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INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT
INTERNATIONAL DEVELOPMENT ASSOCIATION

APPRAISAL OF
KARIBA NORTH HYDROELECTRIC PROJECT
ZAMBIA

June 23, 1970

Public Utilities Projects Department

CURRENCY EQUIVALENTS

On January 16, 1968, the Zambia currency unit was changed from

Zambia Pound (£Z) to Kwacha (K)
£Z1 = K2.00

On February 16, 1970, the Southern Rhodesian currency unit was changed from:

Rhodesian Pound (£R) to Rhodesian Dollar (\$R)
£R1 = \$R2.00

Currency Units

	= Kwacha (K)
	= Dollar Rhodesian (\$R)
	= Pound Sterling (£ stg)
	= Zambia Pound (£Z)
	= Rhodesian Pound (£R)
K1	= 100 ngwee
K1	= \$R1 = US\$1.40
1 ngwee	= R 1¢ = US\$0.014
K1,000,000	= US\$1,400,000
US\$1	= K0.71 = \$R0.71
US\$1,000,000	= K714,286 = \$R714,286
£ stg 1	= US\$2.40
£R1	= US\$2.80
£Z1	= US\$2.80

Financial year = July 1 to June 30

UNITS AND MEASURES

kW	= kilowatt
MW	= megawatt = 1,000 kW
kWh	= Kilowatt hour
GWh	= Gigawatt hour = 1,000,000 kWh
kV	= kilo volt
One acre ft	= 1233.5 m ³
One million acre ft	= 1233.5 million m ³
RPM	= revolutions per minute
ft	= foot = 0.3048 meters
mile	= 1.609 kilometers

ACRONYMS

CAPC	= Central African Power Corporation
CEC	= Central Electricity Corporation
CDC	= Commonwealth Development Corporation
CDFC	= Commonwealth Development Finance Company Limited
CPC	= Copperbelt Power Company Limited
KNBC	= Kariba North Bank Company Limited
SRESC	= Southern Rhodesia Electricity Supply Commission
UDI	= Unilateral Declaration of Independence
ZESCO	= Zambia Electricity Supply Corporation Ltd.

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APPRAISAL OF KARIBA NORTH HYDROELECTRIC PROJECT

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This report has been prepared by Messrs. C.H.
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APPRAISAL OF KARIBA NORTH HYDROELECTRIC STATION

SUMMARY AND CONCLUSIONS

i. This report covers the appraisal of a project of the Kariba North Bank Company Limited (KNBC) which is wholly owned by the Government of Zambia. The Project consists of a 600 MW hydroelectric station on the North Bank of the Zambezi River at Kariba in Zambia. The output of the station would be fed into the transmission system of the Central African Power Corporation (CAPC) which is jointly owned by Zambia and Southern Rhodesia, and which supplies nearly all of the power requirements of the two countries.

ii. The Project is urgently required to enable CAPC to meet increasing demands on its system. In Zambia adequate supplies of power are vital to the economy of the country since the copper industry, which accounts for about 40% of the gross domestic product, is a very large user of power.

iii. The estimated cost of the Project is equivalent to about US\$48 million. The Zambian Government has asked the Bank to make a loan of US\$40 million equivalent to KNBC to finance the estimated foreign exchange cost and interest during construction on the Bank loan. The Project is the least cost way of providing the required additional generating capacity. The incremental financial rate of return on the Project would be about 17%.

iv. The Bank made a loan of US\$80 million in 1956 to finance part of the cost of the first stage of Kariba, consisting of a dam across the Zambezi River, a 705 MW power station on the South Bank (in Southern Rhodesia) and a 330 kV transmission system. It made another loan of US\$7.7 million to CAPC in 1964 to finance part of the cost of transmission expansion in Zambia. Both loans were completely drawn down and the projects are operating satisfactorily.

v. In normal circumstances CAPC would construct the Project and carry out needed expansion of its transmission system and the Bank would make a loan to CAPC to help finance the work. Because such an approach is not possible at the present time, the Zambian Government has established KNBC to construct the Project. KNBC will appoint CAPC as its agent for construction and will lease the station to CAPC after it is completed. CAPC will make a loan to KNBC to cover the local costs of construction and it will finance the whole of the cost of the expansion of its transmission system in Zambia and Southern Rhodesia during the next six years.

vi. The proposed Bank loan would be guaranteed by the Government of Zambia. To meet the Government's request that its responsibilities as guarantor under the existing Kariba loans and the proposed Bank loan will not exceed 50% of the total loan amounts and thus continue the present arrangements for the equal sharing of guarantees by Zambia and Southern Rhodesia, the Bank would, on making the loan, release Zambia from its

guarantee obligations on parts of the existing loans, after an agreed date (but not before July 1, 1973) in order to maintain the equal sharing. The existing loans would continue to be backed by a United Kingdom guarantee.

vii. Because of the Unilateral Declaration of Independence (UDI) by Southern Rhodesia in 1965, the Board of CAPC and the Higher Authority for Power, which has to approve major decisions of CAPC, are not considered legally constituted by the Zambian Government and cannot function effectively. To give effect to the above arrangements both should be able to function effectively. The United Kingdom Government has made an Order-in-Council which will permit the Government to appoint two members to the Authority. This will permit the Authority to function effectively and to take action which will enable the Board of CAPC to also function effectively.

viii. At the end of the construction period, KNBC's sole asset will be the North Bank Station, on which the annual depreciation will equal the amortization on the proposed Bank and CAPC loans. KNBC's gross income, which will be paid by CAPC in the form of rent, will be the sum of the debt service on its loans and reasonable administration expenses. During the period June 30, 1970, to June 30, 1976, the consolidated net fixed assets of CAPC and KNBC will increase from K142 million (US\$199 million) to K185 million (US\$259 million), an increase of 30%. The overall financial position of CAPC and KNBC will be satisfactory; the rate of return on combined net fixed assets in operation will be about 9% in 1975/76, and the debt/equity ratio as at June 30, 1976, 58/42. CAPC will also have built up funds amounting to about K13 million (US\$18 million) which could be used to assist in financing the next stage of development.

ix. Satisfactory agreement having been reached regarding the matters summarized in paragraphs 7.01 and 7.02 of this report, the Project is suitable for a Bank loan of US\$40 million equivalent to KNBC for a term of 25 years, including a grace period of 5 years.

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APPRAISAL OF KARIBA NORTH HYDROELECTRIC PROJECT

1. INTRODUCTION

1.01 This report covers the appraisal of a project of the Kariba North Bank Company Limited (KNBC) which is wholly owned by the Government of Zambia. The Project consists of a hydroelectric station on the North Bank of the Zambezi River at Kariba in Zambia with an installed capacity of 600 MW. The estimated cost of the Project is equivalent to about US\$48 million. The Bank has been asked by the Government of Zambia to make a loan of US\$40 million equivalent to KNBC to cover the foreign exchange cost and interest during construction on the Bank loan. The Project will be part of the second stage of the Kariba development.

1.02 The Bank made a loan (No. 145-RN) of US\$80 million to the Federal Power Board (the predecessor of the Central African Power Corporation (CAPC)) in 1956 to finance part of the cost of the first stage of Kariba. The first stage, consisting of an arch dam across the Zambezi River, a 705 MW power station on the South Bank in Southern Rhodesia and 330 kV transmission system, commenced supplying power in December 1959 and was completed in 1962. In October 1964 a loan (No. 392-RMS) of US\$7.7 million was made to CAPC to finance part of the cost of transmission expansion in Zambia. Both loans have been drawn down and both projects are operating satisfactorily.

1.03 Zambia is a landlocked country with a population of about 4 million and an area of some 290,600 square miles. It is bordered on the north by the Democratic Republic of the Congo, on the east by Tanzania and Malawi, on the south by Mozambique, Southern Rhodesia and South West Africa, and on the west by Angola. Most of the country consists of a high plateau with an elevation of 3,000 to 4,000 ft above sea level, which is intersected by the deep valleys of the Zambezi River and its main tributaries, the Kafue and Luangwa Rivers.

1.04 The lifeline of the country is the railroad which runs from Livingstone in the south on the Southern Rhodesian border to the Copperbelt near the Congolese border in the north. Most of the modern sector of the economy and a large part of the population are concentrated in areas near the railroad. The production of copper dominates the economy of Zambia. It accounts for about 40% of the gross domestic product, about 95% of total exports which are shipped mostly by rail to Beira in Mozambique or Lobito in Angola, and provides more than 60% of recurrent government revenue. During the period 1962 to 1969 copper output increased at an average rate of over 4% per annum and during the next five years an average increase of 3% per annum is forecast. The Government considers this forecast to be conservative. It now has a 51% participation in existing mining companies and wants to increase production more rapidly and it is endeavoring to get foreign interests to start new mining ventures.

1.05 Adequate supplies of electric power are vital to the economy of Zambia since the copper industry is a very large user. Consumption in the Copperbelt during 1968/69 was nearly 3,000 GWh, about 92% of the total consumption in Zambia; it is likely to reach about 5,000 GWh during 1975/76.

1.06 The CAPC, which is jointly owned and operated by Southern Rhodesia and Zambia, supplies power in bulk to undertakings distributing electricity in both countries (see map). During 1968/69 sales by CAPC in Zambia amounted to 3,237 GWh and in Southern Rhodesia to 2,429 GWh. It supplies nearly all of Zambia's requirements by generating stations (Kariba South and thermal stations) situated in Southern Rhodesia. Less than 10% is supplied by generating stations located in Zambia. To meet increasing system demand, CAPC requires additional generating capacity in service by June 1974 and an expansion of its transmission system.

1.07 Although the Zambian Government is aware of the benefits obtained from CAPC's integrated system, it is concerned that should supply from Southern Rhodesia be discontinued or curtailed its economy would be seriously affected. It is, therefore, most anxious to have generating capacity in Zambia sufficient to meet its own demand should such an occasion arise. With this object in view, it commenced in 1966 the construction of two hydroelectric stations at Victoria Falls, with a total installed capacity of 100 MW, and another hydroelectric station at Kafue with an installed capacity of 600 MW early in 1967. The output of these stations would be purchased by CAPC and fed into its transmission system. Because of lack of storage at Kafue its firm output will be small and the combined output in 1972, when all three stations are scheduled to be in operation, would meet less than half of Zambia's requirements. To achieve its objective and to provide the additional generating capacity required by CAPC, the Zambian Government wants to proceed with the construction of Kariba North as soon as possible.

1.08 In normal circumstances CAPC would construct the Kariba North Station and carry out the expansion of its transmission system and the Bank would make a loan to assist in financing the work. Because of the Unilateral Declaration of Independence (UDI) by Southern Rhodesia in November 1965, the above arrangements cannot be followed at the present time. Other arrangements have been worked out which include the establishment of KNBC to construct the Kariba North Station. KNBC will appoint CAPC as its agent for construction and will subsequently lease the station to CAPC which will operate and maintain it. CAPC will make a loan to KNBC to cover the local cost of the construction of the station and it will finance the total cost of transmission development during the next six years. The history of events leading up to these arrangements is given in Annex 1.

1.09 At the present time the Board of CAPC and the Higher Authority for Power (see paragraph 6 of Annex 1), which has to approve major decisions of CAPC, are not considered legally constituted by the Zambian Government and cannot function effectively. To give effect to the above arrangements the Board and the Authority must be able to function effectively since they should both approve capital expenditure on the Project, and the transmission expansion program, and the proposed Loan to KNBC. The Board should also approve and sign agreements with KNBC covering Agency and Lease Arrangements and the proposed CAPC loan (see paragraph 5.05).

1.10 The Higher Authority for Power, which should consist of two Ministers appointed by the Zambian Government and two by the Southern Rhodesian Government, cannot function because all decisions have to be unanimous and the Zambian members do not recognize the ministers appointed by the Smith regime in Southern Rhodesia. The Board of CAPC should have a Chairman and seven members. Three of the members should be appointed by the Zambian Government, three by the Southern Rhodesian Government and the Chairman and one member by the Higher Authority for Power. A quorum of five members is required. The terms of office of the Chairman, the Southern Rhodesian members appointed before UDI and the member appointed by the Higher Authority have expired and the Board is without a quorum and is unable to exercise its statutory functions. Day-to-day operations are carried out under a Committee consisting of the three Zambian members, the three Southern Rhodesian members and the Chairman who has remained in function after his legal term of office expired.

1.11 The United Kingdom Government has made an Order-in-Council which will permit the Government to appoint two members to the Higher Authority in place of the Ministers to be appointed by the Southern Rhodesian Government. Before the Order-in-Council can be made operative it will be necessary for the Zambian Government to have taken legislative action regarding the change in membership of the Authority. As the Zambian Parliament is presently in recess and does not meet until September 1970 the United Kingdom Order-in-Council will not be operative until October 1, 1970.

1.12 After the Order-in-Council has become operative and two members have been appointed to the Higher Authority by the United Kingdom Government, the Authority would be able to appoint a Chairman and a Board member. The Board would then have a quorum of five members, and could approve the Agency, Lease and Loan Agreements with KNEC. The execution of the three agreements would be a condition of effectiveness of the proposed Bank loan to KNEC.

1.13 This report is based on information obtained from the Zambian and United Kingdom Governments, the CAPC and its Consultants (Merz and McLellan, Sir Alexander Gibb and Partners of London, and Coyne et Bellier of Paris), the results of many meetings and discussions and the findings of an appraisal mission, consisting of Messrs. C.H. White and A.A.M. Onslow, which visited Zambia in March 1970.

2. THE POWER SECTOR

2.01 CAPC supplies nearly all of the power requirements of Zambia and Southern Rhodesia. CAPC is well managed and efficiently operated by a competent and experienced staff. It has only five consumers. Four of these are public supply undertakings, namely, the Southern Rhodesia Electricity Supply Commission (SRESC), the Bulawayo Municipality and the Salisbury Municipality, in Southern Rhodesia, and the Central Electricity Corporation (CEC) in Zambia. The fifth consumer is the Copperbelt Power Company (CPC) which supplies the Copperbelt area in Zambia.

2.02 The SRESC is responsible for power supply throughout Southern Rhodesia, except for a few isolated areas which have their own small generating stations, and the areas supplied by the Bulawayo and Salisbury Municipalities.

2.03 In Zambia, in addition to the CEC which supplies Lusaka and the surrounding area, and the CPC, there are two small Government-owned undertakings. These are the Victoria Falls Electricity Board which supplies the Livingstone area and the town of Victoria Falls in Southern Rhodesia, and the Northern Electricity Supply Corporation which supplies small towns and villages in isolated areas by diesel generating stations, which have a combined capacity of about 11 MW.

2.04 The Zambian Government has recently established the Zambia Electricity Supply Corporation Ltd. (ZESCO) to take over existing supply undertakings in Zambia, other than CAPC and KNBC, and to be responsible for all aspects of the generation, transmission and supply of electricity other than those carried out by the above-mentioned two authorities.

2.05 The General Manager of ZESCO is M. P.A. Bertrand from Electricité de France who has had many years of experience in the supply industry. Staff of the Government Electricity Department and of the Authorities to be taken over will be transferred to ZESCO and other staff will be recruited. ZESCO will take over from the Government Electricity Department, a 60 MW station in operation and another 40 MW station under construction at Victoria Falls and the Kafue hydroelectric project presently under construction. The output of these stations will be purchased by CAPC from ZESCO. It is expected the Victoria Falls Electricity Board, the Northern Electricity Supply Corporation, the CEC, and the Government Electricity Department will be taken over by ZESCO in July or August 1970.

Generating Capacity Available to CAPC

2.06 The CAPC owns only one generating plant, the 705 MW Kariba South Hydroelectric Station. The output of the 60 MW station at Victoria Falls, owned by the Government, and the output of an 8 MW hydroelectric station (except for a small amount of power required to meet local needs), owned by the Victoria Falls Electricity Board, are purchased by CAPC and

fed into its transmission system. CAPC also purchases power from Gecom, a mining company in the Democratic Republic of the Congo. At the present time CAPC can take up to 60 MW from Gecom, to be reduced to 40 MW in 1971 and 20 MW in 1972 when the contract expires.

2.07 The Bulawayo and Salisbury Municipalities and the SRESC in Southern Rhodesia and the CPC in Zambia each have thermal stations which supply CAPC's system. The CEC also has a small station (12 MW) at Lusaka, which could supply CAPC's system, but it is not used as it is old and expensive to operate. The operations of the above-mentioned stations are controlled by CAPC which meets their fixed and operating costs (see paragraph 6.11). The combined effective capacity of the thermal stations (excluding Lusaka) is 451 MW.

2.08 The total generating capacity presently available to CAPC is:

Kariba South	705 MW
Victoria Falls	68 "
Gecom	60 "
Thermal Stations	<u>451 "</u>
	<u>1,284 MW</u>

2.09 A table showing available generating capacity and the capacity required to meet expected system demand and energy requirements during the period 1968/69 through 1979/80 is attached as Annex 5. At the present time the capacity available is more than sufficient to meet system demand. Provided the Victoria Falls 40 MW station is completed on schedule and the Kafue project commences providing power not later than December 1971 (6 months later than the present scheduled date) sufficient capacity should be available to meet system demand and energy requirements up to late 1974. Additional capacity would then be required, otherwise a deficit of 100 MW could be expected in 1974/75. If a supply is given to Gecom (see paragraph 4.06) the expected deficit would be increased to 168 MW.

Development Program

2.10 CAPC's development program for the period July 1, 1969, through June 30, 1976, consists of:

- (a) the Kariba North Hydroelectric Station (the Bank Project) with an installed capacity of 600 MW;
- (b) the expansion of the 330 kV transmission system in Zambia which includes the installation of additional substation capacity at Kitwe and Leopard's Hill and the construction of additional transmission lines between Leopard's Hill and Kitwe substation (see map);
- (c) the expansion in Southern Rhodesia of the 330 kV transmission system, which includes the construction of new

substations at Alaska and Gwelo, the installation of additional capacity in substations at Sherwood, Bulawayo and Norton, and the construction of additional 330 kV transmission lines between Kariba and Norton and between Sherwood and Bulawayo (see map).

The estimated cost of this program is about US\$99 million excluding interest during construction. The transmission expansion is to be financed by CAPC almost entirely from internally generated funds (paragraphs 6.14 and 6.15).

2.11 The Kariba North Project is scheduled to have its first generating unit in operation in June 1974 and all units in operation by June 1975 (see paragraph 3.01). Provided this is accomplished and the transmission expansion is completed on schedule, CAPC should have sufficient generating and transmission capacity to meet system requirements, based on present forecasts, up to 1977/78. Additional generating capacity and transmission facilities would then be required and these should be provided by the second stage of the Kafue Hydroelectric Scheme and the further expansion of CAPC's transmission system. Although it would be possible to install another 300 MW of generating capacity at Kariba North this could not be considered as an alternative to the second stage of Kafue as the additional capacity would provide very little firm power. Plans have not yet been made for the construction of the second stage of Kafue. To have it in operation by 1977/78, a decision will have to be made early in 1972 for construction work to start in 1973/74.

3. THE PROJECT

3.01 The Project proposed for Bank financing consists of an underground power station on the North Bank of the Zambezi River at Kariba in Zambia, with an installed capacity of 600 MW. The station will be designed so that the capacity could be subsequently increased to 900 MW. The initial generating plant will consist of four 150 MW turbo-generators. The turbine would be of the vertical-shaft Francis type and will utilize an average net operating head of about 305 feet. The first 150 MW generating unit is scheduled to be in service by June 1974, the second in October 1974, the third in February 1975 and the fourth in June 1975. These dates are realistic.

Estimated Cost

3.02 The estimated cost of the proposed Project is the equivalent of US\$47.7 million. The estimated cost of the principal features of the Project is shown in the following table. A more detailed breakdown of costs is given in Annex 2.

	Kwacha (millions)			US\$ (millions)		
	<u>Local</u>	<u>Foreign</u>	<u>Total</u>	<u>Local</u>	<u>Foreign</u>	<u>Total</u>
Preliminary Works & Housing for Operating Staff	1.80	0.13	1.93	2.52	0.18	2.70
Civil Works	4.31	7.33	11.64	6.04	10.26	16.30
Generating Plant and Equipment	1.35	10.66	12.01	1.89	14.93	16.82
Engineering and Site Supervision	0.42	1.70	2.12	0.59	2.38	2.97
Contingencies	1.30	2.13	3.43	1.82	2.98	4.80
Provision for Price Increases	0.89	2.05	2.94	1.24	2.87	4.11
Total Construction Costs	<u>10.07</u>	<u>24.00</u>	<u>34.07</u>	<u>14.10</u>	<u>33.60</u>	<u>47.70</u>
Interest on Bank Loan during Construction		<u>4.57</u>			<u>6.40</u>	
Total Foreign Exchange Requirement		<u>28.57</u>			<u>40.00</u>	

Basis for Cost Estimates

3.03 In preparing the cost estimates the Consultants were guided by the costs of similar civil works (the Kafue project) now under construction in Zambia and by their knowledge of working conditions in Zambia. The costs of plant and equipment are based on prices recently obtained as the result of international competitive bidding for similar plant and equipment.

3.04 To cover increases in cost due to any difficulties which might arise during the construction of the Project, and unforeseen extras, contingency allowances of 20% on civil works and 6% on plant and equipment have been included in the estimate. Following an investigation by the Consultants, an allowance for price increases at the rate of 2.4% per annum on labor and materials has also been included.

3.05 The cost estimate and the contingency and price allowances are realistic.

Unit Costs and Generating Costs

3.06 The estimated cost of the 600 MW Kariba North Station (US\$47.7 million) is equivalent to a cost of only US\$79.50 per kW installed. This very low cost is due in part to the fact that many required facilities were installed with the Kariba South Station.

3.07 In 1975/76 when Kariba North is expected to be in full operation the capability of the Kariba South Station may be slightly less than its present capability of 705 MW because the net available head may be reduced due to a rise in tailwater level and a small reduction in the average level of the reservoir. To take account of these possibilities the capability of Kariba South has been tentatively reduced to 666 MW (see Annex 5).

3.08 Taking the above reduction into account, the combined capability of the North and South Stations would be 1,266 MW. The cost of the two stations is estimated at about US\$196 million, equal to US\$155 per kW, which is a low cost for hydroelectric capacity.

3.09 During the year ending June 30, 1976, the combined output of the North and South Stations is expected to reach the estimated annual average output of 8,500 GWh. The estimated cost per kWh produced during this year is about 1.74 US mills, which is very low cost power.

Status of Engineering

3.10 The Project has been planned and is being designed by Merz and McLellan and Sir Alexander Gibb and Partners of London, and Coyne et Bellier of Paris, who were the consultants for the first stage of the Kariba development. The Consultants will supervise the construction of the Project. With the approval of the Bank an invitation to contractors to apply for prequalification for the main civil works was advertised in

February 1970. Twenty-four firms submitted applications and twelve of these have been approved. Contract documents and specifications for the generating plant (2 contracts) and for the main civil works are scheduled to be issued in June 1970 and contracts awarded by January 1 and January 31, 1971, respectively.

Procurement and Disbursement

3.11 Procurement will be on the basis of international competitive bidding except for items involving expenditures of less than US\$10,000, which would be procured on the basis of other procedures to be approved by the Bank. Disbursements from the proposed loan would be made only for the foreign exchange cost of plant and equipment, materials, services and erection, and civil works contracts. Expenditure prior to the signing of the loan would not be eligible for reimbursement. Any unutilized balance of the loan at the completion of the Project should be cancelled.

4. JUSTIFICATION OF THE PROJECT

4.01 Sales by CAPC during the past four years have increased from 4,237 GWh in 1964/65 to 5,666 GWh in 1968/69 at an average rate of 7.5% per annum. During the period sales in Zambia increased from 2,445 GWh to 3,237 GWh and in Southern Rhodesia from 1,792 GWh to 2,429 GWh. The rate of increase has, however, been very uneven (see Annex 3).

4.02 In Southern Rhodesia, the increase in sales by CAPC was very small during the two years after the unilateral declaration of independence. In 1967/68 a considerable amount of industrial development resulted in a 17.3% increase in sales, followed by an increase of 9.8% in 1968/69.

4.03 In Zambia, sales to the Copperbelt Power Company in 1966/67 showed only a 2.7% increase over the previous year. This was due to a reduction in mining activities because of difficulties experienced in the transportation of copper for export resulting from Southern Rhodesia's declaration of independence. However the average rate of increase for the past four years was 6.5% per annum.

4.04 Sales to CAPC's other consumer in Zambia, the CEC, which supplies the Lusaka area, increased at the very high rate of 21.1% per annum over the past four years. This was due to the rapid growth of the city after Zambia became independent in October 1964 and the industrial development which is taking place.

Forecast of Sales

4.05 The CAPC's forecast of sales for the years 1969/70 through 1979/80 broken down into sales to each of its five consumers is shown in Annex 3. The forecast shows that during the period sales are expected to increase at an average rate of 8.5% and amount to 13,749 GWh in 1979/80. Because of the situation in the area the forecast of sales is of course subject to some risk but as it is conservative it is considered reasonable and acceptable. A summary of the forecast is given in the following table:

<u>Consumer</u>	<u>Forecast of Sales (GWh)</u>					<u>Total Sales</u>
	<u>Bulawayo</u>	<u>Salisbury</u>	<u>SRESC</u>	<u>CPC</u>	<u>CEC</u>	
1969/70	371	722	1,491	3,193	400	6,177
1979/80	729	1,152	4,768	6,163	937	13,749
Average % increase per annum	6.8	4.9	11.8	6.8	13.1	8.5

4.06 Gecom, a mining company in the Democratic Republic of the Congo which presently supplies a small amount of power to CAPC under an agreement which terminates in 1972, has asked for a supply of up to

105 MW from CAPC during the years 1972/73 through 1976/77 (see Annex 4). As negotiations for this supply are in an early stage and as a tariff has not yet been discussed, possible revenues from sales to Gecom in have not been included in CAPC's financial forecast (see paragraph 6.12).

4.07 Sales to the Bulawayo and Salisbury Municipalities in Southern Rhodesia during the period are expected to increase at an average rate of 6.8% and 4.9% respectively, but sales to SRESC are expected to increase at the much higher rate of 11.8%. This is due mainly to a very big increase in sales in 1971/72 and 1972/73 when a large fertilizer factory, now under construction, comes into operation, and to a considerable increase in 1975/76 when consumers in the eastern districts presently supplied by local generating plants are connected to the SRESC system.

4.08 Sales to the CPC in Zambia during the period are expected to increase from 3,193 GWh in 1969/70 to 6,163 GWh in 1979/80 at an average rate of 6.8% per annum. This increase is based on a number of factors, such as:

- (a) an increase in copper production. The planned increase is relatively small. The mining companies are reluctant to disclose production estimates, but as far as can be ascertained the increase is probably about 3% per annum.
- (b) the need to mine lower grade ores at deeper levels. Mainly because of this, electricity consumption per ton of copper produced increased from 2,450 kWh in 1959/60 to 3,182 kWh in 1968/69 and this trend is expected to continue.
- (c) the installation of new processes, which include a furnace at the Mufulira mine, and a leach plant at Nchanga which will require 25 MW and 15 MW respectively.
- (d) the opening up of new mining areas, and an increase of about 7% per annum in bulk supplies to municipalities and townships in the Copperbelt.

Taking the above factors into consideration, the forecasts of sales to CPC are considered acceptable. They may in fact be on the low side as the Zambian Government wants the copper mines to increase production at a higher rate.

4.09 Sales to CEC in Zambia during the period under consideration are expected to increase at the high average rate of 13.1% per annum. During 1969/70 the rate of increase is expected to be 66% because of new industrial loads being connected. Sales for the first nine months of the year indicate this rate of increase will be achieved. In view of the industrial expansion which is taking place in the CEC area of supply, the forecast of sales is considered acceptable.

Growth in Demand and Energy Requirements

4.10 During the year 1968/69 the demand on the CAPC system was 879 MW and energy requirements, including transmission losses, were 5,929 GWh. The system load factor was 77% which is very high. This is due mainly to the copper mines in Zambia which operate on a 24-hour basis. The load factor of the Zambian system was 84% and that of the Southern Rhodesian system 69%.

4.11 During the period 1969/70 through 1979/80 the system demand is expected to increase and reach about 2,150 MW in 1979/80. Energy requirements, including transmission losses, during this year are expected to amount to about 14,500 GWh. The load factor of the system is expected to remain about 77%. An amount of 18% of system demand is included in Annex 4 as a reserve to cover spinning reserve, breakdowns, and planned outages of generating plant. This amount may appear a little high but, in view of the fact that during recent years some trouble has been experienced with the Kariba South turbines (hairline cracks have appeared in the runners) and taking into account the age of the thermal plant in Rhodesia and teething troubles that may be experienced with new plant at Victoria Falls, Kafue and Kariba North, it is reasonable.

Alternative Means of Providing Additional Generating Capacity

4.12 There are three possible ways of providing the additional generating capacity needed for the CAPC by late 1974, at the same time meeting the Zambian Government's requirement that sufficient capacity should be available in Zambia to meet the power requirements of the country should the need arise (see paragraph 1.07). These are:

- (a) the construction of a thermal station in Zambia;
- (b) the construction of the Kariba North Project followed by the second stage of Kafue;
- (c) the construction of the second stage of Kafue followed by the Kariba North Project.

4.13 The construction of a thermal power station in Zambia with a capacity of 600 MW as a possible alternative to the Kariba North Project was investigated by CAPC's Consultants. The estimated cost of the station is US\$90 million (excluding interest during construction) some US\$42 million more than Kariba North. As the cost of operating the thermal plant would also be far higher than the operation of Kariba North, such a station could not be considered as an alternative to Kariba North.

4.14 A comparison of alternatives (b) and (c) shows that it is more advantageous to construct Kariba North first followed by the second stage of Kafue, since the estimated cost of Kafue is higher than that of Kariba North (US\$63.7 million compared with US\$47.7 million) and the estimated firm output of the two schemes is about the same. This

arrangement would be more advantageous at all discount rates; at 7% it shows a saving of US\$8.8 million, which would increase with higher discount rates.

Incremental Rate of Return

4.15 The incremental financial rate of return on the proposed Project is about 17%. The cost stream made for this calculation includes the capital cost of the Project plus the cost of additional transmission facilities attributable to the Project. The revenue stream was calculated by multiplying the incremental kWh sales attributable to the Project by the estimated average price per kWh sold.

Other Benefits

4.16 Apart from the need to construct the Kariba North Station to provide additional generating capacity, there is another reason why the Project should be constructed as soon as possible: this is to alleviate the need for the systematic spilling of water not needed for power production at Kariba, the effects of which are causing concern.

4.17 Spilling, which now takes place during four or five months of each year, is affecting the stability of the banks downstream of the dam, particularly the South Bank, and is causing enlargement of the stilling pool. Although sealing work on the banks and underwater has improved the situation, there is still a possibility that a deep-seated slide on the South Bank could develop; the Consultants consider this unlikely, but if it should occur the power station tailrace tunnels could be blocked, causing the generating plant to be shut down. To avoid such a possibility the Consultants recommend the need for systematic spilling should be obviated as soon as possible. The Bank and CAPC agree with this recommendation.

4.18 The Project would have no other environmental consequences for it would not alter the characteristics of Lake Kariba or the regime of the Zambezi River, except for slightly lowering the average level of the lake and evening out the river flow below the dam. The environment was significantly affected some twelve years ago when the dam was constructed and the lake created. The most important environmental impact of the Kariba development was the relocation of about 55,000 Africans whose villages were flooded by the lake. The dam also interfered with traditional agriculture along the river which was based on the annual floods. In recent years an increase in bilharzia has been noted. There were also some environmental benefits - a reduction of tsetse fly migration, making tsetse control easier, flood control, and the creation of a potential for the development of tourism and fisheries. Although the environmental costs of the Kariba development have not been quantified, the benefits of the Kariba development to the economies of Zambia and Southern Rhodesia have been considerable and judged more than sufficient to outweigh such costs.

5. THE BORROWER

5.01 The Kariba North Bank Company Limited (KNBC) was registered as a private limited company under the laws of Zambia with a nominal share capital of K100 (US\$140) in March 1970, after the Memorandum and Articles of Association of the Company had been agreed to by the CAPC and the Bank. The capital of the Company is divided into one hundred shares of one kwacha each. Ninety-nine shares are held by the Minister of Development and Finance and one by the Minister of Power, Transport and Works. Although the objects of the Company are very wide it intends to confine its activities to the establishment of the Kariba North Station, the proposed Bank Project.

5.02 The Articles of Association of the Company require that the number of Directors shall be not less than five or more than ten. Directors may be appointed and removed from office at any time by the majority shareholder of the Company (the Minister for Development and Finance). Nine Directors have been appointed of whom one, Mr. E. M. Shepherd, is the General Manager of CAPC.

5.03 KNBC will appoint CAPC as its agent for the construction of the station and it will lease it to CAPC which will operate it. As a charge for the lease of the station, CAPC will pay to KNBC amounts equal to the interest and redemption payment due by KNBC on all loans made to it for the construction of the station plus all reasonable administrative costs of KNBC.

5.04 The senior staff of KNBC will consist only of a Managing Director or General Manager, a Financial Controller and a Secretary. The Managing Director or General Manager designate is Mr. A. J. Davidson, the Zambian Government's Director of Electrical Engineering, who is acceptable to the Bank. A person suitable to fill the post of Controller has been located and is being recruited. The duties of Secretary will probably be carried out by an Assistant Secretary in the Ministry of Power, Transport and Works on a part-time basis. The duties of the Managing Director or General Manager will include advising the Board on the award of construction contracts. The Financial Controller will be responsible for the maintenance of proper accounting records of the company and preparation of quarterly and annual accounts. He will also be responsible for withdrawals from the proposed Bank and CAPC loans. Assurance has been obtained from KNBC that it will consult the Bank before making appointments to the post of Managing Director or General Manager.

5.05 CAPC has agreed to make a loan to KNBC to cover the local cost of the Project. Draft agreements covering the Agency and Lease arrangements and the proposed loan by CAPC to KNBC have been approved by the Zambian Government, the Committee of CAPC, and the Bank. The signing of these documents is a condition of effectiveness of the proposed Bank loan. The draft loan agreement between CAPC and KNBC contains a covenant

that requires KNBC not to enter into any activity other than the establishment of the Kariba North Station, during the life of the loan (25 years), without written permission of CAPC. Similar assurances have been obtained by the Bank from KNBC. Assurance has also been obtained that KNBC will not amend the Agency, Lease and Loan Agreements with CAPC without the prior approval of the Bank.

KNBC Financing Plan

5.06 Sources and applications of funds for KNBC for the period 1970/71 - 1975/76 (Annex 9), are summarized below:

<u>Financial Requirements</u>	<u>1970/71 - 1975/76</u>	
	<u>millions of kwacha</u>	<u>millions of US dollars (equivalent)</u>
Construction expenditure		
Proposed Project		
Foreign currency	24.0	33.6
Local currency	<u>10.1</u>	<u>14.1</u>
	34.1	47.7
Interest during construction		
Proposed Bank loan (foreign currency)	4.6	6.4
Proposed CAPC loan (local currency)	<u>2.1</u>	<u>3.0</u>
	6.7	9.4
 Total Requirements	 <u>40.8</u>	 <u>57.1</u>
 <u>Sources</u>		
Borrowings:		
Proposed IBRD Loan	28.6	40.0
Proposed CAPC Loan	<u>12.2</u>	<u>17.1</u>
 Total Sources	 <u>40.8</u>	 <u>57.1</u>

It is proposed that the foreign exchange cost of the Project would be financed by a loan from the Bank of US\$40 million (K28.6 million), and the local currency by a loan from CAPC of K12.2 million (US\$17.1 million). It is assumed that both loans would be for 25 years, with a grace period of about five years, during which the interest would be financed. It is also assumed that interest on both loans would be at the rate of 7% per annum, and, in the case of the Bank loan only, there would be a commitment charge of 3/4% per annum on the undisbursed balance of the loan. During negotiations, the Zambian Government agreed to provide, on terms satisfactory to the Bank, any additional funds necessary to complete the Project.

5.07 It is estimated that KNBC will earn 7.1% on its net fixed assets in operation 1975/76. However, since it is presently envisaged that KNBC will engage in no project other than the Kariba North Station and since the lease agreement between KNBC and CAPC will require CAPC to meet all KNBC's costs (see paragraph 5.03), it is considered a rate covenant would be inappropriate. (Additional earnings from the Project will, of course, accrue to the Zambian Government through its 50% interest in CAPC.) KNBC has therefore agreed that the lease agreement will not be amended without prior approval of the Bank (see paragraph 5.05). To ensure that its financial position will remain sound, assurances have been obtained from KNBC that it will not borrow any funds additional to those provided for in the financing plan (paragraph 5.06).

Guarantees

5.08 The proposed loan of US\$40 million to KNBC would be guaranteed by the Zambian Government. Under the original arrangements contemplated for financing Stage II of the Kariba Project, a loan to CAPC would have been guaranteed as to 50% by Zambia and 50% by Southern Rhodesia. All concerned agree that Zambia should not be required to incur a greater liability under the proposed arrangements than it would have incurred under the original arrangements. The United Kingdom, which continue to guarantee in full the existing loans, has accordingly agreed that the Bank release Zambia of its obligations as guarantor of 50% of the discounted amount of loans 145-RN and 392-RNS to such an amount as will, when taken together with Zambia's guarantee obligation under the proposed loan, result in Zambia being responsible for no more than 50% of the discounted total outstanding loan obligations for the Kariba system. Both Governments have agreed that such release would take place at a date on which one-half of the discounted value of the payments of principal and interest on the portions of loans 145-RN and 392-RNS held by the Bank and by the Metropolitan Life Insurance Company, a major participant, would equal one-half of the discounted payments of principal and interest on the new loan. The applicable discount rate would be the rate of interest on the new loan.

Audit and Insurance

5.09 KNBC has not yet made any arrangement for the audit of its accounts. During negotiations assurances were received that KNBC will have its accounts audited annually by independent auditors acceptable to the Bank, and that its accounts and audit reports will be submitted to the Bank within four months of the end of KNBC's fiscal year. CAPC is required to carry adequate insurance under the terms of its lease from KNBC, and KNBC has agreed to a similar covenant in its loan agreement with the Bank.

6. FINANCIAL POSITION OF CAPC

Past Operating Results and Financing of CAPC

6.01 Since CAPC will finance the local cost of the Kariba North Project and will also be KNBC's sole customer, it is necessary to review CAPC's past and future financial position as well as that of KNBC. Annex 6 shows the income statements for the four years ended June 30, 1966 through 1969. These reflect a satisfactory financial position with a return on average net fixed assets in operation ranging from 6.4% to 8.1% (see Annex 14). This return has enabled CAPC to meet the financial requirements of previous Bank loans, namely, for CAPC to finance 50% of the second stage of Kariba including transmission (see paragraphs 6.13-6.15).

Present Financial Position

6.02 Annex 8 shows CAPC's Balance Sheets for the years ended June 30, 1966 through 1969. The Balance Sheet of June 30, 1969 can be summarized as follows:

<u>ASSETS</u>		<u>K & \$R million</u>
Gross Fixed Assets	166.5	
Less: Depreciation	<u>22.6</u>	
Net Fixed Assets		143.9
Administrative Assets etc.		.9
Net Current Assets		<u>3.1</u>
		<u>147.9</u>
 <u>LIABILITIES</u>		
Equity		26.9
Long-term debt (excluding current portion)		
IBRD	42.9	
CDC & CDFC	29.0	
Government	<u>49.1</u>	
		121.0
		<u>147.9</u>

The debt/equity ratio of 82/18 reflects the fact that no equity contributions have been made by the owners; the K26.9 million equity is an accumulation of earned surplus (K18.4 million) and exchange adjustment reserve (K8.5 million). The cash working capital of CAPC, with K5.4 million in Zambia and \$R2.2 million in Southern Rhodesia, is currently satisfactory (future cash positions are discussed in paragraph 6.16).

6.03 The loans as at June 30, 1969, can be summarized as follows:

	<u>IBRD</u>	<u>CDC</u>	<u>CDFC</u> (K & \$R millions)	<u>Governments</u>	<u>Total</u>
Original Loans	62.6	30.0	6.0	56.0	154.6
Exchange Adjust- ment <u>1/</u>	(3.5)	(4.3)	(0.7)	-	(8.5)
Repayments to 6/30/69	<u>(13.7)</u>	<u>(0.3)</u>	<u>(1.3)</u>	<u>(5.8)</u>	<u>(21.1)</u>
Balance 6/30/69	<u>45.4</u>	<u>25.4</u>	<u>4.0</u>	<u>50.2</u>	<u>125.0</u>

All these loans should be serviced by CAPC, but due to reasons stated in paragraphs 6.04 to 6.07 below, the guarantors have serviced the IBRD loan, while the Zambian Government has serviced half the CDC and CDFC loans.

6.04 The Bank loans consist of: the first loan (145-RN), made in 1956, of US\$80 million, repayments commenced in June 1963, finish in December 1981, and bear interest at 5%; and the second (392-RNS), was made in 1964 for US\$7.7 million, repayments commenced in March 1968, finish in September 1989, and bear interest at 5½%. Following the dissolution of the Federation of Rhodesia and Nyasaland, the IBRD loans were guaranteed as to one-half by the Zambian Government and as to one-half by the Southern Rhodesian Government, the whole loan being backed up by a guarantee from the U.K. Government. With the Unilateral Declaration of Independence by Southern Rhodesia in November 1965, CAPC found itself, due to exchange control regulations in Zambia and Southern Rhodesia, unable to meet the debt service. The Zambian Government, as Guarantor, paid one-half of the debt service to the Bank, and the U.K. Government paid the other half. Subsequently, CAPC reimbursed the Zambian Government in kwacha for the amount paid by them; no request for reimbursement has been made by the U.K. Government, but CAPC was ordered by the Southern Rhodesian Exchange Control to pay an equivalent amount into a blocked account, in the name of the U.K. Government, in Southern Rhodesia. This arrangement has been in force for all debt service payments due to the Bank after the payment made December 1, 1965, and is likely to continue until the present situation in Southern Rhodesia is solved.

6.05 The Commonwealth Development Corporation (CDC) loan was for £stg 15 million; repayments, with an average interest rate of 6.975%, started in March 1965 and the last amount will be due in March 2002. CDC is hoping that this can be rescheduled to shorten the terms (see paragraph 6.17). The Governments of Southern Rhodesia and Zambia have each separately guaranteed one-half of the debt service on the loan. CAPC was unable to obtain Zambian or Southern Rhodesian Exchange Control approval to pay installments of interest and principal due on and after March 25, 1967. Half the amounts due were paid by the Zambian Government in its capacity as part guarantor and were reimbursed by CAPC to them in

1/ With the revaluation of sterling, French francs and Netherlands guilders, the loans were revalued to take into account the new rates of exchange, with a resulting exchange adjustment reserve of K8.5 million.

kwacha. The other half, following a series of Zambian High Court judgments against CAPC in Zambia, was paid by CAPC to CDC in Zambian currency; the funds were blocked by Zambian Exchange Control, but may be invested by CDC in projects in Zambia approved by the Government. CAPC is expected to have to continue to service the CDC loan in this manner.

6.06 The loan from the Commonwealth Development Finance Co., Ltd. (CDFC) was for £stg 3 million, repayments, with interest at 6% per annum, both of which are due in sterling, started in June 1963, the final one being due in December 1981. CAPC was unable to obtain Exchange Control approval from Southern Rhodesia and Zambia to pay the debt service due on or after December 15, 1965 (except that Zambia gave approval for payment of its half of the installment due December 1966). Half the amounts due have since been paid in sterling by the Zambian Government in its capacity as part guarantor, and have been reimbursed by CAPC in Zambian currency. The other half has been paid in Rhodesian currency to a blocked account in the name of CDFC in Southern Rhodesia in compliance with directions by Southern Rhodesian Exchange Control and it is likely this procedure will also continue. CDFC does not acknowledge that payments made to the blocked account in Southern Rhodesia constitute a valid discharge of CAPC's obligations under the loan agreement.

6.07 The Government loans originally consisted of three loans from the Federation of Rhodesia and Nyasaland, as under:

<u>Loan No.</u>	<u>Original Amount</u>	<u>Interest Rate</u>	<u>Redemption Dates</u>
1	LR 20,000,000	4 $\frac{1}{2}$ %	June '62 - June '94
2	LR 4,000,000	5%	June '66 - June '85
3	LR 4,000,000	6%	June '77 - June '80

With the dissolution of the Federation, the Zambian and Southern Rhodesian Governments succeeded the Federation as creditor in respect of one-half of each loan. Debt service has been duly paid by CAPC in Zambia and Southern Rhodesia, on due dates.

6.08 While CAPC can be seen to be in technical default on its loans, other than those from the two Governments, it is through no fault of CAPC itself, which has reimbursed the guarantor or paid, on instructions, the amount to blocked accounts. CAPC has always had sufficient funds and been willing to meet its debt service payments as and when due. While IBRD has been satisfied, CDC and CDFC have not, both of them should be repaid in sterling, whereas the Southern Rhodesian portion of the amounts due has been paid in blocked funds.

Estimated Future Operating Results and CAPC's Financial Position

6.09 Under the terms of the lease agreement between KNBC and CAPC, the whole of the Kariba North output will be used in CAPC's system. The rent will equal KNBC's administration costs and the debt service due by

KNBC on the Bank loan, CAPC's loan and any other loan made to KNBC for the purpose of constructing the Project.

6.10 CAPC has agreed tariffs with Zambia for the supply of power to its system from Kafue and Victoria Falls. The average cost to CAPC will vary, depending on the amount of primary and secondary energy taken, between 0.143 ngwee (2.00 mills US) and 0.221 ngwee (3.09 mills US) per kWh at Kafue and will be about 0.233 ngwee (3.26 mills US) per kWh at Victoria Falls. While the Kafue tariff does not cover the full operation costs and debt service of the station, both CAPC and the Zambian authorities are satisfied at present with the tariff agreement as an interim measure. However, it is expected that the Kafue tariff will have to be revised on completion of the second stage of the scheme. At that time, the rate base will be higher following the provision of upstream storage and the installation of additional generating capacity; the energy available will also be increased. Additionally, Zambia has indicated that it may refinance the first stage of Kafue on more conventional terms (i.e. about 20-25 years at 6 $\frac{1}{2}$ -7%) in which case Zambia would request a review of the tariff after the refinancing had been completed. For these reasons, the Kafue tariff agreement, which will be for a period of twenty-five years, will have provision for review at the request of either party at any time, provided that any adjustments agreed between the two parties receive the concurrence of the Bank. The government of Zambia and the Committee of CAPC have agreed the Kafue tariff and, prior to the proposed Bank loan being made effective, a formal contract, based on the agreed tariff, will be signed.

6.11 CAPC controls the operations of the interconnected thermal generating stations at Bulawayo, Lusaka, Salisbury, and Umniati and is obliged, by statute, to purchase their output of electricity for such sum as is necessary to reimburse the owners the cost of generation. Where, with CAPC's concurrence, the output at any generating station has ceased, CAPC shall defray all expenses of that station. A similar agreement was reached with the Copperbelt Power Company, effective December 1, 1966. There are also other agreements for smaller supplies and for standby arrangements.

6.12 Annex 6 gives the estimated income statements for CAPC for 1969/70 through 1975/76, which are consolidated with KNBC's in Annex 11, omitting inter-company transactions. These show satisfactory results, with CAPC generating sufficient funds to finance 50% of development, earning a rate of return on its net fixed assets in operation of between 7.7% and 10.8%. The consolidated rate of return is about 9.6% in 1975 and 9.5% in 1976. In arriving at the estimates, the gross revenue has been based on the most recent estimates of maximum demand and energy consumption (February/March 1970) using the present tariffs. It is possible that there may be additional revenue from Gecom in the Democratic Republic of the Congo from 1972/73 onwards. This has been excluded from the present forecasts since negotiations for such export are at an early stage and the tariff has not yet been discussed.

6.13 Under the terms of previous Bank loans, CAPC is required to provide at least 50% towards the cost of the second stage of Kariba, including transmission. Until March 31, 1970, CAPC had provided slightly over 50% of such funds.

6.14 A summary of the combined financing plan of KNBC and CAPC, (Annex 12), is shown below. It presents the situation much as it would have been, if CAPC had been able to carry out the Project as originally intended (see paragraph 1.08).

1969/70 - 1975/76			
	<u>K million</u> <u>\$R million</u>	<u>US\$ million</u> <u>equivalent</u>	<u>Percentage</u> <u>of Total</u>
<u>Financial Requirements</u>			
Construction expenditure			
Proposed IBRD Project			
Foreign currency	24.002	33.603	34.0
Local currency	<u>10.071</u>	<u>14.099</u>	<u>14.3</u>
	34.073	<u>47.702</u>	<u>48.3</u>
Transmission - Zambia	14.191	19.867	20.1
- Southern Rhodesia	21.574	30.204	30.5
Other expenditure	<u>.760</u>	<u>1.064</u>	<u>1.1</u>
	<u>36.525</u>	<u>51.135</u>	<u>51.7</u>
Total Requirements	<u>70.598</u>	<u>98.837</u>	<u>100.0</u>
<u>Sources</u>			
Internal Cash			
Generation	131.283	183.796	
Less: Debt Service	<u>87.448</u>	<u>122.427</u>	
	43.835	<u>61.369</u>	57.1
Borrowings:			
Proposed IBRD Loan	28.571	40.000	37.3
Proposed Southern Rhodesian overdraft	<u>4.290</u>	<u>6.005</u>	<u>5.6</u>
	<u>32.861</u>	<u>46.005</u>	<u>42.9</u>
	<u>76.696</u>	<u>107.374</u>	<u>100.0</u>
Increase in cash balances	<u>6.098</u>	<u>8.537</u>	

6.15 In order to finance part of the Southern Rhodesian transmission expenditure, it will be necessary for CAPC to borrow about \$14.3 million in that country, which it anticipates can be done without difficulty. It is estimated that this amount will be borrowed over the years 1971/72 through 1973/74 and repaid during 1974/75 and 1975/76. During the period, CAPC will be providing 57% of the total sources from its internal cash

generation with a further 37% coming from the proposed Bank loan and the final 6% from temporary borrowing in Southern Rhodesia. In 1976 CAPC's debt/equity ratio is expected to have improved to 50/50 (58/42 CAPC and KNBC combined). CAPC's debt service will then be covered 1.6 times by internal cash generation (1.5 times for the two companies combined).

6.16 Balance Sheets for CAPC and for KNBC and CAPC consolidated are shown in Annexes 8 and 13. It will be noted that CAPC's cash position shows balances of K13 million in 1976. It is unlikely that balances will in fact be as high, since it is probable that by 1976 CAPC will be involved in capital expenditure on the next generating project after Kariba North. No provision for any generating facilities beyond the present Project has been made in the forecasts.

6.17 CDC considers that its loan to CAPC extends for too long (originally 46 years), and has asked CAPC if it will reschedule the loan, the last repayment of which is not due until 2002. The Chairman of CAPC has undertaken to put to the Board of CAPC, when it has been legally reconstituted, a proposal that, effective 1975, debt service payments will be increased so that the loan is fully amortized at the same time as that for the Bank, namely in 1995. It is anticipated that the rescheduling would increase CAPC's annual debt service by some K213,000 for the years 1975-1995. No provision has been made in CAPC's financial forecasts. Rescheduling would effect no significant change in the debt service coverage, and no difficulty in rescheduling the loan is anticipated.

7. AGREEMENTS REACHED DURING NEGOTIATIONS

7.01 The following agreements were reached during loan negotiations:

- (a) during the life of the Bank loan KNBC will not, without the prior approval of the Bank, enter into any activity other than the establishment of the Kariba North Station, borrow funds additional to those provided for in the financing plan, or amend the Agency, Lease, Loan and Kafue Tariff Agreements with CAPC (paragraphs 5.05, 5.07 and 6.10);
- (b) during the life of the Bank loan, KNBC will consult the Bank before making any appointments to the post of Managing Director or General Manager (paragraph 5.04);
- (c) the Zambian Government will agree to provide, on terms satisfactory to the Bank, any additional funds required to complete the Project (paragraph 5.06);
- (d) KNBC will have its accounts audited annually by independent auditors acceptable to the Bank, and its accounts and audit reports will be submitted to the Bank within four months of the end of each fiscal year (paragraph 5.09); and
- (e) the release of Zambia from its guarantee obligations on parts of Loans Nos. 145-RN and 392-RNS (paragraph 5.08).

7.02 Conditions of effectiveness of the loan are:

- (a) the Agency, Lease and CAPC Loan Agreements have been executed by CAPC and KNBC (paragraph 1.12);
- (b) the Agreement between CAPC and the Zambian Government for the supply of power from Kafue has been signed (paragraph 6.10).

Z A M B I A

APPRAISAL OF KARIBA NORTH HYDROELECTRIC PROJECT

HISTORY

1. When the Bank loan (Loan 145-RN) of US\$80 million equivalent for the first stage of the Kariba Project was made in 1956, the power situation in the three territories of Southern and Northern Rhodesia and Nyasaland, which at that time formed the Federation of Rhodesia and Nyasaland, had reached a critical stage where it was no longer practical to meet growing demands by additions to existing thermal generating stations.

2. In 1955 the Federal Government reached the conclusion that the construction of the Kariba Hydroelectric Project on the Zambezi River, with a transmission system to interconnect existing generating stations in Southern and Northern Rhodesia, would be the best solution to the power problem. It decided that the Project should be built in two stages: the first consisting of an arch dam, an underground power station on the South Bank (in Southern Rhodesia) with an installed capacity of 500 MW, and a 330 kV transmission system; and the second consisting of an underground power station on the North Bank (in Northern Rhodesia) with an installed capacity of 700 MW, and the expansion of the 330 kV transmission system.

3. The Government also decided that the first stage should be built as soon as possible so that demand in 1960 could be met without adding thermal units other than those already committed. At this time it was envisaged that construction work on the second stage would commence immediately after the completion of the first stage.

4. On May 1, 1955, a Federal Electricity Act came into force and the Federal Power Board was established, the Board having among its general functions and duties "the provision or administration of services common to two or more Territories for the bulk supply of electricity." The Board was directed by the Federal Government to undertake the construction and subsequent operation of the first stage of the Kariba Project. To finance this stage the Board obtained, in addition to the Bank loan, loans of £ stg 15 million from the Commonwealth Development Corporation, £ stg 3 million from the Commonwealth Development Finance Company Limited and £R28 million from the Federal Government.

5. Work on site commenced late in 1955. The first generating unit at Kariba South commenced supplying power on December 28, 1959; and the first stage, comprising an arch dam which impounds the Zambezi River and creates a reservoir with a capacity of some 130 million acre feet, an underground power station with an installed capacity of 600 MW, and a 330 kV transmission system, was completed in mid-1962 on schedule. Instead of five 100 MW generating units, as originally planned, six 100 MW units were installed. Although the nameplate rating of each of the units is 100 MW, they are each capable of a maximum output of 117.5 MW, and the

capability of the station is therefore 705 MW. The cost of the first stage, K155.2 million (US\$217.3 million), was lower than the original estimated cost of K161.6 million (US\$226.2 million).

6. At the end of 1963 the Federation of Rhodesia and Nyasaland was dissolved and the Central African Power Corporation (CAPC) was established by a United Kingdom Order-in-Council to take over the operations of the Federal Power Board, which ceased to function. Under a loan assumption agreement and guarantee agreements, which were signed with the Bank on December 30, 1963, CAPC assumed the Federal Power Board's obligations to the Bank and Northern and Southern Rhodesia each guaranteed a half of the payments due under Bank Loan No. 145-RN. The United Kingdom guarantee remained unchanged. A Higher Authority for Power was established comprised of two Ministers from Northern Rhodesia and two Ministers from Southern Rhodesia. All major decisions regarding CAPC, including the approval of capital expenditure and borrowing, have to be made by the Higher Authority. Decisions by the Higher Authority must be unanimous.

7. On October 2, 1964, the Bank made a loan (Loan 392-RNS) of US\$7.7 million equivalent to the CAPC to finance part of the cost of a second 330 kV transmission line between Kariba South and Kitwe in the Copperbelt in Northern Rhodesia and the expansion of substations at Kariba, Lusaka and Kitwe. These facilities were required to enable CAPC to meet increasing demands for power and to give greater security of supply. This development, which is considered part of the second stage of the Kariba Project, was commissioned in October 1968, some months ahead of schedule. The total cost was slightly less than the estimated cost of US\$15.4 million.

8. On October 24, 1964, Northern Rhodesia became independent as the Republic of Zambia and succeeded to the responsibilities of Northern Rhodesia under the Guarantee Agreements for Loans Nos. 145-RN and 392-RNS.

9. Load growth on the CAPC system during the early 1960's was less than expected and this, coupled with the fact that the South Bank station had a capability of 705 MW instead of 500 MW, as originally planned, resulted in the postponement of the construction of the Kariba North Station. However, by January 1965 it became apparent that additional generating capacity would be required by 1970 and CAPC instructed its Consultants to prepare a report on system development. The report was received in September 1965 and it recommended the construction of the Kariba North Station with six 150 MW generating units and the expansion of the 330 kV transmission system, the first 150 MW unit to be in service in 1970 and the sixth unit by 1976. The report was accepted by CAPC.

10. CAPC notified the Higher Authority for Power in December 1965 of its acceptance of the Consultants' report and requested permission to proceed with the proposed development, but by this time Southern Rhodesia had declared itself independent (November 1965) and the Authority had ceased to function because the appointment of two Ministers to it by the Smith regime to represent Southern Rhodesia was not recognized by the

Zambian members. The Bank subsequently worked out a number of schemes to permit preliminary work on the Project to go ahead. Satisfactory arrangements were not agreed until the beginning of 1967, but by this time the Zambian Government had decided to proceed with the construction of a 200 MW hydroelectric scheme on the Kafue River in Zambia and two schemes at Victoria Falls with a combined capacity of 100 MW. One of the Victoria Falls schemes with an installed capacity of 60 MW was commissioned in 1969 and the other 40 MW scheme is scheduled to be in operation in May 1971. The power generated by the Victoria Falls stations, with the exception of a small amount to meet local needs, will be purchased by CAPC and fed into its transmission system.

11. In September 1966, the Zambian Government announced the size of the Kafue scheme would be increased and that it would have an initial capacity of 500 MW and an ultimate capacity of 750 MW. Although the cost of this Kafue development was more than twice as much per kW installed as the proposed Kariba North Station, the Zambian Government decided on its construction instead of Kariba North for security reasons.

12. Construction of the first stage of the Kafue scheme commenced early in 1967. It is being financed by the Zambian Government and the Yugoslav contractors. The scheme will have an initial installed capacity of 600 MW (instead of 500 MW as originally planned) which could be increased to 900 MW by the installation of two additional generating units at a later date. As very little storage will be provided initially, the firm output will be little more than 200 MW. During a year of average rainfall the firm energy output is expected to be about 1,800 GWh and the secondary output about 1,000 GWh. The power generated at Kafue will be purchased by CAPC and fed into its transmission system. The first generating unit at Kafue is now expected to be in operation by July 1971 (some 6 months behind schedule) but it is by no means certain that this date will be achieved, as a considerable amount of work has to be completed before the river is in flood in November/December 1970. If this work is not completed in time it is doubtful if the first unit could be in operation before December 1971.

13. The estimated cost of the initial development at Kafue is US\$100.5 million, to which must be added about US\$14 million for interest during construction, making a total of US\$114.5 million. The cost per kW installed (excluding interest during construction) is US\$167.5, which is low, but this cost is misleading as the firm capacity of the scheme is only about 200 MW.

14. To increase the firm capacity of Kafue to 900 MW it would be necessary to provide upstream storage and install two additional 150 MW generating units. The cost of this second stage (excluding interest during construction) is estimated at US\$63.7 million. The total estimated cost of the two stages (excluding interest during construction) is about US\$164.2 million, or US\$182 per kW installed, which is a low cost for the type of development.

15. In view of the relatively small amount of firm power which will be obtained from the first stage of Kafue and the Victoria Falls schemes and the obvious need within the next few years for additional generating capacity to meet growing demands on its system, CAPC instructed its Consultants in April 1968 to report on the next stage of development. The report was received in February 1969 and it recommended the construction of Kariba North with an installed capacity of 600 MW (which could be expanded at a later date to 900 MW) and the expansion of CAPC's transmission system, followed by the construction of the second stage of Kafue. An economic comparison of the two developments showed that, by constructing the schemes in this order, a considerable saving would be obtained (see paragraph 4.14). The installation of another 300 MW at Kariba North could not be considered as an alternative to the second stage of Kafue as the additional capacity would provide very little firm power.

16. The report further recommended that four 150 MW generating units be installed at Kariba North and that work on the station be commenced as soon as possible in order to have the first generating unit in operation by June 1974 and the fourth unit by June 1975. The recommendations were accepted by the CAPC and the Zambian Government which are both most anxious to proceed with the construction of the Kariba North Station, and the Zambian Government has asked the Bank to assist in its financing.

17. Before Southern Rhodesia declared itself independent of the United Kingdom, the arrangements for financing the Kariba North Project and the expansion of CAPC's transmission system would have been for CAPC to provide half the cost from earnings (in accordance with covenants in Bank Loan Agreements Nos. 145-RN and 392-RNS) and for the Bank to have made a loan to CAPC to cover the other half of the cost, which, with the existing loans to CAPC, would have been guaranteed severally in equal shares by the Southern Rhodesian and Zambian Governments with the United Kingdom backing the Southern Rhodesian guarantee. The Southern Rhodesian and Zambian Governments would have provided the necessary foreign exchange to enable CAPC to meet its loan liabilities from its own funds within the two countries, while keeping its reserves in the two countries under arrangements which reasonably shared the location of the resources taking into account the cash requirements of CAPC.

18. Because of the situation in Southern Rhodesia the above arrangements could not be followed at the present time. Also, because of the situation, neither the Higher Authority for Power nor the Board of CAPC are properly constituted.

19. The Higher Authority for Power, which should consist of two Ministers appointed by the Southern Rhodesian Government and two by the Zambian Government, cannot function because all decisions have to be unanimous and the Zambian members do not recognize the Ministers appointed by the Smith regime (see paragraphs 6 and 10). The Board of CAPC should have a Chairman and seven members. Three of the members should be appointed by the Zambian Government, three by the Southern Rhodesian Government, and the Chairman and one member by the Higher Authority for

Power. A quorum of five members is required. The terms of office of the Chairman, the Southern Rhodesian members appointed before UDI and the member appointed by the Higher Authority have expired and the Board is without a quorum and is unable to exercise its statutory functions. Day-to-day operations are carried out under a Committee consisting of the three Zambian members, the three Southern Rhodesian members and the Chairman who has remained in function after his legal term of office expired.

20. In these circumstances, a number of possible arrangements for financing, constructing and operating the Kariba North Project and the expansion of CAPC's transmission system have been considered. After a series of meetings between representatives of the United Kingdom and Zambian Governments, the CAPC and the Bank, agreement was finally reached at a meeting held at the Commonwealth and Foreign Office in London from July 30 to August 1, 1969. The arrangements now being followed are based on those agreed at the above-mentioned meeting.

June 23, 1970

ANNEX 2

ZAMBIA

APPRAISAL OF THE KARIBA NORTH PROJECT

Estimated Cost of the Project

	Kwacha (thousands)			US\$ (thousands)		
	Local	Foreign	Total	Local	Foreign	Total
CIVIL ENGINEERING WORKS						
Preliminary Works						
Site Investigations	40	90	130	56	126	182
Access Road	177	10	187	248	14	262
Tailrace Adit	170	-	170	238	-	238
Housing	1,410	30	1,440	1,974	42	2,016
Main Civil Works						
Intakes	445	775	1,220	623	1,085	1,708
Penstocks	642	1,100	1,742	899	1,540	2,439
Machine Hall	1,230	2,440	3,370	1,722	2,996	4,718
Elasting Break	37	63	100	52	88	140
Tailrace Tunnels	155	270	425	217	378	595
Tailrace Outlets	520	880	1,400	728	1,232	1,960
Busbar Shafts	80	143	223	112	200	312
Transformer House	234	406	640	328	568	896
Access Tunnel	350	150	500	490	210	700
Switching Station	115	205	320	161	287	448
Administration Building	80	70	150	112	98	210
River Works	15	25	40	21	35	56
Drilling and Grouting	170	80	250	238	112	350
Steel Lining to Penstocks	50	275	325	70	385	455
Gates and Ancillary Equipment	100	600	700	140	840	980
Lift Shaft	39	67	106	54	94	148
Dewatering Shaft	20	34	54	28	48	76
Drainage Gallery	15	20	35	21	28	49
Demolition of Intake Cofferdam	15	25	40	21	35	56
Subtotal	6,109	7,458	13,567	8,553	10,441	18,994
Contingencies at 20%	1,219	1,494	2,713	1,707	2,091	3,798
Engineering	82	820	902	115	1,148	1,263
Site Supervision	246	164	410	344	230	574
Total for Civil Works	7,656	9,936	17,592	10,719	13,910	24,629
PLANT AND EQUIPMENT						
Generating Plant and Cranes	760	6,826	7,586	1,064	9,556	10,620
Electrical Plant and Equipment	390	2,070	2,460	546	2,898	3,444
Switching Station Equipment	201	1,770	1,971	281	2,478	2,759
Subtotal	1,351	10,666	12,017	1,891	14,932	16,823
Contingencies at 6%	81	639	720	113	895	1,008
Engineering	5	624	629	7	874	881
Site Supervision	91	87	178	127	122	249
Total for Electrical and Mechanical Work	1,528	12,016	13,544	2,138	16,823	18,961
Total for Civil Works and Electrical and Mechanical Works	9,184	21,952	31,136	12,857	30,733	43,590
Escalation	887	2,050	2,937	1,241	2,870	4,111
TOTAL	10,071	24,002	34,073	14,098	33,603	47,701
Interest During Construction	2,110	4,570	6,680	2,954	6,398	9,352
TOTAL	12,181	28,572	40,753	17,052	40,001	57,053

April 23, 1970

ZAMBIA
APPRAISAL OF THE KARIBA NORTH PROJECT
CENTRAL AFRICAN POWER CORPORATION
Actual Sales 1964/65 - 1968/69

Year Ending June 30	RHODESIA						ZAMBIA						Total Sales Including Gecordin		Total Sales Including Gecordin				
	Bulawayo Municipality		Salisbury Municipality		Southern Rhodesian Electric Supply Commission		Sub-Total		Copperbelt Power Co.		Central Electricity Corporation		Sub-Total		Total Sales Excluding Gecordin		Gecordin		
	GWh	% Increase Per Annum	GWh	% Increase Per Annum	GWh	% Increase Per Annum	GWh	% Increase Per Annum	GWh	% Increase Per Annum	GWh	% Increase Per Annum	GWh	% Increase Per Annum	GWh	% Increase Per Annum	GWh	% Increase Per Annum	
1965	292	-	568	-	932	-	1,792	-	2,333	-	112	-	2,445	-	4,237	-	-	-	
1966	302	3.4	583	2.6	985	5.7	1,870	4.3	2,490	6.7	136	21.4	2,626	7.4	4,496	6.1	-	6,644	
1967	309	2.3	595	2.1	981	-	1,885	0.8	2,557	2.7	145	6.6	2,702	2.9	4,548	1.2	-	7,682	
1968	336	8.7	642	7.9	1,234	25.8	2,212	17.3	2,794	9.3	197	35.8	2,991	10.7	5,203	14.4	50	9,118	
1969	353	5.1	684	6.5	1,392	12.8	2,429	9.8	2,996	7.2	241	22.3	3,237	8.2	5,666	8.9	211	9,929	
Average % Increase Per Annum		4.9		4.7		10.5		7.9		6.5		21.1		7.3		7.5			
<u>Estimated Sales 1969/70 - 1979/80</u>																			
1970	371	5.1	722	5.6	1,491	7.1	2,584	6.4	3,193	6.6	400	66.0	3,593	11.0	6,177	9.0	-	6,177	
1971	405	9.2	757	4.8	1,622	8.8	2,784	7.7	3,412	6.9	448	12.0	3,860	7.4	6,644	7.6	-	6,644	
1972	433	6.9	792	4.6	2,261 ^{1/}	39.4	3,486	25.2	3,658	7.2	538	20.1	4,196	8.7	7,682	15.6	-	7,682	
1973	463	6.9	827	4.4	3,060 ^{1/}	35.3	4,350	24.8	4,100 ^{2/}	12.1	618	14.9	4,718	12.4	9,068	18.0	50	9,118	
1974	495	6.9	865	4.6	3,324	8.6	4,684	7.7	4,358 ^{2/}	6.3	676	9.4	5,034	6.7	9,718	7.2	211	9,929	
1975	530	7.1	905	4.6	3,525	6.0	4,960	5.9	4,654	6.8	738	9.2	5,392	7.1	10,352	6.5	332	10,684	
1976	567	7.0	948	4.8	3,908 ^{2/}	10.9	5,423	9.3	4,963	6.6	775	5.0	5,738	6.4	11,161	7.8	489	11,650	
1977	607	7.1	995	5.0	4,109	5.1	5,711	5.3	5,236	5.5	813	4.9	6,049	5.4	11,760	5.4	680	12,440	
1978	649	6.9	1,045	5.0	4,321	5.2	6,015	5.3	5,538	5.8	853	4.9	6,391	5.7	12,406	5.5	-	12,406	
1979	688	6.0	1,097	5.0	4,541	5.1	6,326	5.2	5,842	5.5	895	4.9	6,737	5.4	13,063	5.3	-	13,063	
1980	729	6.0	1,152	5.0	4,768	5.0	6,649	5.1	6,163	5.5	937	4.7	7,100	5.4	13,749	5.3	-	13,749	
Average % Increase Per Annum (1970/1980)		6.8		4.9		11.8		9.6		6.8		13.1		7.3		8.5			

^{1/} Fertilizer plant in operation
^{2/} Eastern districts connected to SRESO system
^{3/} Mafuilira Furnace and Nchanga leach plant in operation

Z A M B I A
APPRAISAL OF THE KARIBA NORTH PROJECT

CENTRAL AFRICAN POWER CORPORATION

Forecast of System Demand and Energy Requirements, 1968/69 - 1979/80

Year Ending June 30,	Actual	Forecast										
	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
<u>System Demand - MW</u>												
Rhodesia	419	470	501	614	731	775	830	913	963	1,015	1,063	1,116
Zambia	460	529	587	644	692	740	789	837	885	941	989	1,038
Gecomin	-	-	-	-	25	37	58	86	105	-	-	-
Total	879	999	1,088	1,258	1,448	1,552	1,677	1,836	1,953	1,956	2,052	2,154
18% Reserve	158	180	196	226	261	279	302	331	352	352	369	387
<u>Required Generating Capacity</u>												
Including Gecomin	1,037	1,179	1,284	1,484	1,709	1,831	1,979	2,167	2,305	2,308	2,421	2,541
Excluding Gecomin	1,037	1,179	1,284	1,484	1,679	1,788	1,911	2,065	2,181	2,308	2,421	2,541
<u>System Energy Requirements - GWh</u>												
Rhodesia	2,429	2,584	2,784	3,486	4,350	4,684	4,960	5,423	5,711	6,015	6,326	6,649
Zambia 1/	3,272	3,636	3,934	4,292	4,824	5,150	5,517	5,873	6,193	6,545	6,911	7,274
Gecomin	-	-	-	-	50	211	332	489	680	-	-	-
Total System Requirements	5,701	6,220	6,718	7,778	9,224	10,045	10,809	11,785	12,584	12,560	13,237	13,923
Transmission Losses (4%)	228	249	268	310	368	402	432	472	502	502	529	557
Total Energy Requirements												
Including Gecomin	5,929	6,469	6,986	8,088	9,592	10,447	11,241	12,257	13,086	13,062	13,766	14,480
Excluding Gecomin	5,929	6,469	6,986	8,088	9,540	10,227	10,896	11,748	12,380	13,062	13,766	14,480

1/ Includes energy distributed and sold by Victoria Falls Electricity Board.

May 12, 1970

ANNEX 1

Z A M B I A
APPRAISAL OF THE KARIBA NORTH PROJECT

CENTRAL AFRICAN POWER CORPORATION
Available Generating Capacity 1968/69 - 1979/80
MW sent out

Year Ending June 30,	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Available Generating Capacity - MW												
<u>Hydro Stations</u>												
Kariba South	705	705	705	705	705	705	705	666 ^{2/}	666	666	666	666
Kariba North	-	-	-	-	-	-	150	600	600	600	600	600
Victoria Falls Stations	68	68	88	108	108	108	100 ^{3/}	100	100	100	100	100
Kafue (non-firm) ^{1/}	-	-	-	300	600	600	600	600	600	600	600	600
Total	773	773	793	1,113	1,413	1,413	1,855	1,966	1,966	1,966	1,966	1,966
<u>Thermal Stations</u>												
Bulawayo, Umisti and Salisbury Nos. 2 & 3	336	336	336	336	336	336	336	336	336	266 ^{4/}	206	149
Nchanga	55	55	55	55	55 ^{5/}	55 ^{5/}	-	-	-	-	-	-
Copperbelt Waste Heat	20	20	17	14	12	10	10	10	10	10	10	10
Copperbelt Gas Turbines ^{6/}	40	40	40	60	60	60	60	60	60	60	60	60
Total	451	451	448	465	463	461	406	406	406	336	276	219
Gecomin System	60	60	40	20	-	-	-	-	-	-	-	-
<u>Total Available Generating Capacity</u>	1,284	1,284	1,281	1,598	1,876	1,874	2,261	2,372	2,372	2,302	2,242	2,185
<u>Required System Capacity (including reserve)</u>												
Including supply to Gecomin	1,037	1,179	1,284	1,484	1,709	1,831	1,979	2,167	2,305	2,308	2,421	2,541
Excluding supply to Gecomin	1,037	1,179	1,284	1,484	1,679	1,788	1,911	2,065	2,181	2,308	2,421	2,541
<u>Surplus (deficit) capacity</u>												
Including supply to Gecomin	247	105	(3)	114	167	43	282	205	67	(6)	(179)	(356)
Excluding supply to Gecomin	247	105	(3)	114	197	86	350	307	191	(6)	(179)	(356)

1/ Kafue non firm, but normally available as peaking capacity.
2/ Kariba South may be derated to 111 MW per unit when Kariba North is in full operation, because net available head may be reduced due to a rise in tailwater level and a small reduction in the average level of the reservoir.
3/ Victoria Falls 8 MW station obsolete assumed out of service.
4/ Thermal stations older than 25 years progressively retired.
5/ Nchanga Station shut down in 1972/73 if supply not given to Gecomin.
6/ Gas turbines privately owned and may not remain available for system purposes indefinitely.

ZAMBIA
APPRAISAL OF THE KARIBA NORTH PROJECT
CENTRAL AFRICAN POWER CORPORATION

INCOME STATEMENTS 1966-1976

(in thousands of Kwacha and Rhodesian Dollars)

Year ended June 30	Actual				Estimated							TOTAL 1970-1976
	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	
Kwh Sales (millions)	3,852	4,307	5,203	5,666	6,177	6,644	7,682	9,068	9,718	10,352	11,161	60,802
Average price per kwh (cents)	0.495	0.526	0.505	0.494	0.484	0.470	0.442	0.399	0.390	0.383	0.378	-
<u>Gross operating revenue</u>	19,074	22,661	26,268	27,962	29,919	31,225	33,939	36,211	37,891	39,690	42,193	251,068
<u>Cost of Operations</u>												
<u>Electricity Purchases</u>												
Thermal	5,520	8,290	10,850	11,467	11,741	12,902	10,864	8,876	10,449	6,311	5,833	66,976
Victoria Falls	-	-	-	11	233	700	1,630	1,610	1,590	1,560	1,540	8,863
Kafue	-	-	-	-	-	-	1,800	4,000	5,200	6,200	6,200	23,400
Kariba North	-	-	-	-	-	-	-	-	-	-	3,820	3,820
Other	-	-	-	-	434	439	302	224	224	224	224	2,071
Operation and maintenance	1,591	1,773	1,751	1,864	2,300	2,400	2,600	2,800	3,000	3,600	3,800	20,500
Depreciation	2,598	2,741	2,847	2,876	2,900	3,750	4,622	4,852	5,082	5,330	5,842	32,378
TOTAL OPERATING EXPENSES	9,709	12,804	15,448	16,218	17,608	20,191	21,818	22,362	25,545	23,225	27,259	158,008
NET OPERATING INCOME	9,365	9,857	10,820	11,744	12,311	11,034	12,121	13,849	12,346	16,465	14,934	93,060
Less:												
Interest charged to operations	7,502	7,507	6,971	6,771	6,560	6,320	6,126	6,013	5,878	5,660	5,106	41,663
Interest earned - KNEC	-	-	-	-	-	89	239	411	609	761	847	2,956
- Other	149	219	277	315	370	400	315	195	120	200	425	2,025
NET REVENUE	2,012	2,569	4,126	5,288	6,121	5,203	6,549	8,442	7,197	11,766	11,100	56,378
<u>Interest and Finance</u>												
Charges written off	213	118	33	10	-	-	-	-	-	-	-	-
Preliminary investigations, etc. written off	-	278	-	69	-	-	-	-	-	-	-	-
	<u>1,799</u>	<u>2,173</u>	<u>4,093</u>	<u>5,209</u>	<u>6,121</u>	<u>5,203</u>	<u>6,549</u>	<u>8,442</u>	<u>7,197</u>	<u>11,766</u>	<u>11,100</u>	<u>56,378</u>

April 1970

ZAMBIA
APPRAISAL OF THE KARIBA NORTH PROJECT
CENTRAL AFRICAN POWER CORPORATION

BALANCE SHEETS 1966-1976

(in thousands of Kwacha and Rhodesian Dollars)

Year ended June 30	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
	Actual				Estimated						
ASSETS											
<u>Fixed Assets</u>											
Gross plant in operation	164,088	165,302	165,355	166,498	167,570	173,358	181,024	191,926	196,677	200,998	202,543
Less: Depreciation Reserve	13,989	16,977	19,793	22,637	25,512	29,237	33,834	38,661	43,718	49,023	54,840
Net Plant in operation	<u>150,099</u>	<u>148,325</u>	<u>145,562</u>	<u>143,861</u>	<u>142,058</u>	<u>144,121</u>	<u>147,190</u>	<u>153,265</u>	<u>152,959</u>	<u>151,975</u>	<u>147,703</u>
Administration assets, etc	789	780	803	867	882	897	912	927	942	957	972
Proposed Loan to KNBC	-	-	-	-	-	2,481	4,510	7,451	10,270	11,576	11,570
<u>Current Assets</u>											
Accounts Receivable	1,760	2,798	2,856	2,923	3,000	3,100	3,200	3,300	3,400	3,500	3,600
Bank Balances & Treasury Bills	4,527	6,172	4,241	7,600	11,120	7,256	5,164	1,813	2,206	6,147	13,021
Current portion of KNBC Loan	-	-	-	-	-	-	-	-	-	295	315
TOTAL CURRENT ASSETS	<u>6,287</u>	<u>8,970</u>	<u>7,097</u>	<u>10,523</u>	<u>14,120</u>	<u>10,356</u>	<u>8,364</u>	<u>5,113</u>	<u>5,606</u>	<u>9,942</u>	<u>16,936</u>
TOTAL ASSETS	<u>157,175</u>	<u>158,075</u>	<u>153,462</u>	<u>155,251</u>	<u>157,060</u>	<u>157,855</u>	<u>160,976</u>	<u>166,756</u>	<u>169,777</u>	<u>174,450</u>	<u>177,181</u>
LIABILITIES											
<u>Equity</u>											
Earned Surplus	6,899	9,072	13,165	18,374	24,295	29,498	36,047	44,489	51,686	63,452	74,552
Exchange adjustment reserve	86	86	8,506	8,506	8,506	8,506	8,506	8,506	8,506	8,506	8,506
TOTAL EQUITY	<u>6,985</u>	<u>9,158</u>	<u>21,671</u>	<u>26,880</u>	<u>32,801</u>	<u>38,004</u>	<u>44,553</u>	<u>52,995</u>	<u>60,192</u>	<u>71,958</u>	<u>83,058</u>
<u>Long-Term Debt (excluding current portion)</u>											
IBRD	52,638	51,189	45,450	42,920	40,262	37,470	34,535	31,449	28,209	24,809	21,231
Other long-term Debt	<u>87,467</u>	<u>85,983</u>	<u>79,637</u>	<u>78,055</u>	<u>76,305</u>	<u>74,475</u>	<u>72,558</u>	<u>70,562</u>	<u>68,472</u>	<u>66,030</u>	<u>61,499</u>
TOTAL LONG-TERM DEBT	<u>140,105</u>	<u>137,172</u>	<u>125,087</u>	<u>120,975</u>	<u>116,567</u>	<u>111,945</u>	<u>107,093</u>	<u>102,011</u>	<u>96,681</u>	<u>90,839</u>	<u>82,730</u>
<u>Current Liabilities</u>											
Accounts payable	894	1,395	1,382	1,545	1,814	1,874	1,934	1,984	2,044	2,154	2,264
Temporary overdraft in Southern Rhodesia	-	-	-	-	-	-	1,194	3,384	4,290	2,527	-
Retention monies	1,428	443	98	214	-	-	-	-	-	-	-
Finance charges accrued	1,935	2,544	1,559	1,525	1,470	1,410	1,350	1,300	1,240	1,130	1,020
Current portion of debt	<u>5,828</u>	<u>7,363</u>	<u>3,665</u>	<u>4,112</u>	<u>4,408</u>	<u>4,622</u>	<u>4,852</u>	<u>5,082</u>	<u>5,330</u>	<u>5,842</u>	<u>8,109</u>
TOTAL CURRENT LIABILITIES	<u>10,085</u>	<u>11,745</u>	<u>6,704</u>	<u>7,396</u>	<u>7,692</u>	<u>7,906</u>	<u>9,330</u>	<u>11,750</u>	<u>12,904</u>	<u>11,653</u>	<u>11,393</u>
TOTAL LIABILITIES	<u>157,175</u>	<u>158,075</u>	<u>153,462</u>	<u>155,251</u>	<u>157,060</u>	<u>157,855</u>	<u>160,976</u>	<u>166,756</u>	<u>169,777</u>	<u>174,450</u>	<u>177,181</u>

1/ Includes part of previous year's amortization, which could not be paid due to exchange control regulations.

ZAMBIA

KARIBA NORTH BANK CO. LTD.

ESTIMATED SOURCES AND APPLICATIONS OF FUNDS 1971-1976
(in thousands of Kwacha)

<u>Year ending June 30</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>TOTAL</u>
<u>SOURCES OF FUNDS</u>							
<u>Internal Cash Generation</u>							
Net Operating Income	-	-	-	-	-	2,835	2,835
Depreciation	-	-	-	-	-	985	985
Total Cash Generation	-	-	-	-	-	3,820	3,820
<u>Borrowings</u>							
Proposed IBRD Loan	950	4,039	9,577	8,947	4,318	740	28,571
Proposed CAPC Loan	2,481	2,029	2,941	2,819	1,601	309	12,180
Total Borrowings	3,431	6,068	12,518	11,766	5,919	1,049	40,751
TOTAL SOURCES	3,431	6,068	12,518	11,766	5,919	4,869	44,571
<u>APPLICATIONS OF FUNDS</u>							
<u>Construction Expenditure (excluding capitalized interest)</u>							
Proposed Kariba North Bank Project							
- Foreign currency	742	3,650	8,770	7,570	2,530	740	24,002
- Local currency	2,392	1,790	2,530	2,210	840	309	10,071
Total Construction Expenditure	3,134	5,440	11,300	9,780	3,370	1,049	34,073
<u>Debt Service</u>							
<u>Interest (including capitalized interest)</u>							
Proposed IBRD Loan	208	389	807	1,377	1,788	1,988	6,557
Proposed CAPC Loan	89	239	411	609	761	847	2,956
Total Interest	297	628	1,218	1,986	2,549	2,835	9,513
<u>Amortization</u>							
Proposed IBRD Loan	-	-	-	-	-	690	690
Proposed CAPC Loan	-	-	-	-	-	295	295
Total Amortization	-	-	-	-	-	985	985
Total Debt Service	297	628	1,218	1,986	2,549	3,820	10,498
TOTAL APPLICATIONS	3,431	6,068	12,518	11,766	5,919	4,869	44,571

ZAMBIA

KARIBA NORTH BANK CO., LTD.

ESTIMATED BALANCE SHEETS 1971-1976

(in thousands of Kwacha)

<u>Year ending June 30</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>
<u>ASSETS</u>						
Fixed Assets						
Gross plant in operation	-	-	-	-	39,702	40,751
Less: Depreciation reserve	-	-	-	-	-	985
Net plant in operation	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>39,702</u>	<u>39,766</u>
Work in Progress	<u>3,431</u>	<u>9,499</u>	<u>22,017</u>	<u>33,783</u>	<u>-</u>	<u>-</u>
TOTAL ASSETS	<u><u>3,431</u></u>	<u><u>9,499</u></u>	<u><u>22,017</u></u>	<u><u>33,783</u></u>	<u><u>39,702</u></u>	<u><u>39,766</u></u>
<u>LIABILITIES</u>						
Long-term debt (excluding current portion)						
Proposed IBRD Loan	950	4,989	14,566	23,513	27,141	27,142
Proposed CAPC Loan	<u>2,481</u>	<u>4,510</u>	<u>7,451</u>	<u>10,270</u>	<u>11,576</u>	<u>11,570</u>
Total long-term debt	<u>3,431</u>	<u>9,499</u>	<u>22,017</u>	<u>33,783</u>	<u>38,717</u>	<u>38,712</u>
Current portion of debt	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>985</u>	<u>1,054</u>
TOTAL LIABILITIES	<u><u>3,431</u></u>	<u><u>9,499</u></u>	<u><u>22,017</u></u>	<u><u>33,783</u></u>	<u><u>39,702</u></u>	<u><u>39,766</u></u>

ZAMBIA
APPRAISAL OF THE KARIBA NORTH PROJECT

ESTIMATED CONSOLIDATED INCOME STATEMENTS 1970-1976

(in thousands of Kwacha and Rhodesian Dollars)

<u>Year ending June 30</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>TOTAL</u>
<u>Gross Operating Revenue</u>	29,919	31,225	33,939	36,211	37,891	39,690	42,193	251,068
<u>Cost of Operations</u>								
Electricity Purchases	12,408	14,041	14,596	14,710	17,463	14,295	13,797	101,310
Operation and Maintenance	2,300	2,400	2,600	2,800	3,000	3,600	3,800	20,500
Depreciation	<u>2,900</u>	<u>3,750</u>	<u>4,622</u>	<u>4,852</u>	<u>5,082</u>	<u>5,330</u>	<u>6,827</u>	<u>33,363</u>
TOTAL OPERATING EXPENSES	17,608	20,191	21,818	22,362	25,545	23,225	24,424	155,857
NET OPERATING INCOME	12,311	11,034	12,121	13,849	12,346	16,465	17,769	95,895
Interest Charged to Operations	6,560	6,320	6,126	6,013	5,878	5,660	7,094	43,651
Interest Earned	<u>370</u>	<u>400</u>	<u>315</u>	<u>195</u>	<u>120</u>	<u>200</u>	<u>425</u>	<u>2,025</u>
NET REVENUE	<u>6,121</u>	<u>5,114</u>	<u>6,310</u>	<u>8,031</u>	<u>6,588</u>	<u>11,005</u>	<u>11,100</u>	<u>54,269</u>

April 1970

ZAMBIA

APPRAISAL OF THE KARIBA NORTH PROJECT

ESTIMATED CONSOLIDATED SOURCES & APPLICATIONS OF FUNDS 1970-1976

(in thousands of Kwacha and Rhodesian dollars)

<u>Year ending June 30</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>TOTAL</u>
<u>Sources of Funds</u>								
Internal Cash Generation	15,581	15,184	17,058	18,896	17,548	21,995	25,021	131,283
<u>Borrowings</u>								
Proposed IBRD Loan	-	950	4,039	9,577	8,947	4,318	740	28,571
Proposed borrowing in Southern Rhodesia	-	-	1,194	2,190	906	-	-	4,290
TOTAL BORROWING	-	950	5,233	11,767	9,853	4,318	740	32,861
TOTAL SOURCES	<u>15,581</u>	<u>16,134</u>	<u>22,291</u>	<u>30,663</u>	<u>27,401</u>	<u>26,313</u>	<u>25,761</u>	<u>164,144</u>
<u>Applications of Funds</u>								
<u>Construction Expenditure(excluding capitalized interest)</u>								
Proposed Project - Foreign currency	-	742	3,650	8,770	7,570	2,530	740	24,002
- Local currency	-	2,392	1,790	2,530	2,210	840	309	10,071
Other capital expenditure	<u>1,312</u>	<u>5,828</u>	<u>7,706</u>	<u>10,942</u>	<u>4,791</u>	<u>4,361</u>	<u>1,585</u>	<u>36,525</u>
TOTAL CONSTRUCTION EXPENDITURE	1,312	8,962	13,146	22,242	14,571	7,731	2,634	70,598
<u>Debt Service</u>								
<u>Interest</u>								
Proposed IBRD Loan	-	208	389	807	1,377	1,788	1,988	6,557
Proposed borrowing in Southern Rhodesia	-	-	46	173	278	320	68	885
Existing Loans	<u>6,560</u>	<u>6,320</u>	<u>6,080</u>	<u>5,840</u>	<u>5,600</u>	<u>5,340</u>	<u>5,038</u>	<u>40,778</u>
TOTAL INTEREST	6,560	6,528	6,515	6,820	7,255	7,448	7,094	48,220
<u>Amortization</u>								
Proposed IBRD Loan	-	-	-	-	-	-	690	690
Proposed borrowing in Southern Rhodesia	-	-	-	-	-	1,763	2,527	4,290
Existing Loans	<u>4,112</u>	<u>4,408</u>	<u>4,622</u>	<u>4,852</u>	<u>5,082</u>	<u>5,330</u>	<u>5,842</u>	<u>34,248</u>
TOTAL AMORTIZATION	4,112	4,408	4,622	4,852	5,082	7,093	9,059	39,228
TOTAL DEBT SERVICE	<u>10,672</u>	<u>10,936</u>	<u>11,137</u>	<u>11,672</u>	<u>12,337</u>	<u>14,541</u>	<u>16,153</u>	<u>87,448</u>
TOTAL APPLICATIONS	<u>11,984</u>	<u>19,898</u>	<u>24,283</u>	<u>33,914</u>	<u>26,908</u>	<u>22,272</u>	<u>18,787</u>	<u>158,046</u>
Annual Surplus (or Deficit)	3,597	(3,764)	(1,992)	(3,251)	493	4,041	6,974	6,098
Surplus (or Deficit) at the beginning of the year	7,600	11,197	7,433	5,441	2,190	2,683	6,724	7,600
Surplus (or Deficit) at the end of the year								
- Zambia	7,753	5,105	5,441	2,190	2,683	6,724	10,841	10,841
- S. Rhodesia	<u>3,444</u>	<u>2,328</u>	-	-	-	-	<u>2,857</u>	<u>2,857</u>
TOTAL	<u>11,197</u>	<u>7,433</u>	<u>5,441</u>	<u>2,190</u>	<u>2,683</u>	<u>6,724</u>	<u>13,698</u>	<u>13,698</u>

April 1970

ZAMBIA

APPRAISAL OF THE KARIBA NORTH PROJECT

ESTIMATED CONSOLIDATED BALANCE SHEETS 1970-1976

(in thousands of Kwacha and Rhodesian dollars)

<u>Year ending June 30</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>
<u>ASSETS</u>							
<u>Fixed Assets</u>							
Gross plant in operation	167,570	173,358	181,024	191,926	196,677	238,591	241,185
Less: Depreciation reserve	<u>25,512</u>	<u>29,237</u>	<u>33,834</u>	<u>38,661</u>	<u>43,718</u>	<u>49,023</u>	<u>55,825</u>
Net plant in operation	142,058	144,121	147,190	153,265	152,959	189,568	185,360
Work in progress	-	3,342	9,171	21,278	32,435	-	-
Administrative assets	882	897	912	927	942	957	972
<u>Current Assets</u>	<u>14,120</u>	<u>10,356</u>	<u>8,364</u>	<u>5,113</u>	<u>5,606</u>	<u>9,647</u>	<u>16,621</u>
TOTAL ASSETS	<u>157,060</u>	<u>158,716</u>	<u>165,637</u>	<u>180,583</u>	<u>191,942</u>	<u>200,172</u>	<u>202,953</u>
<u>LIABILITIES</u>							
<u>Equity</u>							
Earned Surplus	24,295	29,409	35,719	43,750	50,338	61,343	72,443
Exchange adjustment reserve	<u>8,506</u>						
TOTAL EQUITY	32,801	37,915	44,225	52,256	58,844	69,849	80,949
<u>Long-Term Debt (excluding current portion)</u>							
Proposed IBRD Loan	-	950	4,989	14,566	23,513	27,141	27,142
Existing Loans	<u>116,567</u>	<u>111,945</u>	<u>107,093</u>	<u>102,011</u>	<u>96,681</u>	<u>90,839</u>	<u>82,730</u>
TOTAL LONG TERM DEBT	116,567	112,895	112,082	116,577	120,194	117,980	109,872
<u>Current Liabilities</u>	<u>7,692</u>	<u>7,906</u>	<u>9,330</u>	<u>11,750</u>	<u>12,904</u>	<u>12,343</u>	<u>12,132</u>
TOTAL LIABILITIES	<u>157,060</u>	<u>158,716</u>	<u>165,637</u>	<u>180,583</u>	<u>191,942</u>	<u>200,172</u>	<u>202,953</u>

ZAMBIA
APPRAISAL OF THE KARIBA NORTH PROJECT

KARIBA NORTH BANK CO. LTD. & CENTRAL AFRICAN POWER CORPORATION

FINANCIAL RATIOS 1966-1976

<u>Year ended June 30</u>	<u>Actual</u>				<u>Estimated</u>						
	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>
<u>Average Net Fixed Assets in Operation</u> (in millions of Kwacha/Rh dollars)											
CAPC	147.26	149.21	146.94	144.71	142.96	143.09	145.66	150.2	153.11	152.47	149.84
Consolidated	-	-	-	-	-	-	-	-	-	171.26	187.46
<u>Net Operating Income</u> (in millions of Kwacha/Rh dollars)											
CAPC	9.37	9.86	10.82	11.74	12.31	11.03	12.12	13.85	12.35	16.47	14.93
Consolidated	-	-	-	-	-	-	-	-	-	16.47	17.77
<u>Return on Net Fixed Assets</u> (per cent)											
CAPC	6.4	6.6	7.4	8.1	8.6	7.7	8.3	9.2	8.1	10.8	10.0
Consolidated	-	-	-	-	-	-	-	-	-	9.6	9.5
<u>Interest Charged to Operation</u> (in millions of Kwacha/Rh dollars)											
CAPC	7.50	7.51	6.97	6.77	6.56	6.32	6.13	6.01	5.88	5.66	5.11
Consolidated	-	-	-	-	-	-	-	-	-	-	7.09
<u>Times Interest Covered by Net Operating Income</u>											
CAPC	1.2	1.3	1.6	1.7	1.9	1.7	2.0	2.3	2.1	2.9	2.9
Consolidated	-	-	-	-	-	-	-	-	-	-	2.5
<u>Debt Service</u> (in millions of Kwacha/Rh dollars)											
CAPC	10.67	10.97	10.68	10.44	10.67	10.73	10.75	10.87	10.96	12.75	13.47
Consolidated	-	-	-	-	-	-	-	-	-	-	16.15
<u>Times Debt Service Covered by Internal Cash Generation</u>											
CAPC (excluding KNBC interest)	1.1	1.1	1.3	1.4	1.5	1.4	1.6	1.8	1.7	1.8	1.6
Consolidated	-	-	-	-	-	-	-	-	-	-	1.5
<u>Debt/Equity Ratio</u>											
CAPC	95/5	94/6	85/15	82/18	78/22	75/25	71/29	66/34	62/38	56/44	50/50
Consolidated	-	-	-	-	78/22	75/25	72/28	69/31	67/33	63/37	58/42

April 1970

