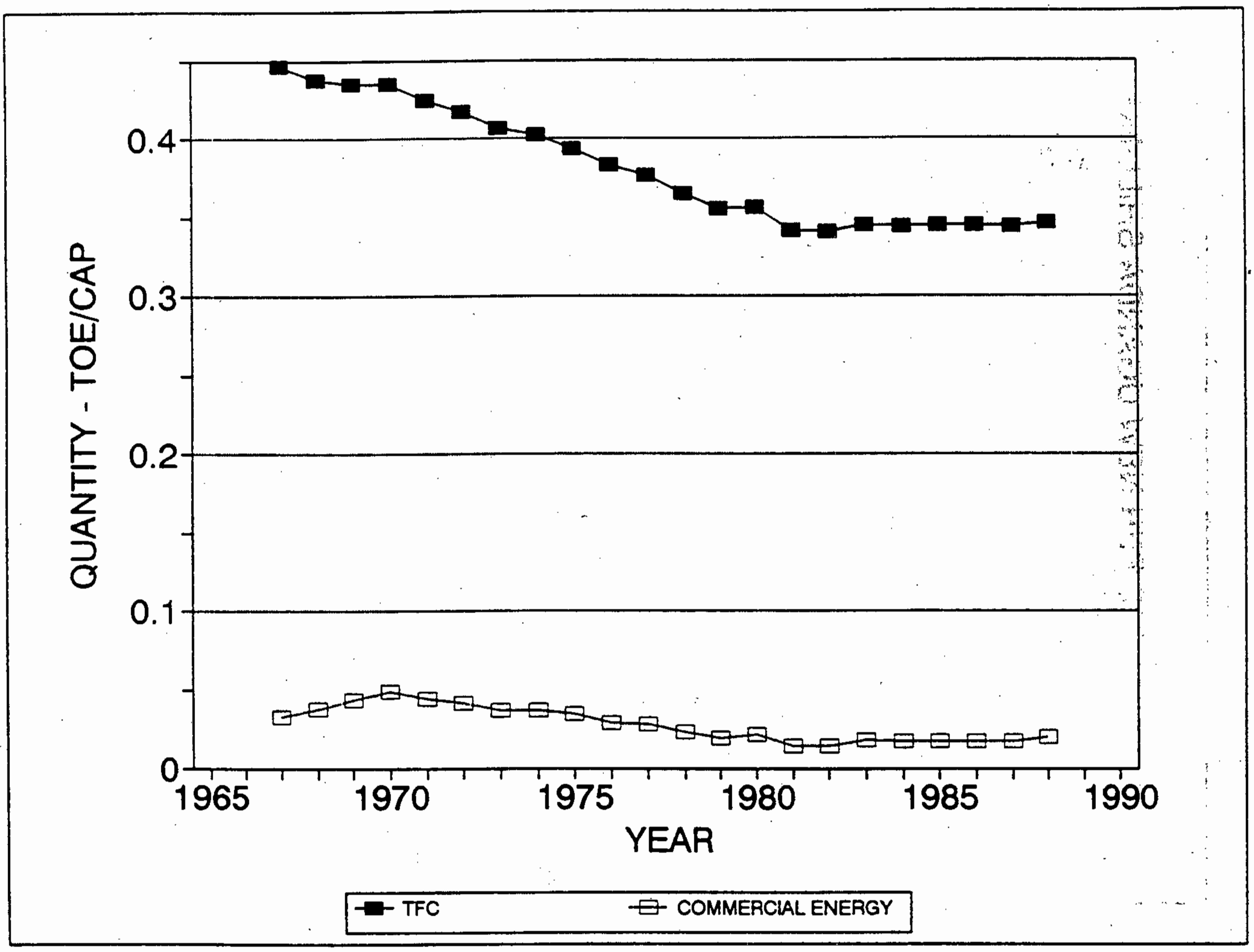

Figure 14. Energy final consumption per capita

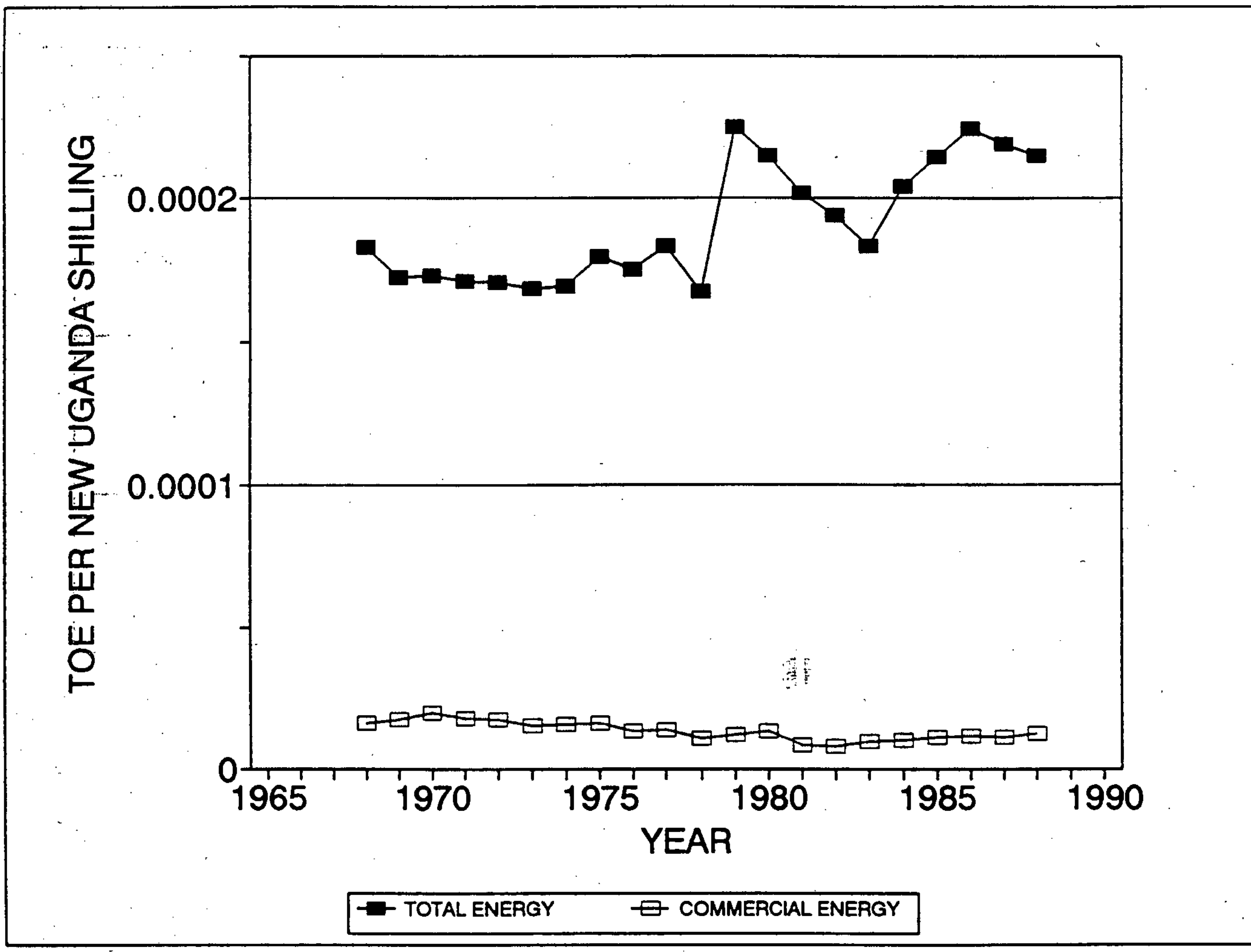

Figure 15. Energy intensity: final consumption / GDP (Real 1985)

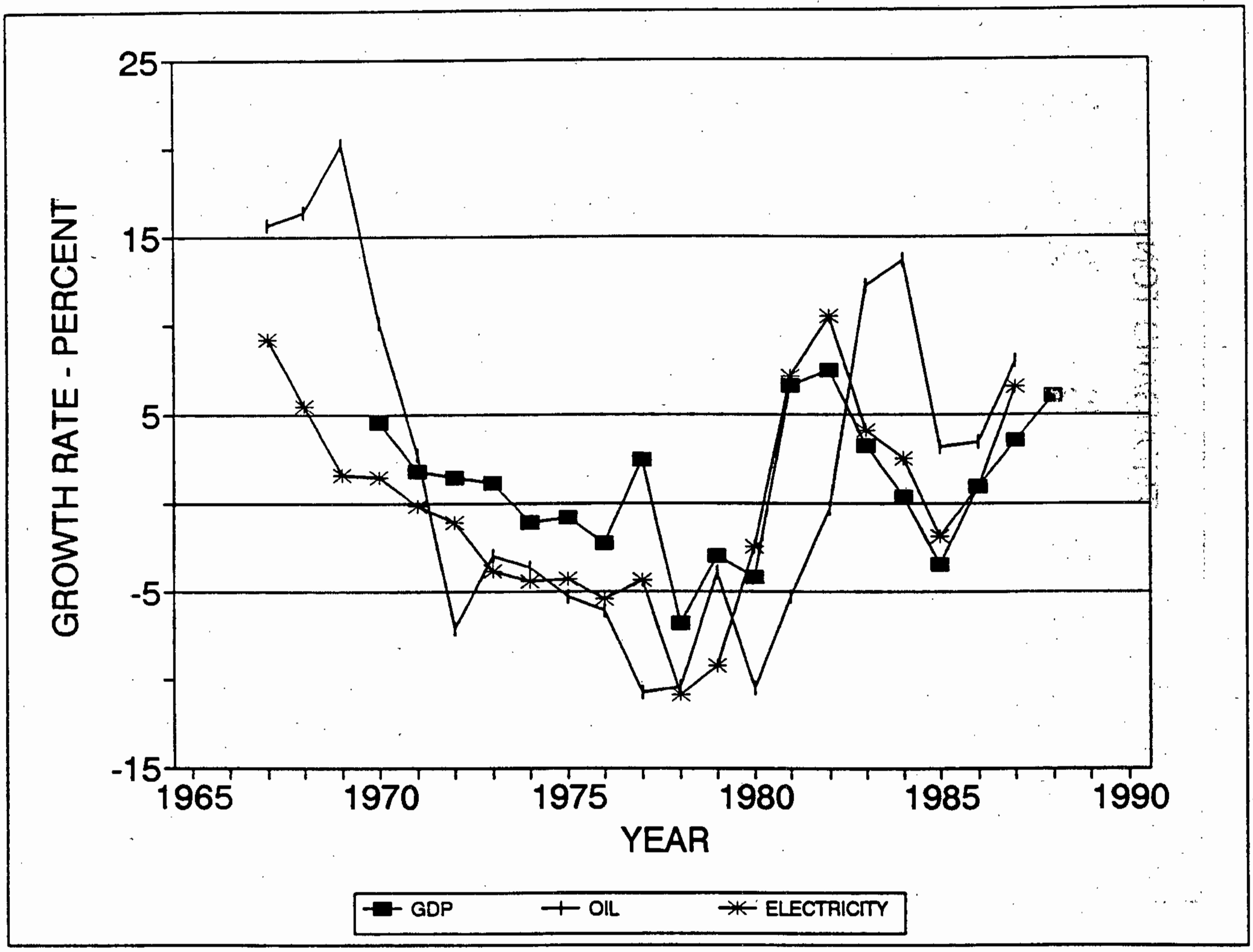

Figure 16. Growth rates (3 pts moving average)

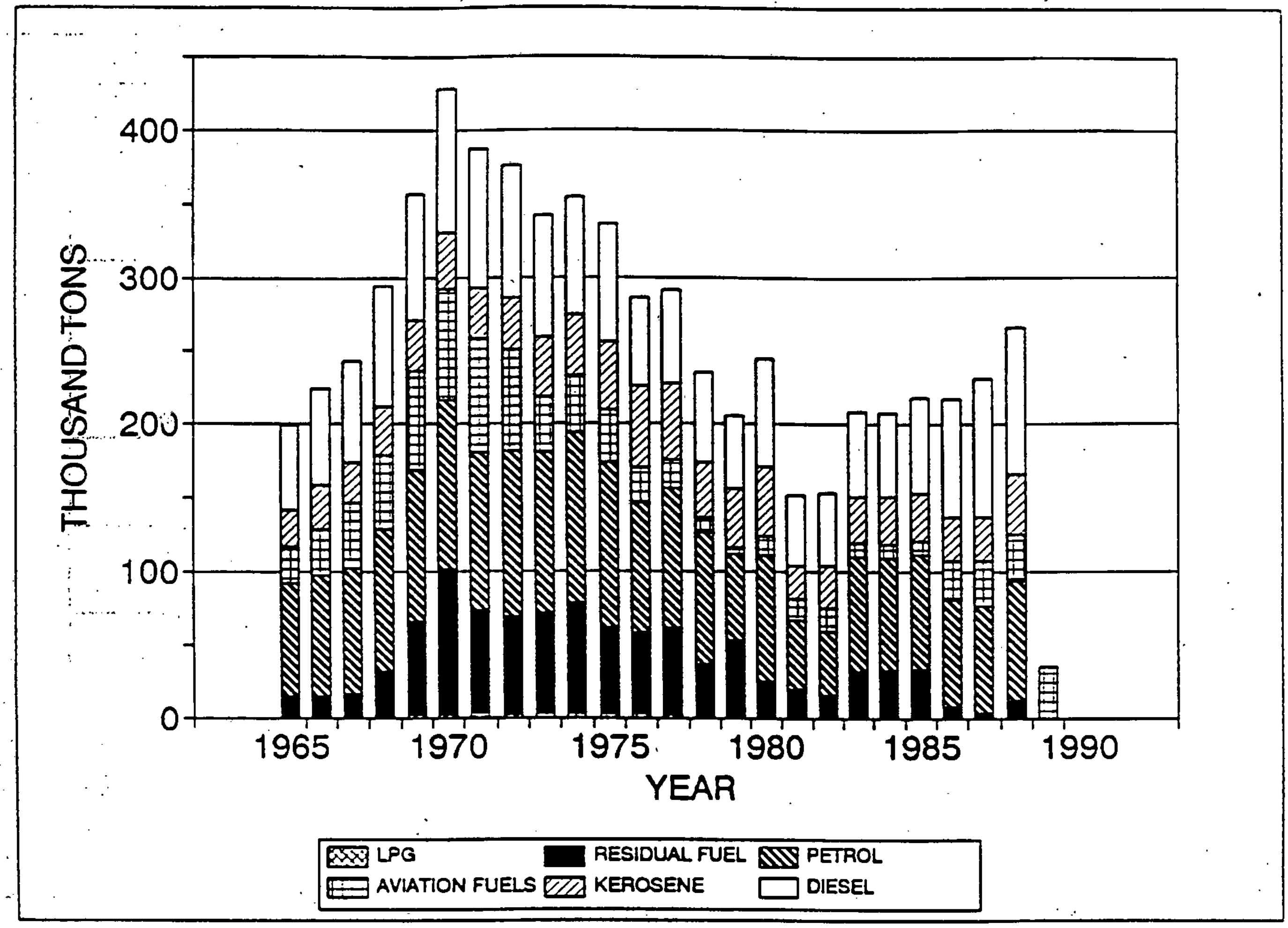

Figure 17. Oil product consumption by type

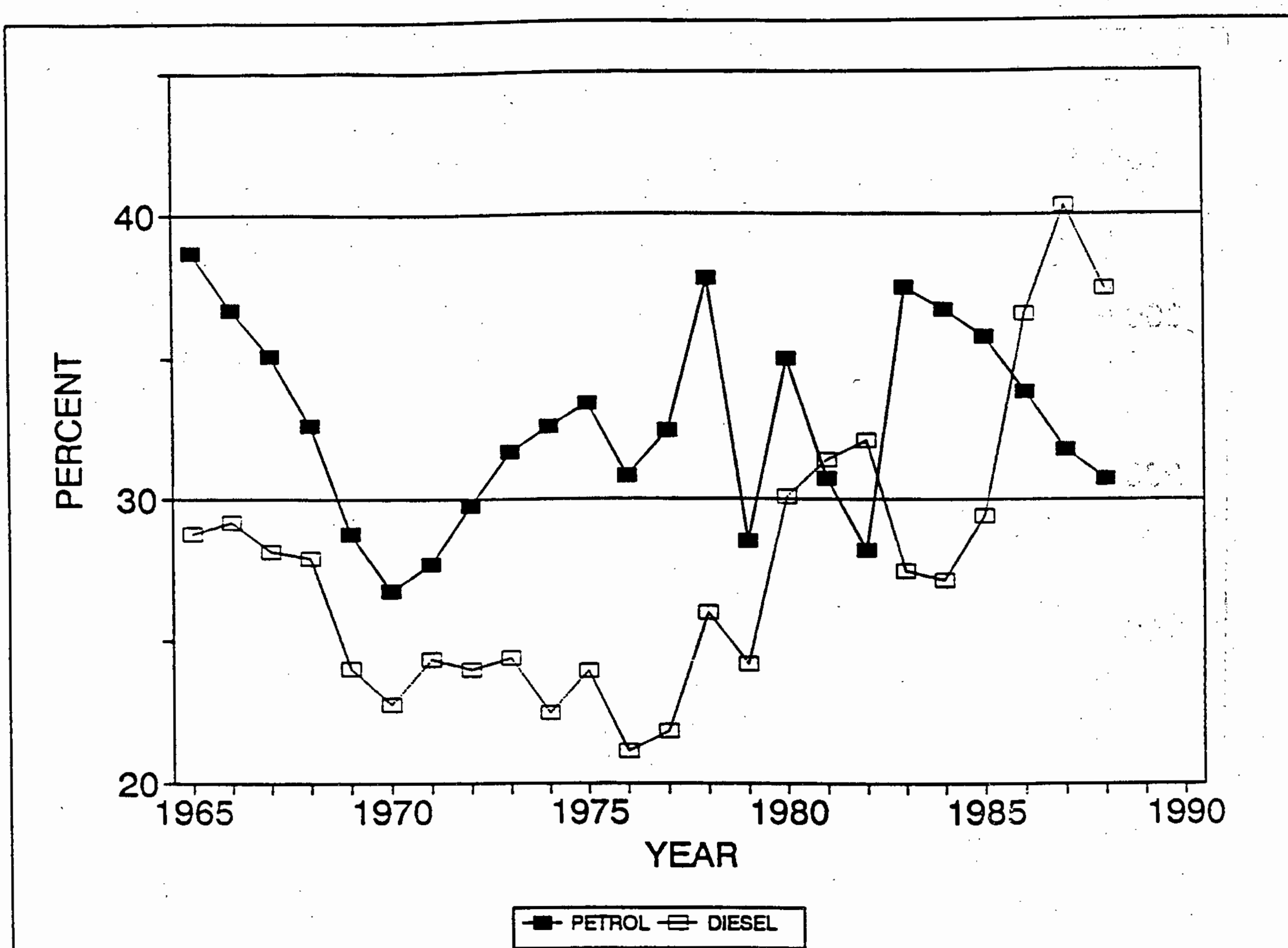

Figure 18. Petrol and diesel as a percentage of oil consumption

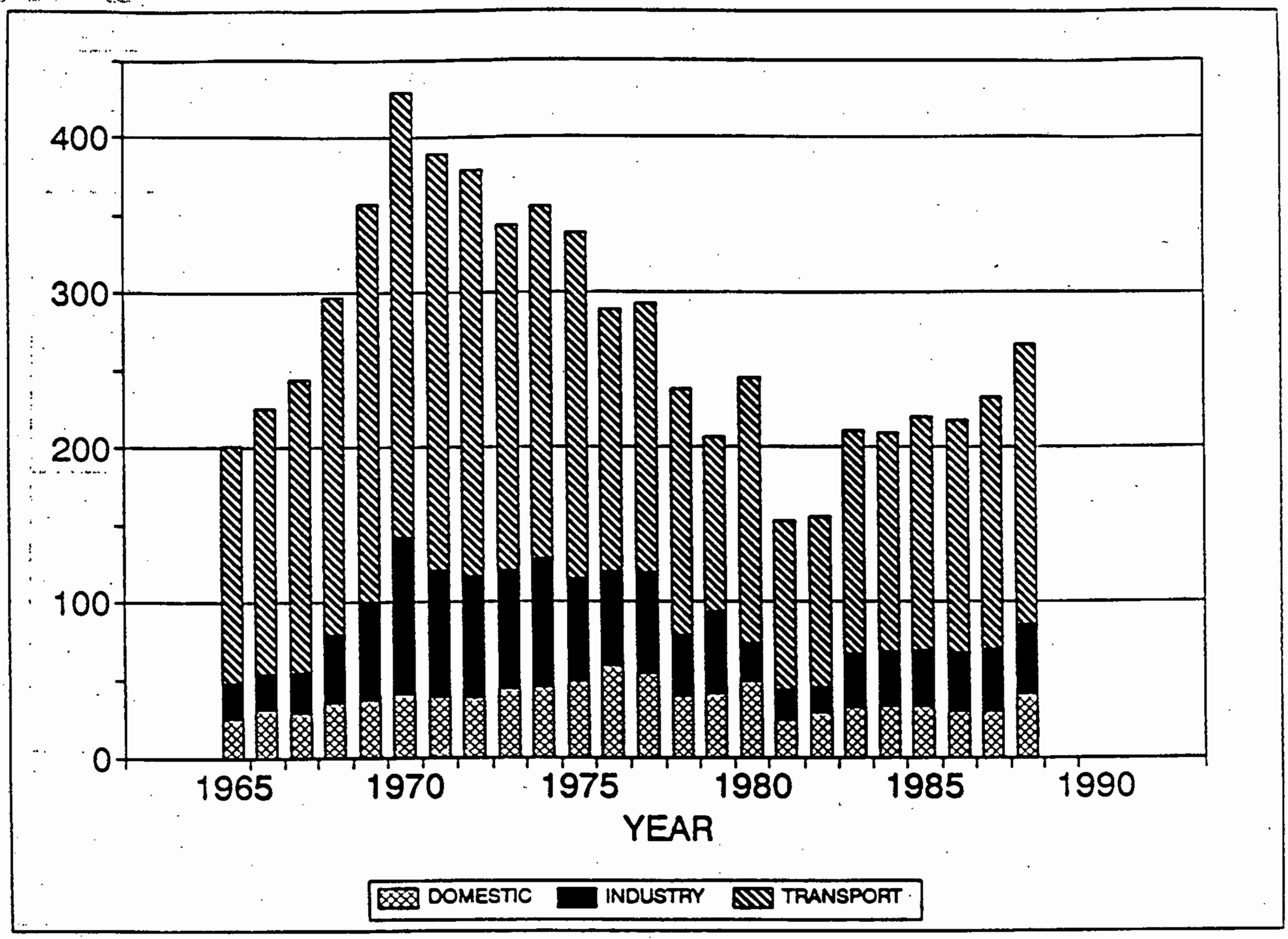

Figure 19. Sectorial distribution of oil consumption

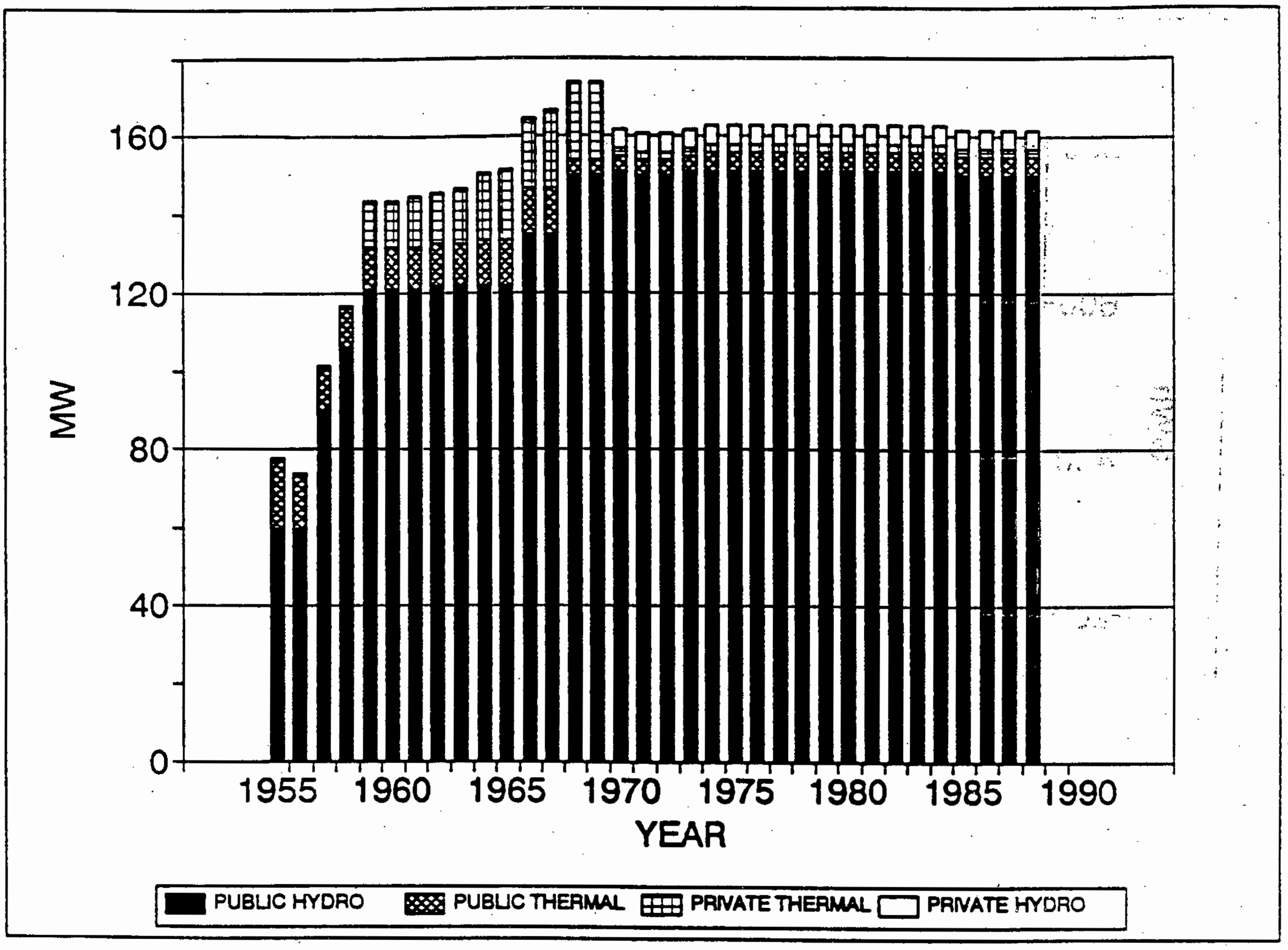

Figure 20. Electrical installed capacity

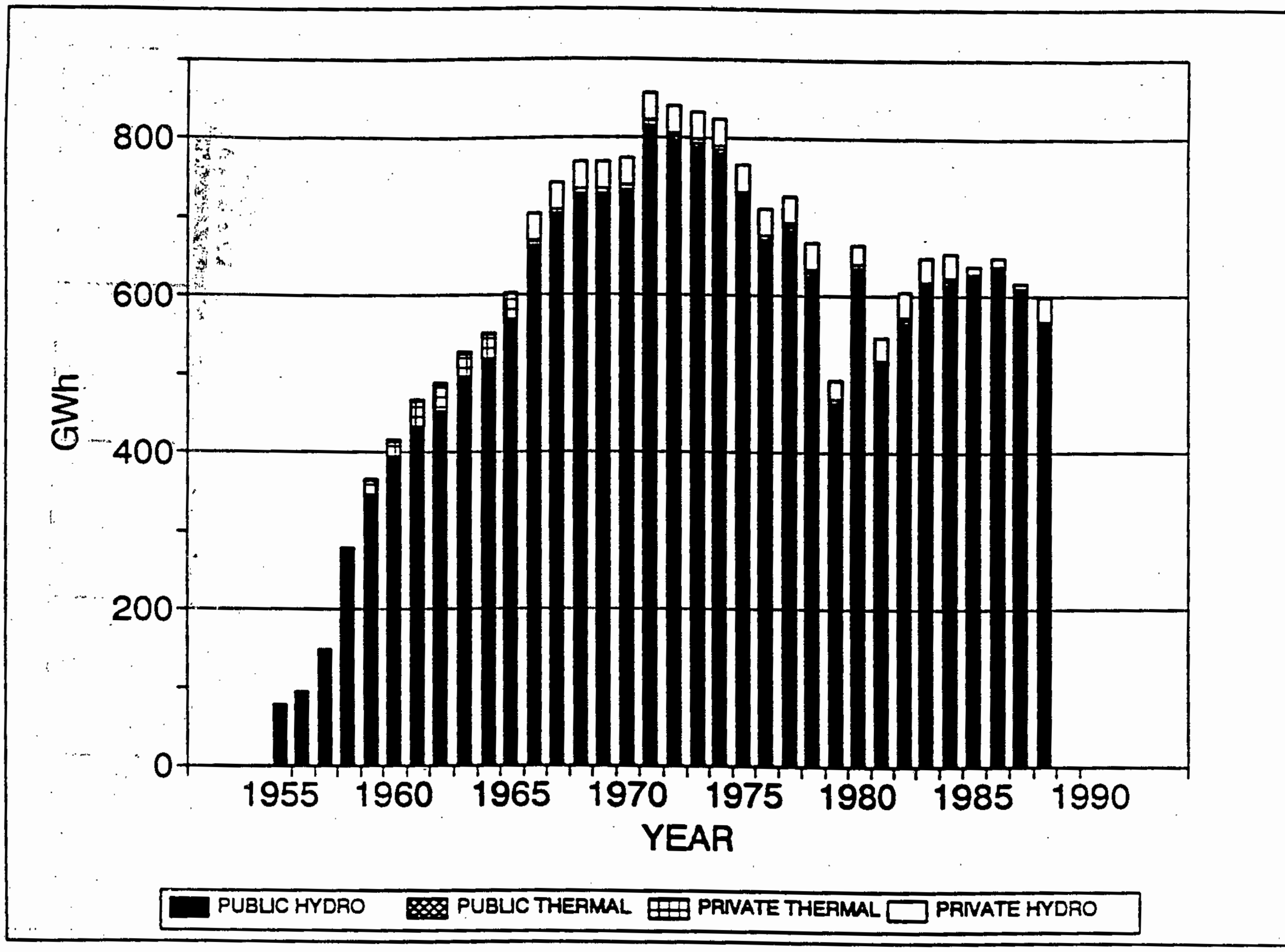

Figure 21. Electricity production

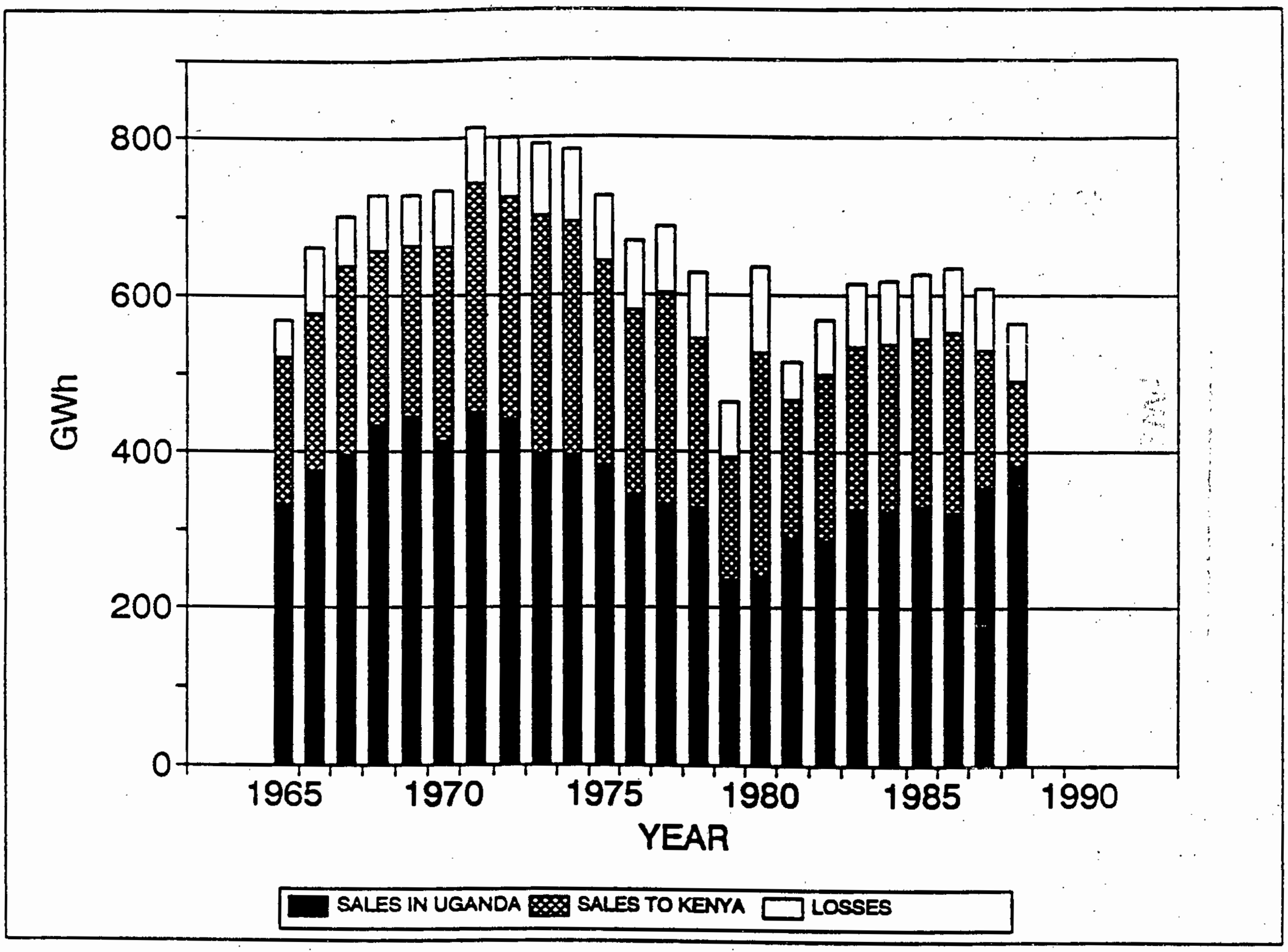

Figure 22. Public sector electricity sales and losses

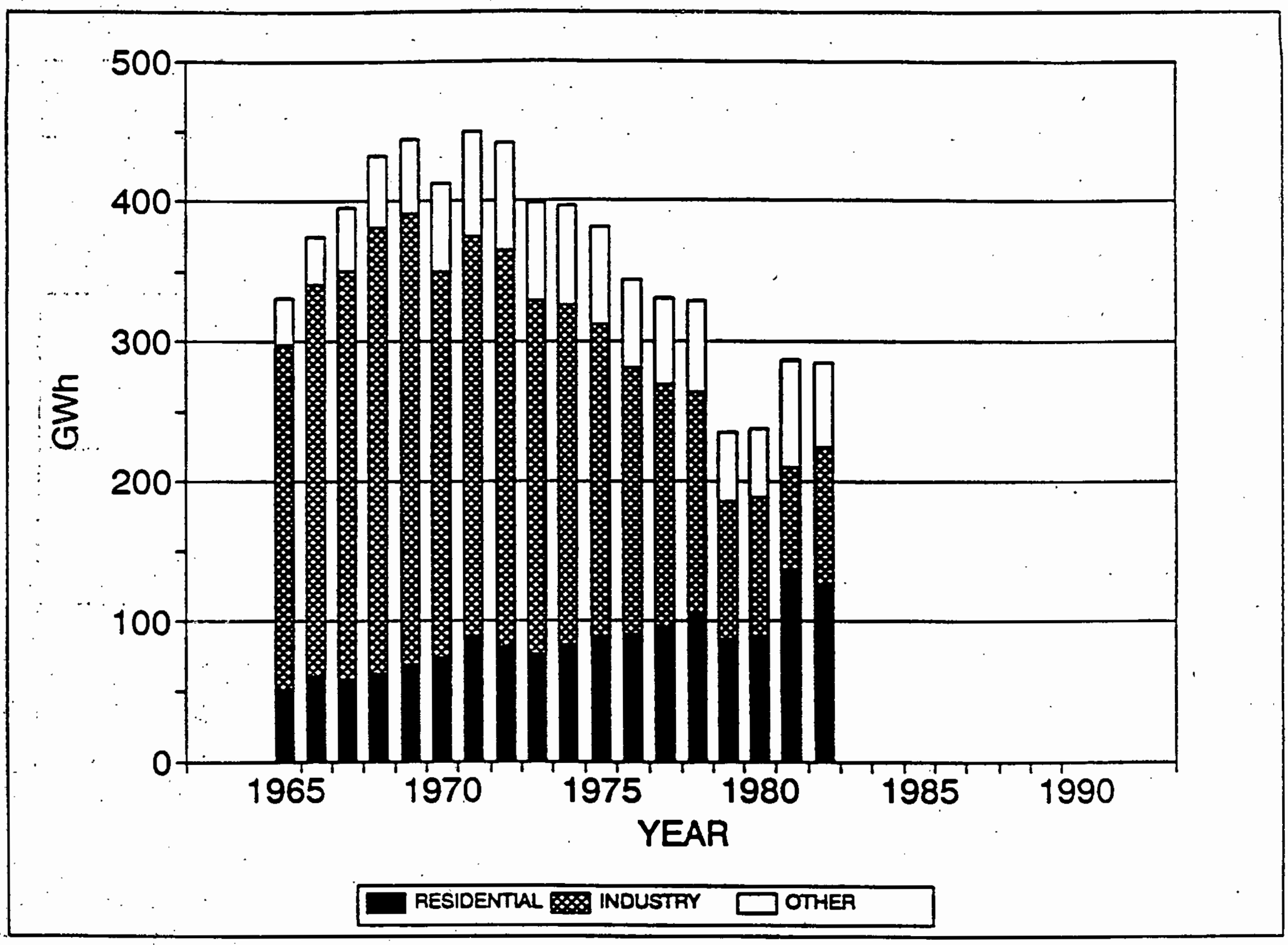

Figure 23. Uganda Electricity Board sales in Uganda: sectorial distribution

MAP