

THE WORLD BANK GROUP ARCHIVES

PUBLIC DISCLOSURE AUTHORIZED

Folder Title: Electrical Power Study - Brazil - Furnas I - 1958 - 1970

Folder ID: 30248796

Subseries: Early special evaluation studies working files

Series: Special Evaluation Studies

Dates: 09/09/1958 – 05/01/1970

Fonds: Records of the Office of Operations Evaluation

ISAD Reference Code: WB IBRD/IDA OPE-09-01

Digitized: 05/11/2023

To cite materials from this archival folder, please follow the following format:
[Descriptive name of item], [Folder Title], Folder ID [Folder ID], ISAD(G) Reference Code [Reference Code], [Each Level Label as applicable], World Bank Group Archives, Washington, D.C., United States.

The records in this folder were created or received by The World Bank in the course of its business.

The records that were created by the staff of The World Bank are subject to the Bank's copyright.

Please refer to <http://www.worldbank.org/terms-of-use-earchives> for full copyright terms of use and disclaimers.



THE WORLD BANK

Washington, D.C.

© International Bank for Reconstruction and Development / International Development Association or

The World Bank

1818 H Street NW

Washington DC 20433

Telephone: 202-473-1000

Internet: www.worldbank.org

PUBLIC DISCLOSURE AUTHORIZED

OED SPECIAL STUDIES

85035--003

Elec. Power Study - Brazil - Furnas I

1965-1968



30248796

A1994-141 Other #: 12

205084B

Electrical Power Study - Brazil - Furnas I - 1958 - 1970

DECLASSIFIED
WBG Archives

II

11677

RESTRICTED

CIRCULATING COPY

Report No. PU-41

TO BE RETURNED TO REPORTS DESK

This report was prepared for use within the Bank and its affiliated organizations. They do not accept responsibility for its accuracy or completeness. The report may not be published nor may it be quoted as representing their views.

DECLASSIFIED

MAR 07 2023

WBG ARCHIVES

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT
INTERNATIONAL DEVELOPMENT ASSOCIATION

APPRAISAL OF THE MARIMBONDO HYDROELECTRIC PLANT
AND TRANSMISSION LINES AND OTHER GENERATING EQUIPMENT
CENTRAL ELETRICA DE FURNAS S.A.

BRAZIL

May 1, 1970

CURRENCY AND EQUIVALENTS

US\$1	=	New Cruzeiro \$ (Ncr\$) 3.83
Ncr\$1	=	US\$0.261
Ncr\$1 million	=	US\$261,097

UNITS AND EQUIVALENTS

kv	=	Kilovolt
kw	=	Kilowatt
Mw	=	Megawatt (1,000 kw)
Mwh	=	Megawatt hour
kwh	=	Kilowatt hour
One meter (m) (= 100 cm)	=	3.28 feet
One kilometer (km)	=	0.6214 miles

LIST OF ABBREVIATIONS

Furnas	Central Eletrica de Furnas S.A.
Eletrobras	Centrais Eletricas Brasileiras S.A.
CEMIG	Centrais Eletricas de Minas Gerais S.A.
Light	Light Servicos de Eletricidade S.A.
CESP	Centrais Eletricas de Sao Paulo S.A.
CPFL	Cia. Paulista de Forca e Luz S.A.
DAEE	Departamento de Aguas e Energia Eletrica do Estado de Sao Paulo
UNDP	United Nations Development Programme
AID	U.S. Agency for International Development

Furnas Fiscal Year ends December 31.

BRAZIL

CENTRAL ELETRICA DE FURNAS S.A.

APPRAISAL OF THE MARIMBONDO HYDROELECTRIC PLANT
AND TRANSMISSION LINES AND OTHER GENERATING EQUIPMENT

TABLE OF CONTENTS

	<u>Page No.</u>
SUMMARY AND CONCLUSIONS	i - vii
I. INTRODUCTION	1
II. SECTOR DEVELOPMENT	3
III. THE BORROWER	6
IV. GENERATING EXPANSION PROGRAM	9
V. THE PROJECT	10
Marimbondo Hydroelectric Plant	10
Transmission	10
Furnas Turbo-Generator Units 7 and 8	11
Engineering, Training, and Managerial Services	11
Estimated Cost	11
External Financing	12
Unit Costs	13
Engineering and Construction	13
VI. PROCUREMENT AND DISBURSEMENT	15
VII. JUSTIFICATION OF THE PROJECT	17
Alternative Sources of Energy and Capacity	18
Incremental Rate of Return	18
VIII. TARIFFS	20
IX. FINANCIAL ASPECTS	22
Past Operations	22
Present Financial Position	23
Proposed Financing Plan	24
Estimated Future Operations	26
X. RECOMMENDATIONS	28

This report is based on the findings of a Bank mission comprised of Messrs. R. L. Bloor, M. J. Reis and M. J. Schloss, who visited Brazil in October/November 1969.

LIST OF ANNEXES

1. Actual and Forecast Sales of Electricity
2. Port and Marine Taxes
3. Instruction for Award of Contracts
4. Peak and Energy Balance
5. Incremental Rate of Return
6. Tariffs
7. Actual and Estimated Income Statements, 1966-1978
8. Actual and Estimated Balance Sheets, 1966-1978
9. Schedule of Long-Term Debt, 1966-1978
10. Estimated Source and Application of Funds Statements, 1969-1978
11. Investment Expenditures Excluding Interest During Construction,
1969-1978
12. Interest Schedule, 1969-1978
13. Amortization Schedule, 1969-1978

MAP

Brazil - South-Central Region

BRAZIL

APPRAISAL OF THE MARIMBONDO HYDROELECTRIC PLANT AND TRANSMISSION LINES AND OTHER GENERATING EQUIPMENT OF CENTRAL ELETRICA DE FURNAS S.A.

SUMMARY AND CONCLUSIONS

- i. This report covers the appraisal of a project of Central Eletrica de Furnas S.A. (Furnas) consisting of the construction of the 1,400 Mw Marimbondo hydroelectric plant, associated transmission between the plant and Rio de Janeiro, and 300 Mw turbo-generator capacity in the existing Furnas plant. The project is estimated to cost US\$287 million equivalent; the proposed external financing would amount to US\$106 million equivalent, of which US\$80 million is proposed to be provided by a Bank loan and US\$26 million by major industrialized countries under joint financing arrangements described herein. Brazilian industry would compete for equipment orders as under previous loans and, with a 15% margin of preference, is expected to win considerable contracts which would be eligible for Bank financing. The project is a part of the overall expansion program of Furnas, the total cost of which is estimated at US\$1,250 million during the 10-year period 1969-1978, some 15% to 20% of the total sector requirement.
- ii. Total Bank lending for the electric power sector in Brazil has been US\$542 million. The sector is highly concentrated in the south-central region which is the industrial heart of the country, using 80% of all electric power produced. Furnas is an important generator and transmitter of power in this region.
- iii. The Borrower would be Furnas, an autonomous electric utility corporation owned principally by the Federal Government. Four previous Bank loans, totalling US\$191.3 million, have been made to Furnas for the construction of three hydroelectric stations and associated transmission. The first of these has been in commercial operation since 1963, the second is in commercial operation although construction is not yet complete, and site preparation and construction plant mobilization is in progress on the third. Construction schedules have been well-maintained and cost estimates have not been exceeded.
- iv. The project is technically sound. Its estimated cost, the proposed construction schedule and the proposed financial plan are reasonable. The facilities to be provided are required to enable Furnas to meet its part of the expected demand for power in the south-central region of Brazil for which an intensive power market study through 1985 has recently been completed by Centrais Eletricas Brasileiras S.A. (Eletrobras), a holding company which implements Government policy in the electric power sector. The study has been reviewed in the Bank and found to form a satisfactory basis for judging the need for the proposed project.

v. The project has been shown to be the least-cost alternative to add to the Furnas system in a report prepared by Furnas' consultants. The discount rates equating the costs of alternatives are 12¹/₂% and 16% per annum, respectively, for a combination thermal/hydro alternative and a full-thermal alternative. The incremental rate of return for the Marimbondo plant and transmission is 20% and for the additional capacity in the Furnas plant is not less than 24%, which are satisfactory.

vi. Furnas is a suitable Borrower. Since its inception in 1957, the organization has developed well. With the assistance of its well-qualified consultants, Furnas should be able to accomplish the work satisfactorily. It has maintained a satisfactory financial position, taking full advantage of favorable tariff regulations in Brazil.

vii. The project is a suitable basis for a Bank loan of US\$80 million equivalent for 30 years, including a grace period of 7¹/₂ years. Under the proposed joint financing arrangements, the balance of the external financing required of US\$26 million equivalent would be provided through credits arranged between Furnas and major supplier countries. Contracts would be awarded to low bidders after international competitive bidding without taking financing terms into account.

BRAZIL

APPRAISAL OF THE MARIMBONDO HYDROELECTRIC PLANT AND TRANSMISSION LINES AND OTHER GENERATING EQUIPMENT OF CENTRAL ELETRICA DE FURNAS S.A.

I. INTRODUCTION

1.01 Central Eletrica de Furnas S.A. (Furnas), a corporation almost wholly owned by the Federal Government, has requested a Bank loan of US\$80 million equivalent to cover a part of the required external financing for a project whose total cost is estimated to be US\$287 million. The remaining part of the external financing of US\$26 million equivalent would be provided by major industrialized countries under arrangements for joint financing described below in paragraph 5.10. The project would form a part of the Furnas program for meeting the increasing demand for electrical energy which over the next 10 years will require annual investments of the order of US\$125 million equivalent, some 15% to 20% of the total sector requirement.

1.02 The project would consist of construction of --

- i) the 1,400 Mw Marimbondo hydroelectric plant on the Rio Grande River;
- ii) two single-circuit 500 kv transmission lines, with a total length of 1,400 km, between the plant and Rio de Janeiro; and
- iii) two 150 Mw turbo-generator units for installation in the existing Furnas hydroelectric plant.

This would be the fifth Bank loan to Furnas, each of the preceding loans having financed a hydroelectric plant on the Rio Grande, or related transmission, or both: (a) Loan 211-BR (1958) for US\$73 million for the 900 Mw Furnas plant ^{1/}; (b) Loan 403-BR (1965) for US\$57 million for the 1,050 Mw Estreito plant; (c) Loan 474-BR (1966) for US\$39 million for the Estreito transmission; and (d) Loan 565-BR (1968) for US\$22.3 million for the 360 Mw Porto Colombia plant. The first two plants are in service; there have been some construction problems at some of the plants but there are no problems of any importance at present. Work on the Porto Colombia project has covered the first steps for equipment procurement, site preparation including roads and housing, and the mobilization and erection of construction plant. All of the projects except the 900 Mw Furnas plant were studied between 1963 and 1966 under a United Nations Development Programme (UNDP) grant whose objective was the creation of a long-range expansion program for electric facilities in Brazil's south-central region. The Bank was the Executing Agency for the study.

1.03 This report is based on the findings of a Bank mission comprised of Messrs. R. L. Bloor, M. J. Reis and M. J. Schloss, who visited Brazil in October/November 1969.

^{1/} The name of the company derives from this first plant built at Furnas Falls.

1.04 The Government's policy has been to make small adjustments in the exchange rate every 30 to 60 days. At the time of preparation of the basic data for this report, a rate of NCr\$3.83 to US\$1 was in effect; the present exchange rate is NCr\$4.49 to US\$1. Changes in the exchange rate do not affect the Borrower's financial position as they are offset by tariff adjustments, and hence, do not require frequent recasting of the financial statements.

II. SECTOR DEVELOPMENT

2.01 Most electric power in Brazil is produced by government entities, but there is substantial private production. In 1968 the total installed capacity of 8,741 Mw was distributed as follows:

Federal Government	18%	~ 1573 MW
State Governments	39%	~ 3403 MW
Private (including captive plants)	43%	~ 3759 MW

Future expansion of the sector in generation and transmission will be practically all by Government companies and by 1975 they will represent about 80% of the total capacity. Production varies greatly in the different sections of the country, as indicated below:

Northeast	11%
North and West-Central	1%
South-Central	77%
South	11%

Total production in 1968 was about 39 billion kwh or 425 kwh per capita, whereas in the South-central section production was 760 kwh per capita -- a rate comparable to some of the lower national rates in Europe.

2.02 The Government sector is headed by Eletrobras, a Federal limited liability holding company created in 1961 to implement Government policy in the electric power sector. Eletrobras is the majority stockholder in its 16 subsidiary (Federal) companies, and a minor stockholder in 19 associated companies controlled by State Governments. It administers public funds to expand the Federal power systems and makes loans to other utilities in need of financing.

2.03 The south-central region, which includes the states of Sao Paulo, Minas Gerais, Rio de Janeiro, Guanabara, Espirito Santo and Goias, contains 45% of the country's population although only 13% of its area, accounts for 40% of its agricultural production and 70% of its industrial production, and consumed in 1968 about 25 billion kwh of electricity or about 80% of the country's total consumption. The principal generating companies in the region are --

Central Eletrica de Furnas S.A. (Furnas),
Centrais Eletricas de Sao Paulo S.A. (CESP)
the State-owned company of Sao Paulo,
Centrais Eletricas de Minas Gerais S.A. (CEMIG)
the State-owned company of Minas Gerais, and
Light Servicos de Eletricidade S.A. (Light)
a subsidiary of a Canadian company.

These companies are interconnected by a transmission system (see Map) and up until now the principal inter-company movement of power has been from Furnas to Light. CESP is beginning to bring in large sources of power and in the future will supply a large part of the Sao Paulo market; Furnas will be the principal supplier of the Rio de Janeiro area; CEMIG will supply the state of Minas Gerais; and there will be some interchanges among the companies. Light will not expand its generating facilities, but will continue to be the principal distributor in the Sao Paulo and Rio de Janeiro areas.

2.04 The study under the UNDP grant mentioned in paragraph 1.02 was undertaken by a consortium of consulting engineering firms ^{1/}, and yielded a program for the region's power development through 1980 when, based on an intensive market study, consumption of at least 65 billion kwh was expected. The program is predominantly hydroelectric since there are many such sites that can be developed at low unit cost, whereas the known indigenous fossil fuels are either scarce or of poor quality and remote from the region. All the companies have adhered to the program and are expected to continue doing so; all features of the proposed project are parts of the program. CESP of Sao Paulo was committed so heavily to a program of its own when the UNDP study was initiated in 1963 that it has not yet started a project under the program, but plans to do so soon. Its plants now under construction fit into the program satisfactorily although the transmission voltage it selected, while workable, will not represent the most economical solution.

2.05 During the past year, Eletrobras made a market study of the south-central region to update the development program, which is based on data about five years old. The company was assisted by well-qualified consultants who had worked on the UNDP study. The final report on this market study is now available and it indicates total consumption of at least 75 billion kwh in 1980. The report is judged to be a satisfactory basis for the region's expansion programs. The particular assumptions regarding the market which serve as a basis for appraising the proposed project are set forth in paragraphs 7.02 and 7.03 herein. The program will require periodic review as the actual market develops.

2.06 Although Furnas, CEMIG and CESP each has a fairly definite area of responsibility for the future supply of electricity, the transmission grid makes it possible for them all to obtain substantial advantages from coordinated operation. Furnas has taken the lead in organizing a Committee for the Coordination of Integrated Operation, which includes the nine companies operating in the south-central region and its fringe areas. This Committee meets regularly to consider such matters as --

- i) coordination of reservoir storage operations;
- ii) system planning for reserve capacity;
- iii) establishment of system maintenance programs;
- iv) procedures for load and frequency control;
- v) planning for operations during emergencies;
- vi) establishment of system communication facilities;
- vii) standardization of statistical information and coordination of technical studies.

Although new, the Committee is organized along lines that have been successful elsewhere and it may be expected to achieve for the region a high quality of service at low cost.

^{1/} Montreal Engineering Co. Ltd. of Canada,
G. E. Crippen Associates Ltd. of Canada,
Gibbs and Hill, Inc. of U.S.A., assisted by
counterpart Brazilian staff.

2.07 The development of distribution systems commensurate with the expansion of generating and transmission facilities is proceeding reasonably well. Four Bank loans (475 - 478-BR) totalling US\$61.6 million are helping finance the rehabilitation and expansion of four major systems in the south-central region. For several years, an AID loan of US\$40 million to Light has helped finance a program of distribution improvement in the cities of Rio de Janeiro and Sao Paulo. Using its own funds, Light is about to embark on a five-year plan designed to stay abreast of market growth. CEMIG is undertaking a major expansion of its distribution system in Minas Gerais. All the other companies in the region are actively engaged in or planning the early start of similar programs. With the improved earnings based on revalued assets permitted the utilities since 1964, there is little doubt that the distribution systems will be improved and expanded toward adequate levels. System losses of 14% in 1968 are expected to be reduced to 11% in 1980, a quite satisfactory level, due principally to improvement in distribution systems.

Adding table 3.

III. THE BORROWER

3.01 The Borrower would be Furnas, an autonomous Government corporation established in 1957 and the largest subsidiary of Eletrobras. Furnas is a bulk producer and sells only to other utilities at wholesale. It is a major supplier for the Rio de Janeiro market through Light and several smaller distributors, for the Sao Paulo market through Light and one other small company and it sells to CEMIG. Its principal source of energy is large hydroelectric plants it has constructed on the Rio Grande several hundred kilometers from its markets; and it has built an extensive high-voltage transmission system to reach these markets.

3.02 The share capital of Furnas as established on June 6, 1969, was NCr\$600 million, divided as follows:

<u>Shareholder</u>	<u>Ordinary</u> %	<u>Preferred</u> %
Centrais Eletricas Brasileiras S.A. (Eletrobras)	96.5	92.9
Centrais Eletricas de Minas Gerais S.A. (CEMIG)	1.7	1.7
Departamento de Aguas e Energia Eletrica do Estado de Sao Paulo (DAEE)	1.8	2.7
Light Servicos de Eletricidade S.A. (Light)	-	1.9
Cia. Paulista de Forca e Luz S.A. (CPFL)	-	0.2
Centrais Eletricas de Sao Paulo S.A. (CESP)	-	0.6
TOTAL	100.0%	100.0%
Total number of shares	300 million	300 million

3.03 A 12-member council appointed by the Government directs Furnas. Six of the members are executive directors, and the other six are in Government and business circles. The executive directors are the President, the Vice President (Technical), the Vice President (Operations and Planning), and the three heads of the Departments of Administration, Finance, and Contracts. The personnel are distributed as follows:

<u>Department</u>	<u>No. of Personnel</u>
Technical	1,000 (750 in construction)
Operations and Planning	1,000
Administration	370
Finance	170
Contracts	135
Total	2,675

The number of personnel is not excessive. Furnas does a considerable amount of construction work with its own forces, such as preparatory work at construction sites which would be difficult to accomplish by contract. Furthermore, many of its personnel do work which ordinarily would be done in government bureaus, such as organizing the coordinated operation of all utilities in the region and assisting in the preparation of tariff regulations, market studies, and the solution of other country-wide utility problems.

3.04 The organization of Furnas has developed well -- due partly to a well-informed, hard-working group of executive directors and partly to the technical and financial assistance furnished by the Bank and other development financing institutions. All of the Bank loans have included funds for personnel training, as does the proposed loan. Some 20 employees annually are sent to the United States and to European countries for graduate study and practical training in the technical and financial fields with large utility enterprises, manufacturing companies and government bureaus. In addition, Furnas has converted some of the buildings in the construction village at the Furnas Dam into a training school for operating and maintenance technicians, who are drawn from its own organization as well as from other utilities in Brazil. For the design and construction of major projects, Furnas employs consulting engineers and hires contractors.

3.05 All power generated by Furnas is sold under contract to other utilities for resale to the ultimate consumers. The utilities which purchase Furnas power and the amounts of recorded and projected sales are listed in Annex 1. In 1968, the last year for which nationwide figures are available, Furnas energy sales were nearly 6.0 billion kwh and the demand was 1,260 Mw. Total energy sales in the south-central region for that year were 21 billion kwh.

3.06 As Brazil's largest Federal public utility, Furnas has substantial generating facilities as shown below:

In Operation

<u>Station</u>	<u>Type</u>	<u>Capacity Mw</u>
<u>1/</u> Furnas	Hydro	900
Santa Cruz	Thermal	160
Peixoto	Hydro	<u>2/ 250</u>
<u>1/</u> Estreito, Units Nos. 1 to 4	Hydro	<u>700</u>
TOTAL		2,010

Under Construction

<u>Station</u>	<u>Type</u>	<u>Date of Installation</u>	<u>Capacity Mw</u>
Funil	Hydro	1970	210
<u>1/</u> Estreito			
Units Nos. 5 & 6	Hydro	1972	350
Santa Cruz	Thermal	1972	400
<u>1/</u> Porto Colombia	Hydro	1973/74	<u>360</u>
			1,320

3.07 The transmission system of Furnas is shown on the attached map. In operation and under construction are 2,650 km of 345 kv transmission lines which will be substantially completed in 1972 and fully completed in 1974.

-
- 1/ Financed by the Bank.
 - 2/ This 480 Mw plant is owned by CPFL, another Eletrobras subsidiary; agreement has been reached that Furnas would market energy from 250 Mw of its capacity.

IV. GENERATING EXPANSION PROGRAM

4.01 As shown in paragraph 3.06, the Furnas Corporation has 2,010 Mw of capacity in operation and 960 Mw under construction to be completed by 1972. The Porto Colombia units will come on line in 1973 and 1974, but in order to avoid a shortage in reserve capacity in those years the Corporation plans to install in the Furnas powerhouse units Nos. 7 and 8 of 150 Mw each in the spaces available for them. The 1,400 Mw of Marimbondo is scheduled to come in starting in 1975 and to be completed early in 1977. Furnas has been given the responsibility by the Government to construct Brazil's first nuclear plant (about 500 Mw); several sites in the vicinity of Rio de Janeiro are being explored. The year 1976 has been mentioned as the date for completion of the nuclear plant, but full commercial operation is not considered likely before 1978; this later date appears to be satisfactory with respect to Furnas' ability to meet its market requirements. While a nuclear plant of this size may be economic in many systems of this size, its justification in Brazil is not clear on account of the availability of abundant low-cost hydro potentials extending well into the 1980's. Present plans are to finance it by tied foreign credits and government funds; and the Bank has reserved the right to assure itself that a satisfactory financing plan is adopted for the construction of this or any other project which may be started before the proposed Marimbondo project is completed. As it is expected that another new power plant will be needed early in 1979, the present plan is to build the Itumbiara hydroelectric plant of about 1,000 Mw on the Paranaíba River during 1974-1978. Furnas expects that another plant of about 1,000 Mw will then need to be constructed over the 1975-1980 period. This program aside from the Marimbondo plant will require further study before each additional plant is started, since the market requirements may deviate somewhat from present estimates.

V. THE PROJECT

5.01 The project would consist of the construction of the 1,400 Mw Marimbondo hydroelectric plant on the Rio Grande, a transmission system at 500 kv and 1,400 km long, and the installation of two 150 Mw turbo-generator units in the existing Furnas plant. Included in the project would be foreign engineering, training and managerial services plus the related equipment.

Marimbondo Hydroelectric Plant

5.02 The plant will be situated 650 km northwest of Rio de Janeiro at Marimbondo Falls, about 250 km above the mouth of the Rio Grande where it joins the Paranaíba River to form the Parana River. With a drainage area of 118,600 km² and a gross head of 60 m, Marimbondo will be the largest plant on the river. Like other plants under construction upstream, it will benefit from the regulation of flow provided by the large volume of storage at the existing Peixoto and Furnas plants.

5.03 The main features of the structure will be --

- i) an earth embankment, 3,500 m long with a maximum height of 65 m and with a volume of 20 million m³;
- ii) a gated concrete chute spillway, 150 m wide; and
- iii) a powerhouse intake structure connected by short steel penstocks to an enclosed, above-ground powerhouse 220 m long.

Construction will be simple except for the extensive cofferdam system required by the peculiar topography of the falls. The earth and rock cofferdam structures will have to be built in fairly deep water. Though this has been done before under more adverse conditions, a well-organized and adequately supervised construction effort will be needed. The Brazilian construction industry will be called upon to do the work and with the supervision of the Furnas organization it is fully capable of this; furthermore, the project cost estimates include contingency allowances that should be able to cover construction difficulties.

5.04 The powerhouse will have eight 175 Mw units. The plant factor would be 40% with an annual firm energy capability of some 4.9 billion kwh under driest season conditions as experienced during the 1953-56 drought. These relationships are optimal based on a study of needs of the entire Furnas system. The station will utilize Francis-type turbines suitable to the moderate head.

Transmission

5.05 The fact that the Marimbondo plant will be the largest on the Rio Grande, as well as the farthest from the market, calls for the construction of an extra high voltage transmission system to be superimposed over the present

345 kv system. Various layouts have been studied, with the best one shown on the attached map. Basically, the system connects Marimbondo with Rio de Janeiro (its principal market) by two single-circuit lines totalling some 1,400 km and by 1,200 Mva of transformers in the capital city; its routing also makes possible economic interconnections to the CEMIG area to the north, and the CESP area to the south.

5.06 Transmission at 500 kv is a relatively new and high voltage. For some years, however, it has been in service in the United States over long distances and the equipment has been designed and produced by several manufacturers. Furnas personnel will be trained in its operation elsewhere and experienced consultants will be available when operations begin. Thus, no problems regarding its use in south-central Brazil are expected.

Furnas Turbo-Generator Units 7 and 8

5.07 The Furnas powerhouse has six 150 Mw units in operation, and there are spaces for two more of the same size. Since practically all the equipment needed to install the two units, Nos. 7 and 8, such as the traveling cranes, closure gates, and bulkheads, is already built into the powerhouse, no problems are anticipated.

Engineering, Training and Managerial Services

5.08 These services are needed by Furnas as its system becomes increasingly complex and they must be obtained from abroad since the system is the most advanced of its kind in Brazil. Being the outstanding Federal utility, it must assume the leadership by training personnel abroad and achieving improvements in management and integrated operation with adjacent systems, to include load dispatching and computerized problem-solving, along with equipment for such operations.

Estimated Cost

5.09 The estimated cost of the project is shown below.

	In Millions of NCr\$			In Millions of US\$		
	Local Currency	Foreign Currency	Total	Local Currency	Foreign Currency	Total
<u>Marimbondo Plant</u>	456.9	76.6	533.5	119.3	20.0	139.3
<u>Transmission</u>	293.8	95.7	389.5	76.7	25.0	101.7
<u>Furnas Units 7 and 8</u>	22.6	10.7	33.3	5.9	2.8	8.7
<u>Engineering</u>	-	14.2	14.2	-	3.7	3.7
<u>Contingencies</u>	103.8	16.1	119.9	27.1	4.2	31.3
Training, Technical and Managerial Improvement Services and Related Equipment	-	7.7	7.7	-	2.0	2.0
TOTAL PROJECT COST	877.1	221.0	1,098.1	229.0	57.7	286.7

The total cost of US\$286.7 million equivalent does not include interest during construction. Contingency allowances vary from about 7.5% on equipment proposed for external financing to about 17.5% on the local costs of the Marimondo plant which include the civil works. The US\$52.0 (57.7 minus 5.7) million of foreign currency for equipment is the estimated cost of imports comprising finished goods, components, and raw materials.

External Financing

5.10 The requirement of US\$106 million equivalent in external financing includes about US\$100 million which is the estimated cost of equipment to be purchased after international competitive bidding including contracts won by Brazilian suppliers. These are estimated to amount to nearly one-half of the total contracts on the basis of recent experience with similar loans in Brazil. External financing would be provided by joint financing between the Bank and major industrialized countries as agreed at a meeting in Paris on March 11 and 12, 1970. The pattern of financing would be similar to that used for the Colombian Loans 536-CO, 537-CO, and 575-CO. A major difference in results would be that in this case, and on the basis of recent experience, Brazilians would be expected to secure a substantial part of the equipment orders, as noted above, and these would be financed by the Bank. Otherwise, financing for equipment would be provided on a 50/50 basis between the Bank and the countries in which contracts are placed provided that:

Individual contracts amount to at least the equivalent of US\$200,000 to qualify for joint financing; and

any one country must receive qualifying contracts aggregating at least the equivalent of US\$1 million before being called upon to participate in joint financing.

Foreign engineering, training, technical, and managerial improvement services and related equipment would be financed by the Bank. Joint financing is expected to occur along the following lines:

Marimondo - Joint Financing (US\$ Million)

	Total Financing Required	IBRD		Total	Other Lenders
		100% Brazilian Orders	50% Foreign Orders		
Marimondo Hydroelectric Plant	32.0	12.0	10.0	22.0	10.0
Marimondo Transmission System	54.8	29.8	12.5	42.3	12.5
Furnas Plant Units 7 and 8	5.7	2.9	1.4	4.3	1.4
Contingencies	7.8	3.6	2.1	5.7	2.1
Total Equipment	100.3	48.3	26.0	74.3	26.0
Engineering, Training Services, etc.	5.7	-	-	5.7	-
Total Financing	106.0	48.3	26.0	80.0	26.0

$$106 - 48.3 = 57.7$$

Thus the proposed Bank loan would be US\$80 million equivalent and the proposed financing by other lenders is estimated at US\$26 million equivalent. The proposed Borrower has agreed to make its best efforts to obtain joint loans. If the other lenders should secure contracts which qualify for joint lending and total more than US\$26 million, the amount of Bank financing could be reduced and a corresponding amount of the loan could be cancelled. Agreement has been reached with the Borrower that prematuring of a joint loan because of a default would give the Bank the right to declare a default under the Bank loan.

Unit Costs

5.11 The cost per kw of the Marimbondo plant, due to favorable natural conditions, is only US\$115, which is very low compared with the average cost of this type of hydroelectric plant. Together with the transmission system the cost is under US\$200 per kw, which is likewise a very low unit cost considering that a part of the transmission system will also temporarily serve other plants. The unit cost of Furnas units 7 and 8 is about US\$31 per kw; the lowest unit cost of installing incremental capacity elsewhere in the region has been estimated at US\$44 per kw. The project cost estimate is based partly on Furnas' recent construction experience and partly on the advice of its consultants and prospective suppliers, and it is judged to be adequate.

Engineering and Construction

5.12 The engineering group which in 1966 produced a program of power expansion through 1980 for the south-central region (see paragraph 2.04) recognized that the Marimbondo plant would have one of the lowest cost potentials in the region. However, no basic engineering studies had been made for it and because of the time required for such studies, other projects with more complete planning had to be programmed earlier to meet the growing need for electricity. Since 1966 Furnas has employed two engineering firms, Charles T. Main (U.S.A.) and Promon Engineering Co. (Brazil), to proceed with the engineering studies. Individual consultants from the U.S.A. were also employed for the earth dam design and geological studies. Detailed studies of the entire system in which the plant will operate have been made to establish the plant's optimum installed capacity. A satisfactory report on this study is available. Thus, the general design of the dam structure is now fixed, the size of the powerhouse is established, an accurate cost estimate is available, and the detailed design of structures and equipment is in progress.

5.13 Since it was generally recognized that the construction of Marimbondo required a transmission system with a higher voltage level than the existing system (see paragraph 5.05), a planning group was organized consisting of representatives of Furnas, CEMIG and CESP. Studies were made as to how the integration of their systems could best be carried forward with regard to the routing of lines and voltage levels, including the existing 345 kv level and 500 and 765 kv. The planning group was assisted by Commonwealth Associates, a U.S.A. firm specializing in transmission planning, and Montreal Engineering Co. of Brazil (no relation to the Canadian company of the same name). The group selected a voltage level of 500 kv and the routing of the lines necessary

to carry the output of Marimbondo. That voltage level was found to be more economical than 345 kv; 765 kv was found applicable in only part of the region and furthermore was considered too untried anywhere to be used in Brazil at this time. The group's findings were reported in detail and are considered reasonable. Work is now going forward on detailed planning of the structures and equipment needed.

5.14 The Montreal Engineering Co. of Canada, after studying the need for Furnas units 7 and 8, prepared a satisfactory report recommending installation as soon as practicable. The relatively small amount of engineering required for the design and installation of these units can be supplied by the Furnas organization itself, assisted as necessary by suppliers.

5.15 Site preparation for Marimbondo has been underway for some time, and Furnas has started the mobilization of construction equipment. After mid-1970, Furnas should begin to enter into contracts for the major items of permanent equipment; at the same time a major construction contractor should move onto the job site. It should be practicable to make these arrangements, so as to ensure the first generating unit coming into operation early in 1975 and the last one at the beginning of 1977. It should likewise be possible to construct the transmission facilities on a similar schedule, except to have them completed by the end of 1974. Furnas unit 7 will be needed late in 1973 and unit 8 early in 1974; there should be no problem in meeting those dates. The well-experienced Furnas organization and its well-qualified consulting firms should be able to accomplish all of the work satisfactorily and on schedule. The provisions contained in Loan 565-BR requiring the employment of consultants and contractors satisfactory to the Bank will be repeated in the proposed agreement.

VI. PROCUREMENT AND DISBURSEMENT

6.01 Procurement for the project will fall within two categories:

- i. Permanent equipment to be installed in the project and certain foreign professional services which will be covered by the proposed external financing (including the proposed Bank loan) and estimated to cost US\$106 million.
- ii. The main civil works contracts, which will not be covered by the proposed external financing, and estimated to cost approximately US\$80 million equivalent.

The remainder of the project cost will be for force account work, land, local engineering services, operation of construction camps, and administrative overhead.

6.02 Procurement of goods and services by means of the external financing would be on the basis of international competitive bidding, with the exception of some minor items for which such bidding would be impractical, and the professional services needed for engineering and training. As in the Bank's previous power loans in Brazil, local manufacturers would be eligible to compete in the bidding with the advantage of a 15% margin of preference. In the case of bids composed of both foreign and local currencies the foreign portion would be dealt with as a foreign bid and the local portion as a local bid. In the case of joint loans the interest and terms of the loans would be disregarded in selecting the low bidder. Local manufacturers would be expected to obtain a substantial amount of contracts (see paragraph 5.09). The main civil works contracts will be open to bidding only by Brazilian contractors of which there are enough with the necessary experience to offer significant competition.

6.03 Under previous power loans foreign and domestic bids have been compared by adding 15% in lieu of customs duties to the foreign bids and converting the resulting amount to cruzeiros by using the rate of exchange prevailing 30 days prior to bid opening. Since the last loan was negotiated, certain Port and Marine Taxes have been created (see Annex 2 for details) and an "Instruction No. 6" (see Annex 3) has been issued by the Ministry of Finance. These developments would require that an average of about 3% of the value of imports would be added as part of the landed cost before comparing with local bids and that the rate of exchange used would be that prevailing on the date of award. These taxes apply to imports, exports, and coastwise shipping and the Bank and the Borrower have agreed they may be considered user charges and included in the cost of imports for the purpose of comparing local and foreign bids; the full proceeds of these taxes are assigned to port and merchant marine improvements. However, loan funds would not be available for payment of the taxes.

6.04 No disbursements would be made for expenditures incurred prior to the signing of the loan, except for relevant engineering services which would be about US\$300,000. Disbursements under the proposed loan would cover the CIF cost of equipment from foreign origin after allowing for joint financing arrangements or local cost of equipment acquired from local suppliers as a result of international competitive bidding. For engineering services and training costs disbursements would be for the actual foreign exchange cost. Any unutilized amounts would be cancelled.

VII. JUSTIFICATION OF THE PROJECT

7.01 The market for electricity in south-central Brazil expanded on an average annual rate of 11.2% through the 1950's, then dropped to an average of 8.1% from 1960 through 1968 because growth from 1964 to 1967 was small due to the Government's action to correct economic maladjustments which occurred prior to that period. However, in 1968 the rate was 12.3% and was estimated late in 1969 to be over 13% for that year. Eletrobras' recent studies (see paragraph 2.05) have resulted in a projected annual expansion rate of about 10.5% through the 1970's.

See para 2.05, p. 4.
7.02 To provide a test for the timing of Marimbondo and Furnas units 7 and 8 it was deemed prudent to request Furnas to make a market projection based on the estimated regional market of 1969 projected to 1980 at an annual rate of expansion of 9%. From this projection it may be concluded that if all projects under construction in the region are completed on schedule, including the proposed Marimbondo plant and Furnas units 7 and 8, there may be a shortage of energy of about 8% in 1975 when Marimbondo starts to operate and capacity requirements including reserves will barely be met. It is expected that this energy shortage could be overcome by temporarily overdrawing on storage in the Furnas reservoir -- a procedure resorted to in 1969 when a dry spell in Sao Paulo required Furnas to exceed its contract commitments to Light. It is also clear that through 1980 Furnas cannot expect help from projects under construction by others.

7.03 Furnas has contracts to supply power to some entities on a fixed supply basis, but is also responsible for supplying other areas, notably that centering on Rio de Janeiro, in accordance with the growing market demand, which has been estimated on the basis of the above-mentioned 9% regional expansion but adjusted within the Furnas area of primary responsibility in accordance with its special requirements (see Annex 1). The contract demands are depicted graphically (see Annex 4), together with the indication of the scheduled completion of Furnas' generating facilities under construction and including Marimbondo and Furnas units 7 and 8. The following conclusions may be drawn:

- i) There will be a small shortage of energy in 1974 and 1975 (this could be overcome by special operation of Furnas reservoir).
- ii) Furnas units 7 and 8 are needed in 1973 and 1974 to avoid a substantial reduction in reserve capacity.
- iii) Marimbondo plant must be in operation in early 1975 to avoid shortages of reserve capacity.

- iv) Marimbondo plant will be fully loaded two years after its completion if a planned nuclear plant is in commercial operation by 1977. Since the nuclear plant is quite likely to be at least a year late (paragraph 4.01), the Marimbondo plant is more likely to be fully loaded in about a year. This indicates the total installation is not excessive and justifies the installation of all eight units in one continuous operation.
- v) An additional plant will be required in 1979 for both capacity and energy.

Alternative Sources of Energy and Capacity

7.04 The proposed projects represent the most economic form in which additional generating capacity can be provided. A consultant group formed by Companhia Auxiliadora de Empresas Eletricas Brasileiras and the Montreal Engineering Co. of Canada made a study of alternative new sources, each one of which would equally well enable the Furnas system to deliver the same amount of power to the market. In one approach the study shows that the discount rate which equates the system investment plus operating costs in the Marimbondo plant and its associated transmission facilities, compared with the same items in the most appropriate combination of a thermal plant operated with a hydro plant, is about 12½% per annum. Under another approach the discount rate which equates the system investment and operating costs with Marimbondo plant and its associated transmission facilities, compared with those of the system with a thermal alternative, is estimated to be 16% per annum, which is satisfactory.

7.05 As for Furnas units 7 and 8, in another study by the same consultant group it was shown that the unit cost of installing additional units with a step-up substation would be considerably lower than that of any other alternative source of capacity.

Incremental Rate of Return

7.06 The incremental rate of return of the Marimbondo plant and transmission facilities is 20% valuing output at present basic tariffs. The corresponding rate of Furnas units 7 and 8 is 49%; this unusually high rate is due to the large investments in civil works heretofore made to provide the facilities needed by these new units. The return for units 7 and 8 taking into consideration the complete Furnas installation, i.e., including the applicable investment heretofore made, is 24%. Annex 5 describes in detail how the incremental rates of return were determined.

7.07 In addition to the above rates of return, benefits difficult to quantify accrue to the economy as a whole. In the case of Marimondo transmission lines, other generating units of the system will be able to make some use of them both before and after the Marimondo plant is completed. As for Furnas units 7 and 8, their installation permits a greater use of the Furnas reservoir storage and an increase in the capacity and energy production from plants downstream. Moreover, in addition to the power rates charged by the utilities, certain taxes and other charges are levied on ultimate consumers for further investment in the power sector which charges are not included in the revenues of Furnas or its customers. Thus these additional benefits, which have not been included in the above calculations, would make the full economic returns higher.

VIII. TARIFFS

8.01 In recent years, particularly in 1964, many changes have occurred in Brazilian legislation relating to tariffs for the power sector. Such changes were brought about because of inflation in Brazil and the previous inability of electric utilities to obtain a reasonable rate of return. Thus, with regulation on the basis of historical cost and with substantial inflation taking place, it was impossible to generate a reasonable portion of funds for normal expansion of facilities and, as a result, the level of service deteriorated. A description of tariff regulations and of related taxes and compulsory loans paid by consumers is included in Annex 6. Under the present legislation and the administration thereof the system is working well. Regulation enables electric utilities to achieve a reasonable rate of return and generate funds used for construction purposes. Funds also are raised from consumers through additional charges on electric bills for taxes and compulsory loans, from reinvestment of earnings by Eletrobras in securities of electric utilities in order to finance expansion, from Government and through substantial foreign loans. It has thus been possible in the south-central region to raise the quality of service and meet the increasing demand for power.

8.02 Annual revaluation of assets (see Annex 6, paragraph 4) to reflect the effects of inflation is now mandatory, but related applications for tariff increases based on such revaluations are not mandatory. Protection is afforded by three provisions in existing and in the proposed Loan and Guarantee Agreements, as follows:

- (a) Furnas shall make application for tariff adjustments, based on annual revaluations, within five months after the end of every calendar year so that its tariffs will be sufficient to ensure operations in accordance with sound financial and public utility practice.
- (b) The Government of Brazil shall require agencies with jurisdiction over Furnas' rates to act on tariff applications within a period of not more than 30 days after their receipt.
- (c) The Bank may suspend or cancel in case the applicable legislation is changed materially and adversely affects the Borrower's business.

8.03 The history of changes in the tariffs of Furnas has been satisfactory. Between January 1965 and May 1969 16 applications were filed, all of which with one exception became effective substantially as requested. In the latter case the amount of increase in tariffs was reduced because the Department of Water and Power of the Ministry of Mines and Energy, which regulates electric utilities, with the agreement of Furnas concluded that annual depreciation charges for hydroelectric systems should be limited to 3%, in lieu of the previous maximum of 5%. Seven applications providing for changes in basic tariffs were filed (usually in the month of April) and were on the average effective within a month after filing. The other nine filings were in the form of surcharges to reflect either changes in foreign exchange rates and related increases in the cost of servicing foreign debt or in cost of fuel incidental to thermal generation. These nine surcharges went into effect automatically without advance approval of the Department.

IX. FINANCIAL ASPECTS

9.01 The past, present and prospective financial position and financial results of Furnas have been and are expected to be satisfactory (Annexes 7, 8 and 10). Good management (paragraph 3.04) and tariff regulation (paragraph 8.01) are the principal reasons for this situation.

Past Operations

9.02 During the years 1966 through 1968 demand on Furnas increased substantially from less than 600 Mw in 1966 to 795 Mw in 1967 and 1,261 Mw in 1968. Power sales increased 38% in 1966, 18% in 1967, and 31% in 1968 when they totaled 5,719 million kwh (Annex 7). Reflecting inflation and the related adjustments in tariffs previously mentioned, the average realization per kwh increased from NCr\$0.02217 in 1966 to NCr\$0.03602 in 1968. In terms of U.S. dollars there was practically no change in the price, equivalent to about one cent per kwh.

9.03 From the beginning of 1966 to the end of 1968, fixed assets in operation increased substantially from NCr\$330 million to NCr\$874 million and work in progress from NCr\$36 million to NCr\$567 million. Of the total combined increase of NCr\$1,075 million, NCr\$660 million (61%) represented new construction or acquisitions and NCr\$415 million (39%) represented revaluation of fixed assets.

9.04 Earnings of Furnas have been satisfactory in recent years. Tariff regulation permits a 10% rate of return on revalued assets as discussed in detail in Annex 6. To the extent that realized earnings are less than this 10% return on remunerable investment (rate base) the shortfall (deficiency in earnings) may be subsequently recovered and is one of the elements in setting basic tariffs. Earnings of Furnas in recent years have been sufficient to reduce the amount of accumulated shortfall. Budgeted results anticipate a substantial reduction if not elimination by the end of 1970 of the NCr\$38 million of shortfall at the end of 1968.

9.05 Return calculated on the basis of remunerable investment as defined for purposes of Brazilian regulation, (Annex 6) in the years 1966-1968 has averaged close to 11%. Return calculated in accordance with a test devised by the Bank under Loan 403/474-BR (developed only for the purpose of measuring whether any possible future changes in legislation would materially and adversely affect the position of Furnas), was over 14% in the years 1966, 1967 and 1968. The Bank's test was calculated as the percentage of operating income (excluding income taxes and amortization from costs of operation) and after depreciation at a 2½% rate to the average of the revalued net fixed assets in operation at the beginning and end of the year. Under Brazilian regulation, however, operating income is calculated after inclusion of income taxes, depreciation (presently at a 3% rate) and amortization charges as costs of operation. Amortization charges have substantially the same effect as depreciation charges.

9.06 Coverage of total interest by operating income before income taxes in the years 1966-1968 varied between 1.6 and 3.4 times. Coverage of 1.6 times in 1968 reflects a higher proportion of work in progress in total fixed assets. Work in progress is not part of remunerable investment and thus makes no contribution to operating income. As presented in Annex 7, interest charged to construction (taxable income under Brazilian law) is applied as a reduction of total interest.

Present Financial Position

9.07 Furnas' financial statements have been prepared immediately after the close of the fiscal year and have been promptly audited by Arthur Andersen and Company. These arrangements have been satisfactory. In order to assure that adequate and prompt auditing continues in the future, a covenant similar to that in existing loans requiring Furnas to employ auditors acceptable to the Bank is included in the proposed Loan Agreement.

9.08 The financial position of Furnas as of December 31, 1968, is shown in Annex 8. The summary balance sheets, presented below, show the actual audited data and the effect of revaluing Furnas' accounts on the bases of (a) the coefficient issued annually by the Government and used to revalue assets and local long-term debt to reflect inflation, and (b) the foreign exchange rate applicable at December 31, 1968.

Summary Balance Sheet, December 31, 1968 (thousand NCr)

	<u>Actual 1/</u>	<u>Revalued 2/</u>
<u>ASSETS</u>		
<u>Fixed Assets</u>		
Fixed assets in operation	873,568	1,115,163
Less reserve for depreciation	91,585	102,777
Net fixed assets in operation	781,983	1,012,386
Work in progress	566,593	676,320
Total fixed assets	1,348,576	1,688,706
<u>Current Assets</u>	48,953	48,953
<u>Other Assets</u>	3,532	3,532
<u>TOTAL ASSETS</u>	<u>1,401,061</u>	<u>1,741,191</u>
<u>CAPITAL AND LIABILITIES</u>		
<u>Capital</u>		
Share capital	456,000	576,577
Surplus	22,979	22,979
Reserves	104,910	120,051
Total capital	583,889	719,607
<u>Long-Term Debt</u>	730,699	929,489
<u>Current Liabilities</u>	86,473 3/	92,095 4/
<u>TOTAL CAPITAL AND LIABILITIES</u>	<u>1,401,061</u>	<u>1,741,191</u>

1/ Audited balance sheet based on coefficient applicable to December 31, 1967 accounts and on a foreign exchange rate of NCr\$2.715 to US\$1.

2/ Revalued balance sheet based on coefficient applicable to December 31, 1968 accounts and on a foreign exchange rate of NCr\$3.83 to US\$1.

3/ Includes NCr\$19,591 long-term debt due within one year.

4/ Includes NCr\$23,818 long-term debt due within one year.

9.09 In January 1969 the coefficient issued by the Government for revaluation purposes reflected an inflation in 1968 of 25% and Furnas accordingly revalued its assets and local long-term debt in April 1969. At the same time Furnas revalued its foreign loans on the basis of the exchange rate of NCr\$3.83 to US\$1 as of December 31, 1968. These steps were a necessary part of the tariff increase process. At the end of 1968, fixed assets in operation reflecting this revaluation approximated NCr\$1,115 million and work in progress NCr\$676 million. As indicated in paragraph 3.06, substantial generation facilities are under construction.

9.10 Furnas' balance sheet at the end of any year usually reflects a weak current financial position. Actual balance sheets for the years ending in 1966 through 1968 (Annex 8) indicate current liabilities substantially in excess of current assets. As long as inflation continues it is desirable to operate with minimum reasonable cash balances. The working capital position at December 31 generally reflects the worst current position for any 12-month period. Many of the current liabilities are not due for payment until 6 to 12 months later. Furnas has always been able to meet its current obligations.

9.11 A detailed schedule of individual long-term debts is shown in Annex 9. Long-term debt at December 31, 1968, was about 56% of the total fixed assets. This is within the 66-2/3% debt limitation provided in existing Loan Agreements. A similar debt limitation covenant is included in the proposed Loan Agreement.

Proposed Financing Plan

9.12 The financing plans of Furnas are based on the expectation that most local funds will be obtained through internal cash generation and the purchase of share capital and loans by Eletrobras and that foreign expenditures will be financed by lending institutions such as the Bank and AID and by foreign suppliers including joint financing loans. The Bank will also finance some local expenditures subject to international competitive bidding. These plans are satisfactory. As indicated in paragraph 4.01 future projects are presently estimated to require large expenditures. These, however, are subject to further study and provision is included in the proposed Loan Agreement that no major projects will be undertaken except in accordance with a financing plan satisfactory to the Bank.

9.13 A forecast of the source and application of funds for the 10-year period 1969 through 1978, is shown in Annex 10. The plan for financing this expansion program over the period is summarized in the table which follows. For the years 1969 and 1970, the data in Annex 10 as well as in the projected income statements and balance sheets represent budget estimates used by Furnas in tariff proceedings. For subsequent years the 10% return on future year-end remunerable investment permitted by regulation has been projected. This approach is appropriate in the light of the frequent changes in tariffs of Furnas, the experience of Furnas, and the requirement of Bank Loan and Guarantee Agreements (paragraph 8.02). Tariffs are adjusted to provide the permitted level of earnings. As seen in the table below, total funds required for the

10-year period are estimated at NCr\$5,742 million. Under the projected expansion program, estimated construction expenditures excluding interest charged to construction amount to about NCr\$4,785 million, or about 83% of the total application of funds, excluding debt service. The balance of the required funds consists of about NCr\$739 million for interest charged to construction and about NCr\$219 million for working capital. The proposed Marimbondo project is estimated to cost more than NCr\$1,000 million, or over 20% of the construction expenditures during this 10-year period. A detailed schedule showing the estimated costs of the various projects included in the expansion program is in Annex 11.

Summary of Source and Application of Funds Statement 1969-1978
(thousand NCr\$)

	<u>Amount</u>	<u>Percent</u>
<u>APPLICATION OF FUNDS</u>		
Investment expenditures		
Foreign	2,030,925	35.4
Local	2,753,955	47.9
Total	4,784,880	83.3
Interest charged to construction	738,620	12.9
Total investment expenditures	5,523,500	96.2
Additions to working capital	219,021	3.8
Total Applications of Funds	<u>5,742,521</u>	<u>100.0</u>
<u>SOURCE OF FUNDS</u>		
Internal cash generation	5,214,626	
Less: Interest charged to operations	1,481,875	
Amortization of long-term debt	1,024,194	
Dividends	1,115,873	
Bonuses	97,468	
Total deductions	<u>3,719,410</u>	
Net internal cash generation	1,495,216	26.0
Additional share capital from re-investment of dividends	889,104	15.5
Long-Term borrowings		
Foreign loans	2,173,312	37.9
Local loans	1,184,889	20.6
Total Source of Funds	<u>5,742,521</u>	<u>100.0</u>

9.14 The net internal cash generation as shown in the table above, amounting to 26% of the total source of funds, is before consideration of additional share capital expected to be sold. The forecasts are based on the expectation that Eletrobras will in the future continue to receive dividends of 12% per annum from Furnas and reinvest these dividends (less a tax of 15% thereon) in additional shares of Furnas, as it has substantially done in the past. With reinvestment of dividends by Eletrobras, internal cash generation approximates 41% of required funds with some modest increase if minority stockholders holding about 5% of the capital stock also reinvest dividends received.

9.15 Of the total foreign borrowing of NCr\$2,173 million projected through the year 1978, 26% will be provided from existing Loan Agreements (principally with the Bank and AID), 19% is estimated to be provided by the proposed Bank and joint financing loans, and the balance of 55% will have to be arranged as future projects become ready for financing.

9.16 For the purpose of this report it has been assumed that the interest rate of the proposed Bank loan and the joint loans for the Marimbondo project would be 7%. Amortization of the proposed Bank loan would be adjusted to repayment of the joint loans without reducing any repayments to the Bank below US\$100,000 equivalent. The proposed Bank loan would have a $7\frac{1}{2}$ -year grace period and a $22\frac{1}{2}$ -year amortization period. The joint loans would be amortized over a 10-year period from dates of delivery with the latter defined as the date of completed installation at the site, as determined by the Bank, but not to exceed 18 months from the date of shipment. Interest rates on borrowings from Eletrobras are between $8\frac{1}{2}$ % and 13%. The Eletrobras loan for the Marimbondo project has been included in the financial projections as a 22-year loan, including a 7-year grace period, with a 13% interest rate. This debt will, as does all local long-term debt (paragraph 9.09 and Annex 6), include provision for monetary restatement to reflect changes in price levels. Detailed schedules of the annual interest and amortization payments for all loans have been included in Annex 12 (Interest Schedule) and Annex 13 (Amortization Schedule).

9.17 The proposed financial plan is reasonable. Assurances are provided in the proposed Guarantee Agreement that in the event of a shortage of funds the Government would provide Furnas with the necessary funds to carry out the Bank project.

Estimated Future Operations

9.18 Forecasts of earnings (Annex 7) are based primarily on the expectation that Furnas will, in the future, as it has in recent years, be able to earn the return of 10% on remunerable investment provided for in tariff regulation in Brazil and described in detail in Annex 6. A total return exceeding 10% is contemplated for the years 1969-1970 in the expectation that there will be a reduction in the accumulated shortfall in past earnings (paragraph 9.04). Foreign exchange expenditures have been cast in terms of the official foreign exchange rate as of December 31, 1968, of NCr\$3.83 to US\$1. Normal increases in operating costs reflecting the growth of Furnas have been considered but no provision has been made for subsequent changes

in foreign exchange rates, which change frequently in small amounts, or in price levels. These are provided for under the tariff arrangements.

9.19 In 1969 and future years, Furnas intends to charge and include in cost of operations 3% for depreciation and 3% for amortization. These permitted liberal rates are being used to enhance internal cash generation and assist in financing the construction program. Of total internal cash generation of NCr\$5,214 million over the 10 years 1969-1978, depreciation and amortization total NCr\$2,343 million or 45%.

9.20 The estimated kwh sales are based on sales contracts with customers as described in paragraph 3.05 and shown in Annex 1. In 1969 estimated sales increased very substantially, reflecting the assistance rendered in meeting power requirements in Sao Paulo, which was adversely affected by drought (paragraph 7.02). As a result of these unusually high sales in relation to relatively normal increases in kw demand, estimated price per kwh realized in 1969 was only moderately higher than in 1968 despite customary tariff increases.

9.21 As indicated in the forecast source and application of funds statements (Annex 10), debt service is covered by internal cash generation about 1.6 times during the 10 years 1969-1978, a satisfactory ratio. Projected interest coverage appears low but combined depreciation and amortization charges equal about 6% of plant in service. Excluding the amortization charge and recording a normal depreciation charge of 2 $\frac{1}{2}$ % as used in the Bank's test (paragraph 9.05), the lowest projected interest coverage of 1.1 times would be increased to 1.6 times. It must be recognized that substantial amounts of interest relate to plant in process of construction which makes no contribution to operating income until placed in service. The percentage of total long-term debt to total fixed assets is expected to reach its highest level of 61.9% by the end of 1974 but for the most part is around 60%. The contractual nature of Furnas' operations (paragraph 3.05) imparts stability to its position.

X. RECOMMENDATIONS

10.01 During loan negotiations, agreement was reached on the following principal points:

- a. Covenants substantially in accord with those in existing Loan or Guarantee Agreements with the Borrower are included in the proposed agreements (paragraphs 4.01, 5.15, 8.02, 9.07, 9.11 and 9.17);
- b. the Borrower will make its best efforts to obtain joint loans; and upon the prematuring of a joint loan because of a default the Bank may declare a default under the Bank loan (paragraph 5.10);
- c. for bid comparison purposes the CIF landed cost of imported goods may include certain recently adopted maritime taxes (paragraph 6.03).

10.02 The project forms a suitable basis for a Bank loan of US\$80.0 million equivalent (excluding interest during construction) for 30 years including a grace period of $7\frac{1}{2}$ years.

May 1, 1970

BRAZIL
CENTRAL ELETRICA DE FURNAS S.A.
Actual and Forecast Sales Demand
(Thousands of kw)

C o m p a n y	Recorded Sales Demand					Contracted Demand Commitments (1)							
	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
Centrais Eletricas de Minas Gerais	15	54	129	170	225	235	250	330	375	450	450	450	450
Light - Sao Paulo (2)	559	670	792	982	900	900	900	900	900	900	900	900	900
Light - Rio (3)	-	69	200	250	550	650	764	907	1,064	1,236	1,442	1,670	1,922
Cia. Paulista de Forca e Luz (4)	-	-	70	86	120	140	180	220	270	320	380	440	510
Cia. Brasileira de Energia Eletrica	-	-	65	77	100	113	127	142	159	177	194	212	231
Centrais Eletricas Fluminenses	-	-	-	-	23	34	47	61	77	95	112	131	152
Espirito Santo Centrais Eletricos	-	2	5	18	40	58	75	49	35	42	61	82	105
Cia. Eletrica Brasilia	-	-	-	-	32	32	43	50	32	32	32	67	127
TOTAL SALES DEMAND	574	795	1,261	1,583	1,990	2,162	2,386	2,659	2,912	3,252	3,571	3,952	4,397

- (1) Furnas contracted demand for the supply of the various utilities. The contract year begins April 1st in most cases at which time the demand for the following 12 months comes in force. Furnas is obligated to sell power at 60% load factor, although the purchaser may take and pay for less energy or purchase more energy if available. The annual demand charge is determined by the contracted demand.
- (2) After 1970 growth of Sao Paulo Light demand will be supplied by CESP, the State owned utility in the State of Sao Paulo.
- (3) Amounts of Rio Light contract established up to and including 1971: contract amounts for subsequent years will be set in 1970. Demand shown in 1972-78 based on low growth rate of Rio Light estimated by Eletrobras study. Eletrobras, Furnas and Rio Light have agreed that all additional power required by Rio Light in the future will be supplied by Furnas.
- (4) Eletrobras, Furnas, CESP and Paulista have agreed that Furnas will supply 75% of Paulista growth and CESP 25%; Furnas Paulista contract prepared on this basis.

February 4, 1970

BRAZIL
CENTRAL ELETRICA DE FURNAS S.A.
Recorded and Estimated Energy Sales
(Millions of kwh)

C o m p a n y	Recorded Energy Sales					Estimated Energy Sales (1)								
	<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>1977</u>	<u>1978</u>	
Centrais Eletricas de Minas Gerais	81	113	308	740	1,180	1,270	1,310	1,730	1,970	2,350	2,350	2,350	2,350	
Light - Sao Paulo	3,624	4,164	4,045	6,765	5,120	5,120	5,120	5,120	5,120	5,120	5,120	5,120	5,120	
Light - Rio	-	96	1,044	2,170	3,130	3,700	3,630	4,350	5,160	6,050	6,960	8,000	9,100	
Cia. Paulista de Forca e Luz	-	-	150	261	631	736	946	1,156	1,419	1,682	1,990	2,220	2,680	
Cia. Brasileira de Energia Eletrica	-	-	157	269	376	438	507	578	657	744	825	946	1,000	
Centrais Eletricas Fluminenses	-	-	-	-	122	174	227	289	358	438	507	587	625	
Espirito Santo Centrais Eletricas	-	1	15	37	271	411	508	184	245	315	403	490	586	
Cia. Eletrica Brasilia (2)	-	-	-	-	-	-	-	-	-	-	-	-	-	
TOTAL ENERGY SALES	3,705	4,374	5,719	10,242	10,830	11,849	12,248	13,407	14,929	16,699	18,155	19,713	21,461	

(1) Based on contract demands, given on page 1 of this annex.

(2) Peaking capacity only is needed; energy is traded on an even basis.

February 4, 1970

PORT AND MARINE TAXES

Port Improvement Tax

This tax was created per Decree No. 8.311 of December 6 1945, and Decree No. 3.421 of July 10, 1958, and was subsequently amended by Decree No. 415 of January 10, 1969. It was created to form a part of the "Fundo Portuario Nacional" in order to provide financial resources for the improvement of ports and access channels. Charges apply to exports and coastal shipping as well as to imports. They are calculated on the basis of the commercial value of the merchandise, which is interpreted to mean the CIF value as follows:

- a) 2% when the merchandise is imported;
- b) 0.2% when the merchandise is exported; and
- c) 0.2% when the merchandise is shipped to or from another port in Brazil.

Tax for Renovation of Merchant Marine

This tax was established by Decree No. 3.381 of April 24, 1958 and was subsequently amended by Decree No. 432 of January 23, 1969. It was created to form a part of the "Fundo da Marinha Mercante" in order to provide financial resources for the merchant marine of Brazil. Charges apply to both domestic and foreign shipping as follows:

- a) 20% of the freight value for departure from a national port in the commerce of Brazilian coastal shipping; and
- b) 15% of the freight value for imports from the overseas.

February 4, 1970

MINISTRY OF FINANCE

ORDER (PORTARIA) OF JANUARY 14, 1969

In exercise of the powers conferred on him by law, the Minister of Finance hereby resolves as follows:

No. 6 - I. For the purpose of implementation of the present order, the term "international bidding" shall be understood to cover any call for bids issued by a public authority or a private entity for the supply of machinery, industrial equipment, and materials for processing, when not restricted to domestic manufactures.

II. The definition given in Section I shall also include price quotations from a restricted number of bidders with a view to the purchase of goods.

III. Invitations to participate in international bidding shall comply with all the following regulations:

- (a) They shall contain a clause setting forth or accepting a formula for price adjustment so that the value of domestic currency can be restored in the event of an increase in domestic costs;
- (b) requirements for bonds and guarantees on the part of the bidders should not be in excess of those normally and usually laid down in the countries concerned, including Brazil;
- (c) any penalties for failure to observe the technical or performance guarantees shall be no more severe than those that are traditionally accepted on the international market, and shall be limited to an amount proportional to the value of the supply contract;
- (d) the terms of payment shall admit bids in accordance with the usual supply practices of the domestic manufacturers of machinery and industrial equipment and consistent with the schedule of manufacturing expenses.

IV. The comparison of bids made in international competitions, when financing over more than 15 years is entailed, pursuant to Article 18 of Decree Law No. 37 of November 18, 1966, shall be based on the system set forth in points 1 and 2 below:

- (1) Foreign bids shall observe the following rules:
 - (a) They shall state the CIF price, listing separately the estimated portion of that price that is represented by freight and insurance and handling (estiva) at the port of destination;

- (b) the CIF price shall be converted into new cruzeiros at the rate of exchange of the Banco do Brasil S.A. in force on the day on which the bids are opened; in the event of a change in the rate between that day and the date of the official award, the price quoted in the foreign bids shall be recalculated on the basis of the new rate of exchange;
- (c) the prices in new cruzeiros, determined as set forth in (b) above, shall be augmented by the following unloading charges, even though the importer may be exempt therefrom:
 - (i) Merchant fleet renewal tax;
 - (ii) Port improvement tax;
- (d) if, on the day the bids are opened, any foreign exchange charges are due on the imports, the amount thereof shall be added to the price in new cruzeiros, determined as set forth in (b) above;
- (e) once the total price in new cruzeiros has been determined as provided for above, it shall be augmented by a minimum of 15% pursuant to point III of the Sole Proviso of Article 17 of Decree Law No. 37-66, regulated by Decree No. 61,574 of October 20, 1967; this 15% coefficient shall be applied on the basis of the following formula:

$P^O = (1 \text{ plus } t) (P \text{ plus } D)$
 P^O = Final price for purposes of comparison
 P = CIF price quoted as defined in (b)
 D = Unloading charges, as defined in (c)
 t = Rate for protection margin;

- (f) the final comparative price for foreign bids shall be obtained by adding the price in new cruzeiros of any parts of domestic origin to the price determined as provided for above.
- (2) Domestic bids shall observe the following rules:
- (a) Domestic bids shall be understood to be those with a component of locally manufactured parts representing 50% or more of the value of the complete equipment, which percentage shall be determined using the dollar rate in force on the day on which the bids are opened;
 - (b) the provisions of (a) above shall not include equipment for which the domestic content has been specified in accordance with a Government-approved scheme;

- (c) for the purposes of comparison, the FOB factory price in new cruzeiros of the domestic bid shall be used;
- (d) for the purpose of price comparison, in the event of a change in the rate of exchange, only that portion of the adjustment shall be taken account of that relates to the period between the start of bidding and the official award, even though the domestic bid may include a price adjustment in accordance with a formula contained in the bidding conditions; in such event and in order to reestablish parity with the foreign bid, the price quoted in the domestic bid shall be augmented by the portion of the adjustment based on notional application of the respective formula.

V. The comparison of bids made in international competitions, entailing external financing over less than 15 years or no external financing at all, shall be based on the system set forth in points 1 and 2 below:

(1) Foreign bids shall observe the following rules:

- (a) They shall state the CIF price, listing separately and clearly the portion of that price represented by freight and insurance and explicitly including the cost of handling at the port of destination;
- (b) the CIF price shall be converted into new cruzeiros at the rate of exchange of the Banco do Brasil S.A. in force on the day on which the bids are opened; in the event of a change in the rate between that day and the date of the official award, the prices quoted in the foreign bids shall be recalculated on the basis of the new rate of exchange;
- (c) the price in new cruzeiros, determined as provided for in (b) above, shall be augmented by the following items, even though the importer may be exempt therefrom:

I - import tax, calculated on the basis of the respective rate in the Customs Tariff;

II - merchant fleet renewal tax;

III - port improvement tax;

IV - foreign exchange charges on the imports, if due on the day on which the bids are opened;

V - tax on processed products;

VI - turnover tax;

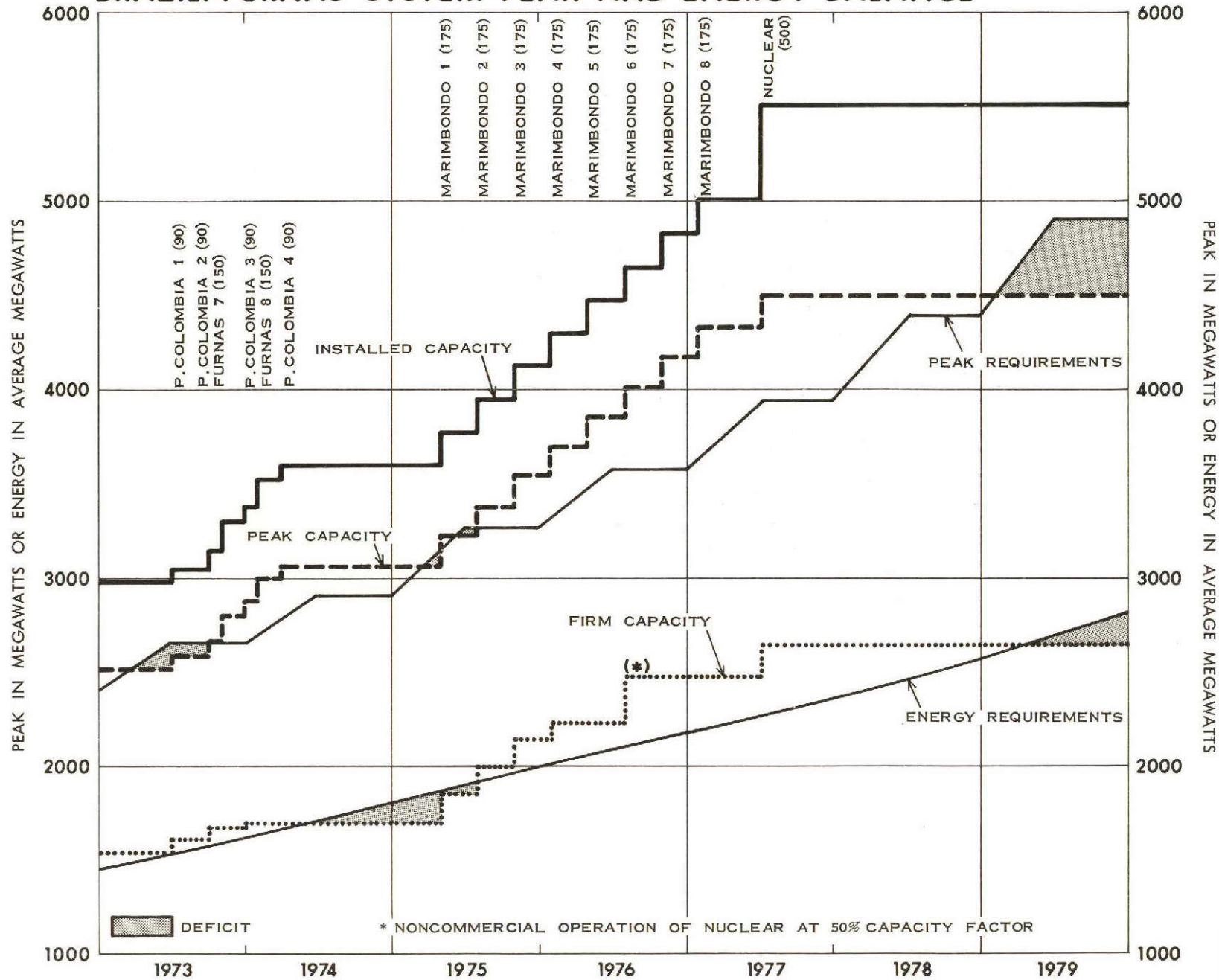
- (d) the comparative price for the foreign bids shall be obtained by adding the price in new cruzeiros of any parts of domestic origin to the price determined as provided for in (b) and (c) above.

(2) Domestic bids shall observe the rules set forth in Section IV, (2) (a), (b), (c) and (d), and, for the purposes of price comparison, the following principle:

- (a) Should the similar domestic product be exempt from domestic taxes or tax free, an amount equivalent to the tax on the inputs required for its production in Brazil shall be deducted from the FOB factory price in new cruzeiros quoted in the domestic bid.

April 22, 1970

BRAZIL: FURNAS SYSTEM-PEAK AND ENERGY BALANCE



BRAZIL

CENTRAL ELETRICA DE FURNAS S.A.

MARIMBONDO PROJECT

Incremental Rate of Return

1. The incremental rate of return of the Marimbondo project was determined as set out below, and is the discount rate at which the present worth of the cost of the project equals the present worth of the revenues produced by it over its life:

- (a) The life of the project is 40 years.
- (b) The annual capital costs comprise construction costs and investments in working capital. The project's annual construction cost is shown in Annex 11. Investments in working capital are projected as the units go into operation: for the Marimbondo plant, the estimated amount is NCr\$27 million, and for Furnas units 7 and 8 it is NCr\$0.7 million.
- (c) The annual net revenue is the annual gross revenue less incremental operating costs. The annual gross revenue is equal to the annual capacity sales attributed to the project multiplied by the demand charge plus the annual energy sales attributed to the project multiplied by the energy charge.
- (d) The annual sales of capacity were determined by allocating the incremental Mw sales first to the Marimbondo plant up to its capacity, and thereafter the rest of the incremental sales to Furnas units 7 and 8. The average annual sales of energy were determined by apportioning the total sales of the Corporation to the respective plants in accordance with the estimated operating conditions, and were estimated at 7.43 billion kwh for Marimbondo once fully in operation. No increase in energy was attributed to Furnas units 7 and 8 since they serve only for peaking capacity.

- (e) The demand charge in the calculations of revenues was NCr\$18.54 per kw per month, and the energy charge was NCr\$9.82 per Mwh. These figures correspond to the revised basic tariff for the period 1969/70 put in effect in May 1969. These tariffs include income taxes of Furnas as part of the costs of operation.

2. On the basis of the above, it was determined that the present worth of capital costs would equal the present worth of the benefits over a 40-year period at a discount rate of 20.2% for Marimbondo plant and transmission, and 49.4% for Furnas units 7 and 8. If the total cost of the Furnas plant were averaged out over the eight units, then the rate of return on the last units would be 23.9%.

February 25, 1970

BRAZIL

CENTRAL ELETRICA DE FURNAS S.A.

Tariffs

1. Regulations governing tariffs are contained in the Water Code of 1934, subsequent amendments and decrees including decrees dated February 26, 1957 and November 4, 1964 and Law 5,073 enacted on August 18, 1966. Prior to 1964, tariffs were based on the use of the historic value of investment, thereby not reflecting the substantial inflation that occurred in Brazil. The 1964 decree allows utilities to revalue their investment to reflect changes in price levels. The 1966 legislation made yearly revaluations of assets mandatory.
2. Under the existing regulations, tariffs are reviewed and approved by the Department of Water and Power of the Ministry of Mines and Energy every three years or at shorter intervals at the initiative of the Waters Department or the utility. In recent years, tariff applications of Furnas have been for two year intervals comprised of a basic application including financial forecasts for two years followed by appropriate subsequent adjustments for price level changes in the second year. Utilities are permitted to apply for tariffs which would yield revenues covering (a) operating costs including income taxes; (b) straight line depreciation of gross fixed assets in operation, excluding land and land rights, at annual rates of up to 5% for thermal plants and up to 3% for all other facilities including hydro plants but with no effective minima in either case; (c) amortization provision of up to 5% or a reversion provision of up to 3% of the total gross fixed assets in operation; and (d) a return of 10% on the remunerable investment. Furnas provides for amortization, not reversion which mechanically requires a deposit of cash with the Government which is withdrawn to pay for property acquired. Remunerable investment in effect is defined as the book value of the estimated end of year gross plant in service (excluding assets acquired through contributions in aid of construction) less depreciation and reversion or amortization reserves, plus reversion or amortization funds and an end-of-year allowance for working capital consisting of materials and supplies, receivables equivalent to two months' billings, and cash up to the value of the reserve for depreciation balance. In principle, shortfalls in achieving the return of 10% in the three-year tariff period may be recovered in the subsequent three-year period. However, another provision in the regulations permits tariff adjustments for recovering shortfalls at more frequent intervals. In the case of Furnas the period has been two years.

3. Without advance approval of the Waters Department surcharges between tariff revisions may be added by utilities to current tariffs to cover compulsory increases in wages, social benefits, cost of fuel and purchased power, and increases in foreign debt service due to changes in the foreign exchange rate. Tariff adjustments of May 1969 of Furnas reflecting monetary corrections also permitted the elimination of surcharges.

4. Tariff adjustments on account of revaluation of balance sheet accounts can be made as often as economic correction factors (coefficients) showing the variations in the price level are calculated and published by the Government. The coefficients are issued annually about one month after the end of each year for the use of industry in general as well as electric utilities. The coefficients are applied by utilities to update the values of plant in service, depreciation and amortization or reversion reserves, and certain local currency loans of Eletrobras and of the National Development Bank. Increased tariffs resulting from revaluation of assets based on coefficients do not, however, completely offset the effects of inflation. In any given year construction expenditures incurred in the immediate prior year are not revalued. Furthermore, the effects of inflation in the current year are not recognized because utility plant is revalued as of the beginning of that year. In addition, no price level adjustment is made for shortfalls in earnings which are to be recovered in succeeding years. Foreign currency components of the book value of fixed assets are converted into local currency at the rate of exchange in effect at the time the assets are acquired except for assets constructed with the proceeds of foreign loans. In such cases the rate of exchange initially used is that in effect at the date of the signing of the loan contract. With the first repayment of principal of such loan, an adjustment is made to reflect the exchange rate in effect at the time of repayment. At the same time as the application of the coefficient, but in lieu of the use of the coefficient, Furnas, as is permitted, adjusts its assets constructed with foreign currency to changes in exchange rates as applied to its foreign debts. As offsets to the fact that remunerable investment does not fully reflect inflation, it must be recognized that cost of service for a given year is related to remunerable investment as of the end of that year and that both cost of service (which includes taxes on income) and remunerable investment are based on estimated projections. Furnas in its tariff applications makes adjustments to reflect the fact that tariffs for a given period generally do not go into effect until some four or five months after the close of the calendar year. Furthermore, as indicated in paragraph 2 above, combined allowances permitted for depreciation and amortization are liberal.

5. In addition to a basic tariff and surcharges, consumers pay three other charges. The Federal Government levies two charges to raise additional resources for the financing of power development, a tax called the Imposto Unico (sole tax), which varies among consumer classes, and the Emprestimo Compulsorio (compulsory loan). These two charges do not apply to sales to other utilities for resale which is Furnas' source of operating revenues.

The sole tax rate is 47% for residential customers, 22% for commercial customers and 2% for industrial customers. The compulsory loan rate is 35% for commercial and industrial customers. The percentage for industrial customers is reduced for companies with energy costs amounting to 3% or more of sales and also for certain industries in the national interest. The above percentages are applied not to the price per kwh actually paid by the customer but to an average price per kwh realized by major Brazilian electric utility systems. The proceeds of the sole tax, which was first imposed in 1954, are distributed, after retention of 5% by the Ministry of Finance, as follows: 37% to Eletrobras which administers the Federal Electrification Fund; 50% to the states; 10% to the municipalities; 1% to the Ministry of Mines and Energy and 2% to its Water Department. The compulsory loan, introduced in 1962 and scheduled to be discontinued at the end of 1973, is administered by Eletrobras and invested in power projects as share capital or as loans with an effective interest rate of about 13%. Eletrobras has consistently reinvested dividends received, less taxes thereon, from Furnas. Customers receive debt certificates for the amount of the compulsory loan paid; the certificates are revalued annually, pay 6% interest, and are repayable in 20 years. Finally, the total rate for power includes a social security tax amounting to 3% of the actual charge for service, excluding the sole tax and compulsory loan, billed to the customer.

February 4, 1970

BRAZIL

CENTRAL ELETRICA DE FURNAS S.A.

Actual and Estimated Income Statements
(thousand NCr\$)

	Actual			Estimated (1)									
Year Ending December 31	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
Sales (millions of kwh)	3,705	4,374	5,719	10,242	10,830	11,849	12,248	13,407	14,929	16,699	18,155	19,713	21,461
Average price per kwh (new cruzeiro)	0.02217	0.02788	0.03602	0.03804	0.04864	0.04049	0.04644	0.05120	0.04640	0.05265	0.05507	0.05216	0.05141
Operating Revenues	82,141	121,961	205,979	397,622	526,743	479,730	568,834	686,444	692,690	879,216	999,750	1,028,233	1,103,203
Operating Expenses													
Operating expenses	3,656	7,700	46,003	98,200	136,100	133,200	149,100	186,100	199,200	205,100	178,000	221,200	209,900
Depreciation	19,210	26,101	24,391	58,310	65,327	66,467	84,316	101,834	102,857	141,584	168,740	170,972	195,486
Amortisation	13,431	18,479	28,788	59,867	67,071	68,241	86,567	104,552	105,602	145,363	173,245	175,536	200,705
Income taxes	6,126	9,200	14,700	22,462	29,272	22,599	26,574	33,396	29,609	45,674	46,666	44,459	46,748
Taxes on dividends etc.	779	1,462	2,764	3,223	4,391	4,483	7,632	10,594	6,273	13,002	7,848	8,480	18,362
Total operating expenses	43,202	62,942	116,646	242,062	302,161	294,990	354,189	436,476	443,541	550,723	574,491	620,647	671,201
Operating Income	38,939	59,019	89,333	147,560	224,582	184,740	214,645	249,968	249,149	328,493	425,259	407,586	432,002
Other Income Net	2,036	70	240	8,000	-	-	-	-	-	-	-	-	-
Gross Income	40,975	59,089	89,573	155,560	224,582	184,740	214,645	249,968	249,149	328,493	425,259	407,586	432,002
Interest Charges													
Total interest - Annex 12	18,745	20,093	66,384	98,573	118,980	147,268	184,605	209,539	248,002	288,037	313,743	309,317	302,431
Less interest charged to construction	-	6,380	49,542	59,740	34,201	69,130	92,820	112,355	137,103	169,351	108,523	111,081	79,911
Net interest charges	18,745	13,713	16,842	38,833	84,779	78,138	91,785	97,184	110,899	118,686	205,220	198,236	222,520
Exchange Adjustment	-	-	-	2,281	-	-	-	-	-	-	-	-	-
Net Income	22,230	45,376	72,731	114,446	139,803	106,602	122,860	152,784	138,250	209,807	220,039	209,350	209,482
Surplus - Balance Beginning of Year	1,553	6,579	11,146	22,979	48,151	80,962	59,367	51,582	62,745	31,295	68,205	82,504	45,744
Total Surplus	23,783	51,955	83,877	137,425	187,954	187,564	182,227	204,366	200,995	241,102	288,244	291,854	255,226
Less: Prior year's adjustments (807)		147	(225)	-	-	-	-	-	-	-	-	-	-
Legal reserve	1,111	2,342	3,742	5,722	6,990	5,330	6,143	7,639	6,912	10,490	11,002	10,467	10,476
Dividends	15,575	29,233	42,257	64,456	78,815	86,586	96,750	109,872	121,748	137,414	152,220	167,261	158,019
Bonuses	1,325	2,707	4,743	7,300	9,125	10,000	10,300	10,600	10,900	11,200	11,500	11,800	12,100
Reserve for future capital increase	-	6,380	10,381	3,817	11,502	25,256	16,675	12,366	28,908	13,075	29,997	55,800	38,199
Increase in capital	-	-	-	7,979	560	1,025	777	1,144	1,232	718	1,021	782	840
Surplus - Balance End of Year	6,579	11,146	22,979	48,151	80,962	59,367	51,582	62,745	31,295	68,205	82,504	45,744	35,592
Times total interest covered by operating income before income taxes	2.4	3.4	1.6	1.7	2.1	1.4	1.3	1.4	1.1	1.3	1.5	1.5	1.6
Rate of return based on remunerable investment	10.1%	9.2%	13.0%	9.0%	12.3%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%

1/ Estimates are based on a constant exchange rate of NCr\$3.83 to US\$1.

April 16, 1970

507, 215

BRAZIL
CENTRAL ELETRICA DE FURNAS S.A.
Actual and Estimated Balance Sheets
(thousand NCr\$)

	Actual				Estimated 1/									
December 31	1966 2/	1967 3/	1968 4/	1968 5/	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
ASSETS														
Fixed Assets														
Fixed assets in operation	423,969	689,600	873,568	1,115,163	1,995,566	2,235,693	2,274,698	2,885,557	3,485,075	3,520,075	4,845,436	5,774,825	5,851,211	6,690,151
Less reserve for depreciation	33,800	62,138	91,585	102,777	161,087	226,414	292,881	377,197	479,031	581,888	723,472	892,212	1,063,184	1,258,670
Net fixed assets in operation	390,169	627,462	781,983	1,012,386	1,834,479	2,009,279	1,981,817	2,508,360	3,006,044	2,938,187	4,121,964	4,882,613	4,788,027	5,431,481
Work in progress	115,451	109,209	566,593	676,320	164,978	393,090	991,619	1,014,240	1,026,710	1,750,770	1,053,831	672,897	1,223,806	860,427
Total fixed assets	505,620	736,671	1,348,576	1,688,706	1,999,457	2,402,369	2,973,436	3,522,600	4,032,754	4,688,957	5,175,795	5,555,510	6,011,833	6,291,908
Current Assets														
Cash	11,869	21,432	32,081	32,081	63,867	19,779	22,708	18,290	14,514	26,168	161,065	201,113	129,352	173,507
Materials and supplies	3,382	5,055	5,476	5,476	11,973	13,414	13,648	17,313	20,910	21,120	29,073	34,649	35,107	40,141
Accounts receivable	2,312	6,022	9,021	9,021	35,661	46,625	50,479	45,974	54,514	65,784	66,382	84,258	95,810	98,539
Other	391	2,100	2,375	2,375	2,375	2,375	2,375	2,375	2,375	2,375	2,375	2,375	2,375	2,375
Total current assets	17,954	34,609	48,953	48,953	113,876	82,193	89,210	83,952	92,313	115,447	258,895	322,395	262,644	314,562
Other Assets	1,326	5,037	3,532	3,532	3,532	3,532	3,532	3,532	3,532	3,532	3,532	3,532	3,532	3,532
Total assets	524,900	776,317	1,401,061	1,741,191	2,116,865	2,488,094	3,066,178	3,610,084	4,128,599	4,807,936	5,438,222	5,881,437	6,278,009	6,610,002
CAPITAL AND LIABILITIES														
Capital														
Share capital	155,000	300,000	456,000	576,577	625,000	688,000	756,000	849,000	967,000	1,063,000	1,209,000	1,329,000	1,460,000	1,662,000
Surplus	6,579	11,146	22,979	22,979	48,151	80,962	59,367	51,582	62,745	31,295	68,205	82,504	45,744	35,592
Reserves:														
Legal	1,630	3,972	7,714	7,714	13,436	20,426	25,756	31,899	39,538	46,450	56,940	67,942	78,409	88,885
Amortization	24,216	46,686	80,992	94,043	153,910	220,981	285,222	375,789	480,341	585,943	731,306	904,551	1,080,087	1,280,792
Future capital increase	-	7,713	15,823	17,913	4,454	13,466	38,722	37,544	17,054	45,962	18,884	48,385	104,185	73,484
Other reserves	167	196	381	381	164	164	164	164	164	164	164	164	164	164
Total capital	187,592	369,713	583,889	719,607	845,115	1,023,999	1,169,231	1,345,978	1,566,842	1,772,814	2,084,499	2,432,546	2,768,589	3,140,917
Long-Term Debt - Annex 2	305,048	541,375	750,290	953,307	1,182,731	1,359,984	1,793,281	2,149,182	2,431,002	2,900,871	3,192,095	3,276,826	3,329,487	3,289,595
Less debt due within one year	8,660	12,902	19,591	23,818	45,031	55,149	59,180	70,922	90,203	98,583	168,045	200,310	209,262	222,655
Net long-term debt	296,388	528,473	730,699	929,489	1,137,700	1,304,835	1,734,101	2,078,260	2,340,799	2,802,288	3,024,050	3,076,516	3,120,225	3,066,940
Current Liabilities														
Long-term debt due within one year	8,660	12,902	19,591	23,818	45,031	55,149	59,180	70,922	90,203	98,583	168,045	200,310	209,262	222,655
Accounts payable and accruals	7,565	20,438	17,402	18,145	18,871	19,626	20,411	21,227	22,076	22,959	23,877	24,832	25,825	26,858
Provision for taxes	7,795	12,851	18,278	18,278	26,898	35,010	28,945	33,627	41,379	38,082	55,661	57,823	56,718	59,007
Dividends payable	15,575	29,233	24,257	24,257	35,950	40,350	44,310	49,770	56,700	62,310	70,890	77,910	85,590	81,525
Bonus payable	1,325	2,707	4,743	4,743	7,300	9,125	10,000	10,300	10,600	10,900	11,200	11,500	11,800	12,100
Guarantee contract	-	-	2,202	2,854	-	-	-	-	-	-	-	-	-	-
Total current liabilities	40,920	78,131	86,473	92,095	134,050	159,260	162,846	185,846	220,958	232,834	329,673	372,375	389,195	402,445
Total liabilities	524,900	776,317	1,401,061	1,741,191	2,116,865	2,488,094	3,066,178	3,610,084	4,128,599	4,807,936	5,438,222	5,881,437	6,278,009	6,610,002
Assets test: Percentage of long-term debt including long-term debt due within one year to total fixed assets	60.3%	57.8%	55.6%	56.5%	59.2%	56.6%	60.3%	61.0%	60.3%	61.9%	61.7%	59.0%	55.4%	52.3%

1/ Estimate is based on coefficient applicable to December 31, 1968 accounts and a constant foreign exchange rate of NCr\$3.83 to US\$1.
2/ Based on coefficient applicable to December 31, 1965 accounts and a foreign exchange rate of NCr\$2.22 to US\$1.
3/ Based on coefficient applicable to December 31, 1966 accounts and a foreign exchange rate of NCr\$2.22 to US\$1.
4/ Based on coefficient applicable to December 31, 1967 accounts and a foreign exchange rate of NCr\$2.715 to US\$1.
5/ Based on coefficient applicable to December 31, 1968 accounts and a foreign exchange rate of NCr\$3.83 to US\$1.

BRAZIL
CENTRAL ELETRICA DE FURNAS S.A.
Schedule of Long-Term Debt
(thousand NC\$)

	Actual					Estimated 1/									
December 31	1966 2/	1967 3/	1968 4/	1968 1/	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	
Local Loans															
Eletrobras: Furnas Project (four loans)	96,130	98,845	116,305	145,381	139,617	133,496	126,900	119,826	112,192	103,992	95,133	85,601	75,294	64,307	
Funil Project	-	135,326	211,045	250,644	316,474	316,716	307,195	296,497	284,477	270,971	255,795	238,744	219,586	198,059	
Estreito Project (three loans)	39,120	54,371	77,418	92,630	151,943	148,583	143,084	136,543	129,478	121,824	113,509	104,450	94,556	83,724	
Estreito and Funil Projects (one common loan)	-	-	16,574	16,574	17,660	16,777	15,894	15,011	14,128	13,245	12,362	11,479	10,596	9,713	
Santa Cruz Project - Stage I	-	1,326	1,813	2,217	2,461	2,338	2,215	2,092	1,969	1,846	1,723	1,600	1,477	1,354	
Minor Projects (two loans)	-	15	13,530	16,204	15,629	13,948	12,267	10,586	8,905	7,224	5,543	3,862	2,181	496	
Marimbondo Project	-	-	-	170	4,749	29,968	128,717	315,837	356,896	504,467	570,048	532,046	494,044	456,042	
Atomic Project	-	-	-	-	2,350	10,126	19,855	37,816	85,911	181,143	263,810	279,859	260,559	241,259	
Gas Turbine Plant	-	-	-	-	3,800	14,670	13,040	11,410	9,780	8,150	6,520	4,890	3,260	1,630	
Santa Cruz Project - Stage II	-	-	-	-	-	-	31,950	36,480	34,048	31,616	29,184	26,752	24,320	21,888	
Porto Colombia	-	-	-	-	-	-	107,077	120,997	136,727	127,612	118,497	109,382	100,267	91,152	
Others 5/	-	36,119	-	-	-	-	-	-	-	-	-	-	-	-	
Total local loans	135,250	326,002	436,855	523,820	654,683	686,622	908,194	1,103,095	1,174,511	1,372,090	1,472,124	1,398,665	1,286,140	1,169,624	
Foreign Loans															
Furnas Project IBRD Loan No. 211-BR	147,803	142,486	167,377	234,642	225,843	214,970	203,461	191,285	178,393	164,751	150,316	135,038	118,868	101,756	
Estreito Project IBRD Loans No. 403/474-BR	5,510	21,911	57,454	81,049	173,897	225,755	307,115	347,801	335,948	323,386	310,096	296,040	281,160	265,438	
AID Santa Cruz Project - Stage I	-	24,975	36,933	51,576	52,299	48,691	45,083	41,475	37,667	34,259	30,651	27,043	23,435	19,827	
AID Santa Cruz Project - Stage II	-	-	877	1,237	5,316	86,669	152,706	179,884	181,994	169,861	157,727	145,594	133,460	121,327	
AID Furnas - Guanabara Transmission System	16,485	24,950	46,980	55,880	61,380	59,146	56,112	53,078	50,044	47,010	43,976	40,942	37,908	34,874	
Porto Colombia Project IBRD Loan No. 565-BR	-	-	-	-	1,149	17,089	49,058	72,885	85,409	85,409	83,035	80,507	77,806	74,934	
Suppliers Credit	-	1,051	3,814	5,103	4,388	2,348	303	-	1	-	-	-	-	-	
Proposed IBRD Loan - Marimbondo Project	-	-	-	-	-	18,123	55,140	101,943	191,914	267,560	283,244	289,215	306,400	305,634	
Joint Financing Loans - Marimbondo Project	-	-	-	-	-	-	-	-	19,916	49,790	78,170	93,854	86,635	77,175	
Future Foreign Loan - Additional Generating Capacity	-	-	-	-	-	-	-	-	-	-	47,875	119,688	215,438	335,126	
Future Foreign Loan - Atomic Project	-	-	-	-	-	-	15,921	57,430	174,394	376,323	494,303	518,876	490,837	462,798	
IGE Gas Turbine Plant	-	-	-	-	3,776	571	188	-	-	-	-	-	-	-	
Future Foreign Loan - Itumbiara Plant	-	-	-	-	-	-	-	-	-	7,660	26,810	53,620	91,920	114,900	
Future Foreign Loan - Itumbiara Transmission	-	-	-	-	-	-	-	-	-	58	3,820	39,291	114,932	134,932	
Future Foreign Loan - Other Transmission	-	-	-	-	-	-	-	-	306	612	2,714	9,948	38,453	65,085	
Total foreign loans	169,798	215,373	313,435	429,487	528,048	673,362	885,087	1,046,087	1,256,491	1,528,781	1,719,971	1,878,161	2,043,347	2,119,971	
Total loans	305,048	541,375	750,290	953,307	1,182,731	1,359,984	1,793,281	2,149,182	2,431,002	2,900,871	3,192,095	3,276,826	3,329,487	3,289,595	

1/ Based on coefficient applicable to December 31, 1968 accounts and a foreign exchange rate of NC\$3.83 to US\$1.

2/ Based on coefficient applicable to December 31, 1965 accounts and a foreign exchange rate of NC\$2.22 to US\$1.

3/ Based on coefficient applicable to December 31, 1966 accounts and a foreign exchange rate of NC\$2.22 to US\$1.

4/ Based on coefficient applicable to December 31, 1967 accounts and a foreign exchange rate of NC\$2.715 to US\$1.

5/ Converted into share capital in 1968.

April 16, 1970

BRAZIL
CENTRAL ELETRICA DE FUERNAS S.A.

ANNEX 10

Estimated Source and Application of Funds Statement 1/
(thousand NC.R)

Year ending December 31	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	Ten-Year Total 1969-1978
SOURCE OF FUNDS											
Internal Cash Generation											
Operating income	155,560	224,582	184,740	214,645	249,968	249,149	328,493	425,259	407,586	432,002	2,871,984
Depreciation	58,310	65,327	66,467	84,316	101,834	102,857	141,584	168,740	170,372	195,486	1,155,893
Amortization	59,867	67,071	68,241	86,567	104,552	105,602	145,363	173,245	175,536	200,705	1,186,749
Total internal cash generation	273,737	356,980	319,448	385,528	456,354	457,608	615,440	767,244	754,094	828,193	5,214,626
Borrowings											
Foreign Loans											
Estreito Project IBRD Loan No. 403/474-BR	92,851	51,857	89,997	51,927	-	-	-	-	-	-	286,632
AID Santa Cruz Project - Stage I	3,807	-	-	-	-	-	-	-	-	-	3,807
AID Santa Cruz Project - Stage II	4,079	81,353	66,037	27,178	8,177	-	-	-	-	-	186,824
AID Furnas - Guanabara Project	8,534	800	-	-	-	-	-	-	-	-	9,334
Porto Colombia Project IBRD Loan No. 565-BR	1,149	15,940	31,969	23,827	12,524	-	-	-	-	-	85,409
Suppliers' Credit	1,038	-	-	-	-	-	-	-	-	-	1,038
Proposed IBRD Loan - Marimbondo Project	-	18,123	37,017	46,803	89,971	75,646	15,684	5,971	17,185	-	306,400
Joint Financing Loans - Marimbondo Project	-	-	-	-	19,916	29,874	29,874	19,916	-	-	99,580
Future Loan Additional Generating Capacity	-	-	-	-	-	-	-	-	-	-	335,126
Future Foreign Loan - Atomic Energy	-	-	15,921	41,509	116,964	201,929	117,980	71,813	95,750	119,688	532,894
Gas Turbine Plant	5,186	-	-	-	-	-	-	38,591	-	-	5,186
Future Loan Itumbiara Plant	-	-	-	-	-	7,660	19,150	26,810	38,300	22,980	114,900
Future Loan Itumbiara Transmission	-	-	-	-	-	58	3,762	35,471	75,104	20,537	134,932
Future Loan Other Transmission	-	-	-	306	306	2,102	7,234	28,505	26,632	6,165	73,250
Total foreign borrowings	116,644	168,073	240,941	191,550	247,858	317,269	241,559	227,077	252,971	169,370	2,173,312
Local Loans											
Eletrobras - Pupil Project	65,830	8,716	-	-	-	-	-	-	-	-	74,546
Eletrobras - Estreito Project	59,313	-	-	-	-	-	-	-	-	-	59,313
Eletrobras - Estreito and Pupil Project	1,086	-	-	-	-	-	-	-	-	-	1,086
Eletrobras - Santa Cruz Project - Stage I	244	-	-	-	-	-	-	-	-	-	244
IBR-Eletrobras - Minor Projects	806	-	-	-	-	-	-	-	-	-	806
Eletrobras - Marimbondo Project	4,579	25,219	98,749	187,120	41,059	147,571	65,581	-	-	-	569,878
Eletrobras - Future Loan - Atomic Project	2,350	7,776	9,729	17,961	48,095	95,232	82,667	25,699	-	-	289,509
Eletrobras - Gas Turbine Plant	3,800	12,500	-	-	-	-	-	-	-	-	16,300
Eletrobras - Future Loan - Santa Cruz Project Stage II	-	-	31,950	4,530	-	-	-	-	-	-	36,480
Eletrobras - Future Loan - Porto Colombia Project	-	-	107,077	13,920	15,730	-	-	-	-	-	136,727
Total local borrowings	138,008	54,211	247,505	223,531	104,884	242,803	148,248	25,699	-	-	1,184,889
Total borrowings	254,652	222,284	488,446	415,081	352,742	560,072	389,807	252,776	252,971	169,370	3,358,201
Share Capital											
	22,951	59,950	66,975	74,370	84,000	94,768	105,129	118,483	130,218	132,260	889,104
Total Source of Funds	551,340	639,214	874,869	874,979	993,096	1,112,448	1,110,376	1,138,503	1,137,283	1,129,823	9,461,931
APPLICATION OF FUNDS											
Construction Expenditures (excluding interest during construction) - Annex 11											
Foreign expenditures	103,068	152,616	226,214	178,750	231,109	297,579	210,750	208,497	252,972	169,370	2,030,925
Local expenditures	206,253	281,422	342,190	361,910	268,524	324,378	248,321	231,435	263,242	226,280	2,753,955
Total expenditures	309,321	434,038	568,404	540,660	499,633	621,957	459,071	439,932	516,214	395,650	4,784,880
Debt Service											
Amortization - Annex 13	27,509	45,031	55,149	59,180	70,922	90,203	98,583	168,045	200,310	209,262	1,024,194
Interest - Annex 12	98,573	118,980	147,268	184,605	209,539	248,002	288,037	313,743	309,317	302,431	2,220,492
Total debt service	126,082	164,011	202,417	243,785	280,461	338,205	386,620	481,788	509,627	511,693	3,244,686
Increase or (Decrease) in Net Working Capital (excluding cash)											
Accounts receivable	26,640	10,964	3,854	(4,595)	8,540	11,270	598	17,876	11,552	2,729	89,518
Materials and supplies	6,497	1,441	234	3,665	3,597	210	7,953	5,576	458	5,034	34,665
Provisions for taxes	(8,620)	(8,112)	6,065	(4,682)	(7,752)	3,297	(17,579)	(2,162)	1,105	(2,289)	(40,729)
Guarantee contract	2,854	-	-	-	-	-	-	-	-	-	2,854
Accounts payable and accruals	(726)	(755)	(785)	(816)	(849)	(883)	(918)	(955)	(993)	(1,033)	(8,713)
Total increase (or decrease) in net working capital	26,644	3,538	9,368	(6,338)	3,536	13,894	(9,946)	20,335	12,122	4,441	77,592
Dividends Paid											
	52,763	74,415	82,626	91,290	102,942	116,138	128,834	145,200	159,581	162,084	1,115,873
Bonuses Paid											
	4,743	7,300	9,125	10,000	10,300	10,600	10,900	11,200	11,500	11,800	97,468
Total Application of Funds	519,554	683,302	874,240	879,397	896,872	1,100,794	975,479	1,098,455	1,209,044	1,085,668	9,320,505
Net Cash Accrual (or Deficit)	31,786	(44,088)	2,929	(4,418)	(3,776)	11,654	134,897	40,048	(71,761)	44,155	44,426
Cash Balance Beginning of Year	32,081	63,867	19,779	22,708	18,290	14,514	26,168	161,065	201,113	129,352	-
Cash Balance End of Year	63,867	19,779	22,708	18,290	14,514	26,168	161,065	201,113	129,352	173,507	-
Times annual debt service covered by internal cash generation	2.2	2.2	1.6	1.6	1.6	1.4	1.6	1.6	1.5	1.6	1.6

1/ Forecast based on a constant foreign exchange rate of NC.R\$3.83 to US\$1.

April 16, 1970

BRAZIL

CENTRAL ELÉTRICA DE FURNAS S. A.

Investment Expenditures Excluding Interest During Construction
(thousand R\$)

PROJECTS	1962	1970	1971	1972	1973	1974	1975	1976	1977	1978	Total 1962-1978
Furnas											
Foreign	-	-	-	-	-	-	-	-	-	-	-
Local	6,378	6,104	-	-	-	-	-	-	-	-	12,482
Total	6,378	6,104	-	-	-	-	-	-	-	-	12,482
Estreito											
Estreito (Original)											
Foreign	80,729	21,517	5,808	3,883	-	-	-	-	-	-	111,931
Local	69,844	17,241	1,323	2,612	151	-	-	-	-	-	120,001
Total	150,573	38,758	7,131	6,495	151	-	-	-	-	-	231,932
Estreito (5 and 6 Units)											
Foreign	38	7,020	12,382	2,163	-	-	-	-	-	-	21,903
Local	110	759	6,362	3,111	-	-	-	-	-	-	10,692
Total	148	7,779	18,744	5,274	-	-	-	-	-	-	32,595
Estreito (Additional Transmission)											
Foreign	115	11,708	65,504	45,582	-	-	-	-	-	-	123,009
Local	678	5,260	44,616	32,315	1,566	-	-	-	-	-	70,424
Total	793	16,968	110,120	77,897	1,566	-	-	-	-	-	193,433
Total Estreito											
Foreign	60,882	40,245	83,766	51,988	-	-	-	-	-	-	256,843
Local	66,612	23,260	18,320	35,936	2,017	-	-	-	-	-	120,127
Total	127,494	63,505	102,086	87,924	2,017	-	-	-	-	-	376,970
Furnas-Guanabara Transmission											
Foreign	7,177	800	-	-	-	-	-	-	-	-	7,977
Local	8,327	3,581	-	-	-	-	-	-	-	-	11,908
Total	15,504	4,381	-	-	-	-	-	-	-	-	19,886
Santa Cruz - Stage I											
Foreign	3,806	-	-	-	-	-	-	-	-	-	3,806
Local	2,285	506	-	-	-	-	-	-	-	-	2,791
Total	6,091	506	-	-	-	-	-	-	-	-	6,597
Santa Cruz - Stage II											
Foreign	3,830	77,806	58,120	17,301	-	-	-	-	-	-	156,559
Local	11,120	47,695	70,056	53,691	-	-	-	-	-	-	182,562
Total	14,950	125,501	128,176	70,992	-	-	-	-	-	-	339,121
Pauli											
Foreign	1,036	-	-	-	-	-	-	-	-	-	1,036
Local	35,844	19,819	706	-	-	-	-	-	-	-	56,369
Total	36,880	19,819	706	-	-	-	-	-	-	-	57,405
Porto Colombia											
Porto Colombia (Plant)											
Foreign	1,119	13,937	24,458	23,754	12,524	-	-	-	-	-	75,822
Local	16,518	75,180	97,081	53,423	24,383	-	-	-	-	-	266,525
Total	17,637	89,117	121,541	77,178	36,907	-	-	-	-	-	342,347
Porto Colombia (Transmission)											
Foreign	-	2,003	7,511	73	-	-	-	-	-	-	9,587
Local	207	606	3,452	3,799	1,223	-	-	-	-	-	8,291
Total	207	2,609	10,963	3,872	1,223	-	-	-	-	-	17,878
Total Porto Colombia											
Foreign	1,119	15,940	31,969	23,827	12,524	-	-	-	-	-	85,409
Local	16,755	76,086	100,543	57,221	25,606	-	-	-	-	-	275,216
Total	17,874	92,026	132,512	81,048	38,130	-	-	-	-	-	360,625
Marimbondo											
Marimbondo (Plant)											
Foreign	-	965	4,398	6,266	15,492	35,584	31,736	24,739	15,462	-	135,211
Local	4,840	21,442	63,250	123,258	117,728	81,232	43,123	20,083	5,259	-	481,216
Total	4,840	22,407	67,648	129,524	133,220	116,817	74,859	44,821	20,721	-	616,427
Marimbondo (Transmission)											
Foreign	-	15,871	23,284	32,750	82,644	69,936	13,822	1,149	1,724	-	247,180
Local	238	4,213	25,311	15,726	35,766	66,146	6,252	95	-	-	196,251
Total	238	20,084	48,595	48,476	118,410	136,082	20,074	1,244	1,724	-	443,431
Total Marimbondo											
Foreign	-	16,836	34,282	39,016	98,136	105,520	45,558	25,887	17,186	-	382,421
Local	5,078	25,655	89,264	138,986	153,494	147,385	50,075	20,132	5,969	-	680,167
Total	5,078	42,491	123,546	178,002	251,630	252,905	95,633	46,019	23,155	-	1,062,588
Furnas - 7 and 8 Units											
Foreign	-	1,287	2,731	7,786	11,720	-	-	-	-	-	23,524
Local	54	651	1,138	1,287	5,157	-	-	-	-	-	11,222
Total	54	1,938	3,869	9,073	16,877	-	-	-	-	-	34,746
Atomic Plant											
Foreign	-	-	15,324	36,746	108,393	182,239	87,171	20,011	-	-	451,924
Local	2,350	7,185	7,981	14,574	41,171	75,984	50,511	7,232	-	-	214,991
Total	2,350	7,185	23,305	51,320	149,564	258,223	137,682	27,243	-	-	666,915
Itumbiara											
Itumbiara (Plant)											
Foreign	-	-	-	-	7,660	19,150	26,810	35,300	22,060	-	111,900
Local	-	-	1,374	4,631	2,222	40,599	61,465	81,941	61,801	-	214,937
Total	-	-	1,374	4,631	9,882	59,749	88,275	117,241	83,861	-	326,837
Itumbiara (Transmission)											
Foreign	-	-	-	-	-	58	3,762	35,171	75,104	20,537	134,932
Local	-	-	-	-	-	14	2,527	11,570	31,461	33,472	85,195
Total	-	-	-	-	-	72	6,289	46,741	106,565	54,009	220,127
Total Itumbiara											
Foreign	-	-	-	-	7,718	19,208	30,572	70,471	97,164	20,567	154,937
Local	-	-	1,384	4,631	9,222	60,643	88,297	118,711	113,265	54,479	299,214
Total	-	-	1,384	4,631	16,940	120,851	118,869	189,182	210,429	75,046	454,151
Other Transmission											
Foreign	-	-	-	306	306	2,102	7,234	28,205	26,632	6,165	71,250
Local	-	-	-	237	237	1,366	5,677	10,720	15,797	10,300	45,534
Total	-	-	-	543	543	3,468	12,911	38,925	42,429	16,465	116,784
Other Construction											
Foreign	-	-	-	-	-	-	-	-	-	-	-
Local	33,147	40,273	29,000	29,000	29,000	35,000	26,000	25,000	27,000	21,000	283,420
Total	33,147	40,273	29,000	29,000	29,000	35,000	26,000	25,000	27,000	21,000	283,420
Gas Turbine Plant											
Foreign	5,184	-	-	-	-	-	-	-	-	-	5,184
Local	16,800	-	-	-	-	-	-	-	-	-	16,800
Total	21,984	-	-	-	-	-	-	-	-	-	21,984
Additional Generation Capacity											
Foreign	-	-	-	-	-	-	47,575	71,513	95,750	119,688	335,126
Local	-	-	-	-	-	-	73,613	95,792	119,688	135,125	394,228
Total	-	-	-	-	-	-	121,188	167,305	215,438	254,813	729,354
Total Construction Expenditures											
Foreign	103,068	152,616	226,214	178,750	231,109	297,579	210,750	208,497	252,972	169,370	2,030,925
Local	206,253	281,422	361,910	366,524	324,173	248,121	221,436	263,212	265,280	275,555	2,753,255
Total	309,321	434,038	588,124	545,274	555,282	545,700	432,186	473,709	518,252	444,925	4,784,180

1/ Forecast based on a constant foreign exchange rate of R\$ 3.85 to U.S. \$1.

December 3, 1969

BRAZIL

CENTRAL ELETRICA DE FURNAS S.A.

Interest Schedule
(thousand NCr\$)

	<u>Rate of Interest</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>1977</u>	<u>1978</u>
<u>Local Loans</u>											
Eletrobras: Furnas Project	Various 1/	11,659	12,013	11,466	10,869	10,237	9,550	8,814	8,020	7,164	6,229
Funil Project	13	34,858	40,339	39,301	38,075	36,698	35,150	33,410	31,457	29,263	26,795
Estreito Project	13	15,321	19,299	18,649	17,775	16,929	16,013	15,024	13,946	12,773	11,493
Estreito and Funil Projects (common loan)	8	1,086	1,395	1,324	1,248	1,183	1,112	1,042	971	901	830
Santa Cruz Project - Stage I	8	170	193	184	173	164	154	144	134	124	115
Minor Projects	Various 2/	1,817	1,708	1,512	1,316	1,118	922	726	529	333	137
Guarantee Charge - BNDE & Eletrobras	-	1,493	2,024	2,628	2,913	2,483	1,882	1,731	1,578	1,420	1,255
Marimondo Project	13	228	2,119	9,685	27,132	41,059	52,571	65,581	72,871	67,931	62,991
Future Loan - Atomic Project	13	-	591	1,748	3,387	6,921	15,248	28,156	38,480	35,755	33,247
Gas Turbine Project	13	-	1,659	1,853	1,642	1,431	1,219	1,007	795	582	371
Future - Porto Colombia	13	-	-	6,535	13,920	15,730	17,478	16,294	15,109	13,924	12,739
Future - Santa Cruz - Stage II	13	-	-	1,950	4,530	4,663	4,347	4,031	3,715	3,399	3,083
Total local interest		<u>66,632</u>	<u>81,340</u>	<u>96,835</u>	<u>122,980</u>	<u>138,616</u>	<u>155,646</u>	<u>175,960</u>	<u>187,605</u>	<u>173,569</u>	<u>159,285</u>
<u>Foreign Loans 3/</u>											
Furnas Project IBRD Loan No. 211-BR	5 3/4	13,431	12,832	12,197	11,526	10,816	10,064	9,269	8,427	7,535	6,592
Estreito Project IBRD Loans No. 403/474-BR	Various 4/	10,471	11,612	16,484	19,797	19,870	19,173	18,441	17,672	16,856	15,986
AID Santa Cruz Project - Stage I	5 3/4	2,944	2,956	2,748	2,540	2,333	2,126	1,918	1,710	1,503	1,296
AID Santa Cruz Project - Stage II	6	249	3,845	7,917	10,077	8,177	10,740	10,012	9,280	8,552	7,824
AID Furnas GB Transmission	5 1/2	3,267	3,356	3,211	3,044	2,877	2,710	2,543	2,376	2,210	2,042
Porto Colombia Project IBRD Loan No. 565-BR	6 1/2	674	1,164	2,539	4,148	5,189	5,480	5,515	5,358	5,190	5,010
Suppliers Credit	7	779	267	126	15	-	-	-	-	-	-
Proposed IBRD Loan - Marimondo Project	7	-	1,432	4,588	7,207	11,481	16,656	19,510	20,187	20,911	21,435
Joint Financing Loans - Marimondo Project	7	-	-	-	-	1,046	2,963	4,984	6,308	6,204	5,576
Future Foreign Loan Additional Generating Capacity	7	-	-	-	-	-	-	5,076	8,816	14,053	20,785
Future Foreign Loan - Atomic Project	Various 5/	-	-	597	2,723	8,571	19,690	30,809	38,223	37,737	35,673
IGE - Gas Turbine Project	6	126	176	26	4	-	-	-	-	-	-
Future Foreign Loan Itumbiara Plant	7	-	-	-	-	-	1,103	1,938	3,374	5,412	7,327
Future Foreign Loan Itumbiara Transmission	7	-	-	-	-	-	1,014	1,133	2,360	5,815	8,804
Future Foreign Loan - Other Transmission	7	-	-	-	544	563	637	929	2,047	3,770	4,796
Total foreign interest		<u>31,941</u>	<u>37,640</u>	<u>50,433</u>	<u>61,625</u>	<u>70,923</u>	<u>92,356</u>	<u>112,077</u>	<u>126,138</u>	<u>135,748</u>	<u>143,146</u>
Total interest		<u>98,573</u>	<u>118,980</u>	<u>147,268</u>	<u>184,605</u>	<u>209,539</u>	<u>248,002</u>	<u>288,037</u>	<u>313,743</u>	<u>309,317</u>	<u>302,431</u>

1/ Interest rate on two loans is 8% and on remaining two loans it is 10%.

2/ Interest rate on one loan is 7% and on other loans it is 12%.

3/ Foreign interest is based on a rate of exchange of NCr\$3.83 to US\$1.

4/ Interest rates: first tranche 5%, second tranche 6%, and third tranche 8%.

5/ 6.5% and 8%.

April 16, 1970

BRAZIL

CENTRAL ELETRICA DE FURNAS S.A.

Amortization Schedule
(thousand NCr\$)

	<u>Amortization</u> <u>Period</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>1977</u>	<u>1978</u>
<u>Local Loans</u>											
Eletrobras: FURNAS Project	Various 1/	5,764	6,121	6,596	7,074	7,634	8,200	8,859	9,532	10,307	10,987
Funil Project	15	-	8,474	9,521	10,698	12,020	13,506	15,176	17,051	19,158	21,527
Estreito Project	15	-	3,360	5,499	6,541	7,065	7,654	8,315	9,059	9,894	10,832
Estreito and Funil Projects (one common loan)	20	-	883	883	883	883	883	883	883	883	883
Santa Cruz Project - Stage I	20	-	123	123	123	123	123	123	123	123	123
Minor Projects	Various 2/	1,381	1,681	1,681	1,681	1,681	1,681	1,681	1,681	1,681	1,685
Marimbondo Project	15	-	-	-	-	-	-	38,002	38,002	38,002	38,002
Future Loan Atomic Project	15	-	-	-	-	-	-	9,650	19,300	19,300	19,300
Gas Turbine Project	10	-	1,630	1,630	1,630	1,630	1,630	1,630	1,630	1,630	1,630
Future - Santa Cruz - Stage II	15	-	-	-	-	2,432	2,432	2,432	2,432	2,432	2,432
Future - Porto Colombia	15	-	-	-	-	-	9,115	9,115	9,115	9,115	9,115
Total local amortization		<u>7,145</u>	<u>22,272</u>	<u>25,933</u>	<u>28,630</u>	<u>33,468</u>	<u>45,224</u>	<u>48,214</u>	<u>99,158</u>	<u>112,525</u>	<u>116,516</u>
<u>Foreign Loans 3/</u>											
FURNAS Project IBRD Loan No. 211-BR	20	10,272	10,873	11,509	12,176	12,892	13,642	14,435	15,278	16,170	17,112
Estreito Project IBRD Loans No. 403/474-BR	20	-	-	8,636	11,241	11,853	12,562	13,290	14,056	14,880	15,722
AID Santa Cruz Project - Stage I	17	3,608	3,608	3,608	3,608	3,608	3,608	3,608	3,608	3,608	3,608
AID Santa Cruz Project	15	-	-	-	-	6,067	12,133	12,134	12,133	12,134	12,133
AID FURNAS GB Transmission	22	3,034	3,034	3,034	3,034	3,034	3,034	3,034	3,034	3,034	3,034
Porto Colombia Project IBRD Loan No. 565-BR	19	-	-	-	-	-	-	2,374	2,528	2,701	2,872
Suppliers Credit	3-5 1/4	2,040	2,039	2,046	303	-	-	-	-	-	-
Proposed IBRD Loan - Marimbondo Project	17 1/2	-	-	-	-	-	-	-	-	-	766
Joint Financing Loans - Marimbondo Project	10	-	-	-	-	-	-	1,494	4,232	7,219	9,460
Future Foreign Loan - Atomic Project	19	-	-	-	-	-	-	-	14,018	28,039	28,039
IGE - Gas Turbine Project	7	<u>1,410</u>	<u>3,205</u>	<u>383</u>	<u>188</u>	-	-	-	-	-	-
Total foreign amortization		<u>20,364</u>	<u>22,759</u>	<u>29,216</u>	<u>30,550</u>	<u>37,454</u>	<u>44,979</u>	<u>50,369</u>	<u>68,887</u>	<u>87,785</u>	<u>92,746</u>
Total amortization		<u>27,509</u>	<u>45,031</u>	<u>55,149</u>	<u>59,180</u>	<u>70,922</u>	<u>90,203</u>	<u>98,583</u>	<u>168,045</u>	<u>200,310</u>	<u>209,262</u>

1/ Two loans amortized in 20 years and two loans amortized in 15 years.

2/ One Inter-American Development Bank loan to Eletrobras relent to FURNAS amortized in 11 years and one Eletrobras loan amortized in 10 years.

3/ Amortization of foreign loans is based on a rate of exchange of NCr\$3.83 to US\$1.

April 16, 1970

II

1174

CIRCULATING COPY

RESTRICTED

Report No. TO-539c

TO BE RETURNED TO REPORTS DESK
IN CENTRAL FILES

This report was prepared for use within the Bank and its affiliated organizations. They do not accept responsibility for its accuracy or completeness. The report may not be published nor may it be quoted as representing their views.

DECLASSIFIED

MAR 07 2023

WBG ARCHIVES

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT
INTERNATIONAL DEVELOPMENT ASSOCIATION

CENTRAL ELETRICA DE FURNAS S.A.
ESTREITO TRANSMISSION PROJECT
BRAZIL

December 1, 1966

Projects Department

CURRENCY EQUIVALENTS

U.S. \$1	=	Cr \$2,220
Cr \$1	=	0.45 mills
Cr \$ billion	=	U.S. \$450,450

WEIGHTS AND MEASURES EQUIVALENTS

One meter (m)	=	3.28 feet
One square meter (m ²)	=	1.196 square yards
One cubic meter (m ³)	=	35.314 cubic feet
One mile	=	1.609 kilometers
One metric ton	=	2,204.6 pounds

TABLE OF CONTENTS

	<u>Page No.</u>
SUMMARY	
I. INTRODUCTION	1
II. PLAN FOR THE TRANSMISSION SYSTEM	2
III. THE PROJECT	3
IV. FINANCIAL ASPECTS	6
Tariffs	6
Financial Position	10
Past Earning Record	14
Proposed Financing Plan	15
Estimated Future Earnings	17
Future Financial Position	18
V. CONCLUSIONS	18

ANNEXES

1. Balance Sheet as of December 31, 1964-1971
2. Income Statement 1964-1971
3. Sources and Applications of Funds 1966-1971

MAP

This report was prepared from information gained during a mission consisting of Messrs. R.L. Bloor and John Bruen which visited Brazil in September-October 1965, on information obtained by Mr. Bruen on a return visit in December 1965, and on data subsequently submitted by Furnas.

BRAZIL

ESTREITO TRANSMISSION PROJECT

SUMMARY

i. Central Eletrica de Furnas S.A. (Furnas) has applied for a loan of US\$39 million equivalent to help finance Stage II of the 533 MW Estreito hydroelectric and transmission project. The estimated cost of the total project, including interest during construction, is US\$140 million equivalent. Assistance in financing Stage I of the project and interest during construction was provided by a Bank Loan, No. 403-BR, of US\$57 million in February 1965.

ii. The Estreito hydroelectric plant is now under construction on the Rio Grande about 500 km from Rio de Janeiro and 400 km from Sao Paulo and Stage II of the project would provide the 345-kv transmission facilities from Estreito to the cities of Rio de Janeiro and Sao Paulo.

iii. This report is a supplement to the previous appraisal report No. TO 459a, and contains the final plan for the transmission facilities, revised cost estimates, the standard to be used by the Bank to analyse any change in the tariff regulations which would adversely affect the rate of return, and the latest information on the financial aspects of the Borrower.

iv. The project would be suitable for a Bank loan of US\$39 million equivalent for a term of 25 years, including a 5-year grace period.

BRAZIL

THE ESTREITO TRANSMISSION PROJECT

I. INTRODUCTION

1. Central Eletrica de Furnas S.A. (Furnas), a corporation owned principally by the Federal Government, has applied to the Bank for a loan of US\$39 million equivalent to help finance the Estreito transmission project, including US\$6 million for interest during construction, the total cost of which is estimated at US\$55.5 million. The project would provide transmission facilities at 345-kv to serve the cities of Rio de Janeiro and Sao Paulo from the 533 MW Estreito hydroelectric plant now under construction on the Rio Grande about 500 km from Rio de Janeiro and 400 km from Sao Paulo.
2. The loan would be supplementary to Bank loan 403-BR of US\$57 million made to Furnas in February 1965 to help finance the construction of the Estreito hydroelectric plant and the minimum transmission facilities needed to connect the plant to the existing transmission grid. At that time, no decision had been reached on the voltage level of the long lines needed to supplement the existing transmission grid so as to carry the full output of the Estreito plant. Furthermore, it was not necessary to start the construction of the transmission facilities at the same time construction of the hydroelectric plant was started.
3. This report will therefore be a supplement to the previous report No. TO 459a. It will primarily consider the required additional transmission facilities but will treat the hydroelectric project financed by loan 403-BR and the new transmission facilities as a single project.
4. The report will also present information on a revised basis for power rate determination, and the latest information on the financial aspects of Furnas. Information on the Borrower, the power market and procurement procedures is as set out in the appraisal report No. TO 459a of February 12, 1965. During the past year work on the civil works contract for the dam, which is not financed by the Bank, has proceeded on schedule. Other activities consisted principally of advertising internationally for major items of materials and equipment. Disbursements on loan 403-BR were US\$1,984,000 as of October 31, 1966.
5. This report was prepared from information gained during a mission consisting of Messrs. R.L. Bloor and John Bruen which visited Brazil in September-October 1965, on information obtained by Mr. Bruen on a return visit in December 1965, and on data subsequently submitted by Furnas.

II. PLAN FOR THE TRANSMISSION SYSTEM

6. Canambra, a consortium of American and Canadian engineering firms, has been planning a power expansion program for the south central region of Brazil for the past several years under the auspices of the United Nations Development Programme. It has found that a group of hydroelectric plants, of which the Estreito plant is one, can be built on the upper Rio Grande with especially favorable characteristics as regards location with respect to markets and construction costs. Canambra has also planned a transmission system from these plants to the principal market centers consisting of the cities of Rio de Janeiro, Sao Paulo, and Belo Horizonte.

7. At the time the Canambra studies started, Furnas was already committed to 345-kv lines from the Furnas plant to Sao Paulo and Rio de Janeiro on the basis of prior studies by a firm of consulting engineers. One line to Sao Paulo has been operating for about two years, another has recently been completed, and a line to Rio is under construction. Canambra considered whether the additional lines needed for the upper Rio Grande group of plants should be designed to operate at a higher voltage level, but concluded that the continuation of the 345-kv level would be the most economical solution.

8. Effective and planned generating capacity included in the upper Rio Grande group of hydroelectric power stations is shown in the following table:

<u>Name</u>	<u>Capacity MW</u>		<u>Status</u>
	<u>Existing</u>	<u>Ultimate</u>	
Furnas	900	1200	Operating
Peixoto	230	480	Operating
Estreito	533	900	Under Construction
Jaguara	400	640	Under Construction
Igarapava	165	165) Needed between 1971 and 1975
Volta Grande	270	270	
Porto Colombia	240	240	
	<u>2738</u>	<u>3895</u>	

9. Transmission facilities are in operation at 345-kv, between Furnas plant and Sao Paulo and Furnas plant and Belo Horizonte, and 345-kv facilities are planned to be in operation as follows:

- 1966 Second line from Furnas to Sao Paulo
- 1967 Line from Furnas to Rio
- 1970 Line from Jaguara to Belo Horizonte
 - *Line from Estreito to Rio
 - *Line from Estreito to Sao Paulo
- 1971 Second line from Furnas to Rio and interconnection to Belo Horizonte
- 1972 Line from Volta Grande to the Sao Paulo system

* Included in the proposed Estreito project.

In addition to the lines shown above, all of the generating plants in the group will be interconnected by relatively short transmission lines to be built as each plant is added to the group. When the system is completed, there will be 3,900 MW of generating capacity and a transmission system with three lines to each of the cities: Sao Paulo, Rio de Janeiro, and Belo Horizonte, together with substations in these cities and at intermediate points along the system. Exclusive of the two generating plants now in operation, and the transmission facilities complete or under construction, the cost of the system is estimated at US\$315 million for generation and US\$135 million for transmission. The design of the system has been based on extensive engineering and economic investigations by Canambra to program construction of facilities so as to most economically meet the estimated demand for energy.

III. THE PROJECT

10. The Estreito hydroelectric and transmission line project will consist of a rockfill dam and a 533 MW powerhouse (firm annual capability in driest period of record 2.8 billion kwh) now under construction on the Rio Grande and transmission facilities as follows (see map):

- a. A 345-kv line 140 km long from Estreito to the Furnas 900 MW hydroelectric plant on the Rio Grande owned by Furnas.
- b. A 345-kv line 35 km long from Estreito to the Peixoto 230 MW hydroelectric plant on the Rio Grande, owned by the Federal Government.
- c. A 345-kv line about 500 km long from Furnas to Rio de Janeiro.

E-403-BR

- d. A 345-kv line about 400 km long from Estreito to Sao Paulo.
- e. 138-kv tie lines in Rio de Janeiro.
- f. Three new substations and the expansion of ten existing substations with related communication equipment.

11. The estimated cost of the project including interest during construction on the existing Bank loan, is US\$140 million equivalent. The portion proposed for Bank financing covers all materials and equipment which will be purchased under international competitive bidding. Brazilian firms will compete for some of this and it is estimated that they may be successful in securing contracts covering about one-third of the total amount. The amount of the proposed loan of US\$39 million is about equal to the estimated international procurement component of the additional transmission facilities without interest during construction (see Stage II below). The Borrower requested a loan of US\$39 million which was intended to include interest during construction. However, the Borrower also proposed a reduction in the estimate for Stage I of the project by an amount about equal to this interest. Such a reduction in the estimate at the present time is considered premature, hence the amount available for interest during construction on both loans would be US\$9 million, as provided for under loan 403-BR.

	Bank Financing US\$	Local Financing US\$ Equivalent Millions	Total US\$
<u>Stage I Financed by Loan 403-BR</u>			
Estreito Power Plant	32.1 + 3.3	29.7 + 2.5	61.8 + 6.9 = 68.7
345-kv connections, Estreito to Furnas & Estreito to Peixoto	10.4 + 1.1	1.1 + 0.36 + 1.1	11.5 + 1.3 = 12.8
Services and Equipment for Techn- ical & Managerial Improvement	1.0 + 1.1	0.1	1.1
Contingencies	4.5	2.6	7.1
Sub-Total Stage I	48.0	33.5	81.5
<u>Stage II to be Financed by Proposed Loan</u>			
345-kv transmission line Furnas to Rio	9.0 + 1.9	2.4 + 2.7	11.4
345-kv transmission line Estreito to Sao Paulo	7.6 + 1.7	2.1 + 2.4	9.7
138-kv tie lines in Rio	0.5 + 1.1	0.2 + 0.4	0.7
Substations	18.2 + 4.0	4.5 + 5.5	22.7
Contingencies	3.7 + 7.7	1.3	5.0
Sub-Total Stage II	39.0	10.5	49.5
Sub-Total Stages I and II	87.0	44.0	131.0
Interest on IBRD loans during Construction	9.0	--	9.0
TOTAL COST	96.0	44.0	140.0

The cost estimate for the new Stage II is based on recent cost experience on very similar work, contains reasonable allowances for contingencies, and should be adequate.

12. The total proposed lending of US\$96 million equals 51.5 percent of Furnas' expansion program which is shown under "Application of Funds" in the tabulation of paragraph 39 below.

$$\begin{aligned}
 & 49.5 < \begin{aligned} & Fx : 49.5 \times .659 = 32.6 - 3.3 = 29.3 + 12.6 = 41.9 \\ & L.C = 49.5 \times .341 = 16.9 - 1.7 = 15.2 + 6.8 = 22.9 \end{aligned} \\
 & \frac{5.4 + .4}{5.8 + 11.2} = .341 \qquad \frac{69.5}{66.5} \qquad \frac{63.9}{63.9}
 \end{aligned}$$

IV. FINANCIAL ASPECTS

Tariffs

13. The regulations governing power operations and tariffs are contained in the Water Code of 1934 and subsequent amendments and decrees, including in particular a decree dated February 26, 1957, and three decrees dated November 4, 1964. Prior to 1964, tariffs were based on the use of historic values of investment and became increasingly unrealistic as inflation developed, causing many utilities to incur operating losses for several consecutive years. The 1964 decrees reflected a major change in Government policies by allowing utilities to revalue their investment, and thus making it possible for utilities to apply for tariffs which would yield adequate returns.

14. Under the existing regulations, tariffs are reviewed and approved by the Waters Division every three years or at shorter intervals, at the initiative of the Waters Division or the utility. Utilities are permitted to apply for tariffs which would yield revenues covering (a) operating costs; (b) straight-line depreciation of gross fixed assets in operation, excluding land and land rights, at annual rates of up to 8 percent for thermal plants and up to 5 percent for all other facilities including hydro plants, but with no minima in either case; (c) a reversion provision of up to 3 percent, or an amortization provision of up to 5 percent, on the total gross fixed assets in operation, also without minima; and (d) a return of 10 percent on the remunerable investment. Remunerable investment is defined as gross plant in service (excluding assets acquired through contributions in aid of construction) less depreciation and reversion or amortization reserves, plus reversion or amortization funds and an allowance for working capital consisting of operating inventories, the equivalent of two months billing, and cash (up to the value of the reserve for depreciation balance) excluding cash representing contributions in aid of construction. Shortfalls in achieving the return of 10 percent in the three-year tariff period may be recovered, in principle, in the subsequent three-year period. Another provision in the regulations, however, permits tariff adjustments for recovering shortfalls to be made at more frequent intervals.

15. Between tariff revisions, the following surcharges may be added by utilities on their current tariffs without permission of the Waters Division: (a) monthly, for compulsory increases in wages, social benefits, cost of fuel and purchased power; and (b) semi-annually, for increases in foreign debt service due to changes in the foreign exchange rate.

16. Tariff adjustments for the revaluation of the balance sheet accounts can be made as often as economic correction factors (coefficients), showing the variations in the purchasing power of the currency, are published by the National Economic Council. The coefficients are issued annually about two months after the end of each year for the use of industry in general. They are applied by utilities to up-date the values of plant in service, depreciation and amortization or reversion reserves, and certain local currency loans for the National Development Bank and/or Eletrobras. Foreign currency components of the book value of fixed assets are converted into local currency

at the rate of exchange in effect at the time the assets are acquired. Foreign debts are revalued on the basis of the current rate of exchange. The amount by which the revaluation of fixed assets exceeds the revaluation of reserves and loans is set aside as a revaluation reserve which is subject to a 5 percent tax.

17. In addition to the tariffs, two surcharges are being levied on the consumer's electric bill by the Federal Government to help finance power expansion in the country. In the case of the distribution companies reviewed in connection with appraisals for Bank loans, the combination of these surcharges have amounted to between 40 percent and 50 percent of the average tariff in 1965. The proceeds of one of these surcharges, the "sole" tax which was created in 1954, are allocated among the Federal, State and Municipal authorities. This tax, the rate of which varies according to classes of consumers, is presently based on an average price per kwh computed periodically by the National Council of Water and Electric Energy. Another surcharge, similarly computed and assessed, is the "compulsory loan", introduced in November 1962 and which is to terminate in 1968. The proceeds go to Eletrobras which in turn invests such funds in various power projects in the form of loans or share capital. Eletrobras issues to the consumers, for the amount of the "compulsory loans" paid, debt certificates carrying an interest rate of 12 percent and redeemable in 10 years. A third surcharge which is the social security tax, is 8 percent of the tariff.

18. The implementation of the revaluation provision was not entirely satisfactory during the initial year, 1965, due not only to the understandable complexities involved with the transition, but also to the permissive character of several important provisions of the new regulations. Revaluation was not then compulsory, the legislation provided for maximum rates of depreciation and amortization but no minimum rates were prescribed and recovery of shortfalls in earnings at intervals and for periods shorter than three years was only optional. In addition, there was uncertainty among utilities in regard to interpretation of certain provisions of the regulations and long delays were experienced in a number of instances before tariffs were actually adjusted to reflect revaluation of assets.

19. The Bank was particularly concerned with two possible consequences of the permissive character of the regulations. Different tariff policies could be followed which in the case of interconnected utilities, might well lead to conflicting principles being used in calculating the apparent cost of important blocks of power and could result that important economic decisions might be based on erroneous assumptions. While efforts were being made by Government to implement sound and, in certain instances, relatively high tariffs, there existed the possibility that, in compliance with the same regulations, utilities might be allowed to revert in the future to inadequate tariff levels.

20. These questions were brought to the attention of the Government early in 1966. It was suggested that regulations should be tightened to ensure that a minimum and uniform level of tariff performance be required from all utilities in the future. The Government indicated that it was

See
Caring's
pl. of
tariffs.
p. 9.

aware of this problem and was planning to continue improving the implementation of the regulations. It was not prepared at the time to propose corrective legislation to Congress. Pending such legislation, however, it was suggested that the Bank should define in a more detailed and specific rate covenant than those in the agreements for earlier power loans, the minimum level of financial performance it expected utilities to achieve, and that the Government would support the extension of this type of a rate covenant to as many other utilities as possible, mainly through Eletrobras.

21. During the negotiations of Furnas' existing tariff covenant, however, the representatives of the Brazilian Government objected that the detailed covenant proposed might conflict with Brazilian law. Pending clarification of this point, negotiations were suspended. Conversations continued and the Government informed the Bank recently that legislation had been enacted by Congress which will: (1) make the revaluation of utilities' assets compulsory, a measure which alleviates much of the Bank's concern, (2) reduce by one half the level of electrification taxes and (3) extend the surcharge on compulsory loans to 1973, provide for their annual revaluation, interest at 6 percent and a 20-year term. !!!?

22. Negotiations between the Government and the Bank over the question of tariffs finally resulted in the following:

- (1) The Government and Furnas agreed to a covenant under which (a) as provided by the Brazilian legislation, tariffs will be set so as to produce revenues at a level consistent with sound financial and public utility practices, using straight-line depreciation which shall be not less than that based on the useful lives of depreciable assets in operation, and (b) as permitted by the Brazilian legislation, assets will be revalued and tariffs will be correspondingly adjusted at least once every calendar year.
- (2) A change in legislation which shall adversely affect the setting of tariffs at the level stated above, shall be an event of default.
- (3) In a letter to Furnas the Bank will define the standard it would use to analyse a change in legislation for the purpose of (2) above. This standard shall be whether revenues from the sale of electricity are sufficient to: (a) cover all of the Borrower's operating expenses, including straight-line depreciation of gross revalued fixed assets in operation, at rates based on the useful lives of assets and (b) produce a reasonable annual rate of return on the revalued average net fixed assets in operation (which under presently foreseeable conditions would be of the order of 10%).

23. Furnas is probably the only utility in Brazil which took immediate advantage of the new regulations. The first revaluation, based on 1963 coefficients, was completed shortly after the regulations were made effective at the end of 1964, and new tariffs were placed in effect in February 1965. Soon after the issuance of the 1964 coefficient it completed its second |||

revaluation and obtained the corresponding additional tariff increase in July 1965. In determining the level of its tariffs, Furnas was allowed to provide for depreciation at the maximum permitted rate of 5 percent and for amortization at 3 percent. It was also allowed to provide for income taxes unlike most utilities, which will compute the permitted return before taxes. As a result, the tariffs introduced in July 1965 were about four times the 1964 tariff. In addition, adjustments for compulsory wage increases and for increases in foreign debt service were promptly put into effect as and when necessary.

24. Revenues for 1965 have only reached about the minimum level required under the existing tariff covenant but they have fallen short of the higher objectives contemplated by Furnas in setting tariffs for 1965. Several reasons account for these results. Despite Furnas' prompt action, the inadequate 1964 tariffs continued to apply for several weeks at the beginning of 1965 and the fully adjusted 1965 tariff applied for only half of the year. Due to inflation during the year the actual year end value of assets was greater than the estimated value which had been used for computing tariffs in mid 1965. On the other hand and although Furnas had both capacity and energy available due to a good water year, it was not able to market all of its power. The load requirements of Sao Paulo Light, its only customer, fell off due to Government restrictions to curb inflation and to certain features of the tariff structure of Furnas. In July 1965 the demand charge, which accounts for about 90 percent of Furnas revenues, was Cr\$9,254 per kw per month equivalent to US\$60.00 a year, and has been computed to recover the investment cost in the 900,000 kw installed capacity of the Furnas plant on sales based on an estimated demand of only 560,000 kw. (Furnas' energy charge is very nominal, about one U. S. mill).

25. Another feature of the tariff is a ratcheted demand provision which means that a highest recorded demand in a given month establishes the minimum charge for the next eleven months. This tariff structure does not encourage the use of full capacity available. If Furnas' demand charge had been calculated on the basis of the larger amount of capacity available with provisions for purchasing secondary and peaking power, the utilities connected to the Furnas grid might have been induced to purchase power from Furnas instead of operating some of their high cost generating plants. If Furnas had marketed all of its available power its demand charges could have been considerably lower and its total revenues greater. During negotiations these matters were discussed and Furnas has indicated that it is aware of the problem and will take these matters into consideration as its system becomes more integrated.

26. Centrais Eletricas de Minas Gerais (Cemig) which has rights to 50 percent of the output of the Furnas plant did not begin purchasing power in 1965 as contemplated although facilities and power were available. The reason for not purchasing power from Furnas is due to the considerably higher level of Furnas' tariff in comparison with alternative sources. Cemig doubled its own tariffs and surcharges early in 1965 based on assets revalued only with the 1963 coefficient. It did not revalue again when the 1964 coefficient was issued because this would have about doubled the

value of the fixed assets and would require further increases in tariffs and surcharges which Cemig feared would impede its load growth. Furnas on the other hand took full advantage of the regulations with the result that Furnas' wholesale tariffs were greater than Cemig's retail tariffs. Cemig has already agreed in connection with its loan 442 BR to a covenant to fully revalue its assets and lower its depreciation charge to 3 percent and eliminate its amortization charge. Furnas has indicated that starting in 1968, when Cemig will begin purchasing large amounts of power in order to meet its future load growth, it will be able to lower its tariffs as a result of lowering its depreciation rate of 5 percent to a normal rate based on the useful lives of its gross depreciable fixed assets in operation estimated to be 2-1/2 percent and also eliminate its 3 percent amortization. This is based on the assumption that Cemig's purchases of power will result in full utilization of Furnas' generation plant thereby making it possible to lower Furnas' tariff without jeopardizing Furnas' required rate of return (see paragraph 43). As a condition of effectiveness of the Cemig loan and the proposed loan, Furnas and Cemig have recently signed a sales contract for the sale of Furnas power to Cemig beginning in September 1966. Furnas has also agreed in a side letter to include shortly a sales contract with Sao Paulo Light Company and in the future to negotiate contracts with other customers which it may serve. Such contracts are to be submitted to the Bank for review and comment.

27. In compliance with the existing loan agreement, Furnas has again revalued its assets on the basis of the 1965 coefficient and has applied for tariff increases which were approved beginning in June 1966 which again include provisions for depreciation charges at 5 percent and amortization charges at 3 percent. The forecasts in this report assume that in 1967 Furnas would use the same basis as in 1966 but from 1968 onward it would seek to achieve a 10 percent return on its renumerable investment after reduced charges for depreciation and elimination of amortization.

Financial Position

28. Furnas' financial statements have been audited by Arthur Andersen and Company since 1958 and these arrangements have been satisfactory. Furnas has already agreed in connection with loan 403 BR, to continue employing outside auditors acceptable to the Bank. In compliance with a provision in the agreements covering Loan 403 BR, Furnas has entered into a contract, also with Arthur Andersen and Company, to reorganize the accounting department and train the accounting personnel.

29. As far as foreign exchange expenditures and sources of funds are concerned, the financial projections have been cast in terms of the official exchange rate as of December 31, 1965, of Cr\$2,220 to US\$1. As far as local currency is concerned normal increases in operating costs due to expanded operations have been considered but no provision has been made for the loss of the value of the Cruzeiro after 1965 as most of the effects will have been provided for under existing tariff regulations and adjustments for inflation mentioned in paragraph 15.

30. The estimated financial position of Furnas as of December 31, 1965 is presented in the following statement and in Annex 1. The final figures which have recently been received show no significant departure from the estimates except for a transfer of assets from work in progress to plant in service, the effect on the attached forecasts would possibly be a larger increase in the tariff level assumed for 1966. It was, therefore, not deemed necessary to prepare a new set of forecasts. Two balance sheets have been prepared to indicate the effect of the revaluation which will be recorded in 1966. The first reflects the value of the assets, capital and liabilities based on the revaluation made in February 1965 using the 1964 coefficient. The second shows the result of revaluation based on the 1965 coefficient of 1.27 issued in February 1966.

CENTRAL ELETRICA DE FURNAS S.A.

Balance Sheet as of December 31, 1965
(Billions of Cruzeiros)

	At End of 1964 Currency Valuation	Increase as a Result of 1965 Revaluation	At End of 1965 Currency Valuation
<u>ASSETS</u>			
Gross Plant in Service	312.29	69.30	381.59
Less: Depreciation Reserve	15.46	.97	16.43
Net Plant in Service	296.83	68.33	365.16
Work in Progress	64.43	9.27	73.70
Total Fixed Assets	361.26	77.60	438.86
Current Assets	59.98 ^{1/}	-	59.98
Total	421.24	77.60	498.84
<u>LIABILITIES</u>			
Capital Stock	120.00	16.02 ^{2/}	136.02
Amortization Reserve	10.87	.68	11.55
Legal and Other Reserves	.60	-	.60
Unappropriated Surplus	4.60	-	4.60
Total Equity	136.07	16.70	152.77
IBRD Loan 211-BR 5.75% 1958-83	127.49	25.50	152.99
IBRD Loan 403-BR 5.5% 1965-90	.48	.10	.58
AID Loan #512 5.5% 1964-87	10.25	2.05	12.30
BNDE Loans (3) 9.75% 1959-80	54.50	12.92	67.42
Eletrobras Loans (2) 8% 1958-81	86.70	20.33	107.03
Total Long Term Debt	279.42	60.90	340.32
Current Liabilities	5.75	-	5.75
Total	421.24	77.60	498.84

^{1/} Includes Cr\$52.62 billion due by Eletrobras on account of share capital subscribed at the end of 1965.

^{2/} This amount is placed in a revaluation reserve until Board action is taken to authorize share capital to cover this amount.

31. As a result of revaluation, fixed assets would increase to Cr\$438.86 billion, bringing total assets to Cr\$498.84 billion. Gross plant in service would increase from Cr\$312.29 billion to Cr\$381.59 billion or about 22 percent. This is less than the coefficient of 1.27 would suggest, because of two factors: the relatively large portion of gross plant in service which was financed with foreign exchange loans would increase by only 20 percent, reflecting the change in the exchange rate from Cr\$1,850 to Cr\$2,220 per dollar; also, the plant includes a small amount of capital expenditure incurred during 1965 and which is not subject to revaluation. The increase of the depreciation reserve to Cr\$16.43 billion would result from the revaluation on the basis of the 1965 coefficient of the revalued depreciation reserve balance outstanding at January 1, 1965 plus the depreciation charges for 1965 on gross plant in service at year end. Work in progress would increase to Cr\$73.70 billion reflecting revaluation of the balance outstanding at January 1, 1965. This revaluation procedure is the same as used for gross plant in service, but its results are not used for tariff purposes until the assets so revalued are transferred to gross plant in service.

32. The expected 22 percent increase in long term debt to Cr\$340.32 billion reflects the change in the foreign exchange rate used to value foreign loans and the revaluation of the local currency loans on the basis of the new coefficient. The amortization reserve would increase to Cr\$11.55 billion, in the same proportion, and for the same reasons as the depreciation reserve. The balance of the revaluation process would be reflected in a Cr\$16.02 billion increase in share capital from the present Cr\$120 billion to Cr\$136 billion, to be made in 1966 within four months of the revaluation. This increase will be subject to a 5 percent revaluation tax in 1966.

33. The present share capital, of Cr\$120 billion is divided equally between common and preferred. The distribution of shares among the shareholders as of December 31, 1965 is shown as follows:

	Common		Preferred		Total	
	Cr\$ Billions	%	Cr\$ Billions	%	Cr\$ Billions	%
Eletrobras	56.86	94.8	54.21	90.4	111.07	92.6
Cemig	1.41	2.3	1.41	2.3	2.82	2.3
DAEE	1.73	2.9	2.15	3.6	3.88	3.2
Sao Paulo Light	-	-	1.53	2.5	1.53	1.3
C.P.F.L.	-	-	.18	0.3	.18	0.2
Cherp.	-	-	.52	0.9	.52	0.4
Total	60.00	100.0	60.00	100.0	120.00	100.0

34. On December 28, 1965, Furnas' capital was increased from Cr\$37.08 billion to the present Cr\$120.00 billion. Shares were issued for Cr\$24.45 billion on account of the previous 1964 revaluation. The balance of Cr\$58.47 billion was entirely subscribed by Eletrobras which paid in 10 percent and committed itself to cancel a corresponding amount of its long term loans to Furnas as soon as these loans are revalued on the basis of the 1965 coefficient. This action was recently completed.

35. In 1965 Furnas incurred two new loans one with Eletrobras and the other with the Bank. Eletrobras which is practically the only supplier of local funds to Furnas, both in the form of share capital and loans, entered into a contract on December 31, 1965 with the National Bank for Economic Development (BNDE) to assume BNDE's three outstanding loans to Eletrobras. BNDE will be reimbursed from Eletrobras' Federal Electricity Fund to cover this transaction. Furnas' obligations under these loans will not change except a quarter of one percent guarantee tax to eletrobras on outstanding balances will be eliminated.

Past Earning Record

36. Income statements for the first two full years of operation, 1964 and 1965, are shown in Annex 2. Sales of kwh in 1965 were about 0.9 billion kwh under Furnas' estimates made late in 1964 and less than the number of kwh sold in 1964 for the reasons given in paragraphs 24 and 25. Gross income, however, increased from Cr\$15.8 billion in 1964 to Cr\$47.5 billion in 1965, reflecting the tariff increases already described in paragraph 23. The rate of return on remunerable investment at the end of 1965, but valued in terms of the 1964 coefficient would be about 7.6 percent after charges of 5 percent for depreciation and 3 percent for amortization. Calculated on the basis of the existing covenant, the return would be about 10 percent (Average revalued net fixed assets in operation and using depreciation charges of 2.5 percent). This illustrates that Furnas' tariffs in 1965 were adequate and as soon as its plant is fully utilized its high depreciation and amortization charges could be reduced.

Proposed Financing Plan

37. A forecast of Sources and Application of Funds for the period 1966-1971 inclusive is shown in Annex 3. During the six-year period Furnas would complete (a) the transmission line from the Furnas hydro plant to Rio de Janeiro, (b) the Estreito plant financed in part by Bank loan No. 403 BR, and (c) the Estreito 2nd Stage transmission facilities to be financed in part by the proposed Bank loan. Furnas is expected to begin construction on future expansion including the Furnas hydro plant units 7 and 8 in 1970.

38. The six-year construction program would total Cr\$412.39 billion. Capital expenditure requirements would total Cr\$375.38 billion of which Cr\$109.89 billion, or about 27 percent of the total funds required would be for the Estreito 2nd Stage transmission to be financed in part by the proposed Bank loan. It is expected that Cr\$37.01 billion would be required for interest during construction or about 9 percent of the total requirements.

39. The following is a summary of these requirements, and the sources from which they are expected to be met:

	<u>1966-1971 Period</u> (Billions of Cruzeiros)	<u>Percent</u>
<u>Application of Funds</u>		
Furnas Transmission Project	50.24	12.2
Estreito 1st Stage Hydro Plant	174.25	42.3
Estreito 2nd Stage Transmission	109.89	26.6
Future Expansion	41.00	10.0
Sub-total Construction Expenditures	<u>375.38</u>	<u>91.1</u>
Interest During Construction	<u>37.01</u>	<u>8.9</u>
Total Requirements	<u><u>412.39</u></u>	<u><u>100.0</u></u>
<u>Source of Funds</u>		
Gross Internal Cash Generation	464.26	
Less: Net Debt Service	221.60	
Taxes	23.41	
Dividends and Bonuses	88.24	
Net Internal Cash Generation	<u>131.01</u>	31.8
New Share Capital	46.00	11.1
Borrowings:		
AID Loan Furnas Transmission	24.77	6.0
IBRD Loan 403-BR Estreito 1st Stage	125.96	30.5
IBRD Proposed Loan Estreito 2nd Stage	86.58	21.0
Eletrobras Loan	2.33	0.6
Total Loans	<u>239.64</u>	<u>58.1</u>
Total Funds	<u><u>416.65</u></u>	
Less: Net Increase in Cash	<u>4.26</u>	<u>(1.0)</u>
	<u><u>412.39</u></u>	<u><u>100.0</u></u>

40. Estimated net cash generated internally would total Cr\$131.01 billion, after payment of debt service, income taxes, dividends and bonuses or about 32 percent of the requirements.

41. It is expected that Eletrobras, as a major stockholder, will contribute new share capital of Cr\$46 billion or about 11 percent of the requirements. In connection with Loan 403-BR, the Government agreed to provide all the funds necessary to complete the Project, which already included the completion of the Estreito 2nd Stage transmission. Eletrobras would continue to be the Government agent for providing the necessary funds. Forecasts of cash dividends to Eletrobras of about Cr\$80 billion have been considered, but Furnas and Eletrobras may well agree that stock dividends should be paid instead, and reduce accordingly the capital contributions to be paid by Eletrobras

42. Borrowings would total about Cr\$240 billion, or 58 percent of the requirements. The proposed Bank loan of Cr\$86.58 billion, or US\$39 million equivalent, would be about 21 percent of the requirements. It is assumed to have a term of 25 years including a grace period of 5 years with an interest rate of 6 percent. Other borrowings include:

- (1) The balance of U.S. AID loan of Cr\$24.77 billion equivalent to finance the foreign costs of the Furnas Transmission Project, having a term of 23 years, including a 3-year grace period with an interest rate of 5.5 percent.
- (2) The balance of IBRD loan 403-Br dated February 28, 1965, of Cr\$125.96 billion equivalent, or about 31 percent of the requirements, to finance in part the Estreito 1st Stage, having a term of 25 years including a 5-1/2-year grace period with an interest rate of 5.5 percent; and
- (3) Eletrobras loan of Cr\$2.33 billion having a term of 15 years including a 3-year grace period with an interest rate of 12 percent.

Estimated Future Earnings

43. Forecast Income Statements for the period 1966 through 1971 inclusive are shown in Annex 2. A depreciation rate of 5 percent and amortization rate of 3 percent will be used through 1967 which will cause the tariffs to be maintained at a high level. Beginning in 1968 tariffs are expected to be lowered to a more normal level with relatively little change in net operating income as a result of the Furnas plant being fully utilized. Tariffs in 1970 are expected to temporarily increase due to the investment costs of the Estreito project being included for the first time in calculating the required 10 percent rate of return and because all of the generating units of the Estreito plant will not be in full operation. In 1971 when the plant is fully utilized the tariffs are expected to return to a normal level due to increases in sales.

44. As shown on the Sources and Application of Funds Statement, net operating income would cover total interest, including capitalized interest, 1.85 times in 1966 declining to 1.33 times in 1969 just before the Estreito plant is placed in operation. The coverage would then rise to an adequate level of 2.20 times in 1970 and increase to 2.33 times in 1971.

45. Total debt service would be covered by internal cash generation 2.17 times in 1966 declining in 1968 and 1969 to a low of 1.22 times, when the AID and Eletrobras loans begin to be amortized, and then rising to 2.02 times in 1970, which is adequate. The effect of meeting amortization payments on the two Bank loans in 1971 would reduce the coverage slightly to 1.94 times.

46. Furnas will be able to allocate yearly 5 percent of its net profits to legal reserves as required by law, pay dividends of 10 percent of the par value of both its common and preferred revalued capital stock and bonuses.

Future Financial Position

47. Annex 1 shows forecast balance sheets as of December 31, 1966 through 1971 inclusive. Furnas' total fixed assets are expected to increase from Cr\$439 billion as of December 31, 1965 to Cr\$747 billion by 1971 or about 1.7 times. Long term debt is expected to increase from Cr\$340 billion to a maximum of Cr\$460 billion by 1969 and then to decrease to Cr\$439 billion by 1971. Equity is expected to increase from Cr\$153 billion to Cr\$310 billion by 1971, or about 2.0 times.

48. Under the terms of the existing debt limitation covenant in Bank loan 403 BR, Furnas' total long-term debt is limited to 66-2/3 percent of its total fixed assets. Certain terms in this covenant have been amended during negotiations, principally to include short-term debt not incurred in the ordinary course of business as part of the debt controlled by the covenant. Annex 2 shows that under the proposed financing plan, debt will be 62.7 percent of total fixed assets in 1966 rising to 64.6 percent in 1968 and declining to 58.8 percent in 1971.

49. Furnas' estimated yearly working capital position during the period under review is adequate. The estimated working capital position as of December 31 for any given year reflects the worst condition for the 12-month period. Actual experience shows that Furnas accrues large amounts of cash during the first three quarters of each year which is more than ample to meet the heavy outlays of cash for dividends, bonuses and debt service which all come due in the last quarter of the year.

V. CONCLUSIONS

50. In February 1965 an appraisal was made of the Estreito Project (No. TO 459a), covering the Estreito hydroelectric plant and the minimum transmission facilities required to connect the plant to the existing transmission grid, and services and equipment for technical and managerial improvement. At that time no decision had been reached on the voltage level of the long transmission lines which were needed, and furthermore it was not necessary to commence construction of the transmission facilities at the same time as the hydroelectric plant.

51. This report is therefore a supplement to the previous report and covers Stage II of the Estreito Project, consisting of transmission facilities to connect the Estreito hydroelectric plant to the load centers of Rio de Janeiro and Sao Paulo. The Project is technically and economically sound and its estimated cost and the proposed construction schedule are reasonable (paragraphs 2, 3, 10 and 11).

52. Furnas, which operates under the regulations of the Water Code, as administered by the Waters Division, is one of the few utilities which has taken full advantage of the new tariff regulations issued in November 1964 (paragraphs 13, 14 and 23).

53. The Government and Furnas have agreed to satisfactory arrangements to the existing tariff and debt limitation covenants which are intended to bring about uniformity in the covenants applying to Brazilian utilities (paragraphs 21, 22 and 48).

54. The Project would be suitable for a Bank loan of US\$39 million equivalent for a term of 25 years, including a 5-year grace period.

December 1, 1966

BRAZIL

CENTRAL ELETRICA DE FURNAS S.A.

Balance Sheet as of December 31, 1964 Through 1971
(Billions of Cruzeiros)

Exchange Rate
1964 - Cr\$1,610 to US\$1
1965 - Cr\$1,850 to US\$1
1965-71 - Cr\$2,220 to US\$1

	Actual 1964*	Partly Estimated 1965	-----Estimated**-----						
December 31:			1965	1966	1967	1968	1969	1970	1971
Fixed Assets									
Gross Plant in Service	298.84	312.29	381.59	381.59	501.59	505.78	510.53	783.40	826.68
Less: Reserve for Depreciation	3.58	15.46	16.43	34.56	58.39	70.40	82.53	101.14	120.73
Net Plant	295.26	296.83	365.16	347.03	443.20	435.38	428.00	682.26	705.95
Work in Progress	25.56	64.43	73.70	157.49	125.22	226.15	289.25	64.28	41.00
Total Fixed Assets	320.82	361.26	438.86	504.52	568.42	661.53	717.25	746.54	746.95
Current Assets	10.53	59.98***	59.98	7.05	9.84	12.19	11.64	12.28	11.62
Total Assets	331.35	421.24	498.84	511.57	578.26	673.72	728.89	758.82	758.57
Liabilities									
Equity									
Capital Stock	61.54	120.00	136.02	136.02	136.02	164.02	182.02	182.02	182.02
Amortization Reserve	2.53	10.87	11.55	23.00	38.05	38.05	38.05	38.05	38.05
Legal and Other Reserves	.37	.60	.60	1.71	2.83	3.91	4.96	7.27	9.26
Unappropriated Surplus	.31	4.60	4.60	20.96	28.31	33.95	37.56	62.84	80.89
Total Equity	64.75	136.07	152.77	181.69	205.21	239.93	262.59	290.18	310.22
Long Term Loans									
IBRD Loan 211 - Furnas	128.84	127.49	152.99	147.97	142.64	137.02	131.07	124.77	118.09
IBRD Loan 403 - Estreito	-	.48	.58	19.83	55.03	96.68	116.53	126.54	124.61
IBRD Proposed Loan	-	-	-	-	20.58	54.58	82.58	86.58	85.43
U.S. AID Loan	-	10.25	12.30	32.77	37.07	35.22	33.37	31.52	29.67
BNDE Loans****	51.41	54.50	67.42	62.49	57.41	52.40	47.21	42.34	37.28
Eletrobras Loans	78.86	86.70	107.03	53.72	52.86	51.18	48.92	46.47	43.81
Total Long Term Loans	259.11	279.42	340.32	316.78	365.59	427.08	459.68	458.22	438.89
Current Liabilities	7.49	5.75	5.75	13.10	7.46	6.71	6.62	10.42	9.46
Total Liabilities	331.35	421.24	498.84	511.57	578.26	673.72	728.89	758.82	758.57
Long Term Debt/Total Fixed Assets	80.7%	77.3%	77.5%	62.7%	64.3%	64.6%	64.1%	61.4%	58.8%

* Valued in terms of monetary correction factor (coefficient) for 1964.

** Valued in terms of monetary correction factor (coefficient) for 1965.

*** Includes Cr\$52.62 billion due by Eletrobras on account of share capital subscribed at end of 1965 by cancellation of an equivalent amount of long term debt due by Furnas to Eletrobras.

**** All BNDE loans have been taken over by Eletrobras in December 1965 with no change in schedules of amortization by Furnas.

BRAZIL

CENTRAL ELETRICA DE FURNAS S.A.

Income Statement 1964-1971
(Billions of Cruzeiros)

Exchange Rate

1964 Cr\$1,610 to US\$1
1965 Cr\$1,850 to US\$1
1966-71 - Cr\$2,220 to US\$1

	Actual 1964	Partly Estimated 1965	----- Estimated -----					
Fiscal Year Ending December 31:	1964	1965	1966	1967	1968	1969	1970	1971
KWH Sales (Millions)	3,215	3,000	4,500	4,500	5,000	5,000	6,500	7,700
Average per KWH (Cruzeiros)	4.91	15.83	17.94	19.73	12.24	12.27	15.14	13.08
Gross Operating Income	15.79	47.50	80.730	88.80	61.20	61.37	98.42	100.74
<u>Cost of Operations</u>								
Operating Expense	1.11	3.04	3.500	3.80	4.00	4.90	5.40	5.40
Depreciation Expense	3.22	11.88	18.13	23.83	12.01	12.13	18.61	19.59
Amortization Expense	2.28	8.34	11.45	15.05	-	-	-	-
Income Taxes 15%	1.39	1.02	3.45	3.58	3.23	3.14	6.94	5.98
Foreign Exchange Expense	1.63	.73	-	-	-	-	-	-
Total Operating Expense	9.63	25.01	36.53	46.26	19.24	20.17	30.95	30.97
Net Operating Income	6.16	22.49	44.20	42.54	41.96	41.20	67.47	69.77
Other Income	.07	-	-	-	-	-	-	-
<u>Income Deductions</u>								
Total Interest	11.56	20.01	23.91	25.87	28.91	30.89	30.65	29.93
Less: Interest Capitalized	(7.75)	(3.29)	(2.72)	(5.70)	(8.47)	(10.65)	(9.47)	-
Interest Expense	3.81	16.72	21.19	20.17	20.44	20.24	21.18	29.93
Net Profit	2.42	5.77	23.01	22.37	21.52	20.96	46.29	39.84
Less: Revaluation Tax 5%	-	1.25	.80	-	-	-	-	-
Net Profit After Revaluation Tax	-	4.52	22.21	22.37	21.52	20.96	46.29	39.84
<u>Allocated To:</u>								
Legal Reserve 5%	.16	.23	1.11	1.12	1.08	1.05	2.31	1.99
Bonuses	.48	-	1.00	1.10	1.20	1.30	1.40	1.60
Dividends	1.39	-	3.74	12.80	13.60	15.00	17.30	18.20
Unappropriated Surplus	.39	4.29	16.36	7.35	5.64	3.61	25.28	18.05
Rate of Return based on Remunerable Investment	-	7.6%		10%	10%	10%	10%	10%

BRAZIL

CENTRAL ELETRICA DE FURNAS S.A.

Sources and Applications of Funds 1966-1971
(Billions of Cruzeiros)

Exchange Rate Cr\$2,220 to US\$1

Fiscal Year Ending December 31:	1966	1967	1968	1969	1970	1971	Total
SOURCES OF FUNDS							
Internal Cash Generation							
Net Operating Income	44.20	42.54	41.96	41.20	67.47	69.77	307.14
Depreciation	18.13	23.83	12.01	12.13	18.61	19.59	104.30
Amortization	11.45	15.05	-	-	-	-	26.50
Accrued Taxes	3.45	3.58	3.23	3.14	6.94	5.98	26.32
Total	77.23	85.00	57.20	56.47	93.02	95.34	464.26
Borrowings							
IBRD Loan 403 - Estreito	19.25	35.20	41.65	19.85	10.01	-	125.96 *
IBRD Proposed Loan - Estreito	-	20.58	34.00	28.00	4.00	-	86.58
US AID Loan	20.47	4.30	-	-	-	-	24.77
Eletrobras Loan	.99	.96	.38	-	-	-	2.33
Total	40.71	61.04	76.03	47.85	14.01	-	239.64
Share Capital	-	-	28.00	18.00	-	-	46.00
Total Sources of Funds	117.94	146.04	161.23	122.32	107.03	95.34	749.90
APPLICATION OF FUNDS							
Additions to Plant (Excluding Capitalized Interest)							
Furnas Transmission - Foreign	17.24	2.32	2.00	-	-	-	21.56
- Local	23.85	3.53	1.30	-	-	-	28.68
Estreito 1st Stage - Foreign	18.00	32.60	36.85	13.80	5.13	-	106.38 **
- Local	21.87	20.00	16.00	7.00	3.00	-	67.87 ***
Estreito 2nd Stage - Foreign	-	20.58	34.00	28.00	4.00	-	86.58
- Local	.110	3.00	6.50	8.40	5.30	-	23.31
Future Expansion Including Furnas Units 7 & 8	-	-	-	-	21.000	20.00	41.00
Total Construction Expenditures	81.07	82.03	96.65	57.20	38.43	20.00	375.38
Total Interest (Including Capitalized Interest)							
IBRD Loan 211 - Furnas	8.77	8.45	8.15	7.79	7.44	7.06	47.66
IBRD Loan 403 - Estreito	1.25	2.60	4.80	6.05	6.45	6.96	28.11
IBRD Proposed Loan - Estreito	.18	1.00	2.65	4.60	5.19	5.19	18.81
U.S. AID Loan	1.23	1.92	2.04	1.94	1.84	1.74	10.71
BNDE Loans	7.82	7.28	6.71	6.15	5.58	5.05	38.59
Eletrobras Loans	4.66	4.62	4.56	4.36	4.15	3.93	26.28
Total Interest	23.91	25.87	28.91	30.89	30.65	29.93	170.16
Amortization							
IBRD Loan 211 - Furnas	5.02	5.33	5.62	5.95	6.30	6.68	34.90
IBRD Loan 403 - Estreito	-	-	-	-	-	1.93	1.93
IBRD Proposed Loan - Estreito	-	-	-	-	-	1.15	1.15
U.S. AID Loan	-	-	1.85	1.85	1.85	1.85	7.40
BNDE Loans	4.93	5.08	5.01	5.19	4.87	5.06	30.14
Eletrobras Loans	1.68	1.82	2.06	2.26	2.45	2.66	12.93
Total Amortization	11.63	12.23	14.54	15.25	15.47	19.33	88.45
Total Debt Service	35.54	38.10	43.45	46.14	46.12	49.26	258.61
Cash Dividends Paid	-	16.54	13.60	15.00	17.30	18.20	80.64
Cash Bonuses Paid	-	2.10	1.20	1.30	1.40	1.60	7.60
Taxes Paid	1.64	4.48	3.98	3.23	3.14	6.94	23.41
Total Expenditures	118.25	143.25	158.88	122.87	106.39	96.00	745.64
Net Cash Accrual or (Deficit)	(.31)	2.79	2.35	(.55)	.64	(.66)	4.26
Cash Balance Beginning of Year	.68	.37	3.16	5.51	4.96	5.60	-
Cash Balance at End of Year	.37	3.16	5.51	4.96	5.60	4.94	-
Total Annual Debt Service Covered by Internal Cash Generation							
	2.17	2.23	1.32	1.22	2.02	1.94	10.90
Times Total Interest Covered by Net Operating Income							
	1.85	1.64	1.45	1.33	2.20	2.33	10.80

* Cr\$.58 billion was drawdown in 1965.

** Capital expenditures of Cr\$.18 billion of foreign expenditures were made in 1965.

*** Capital expenditures of Cr\$.65 billion of local expenditures were made in 1965.

SOUTH CENTRAL BRAZIL

TRANSMISSION LINES

- oooooooooooo Lines comprising Stage II of the Estreito Project (345kv)
- Existing (345kv)
- Under construction (345kv)
- ===== Other existing lines (230kv and under)



#403
CIRCULATING COPY
TO BE RETURNED TO ARCHIVES DIVISION

RESTRICTED

Report No. TO-459a

This report was prepared for use within the Bank and its affiliated organizations. They do not accept responsibility for its accuracy or completeness. The report may not be published nor may it be quoted as representing their views.

DECLASSIFIED

MAR 07 2023

WBG ARCHIVES

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT
INTERNATIONAL DEVELOPMENT ASSOCIATION

ESTREITO HYDROELECTRIC PROJECT
CENTRAL ELETRICA DE FURNAS, S.A.
BRAZIL

February 12, 1965

CURRENCY EQUIVALENTS

U.S. \$1	=	CR \$1500
CR \$1	=	0.67 U.S. mills
CR \$1 billion	=	U.S. \$667,000

This exchange rate is the estimated average rate of exchange for 1964, based on data available in September 1964.

TABLE OF CONTENTS

	<u>Page No.</u>
SUMMARY	
I. INTRODUCTION	1
II. THE BORROWER	1
III. POWER MARKET AND POWER SUPPLY	3
IV. THE PROJECT	6
V. PROCUREMENT AND DISBURSEMENT	9
VI. FINANCIAL ASPECTS	10
Tariffs	10
Past Earning Record	12
Present Financial Position	12
Proposed Financing Plan	14
Future Earnings	17
Future Financial Position	18
VII. CONCLUSIONS	18

ANNEXES

- 1 - Brazil - The South Central Electric Power System - Expansion Program - System Capability and Demand During Driest Period
- 2 - Central Eletrica de Furnas, S.A. - Income Statements 1964 - 1970
- 3 - Central Eletrica de Furnas, S.A. - Sources and Applications of Funds 1964 - 1970
- 4 - Central Eletrica de Furnas, S.A. - Balance Sheets 1964 - 1970
- 5 - Cost Estimates of Items to be Financed by the Proposed Loan
- 6 - Central Eletrica de Furnas, S.A. - Income Statements 1965 - 1970

MAP

BRAZIL

THE ESTREITO HYDROELECTRIC PROJECT

Summary

- i. Central Eletrica de Furnas S.A. (Furnas) has applied to the Bank for a loan of US\$57 million equivalent, including US\$9 million for interest during construction to help finance the first stage of the Estreito hydroelectric project. The project is estimated to cost US\$90.5 million equivalent including interest during construction on the proposed Bank loan.
- ii. Furnas, a corporation owned principally by the Federal Government, is now completing the construction of the 900 MW Furnas hydroelectric project which was financed in part by Loan 211-BR dated October 3, 1958 of US\$73 million.
- iii. The first stage of the Estreito project consists of an embankment type dam and a powerhouse with an initial capacity of 533 MW and transmission facilities to connect to the existing transmission system serving Rio de Janeiro, Sao Paulo, Belo Horizonte and environs. The project is technically sound and economically justified.
- iv. The proceeds of the proposed loan would be used mainly to finance the purchase of equipment for the project, which would be supplied partly by foreign and partly by local suppliers. Awards would be made after international competitive bidding with participation by qualified domestic suppliers who would be granted a 15% preference.
- v. Furnas has completed revaluing its balance sheet accounts through the year 1963 as prescribed by recent decrees which permit revaluation of historical cost investments for tariff making purposes. Furnas expects to further revalue its accounts for the year 1964 at about mid-1965. Tariff increases have been applied for which will enable Furnas to currently achieve a rate of return of not less than 10% of its revalued net fixed assets in operation. Loan covenants have been agreed upon to assure that a proper level of earnings will be maintained in the future and a tariff increase is a condition of effectiveness of the proposed loan.
- vi. The project is suitable for a loan of US\$57 million equivalent for a term of 25 years including about a six and one half year grace period.

BRAZIL

THE ESTREITO HYDROELECTRIC PROJECT

I. INTRODUCTION

1. Central Eletrica de Furnas S.A. (Furnas), a corporation owned principally by the Federal Government, has applied to the Bank for a loan of US\$57 million equivalent including US\$9 million of interest during construction to help finance the first stage of the Estreito hydroelectric project. This project is to be built on the Rio Grande about 500 km. northwest of Rio de Janeiro at an estimated cost of US\$81.5 million equivalent (excluding interest during construction). The first stage would include an embankment type dam and a powerhouse with an installed capacity of 533 MW which would be connected to the existing transmission system serving the cities of Rio de Janeiro, Sao Paulo, Belo Horizonte and environs.

2. Furnas is now completing the construction, on the same river, of the 900 MW Furnas hydroelectric project which was financed in part by Bank Loan 211-BR, dated October 3, 1958, of US\$73 million. The Estreito project is of high priority in a program of power expansion for the south-central region of Brazil. This program was prepared under a United Nations Special Fund grant for which the Bank is the executing agency.

3. This report is based on the findings of a Bank mission which visited Brazil in August-September 1964.

II. THE BORROWER

4. Furnas is a mixed public-private corporation which was formed in 1957. It is a subsidiary of Centrais Eletricas Brasileiras S.A. (Eletrobras), a Federal Government limited liability company created in 1961 to carry out a national electrification plan. It was granted a 30-year concession to construct and operate the Furnas project and in 1962 was given a similar authority covering the Estreito project.

5. Total share capital as of December 1, 1964 was Cr.\$25 billion divided equally between common and preferred shares. The shareholders and their present participations are as follows:

	<u>Common Stock</u>	<u>Preferred Stock</u>
Eletrobras	89.8%	81.2%
Centrais Eletricas de Minas Gerais S.A. (Cemig) (A State company)	4.6%	4.6%
Departamento de Aguas e Energia Eletrica de Sao Paulo (A State company)	5.6%	7.0%
Sao Paulo Light Company controlled by Brazilian Traction of Canada		5.0%
Cia Paulista de Forca e Luz of Eletrobras (formerly American and Foreign Power)		0.6%
Cia Hidreletrica do Rio Pardo of the State of Sao Paulo		1.6%
	<u>100%</u>	<u>100%</u>

Action is being taken to revalue assets in accordance with recent legislation and to convert Eletrobras loans to equity. As a result, the capitalization will be increased and Eletrobras' share will become larger.

6. The by-laws of the company stipulate that the electricity produced will be sold only to the above shareholders and that 50% of the output will go into the State of Sao Paulo, and 50% to Minas Gerais, but subject to adjustment if needed. At present, the State of Minas Gerais has temporarily waived its rights, to allow all the power output to go to Sao Paulo which badly needs it on account of drought conditions. Furnas and the Sao Paulo Light Co. are presently operating under a letter of intent which covers only the general provisions of a sales contract. This arrangement is temporarily satisfactory but as the power supply becomes more adequate, as planned for 1970, long-term sales contracts both for Furnas and the many other electric power producers connected to the same system will have to be negotiated and formalized. The Government has recognized this inadequacy and has agreed to encourage the effective coordination of the operation of all the elements of the system by 1970.

7. The Board of Directors consists of a president, a vice-president acting as technical director, a vice-president acting as financial director, and three other directors without specific duties. Of the latter, one is also vice-president of Cemig, one a vice-president of Sao Paulo Light, and one a former director of the Sao Paulo Department of Waters and Electric Power. The organization at the managerial level is aggressive and competent. The total staff includes 80 engineers and 2,500 others, a large portion of whom are involved in the construction of the Furnas project. The staff lacks sufficient qualified employees in some departments, but consultants and engineering firms are regularly employed on important work for which staff is inadequate. A small part of the proceeds of the proposed loan would be used to train employees.

8. The facilities of the company (see Map) include the Furnas hydro-electric plant with a large reservoir and a powerhouse with four 150 MW units already in service and two more of the same size now being erected which will be in service by June 1965, for a total of 900 MW. The plant is connected to the Cemig system by a 345-kv line 265 km. long; and to the Sao Paulo and Rio systems via Sao Paulo by a 345-kv line 314 km. long. A second 345-kv line along the latter route is under construction. Construction will be started soon on a 345-kv line from the plant direct to Rio de Janeiro. The plant has been operated efficiently and at the peak of its capability since the first unit was brought into service late in 1963.

9. Inflation in Brazil has had a profound effect on utility earnings and operations. It has also made past operating results difficult to interpret and made necessary the continuing review of construction estimates. For this reason the following measures are used in this report. Forecasts of operating results are given in cruzeiros based on an estimated 1964 average exchange rate of Cr.\$1,500 to US\$1.00. The project cost estimate is given in U.S. dollars equivalent in order to simplify its use. Continued inflation is expected, although the Government aims to reduce it, and this must be taken into account in future use of the estimates.

III. POWER MARKET AND POWER SUPPLY

10. The south-central region of Brazil (containing the cities of Sao Paulo, Rio de Janeiro and Belo Horizonte) is the industrial heart of the country (see Map). It contains 43% of the population and is responsible for 76% of the country's industrial activity. Industrial growth was rapid from 1940 to 1962 and in the latter year industry was using 76% of all the electric power produced. The demand for energy at the generation level over the past ten years was as follows:

<u>Year</u>	<u>Millions of kwh</u>	<u>% Growth</u>
1955	9,294	
1956	10,507	13.0
1957	11,561	10.0
1958	12,977	12.2
1959	14,149	9.0
1960	17,050 15,633 13,805	10.5
1961	18,765 17,042 15,275	9.0
1962	21,019 18,917 16,705	11.0
1963	21,761 19,715 17,682	4.2
1964 (estimate)	22,564 20,957 19,364	6.3

A severe drought began in 1963 and the supply was curtailed by rationing, which was continued into 1964 although in the latter year there was some relief due to new generating facilities becoming available. Also during these last two years business was sluggish but it is expected to recover soon.

11. The market for electrical energy in the region has been studied intensively over the past two years by a consortium of foreign engineering firms called Canambra which is working under the United Nations Special Fund grant mentioned above in paragraph 2. Market forecasts through 1970 have been made which are revised from time to time. Using all of Canambra's basic data available through August 1964, a forecast has been prepared on the assumption that drought conditions will decrease in severity in 1965 and 1966 and that business should return by 1967 to the level of activity which existed prior to 1963. The forecast of demand at the generation level is as follows:

<u>Year</u>	<u>Millions of kwh</u>	<u>% Growth</u>
1964	20,957	
1965	23,053	10
1966	25,358	10
1967	28,147	11
1968	31,243	11
1969	34,679	11
1970	38,493	11

12. The electricity supply of the region comes from a large number of plants which have been built with Federal, State, or private funds without much coordination. The plants are predominantly hydroelectric because fossil fuels are scarce in Brazil and because the region is endowed with hydrologic and topographic conditions which are favorable for hydro developments. The plants, which have a total installed capacity of about 4,400 MW, are owned and operated as follows:

<u>Company & Principal Ownership</u>	<u>Capacity in 1964</u>	
	<u>Hydro MW</u>	<u>Thermal MW</u>
Rio Light, Brazilian Traction	831	25
Sao Paulo Light, Brazilian Traction	974	464
CPFL, formerly American & Foreign Power, now Eletrobras	256	30
CBEE, formerly American & Foreign Power, now Eletrobras	32	33
CEMIG, State of Minas Gerais	465	
FURNAS, Federal	600	
CHERP, State of Sao Paulo	61	
USELPA, State of Sao Paulo	146	20
Other small systems & captive plants	400	58
Total	3,765	630
Grand Total	4,395	

13. Canambra has prepared a short-term program for the expansion of the power supply to meet the demand through 1970. This includes additional units being installed in four existing hydro plants, nine new hydro plants and two thermal plants now under construction, and two new hydro plants which were selected after a study of thirteen projects which could be started in the near future. The study also covered new thermal generation but there is so much hydro potential available at low costs that additional thermal capacity will not be economically desirable for years to come.

14. The studies show that energy ^{supplies} requirements, which are predicated on available water rather than installed machine capacity, are of prime importance through 1970 and consequently the program is based on the firm energy capability of the various plants in the driest period of record. The following tabulation shows existing capability, and that of plants under construction and new plants to be completed by 1970. Furnas is expected to contribute from its existing Furnas and proposed Estreito hydro plants about 18% of the estimated requirements in 1970.

<u>Plant</u>	<u>Firm Capability Millions of Kwh/year</u>
Existing hydro 1964 (includes new plants completed during the year)	16,150
Existing thermal 1964	4,550
Hydro under construction (including Chavantes and expansion of plants)	14,000
Thermal under construction	1,340
Estreito hydro, construction to start 1965	3,240
Jaguara hydro, construction to start 1965	2,400
Total in 1970	<u>41,680</u>

Therefore, if all the systems were integrated by 1970, the energy capability of the system would be able to meet the demand for that year with about 8 $\frac{1}{2}$ % reserve. As indicated in Annex 1, the demand would also be met in intervening years, but with smaller reserve capability in some years.

15. The program includes the additions to the existing transmission grid necessary to connect the new generating facilities and to integrate all plants into a fully dependable system. Financing and construction of the needed transmission is currently keeping abreast of the new generating facilities as they come into operation. Arrangements for expanding the distribution systems have not yet been made. Many of these, particularly in Rio de Janeiro and Sao Paulo, are now at the saturation point principally because the private capital companies who are the principal distributors have not been allowed to earn sufficient income to expand the systems and Government funds have not been available to them. It is essential that the improvement of the distribution systems be started soon if the expansion program is to meet the demand as planned. On the basis of tariff regulations recently issued (see paragraph 36), the Government has agreed to grant to the distribution companies increases in tariffs which should enable them to finance a substantial portion of the cost of the expansion of the facilities. Specific arrangements satisfactory to the Bank for the expansion of the distribution facilities in the Rio de Janeiro and Sao Paulo areas are a condition of effectiveness in the proposed Loan Agreement. |||

16. The success of the program will depend vitally on whether the numerous operating entities under a variety of ownerships can agree on sound policies of load dispatching, standby arrangements, and other problems of integrated operation; and will set up an organization to carry out the policies. Nothing has been done about this and under Brazilian conditions, it promises to be difficult to achieve. As noted above in paragraph 6, the Government has agreed to encourage the effective coordination of all elements of the system by 1970. |||

17. The program is estimated to cost about US\$1.3 billion equivalent through 1970, made up as follows:

	Millions of dollars <u>Equivalent</u>
Hydro plants under construction	425
Thermal plants under construction	35
New hydro construction	140
Transmission and substations	440
Distribution	<u>260</u>
	<u>1,300</u>

Furnas' capital expenditures toward this program will consist of about US\$182 million equivalent or about 13% of the program (see paragraph 49). The program is sound providing the conditions noted above in paragraph 15 and 16 can be met. The Estreito project is the first choice for the new hydro construction on the basis of having the lowest unit costs per kw and per kwh.

IV. THE PROJECT

18. The Estreito project will be situated on the Rio Grande which forms the boundary between the States of Minas Gerais and Sao Paulo. The site is 160 km. downstream from the Furnas project and 60 km. downstream from the Peixoto project, a 180 MW hydro plant built by American and Foreign Power Corp. Furnas has a reservoir large enough to regulate the flow throughout the dry spells of several years duration which are characteristic of this region, and there will be large resulting benefits to the Estreito and Peixoto projects.

19. The first stage of the project, to which the loan application relates, consists of the construction of a rockfill dam with a central earth core, about 500 meters long and 80 meters high, with a volume of 3.5 million cubic meters, a concrete intake structure and powerhouse on the left bank, a concrete spillway on the right bank, and the transmission facilities necessary to connect to the existing transmission network.

20. The powerhouse will be designed to contain six generating units of which four will be installed in the first stage, while the date for installation of the fifth and sixth has not yet been determined. The generating units will have a capacity of 133 MW each with Francis type turbines to operate under a normal head of 66 meters. Transmission facilities will be at 345-kv and will consist of one line 140 km. long to Furnas and one line 35 km. long to Peixoto.

21. The Brazilian subsidiary of International Engineering Co. of San Francisco, California, has made the preliminary studies of the project and is now working on the detailed plans and specifications for the dam and powerhouse. Geological explorations by International have revealed good rock foundations for all of the concrete structures and adequate earth and rock for the dam at close range. Extensive rainfall and stream flow studies based on thirty years of record have indicated a spillway capacity requirement of about 13,000 m³ /sec.

There is no silt problem by reason of the upstream reservoirs. The transmission facilities have been designed by Ebasco Services, Inc. The Furnas organization will do its own construction supervision and operate the completed project.

22. Preliminary work on access roads and housing at the site has been started. Plans and specifications for a civil works contract will be available early in 1965. If work under such a contract can start by the end of June 1965 the project can be completed in early 1971. The work will be protected against interruption by possible floods by reason of the Furnas reservoir upstream.

23. The estimated cost of the project including interest during construction on the Bank loan amounts to US\$90.5 million equivalent. The following breakdown between local and foreign costs is based on the Borrower's expectation of the probable outcome of international bidding with Brazilian suppliers participating.

Item	Local Cost	Foreign Exchange	Total Cost
	US\$ Equiv.	Cost U.S. \$	U.S. \$
(Millions)			
Land, camps and site preparation	5.4	--	5.4
Construction Equipment	1.2	4.2	5.4
Civil Works for power station & switchyard	3.7	--	3.7
Dam	7.1	1.8	8.9
Intake and Spillway	10.7	1.1	11.8
Penstocks	2.5	.1	2.6
Turbines and generators	1.0	12.3	13.3
Spare parts and accessory equipt.	1.2	1.8	3.0
Substation equipment	.4	5.1	5.5
Engineering, Supervision, and Training	1.9	1.4	3.3
Sub-total hydro plant	35.1	27.8	62.9
Transmission lines	4.5	2.2	6.7
Substations	.9	3.9	4.8
Sub-total transmission	5.4	6.1	11.5
Contingencies	4.5	2.6	7.1
Totals	45.0	36.5	81.5
Interest during construction on proposed Bank loan			9.0

TOTAL PROJECT COST

45.0
11.9
6.4

45.0
16.4
38.6
5.4
6.8
32.8
5.8
1.0
6.8

36.5
6.0
32.5

23.9
484.3
2.6
11.2
1.4
12.6

90.5
2.6
1.4
2.0

38.2
23.9
62.1
6.8
12.6
19.4

24. The local currency cost estimate was prepared in dollars, as is often done in Brazil, to provide a reasonably firm basis for comparison with actual costs as they are incurred. As will be described in the financial section of this report, increased local costs caused by inflation and which are difficult to predict, are expected to be compensated by (a) corresponding increases of Furnas' internal resources, due to periodic revaluations of assets and corresponding tariff adjustments (see paragraph 38) and (b) the expected Government undertakings to provide all necessary funds to carry out Furnas' expansion (see paragraph 54).

25. The cost estimates were prepared by the Furnas engineering and purchasing groups which have a good record for accuracy on the Furnas project estimates. The contingency allowance includes 15% on civil works and 7¹/₂% on other items. The allowance should be adequate in this case since the site will be protected from floods. The cost per kilowatt is US\$130 not including transmission costs, which is very low for a hydroelectric development. The first stage of the project as described in paragraphs 19 and 20, does not include adequate transmission facilities for the entire output. Since the necessary facilities can be built in less time than the hydroelectric plant, Furnas intends to defer construction of them to a second stage, which will be started in about two years and will consist of transmission lines and substations costing US\$53 million. This high cost is due to the fact that the lines will not only carry all of Estreito's output, but also that of the Jaguará project which Cemig plans to start building downstream from Estreito in 1965. Furthermore, it will provide duplicate facilities in the final system to meet reliability requirements. A covenant has been included in both the proposed Loan and Guarantee Agreements that both Estreito stages will be completed by early 1971 (see paragraph 54).

26. The proposed loan is intended to cover those materials and equipment which will be procured under international competitive bidding and imported construction equipment consisting principally of spare parts for equipment already owned by Furnas for which international competition is impractical. These items are estimated to cost US\$48 million plus interest during construction estimated at US\$9 million for a total loan of US\$57 million. Costs not covered by the proposed loan are those for civil works contracts, materials such as cement, sand and gravel, etc., and small vehicles which are to be procured locally. (See Annex 5 for details).

27. Furnas has asked for and received 14 proposals from firms operating in Brazil for prequalification for bidding on the civil works contracts. One of the requirements was that local bidders should have pertinent construction experience in Brazil. Although examination of the proposals has not been completed, Furnas believes nine of them will probably be acceptable. After specific discussions, the Bank has agreed that it would not be necessary for Furnas to modify its proposed procedures to a more formal procedure of international bidding. The reasons for this are: that there is a well-developed and capable construction industry in Brazil; that a foreign contractor not already established would be likely to encounter difficulties doing business under the peculiar Brazilian economic conditions; and that many of the firms likely to qualify under the Furnas invitation are in fact consortia of firms including foreign contractors.

V. PROCUREMENT AND DISBURSEMENT

28. Local firms will compete for many of the contracts covering materials and equipment to be financed by the proposed loan. While Government-owned power companies are exempt from customs duties and the exchange surcharge and compulsory deposits mentioned below, current Brazilian legislation (Law of Similares) as interpreted by the Superintendency of Money and Credits (SUMOC), prohibits generally the importation of capital goods which can be produced locally. This matter has been discussed and the Government and Furnas have agreed to international competitive bidding on goods to be financed under the proposed loan; and the Government has agreed to take all such measures as necessary to facilitate the importation of goods by Furnas free from all legal and administrative restrictions or limitations in accordance with the arrangements described below.

29. In comparing bids by foreign and local suppliers it will be necessary to determine the exchange rate which is to be used. At the present time the cost of exchange to importers is generally determined by the following: (1) the commercial bank rate of exchange which is close to the official rate of exchange of the Banco do Brasil, (2) the prevailing exchange surcharge, presently 10%, and (3) compulsory deposits, presently 50% of the transaction, for 7 months. The Bank and the Government have agreed that the exchange rate to be used for evaluating bids and calculating the amount to be disbursed from the loan would be the prevailing commercial rate plus the exchange surcharge (not to exceed 30%). The exchange rate derived from this formula would roughly approximate the average between the effective import and export rates, and thus should provide a reasonably fair basis for bid comparisons. In the event of significant changes in the exchange system, the parties would reconsider this formula.

30. A further matter raised by the Government concerns the protection which should be afforded to local industry. On this point, discussions led to the agreement that the maximum protection would be 15%.

31. On the basis described above, the procedure for comparing local and foreign bids and making disbursements covering contracts obtained by local bidders would be as follows: (1) a local bid in cruzeiros will be converted into dollars at the rate of exchange described in paragraph 29 above; (2) the lowest local bidder will be awarded the contract if his evaluated bid is less than the lowest evaluated foreign bid, plus 15%; and (3) dollar reimbursements from the loan for such local expenditures will in principle be computed at the rate described in paragraph 29 above. However, inasmuch as such reimbursements will have to be converted into cruzeiros at the prevailing Banco do Brasil rate of exchange, this may cause a shortage of cruzeiros to the Borrower approximately equal to the amount of the exchange surcharge. The Government has agreed to cover such cruzeiro shortages. For administrative convenience in making disbursements from the loan in respect of cruzeiro expenditures the Bank has agreed to establish from time to time a common disbursement percentage based on the relationship between the Banco do Brasil rate at which loan funds can be converted (presently Cr\$1825 = US\$1), and the exchange rate used for bid comparisons (presently Cr\$2035 = US\$1). Accordingly, a 90% rate has been established for the time being.

VI. FINANCIAL ASPECTS

Tariffs

32. The regulations governing power operations and tariffs are contained in the Water Code of 1934 and subsequent amendments and decrees, including, in particular a decree dated February 26, 1957 and three decrees dated November 4, 1964. The Water Division of the Ministry of Mines and Energy is responsible for implementation of the Water Code, including the granting and supervision of concession contracts and the review and approval of tariff applications.

33. Under the regulations which have applied until recently, tariffs were to be reviewed every three years to yield revenues which would cover: (a) all operating costs; (b) straight-line depreciation on the historic value of gross plant in service, at annual rates prescribed by the Water Division, presently up to 8% for thermal plants and up to 5% for all other facilities, including hydro plants; (c) amortization of the total investment of the concession at annual rates, determined in the concession contracts approved by the Water Division, not to exceed 3%; (d) a cumulative return before income taxes of 10% on the historic value of the remunerable investment (Furnas is subject to 10% income tax on net profit). Remunerable investment is defined as depreciated plant in service at year end, plus an allowance for working capital consisting of actual cash, up to the amount of the depreciation reserve, two month's billings and operating inventories.

34. In addition, adjustments in the form of surcharges on the original three-year tariff were permitted, subject to approval by the Water Division; (a) semi-annually for increases in foreign debt service due to changes in foreign exchange rates, (b) monthly for increases in compulsory wages, social benefits, cost of fuel and purchased power.

35. The rapid depreciation of the currency in recent years resulted in the deterioration of the earnings and finances of utilities. Due to inadequate implementation of the regulations and to delays in obtaining the permitted adjustments, utilities have seldom been able to charge depreciation and investment amortization at the rates prescribed, let alone to earn the permitted 10% return on investment. However, the fundamental shortcoming of this policy was the use of historic values for computing the tariff base as these became a fraction of what they would have been had the currency remained stable. Thus, in real terms, returns on investment have been decreasing gradually and returns on equity have become negligible; as a result, utilities have been unable to generate funds internally towards financing expansion, or to raise outside funds, except from the Federal or State Governments.

36. The revaluation of assets for tariff making purposes has thus become an essential condition of the financial soundness of utilities. This measure, which had been expected to take place within months after the signing of Loan 211-BR in late 1958, but failed at the time to obtain Parliamentary approval, has recently been enacted by two decrees defining the methods for revaluing assets and amending the Water Code to allow tariffs to be determined on the basis of corrected rather than historic values, starting January 1, 1965.

37. The decree covering revaluation of assets is patterned after the provisions of the existing legislation governing the revaluation of balance sheets for all corporations other than utilities and government-controlled corporations. It provides for the revaluation of balance sheet accounts, using official annual correction factors based on cost of living indices published by the National Economic Council. These factors are applied to plant in service, depreciation and amortization reserves, foreign currency loans and local currency loans providing they had been obtained from the National Development Bank (BNDE) and Eletrobras. Foreign currency components of the balance sheet accounts are converted into local currency at the foreign rate of exchange at the times of acquisition of such funds. The amount by which the revaluation of assets exceeds the revaluation of reserves and loans is set aside as a revaluation reserve. This reserve, which is subject to a 5% tax, has to be converted into share capital within a four-month period.

38. The decree governing tariffs allows the use of revalued fixed assets as a basis for determining tariffs. In the future, revaluation of fixed assets and corresponding tariff adjustments can be made every year as official correction factors are issued but this annual provision is not mandatory. These adjustments will be subject to approval by the Water Division. The adjustments for increases in operating costs, as described in paragraph 34, will be automatic. The other provisions of the Water Code will be maintained. Thus, in principle, depreciation and amortization of the concession investment could be charged at the maximum rates that have been permissible until now partly to offset inflation. This, however, would result in a combined allocation which would exceed substantially the usually accepted level of depreciation charges; it would thus call for a considerable increase in Furnas' future tariffs.

39. The Government and Furnas have indicated they are prepared to increase the tariffs of Furnas to this high level and to continue to use the maximum permissible depreciation and amortization criteria at least during the construction period of the project. Furnas has just completed revaluing its fixed assets in service based on the correction factors available through the year 1963. It has applied for tariffs which would provide revenues to cover, *inter alia*, depreciation at 5%, amortization of the concession investment at 3%, and the 10% return on remunerable investment, revalued through 1963. The new tariff would result in an average revenue per kwh of about Cr.\$10 (U.S. Mills 6.7), almost twice the present estimated average of Cr.\$5.1 (U.S. Mills 3.4). Inasmuch as such a tariff increase will slightly exceed the minimum tariff required for 1965 as outlined in paragraph 41 below, it has been agreed that the proposed tariff increase is acceptable and is to be put into effect before the effective date of the proposed loan.

40. As a second step, Furnas plans to further revalue its fixed assets through the end of 1964, based on the correction factors to be published shortly for 1964, and to apply for a new tariff adjustment which would be based on the new values of its fixed assets and the same depreciation and amortization criteria as outlined in paragraph 39. Furnas expects that this second adjustment will be made effective by the middle of 1965.

41. These maximum criteria reflect conditions which are presently accepted by both Furnas and the Government. The high cash generation which would result from using these criteria is reflected in Annex 6. It is not likely that the Borrower will continue to apply these criteria indefinitely since they call for unusually high tariffs. Therefore, in order that adequate tariffs will be maintained, it has been agreed that Furnas' revenues will be sufficient to cover all operating expenses including adequate maintenance and straight line depreciation of 2 $\frac{1}{2}$ % of the gross revalued fixed plant in operation and produce a return of not less than 10% of the total average net revalued fixed plant in operation. The agency responsible for the setting and adjustment of tariffs will review the tariffs of Furnas as often as is necessary in order to verify that future revenues are adequate. On this basis a minimum tariff of at least Cr.\$9.4 (U.S. Mills 6.3) per kwh should be in effect starting in 1965 as outlined in the forecast income statements, Annex 2.

Past Earning Record

42. The estimated income statement for 1964, Furnas' first full year of operation, is shown in Annex 2. It indicates that Furnas will earn a return of 7.1% on its historic investment. The historic investment is already understated as a result of inflation (see paragraph 45); this 7.1% return, however, is after 5% depreciation and 3% amortization of the concession investment, including compensation of exchange losses incurred in amortizing Loan 211-BR. The total of these charges would be equivalent to about 2.5% of Furnas' revalued plant in service, as estimated in paragraph 45. Furnas has just started operations and the value of its plant while already understated is not understated as much as the plant value of utilities which have been in existence for a number of years.

Present Financial Position

43. Arthur Anderson and Co., a well-known accounting firm, have been employed as outside auditors by Furnas since 1958 and these arrangements have been satisfactory. Furnas has agreed to continue to employ outside auditors acceptable to the Bank.

44. Furnas' balance sheet as of December 31, 1964 has been estimated on the basis of data available in September 1964. The proposed revaluation was computed on the basis of official correction factors through 1963 and an estimated correction factor of 1.6 for 1964, which resulted in an equivalent of Cr.\$1,500 to US\$1. The financial projections have been maintained at this fixed level because the future purchasing power of the cruzeiro is unpredictable. Most of the effects of the decreasing purchasing power of the cruzeiro have been provided for under existing regulations by revaluations and tariff adjustments.

The pro forma balance sheets as of December 31, 1964 before and after revaluation would be as follows:

	Before Revaluation (Cruzeiros)	After Revaluation (Millions)	Dollar Equivalent (Thousands)
<u>ASSETS</u>			
Gross Plant in Service	78,820	283,400	188,935
Less Depreciation Reserve	3,360	11,660	7,775
Net Plant in Service	75,460	271,740	181,160
Work in Progress	3,450	3,450	2,300
Total Fixed Assets	78,910	275,190	183,460
Current Assets	2,240	2,240	1,490
Total	81,150	277,430	184,950
<u>LIABILITIES</u>			
Equity:			
Capital Stock	25,000	25,000	16,665
Legal Reserve	400	400 ✓	265
Capitalized Interest on Equity			
Investment ^{1/}	90	90	60
Unappropriated Surplus (Deficit)	(20)	(20) ✓	(15)
Revaluation Reserve	-	77,950 ✓	51,970
Amortization Reserve of the Furnas		103,000	
Concession	2,520	8,750 ✓	5,835
Total Equity	27,990	112,170	74,780
Long-term Debt:			
IBRD Loan 211-BR	25,640	106,470	70,980
BNDE Loans	24,380	55,650	37,100
Total Long-term Debt	50,020	162,120	108,080
Current Liabilities	3,140	3,140	2,090
Total	81,150	277,430	184,950
Debt/Equity Ratio	64/36	59/41	59/41

^{1/} Under Article 159 of the Water Code, the portion of the investment of work in progress financed with the Borrower's own capital shall bear interest at 10% up to the date that such facilities are placed in operation. Such interest shall be capitalized and added to the cost of the plant.

45. As a result of revaluation, gross plant in service, and net plant in service would increase about 3.6 times over their original values to Cr.\$283.4 billion and Cr.\$271.7 billion respectively.

46. Long-term debt obligations would increase from Cr.\$50 billion to Cr.\$162 billion or about 3.3 times and equity would increase from Cr.\$28 billion to Cr.\$112 billion resulting in a debt/equity ratio of 59/41.

47. Long-term debt includes IBRD Loan 211-BR of 1958 for an original amount of US\$73 million at 5-3/4% interest for a term of 25 years. Two principal payments in 1964 have reduced the principal to about US\$71 million or Cr.\$106.5 billion equivalent. The other long-term debt consists of three 15-year local currency loans, at 10% interest, which total about Cr.\$56 billion after revaluation. Principal payments began in 1964 on the first two loans and the amortization of the third loan will commence in 1965.

48. In September 1964 Furnas' share capital was very substantially increased, from Cr.\$6 billion to Cr.\$25 billion, by conversion into shares of about Cr.\$18 billion of government loans, and about Cr.\$1 billion of "interest" accrued during construction of the Furnas plant on the share capital and new cash. Share capital is divided equally between common and preferred shares at Cr.\$1,000 par. Annual dividends have been paid at 6% on common and at 10% on preferred shares. Eletrobras owns 89.8% of Furnas' common shares and 81.2% of its preferred shares (see paragraph 5). The net results of the revaluation would be reflected in a revaluation reserve of Cr.\$78 billion which is to be converted into share capital in 1965 in the same proportion as shares outstanding and will be subject to a 5% tax payable in 1965.

Proposed Financing Plan

49. A forecast of sources and applications of funds for the period 1964-1970 is shown in Annex 3. During this period Furnas contemplates completing (1) the Furnas generating plant to its full complement of six units in 1965; (2) the Furnas transmission system by 1967; (3) the Estreito first stage hydro project, as described in paragraphs 19 and 20, to be partly financed by the proposed Bank loan; and (4) the Estreito second stage transmission project, as described in paragraph 25. Both stages of Estreito are to be finished in 1971.

50. Construction requirements and additions to working capital during this seven-year period are estimated at about Cr.\$299 billion, including plant additions of Cr.\$273 billion and working capital requirements of about Cr.\$26 billion as follows:

	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>Total</u>	Total US\$ equiv. millions
	Billions							Cr.\$	
Furnas Plant	16.2	-	-	-	-	-	-	16.2	10.8
Furnas Trans- mission	-	14.7	32.2	8.0	-	-	-	54.9	36.7
Estreito 1st Stage	3.4	27.4	24.8	36.3	24.7	5.3	.5	122.4	81.5
Estreito 2nd Stage	-	-	12.0	32.4	18.5	14.8	1.8	79.5	53.0
Construction Requirements	19.6	42.1	69.0	76.7	43.2	20.1	2.3	273.0	182.0
Additions to Working Capital	(.4)	2.4	2.1	(.9)	.2	8.1	14.2	25.7	17.1
Total	19.2	44.5	71.1	75.8	43.4	28.2	16.5	298.7	199.1

51. The sources of financing for the above facilities are shown in the following table.

	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>Total</u>	Total US\$ equiv. millions	%
	Billions							Cr.\$		
<i>Net operating income</i> <i>+ Depreciation</i> <i>+ Amortization</i> Internal Cash Generation = Δ	12.3	27.9	32.5	33.9	43.0	51.6	56.0	257.2	171.4	
Less:										
Debt Service	9.3	19.6	23.4	27.4	31.9	33.0	33.5	178.1	118.7	
Dividends	.1	.5	-	-	-	8.2	8.3	17.1	11.4	
Net Cash Available for expansion	2.9	7.8	9.1	6.5	11.1	10.4	14.2	62.0	41.3	
New Share Capital	.1	-	-	-	-	-	-	.1	.1	
Sub-total:										
Own Resources	3.0	7.8	9.1	6.5	11.1	10.4	14.2	62.1	41.4	20.8
IBRD Loan 211-BR	8.0	-	-	-	-	-	-	8.0	5.3	2.7
Proposed IBRD Loan	-	17.2	18.2	25.3	17.4	7.5	-	85.6	57.0	28.7
US AID Loan	-	7.0	15.6	3.8	-	-	-	26.4	17.6	8.8
Future Foreign Loan	-	-	6.3	17.7	11.1	9.6	2.3	47.0	31.4	15.7
BNDE Loans	8.2	12.5	21.9	22.5	3.8	.7	-	69.6	46.4	23.3
Sub-total:										
Borrowings	16.2	36.7	62.0	69.3	32.3	17.8	2.3	236.6	157.7	79.2
Total Sources	19.2	44.5	71.1	75.8	43.4	28.2	16.5	298.7	199.1	100.0

52. Based on data available in September 1964, outstanding balances on existing loans and borrowings from foreign sources contemplated during the period would amount to about Cr.\$175.2 billion equivalent, out of the total Cr.\$298.7 billion required, as detailed below:

- (a) The outstanding balances at the end of 1963, of about Cr.\$8.0 billion equivalent under IBRD Loan 211-BR and about Cr.\$8.2 billion under an existing BNDE Loan, would be fully disbursed in 1964 to complete the Furnas plant.
- (b) A U.S. AID Loan of US\$17.6 million (Cr.\$26.4 billion equivalent) was obtained in October 1964 to finance part of the Furnas transmission system; it will carry interest at $5\frac{1}{2}\%$ and a term of 20 years, including a three-year grace period. Completion of the Furnas transmission project is a requirement of the proposed Estreito Loan Agreement.
- (c) The proposed IBRD Loan of US\$57 million (Cr.\$85.6 billion equivalent) for the first stage of the Estreito project, was assumed to carry interest at $5\frac{1}{2}\%$ and a term of 25 years, including a six and one half year grace period.
- (d) A foreign loan of US\$31.3 million (Cr.\$47.0 billion equivalent) is expected to be obtained in 1966 for financing a part of the Estreito second stage project, to be undertaken at that time; terms similar to those of the proposed IBRD loan above have been assumed.

53. The Cr.\$123.5 billion balance between the requirements and the borrowings described above would have to be obtained locally. This amount which is expressed in cruzeiros at current price levels, is expected to increase as a result of inflation and the "cruzeiro exchange gap" described in paragraph 31. However, most of the increase would be compensated by corresponding increases in Furnas' internal cash generation, due to tariff adjustments reflecting periodic revaluation of fixed assets, and in the funds to be supplied by Eletrobras.

54. The proportion in which the local currency requirements would be contributed from internal cash generation or by local loans from Eletrobras can only be determined when and as future tariffs of Furnas are established. If the minimum tariff criteria as outlined in paragraph 41 are used, it would permit Furnas to finance from its own internal sources about Cr.\$62 billion toward the requirements of the period. This would be after payment of its debt service and by deferring any payment of cash dividends during 1965 through 1968. The balance of the requirements of about Cr.\$61.5 billion would have to come from Eletrobras (excluding the Cr.\$8.2 billion balance of the existing BNDE Loan mentioned in paragraph 52 (a)). About Cr.\$46.5 billion of the Cr.\$61.5 billion would be for the local currency cost of the Estreito first stage and Furnas transmission projects. The remainder or Cr.\$15 billion would have to be obtained starting in 1966 in connection with the Estreito Second Stage project. In this report, it has been assumed that

the necessary local financing will be in the form of BNDE loans at 10% interest and for a term of 20 years, including three years grace. The Bank has received assurances from the Government that all the funds necessary will be made available to Furnas to complete all of the projects. Furnas has also indicated that it intends to exceed the minimum requirements of the tariff criteria at least to the extent of paying cash dividends during the construction period.

55. In order to assure that Furnas will maintain a sound financial position, it has been agreed that an annual assets test is necessary which would limit Furnas' long term debt outstanding at the end of any given year to a maximum of two thirds of the net revalued fixed assets, including revalued work in progress. In calculating debt outstanding to determine this ratio, account will be taken of actual debt drawdowns rather than the face amount of the loan contracts. The level of revenues which would result from the minimum tariff criteria outlined in paragraph 41, should be adequate to provide a reasonable debt service coverage for the maximum amount of debt that could be outstanding under this arrangement. If future tariff action to be taken by Furnas conforms only with the minimum tariff criteria, a small part of the financing required from Eletrobras would have to be in the form of share capital contributions.

56. Furnas has agreed that it will not undertake any additional works not related to the Furnas and Estreito projects or make any major addition to its facilities costing over \$1 million during the 1965-70 construction period.

Future Earnings

57. Forecast income statements for the period 1964-1970 are shown in Annex 2. Sales in 1965 are expected to increase from 3.2 billion kwh in 1964 to only 3.9 billion kwh due to an anticipated water shortage and because the last two units of the Furnas plant will not be placed in commercial operation until the first half of 1965. When the Furnas plant is in full operation, sales will increase to 4.5 billion kwh. The first unit of the proposed Estreito project is expected to be placed in operation with sales again increasing slightly, late in 1968. The remaining units will be commissioned in 1969 and ultimate sales will be 7.7 billion kwh per year.

58. Future earnings using the minimum tariff criteria as stipulated in paragraph 41 would be satisfactory. Beginning in 1965 net income before taxes is computed with a 10% return on average net revalued plant in operation. After taxes, the return would be 7.6% in 1965 reflecting, principally, the effects of the revaluation tax in that year and would be maintained at 9% thereafter. Net income after taxes would cover total interest, including capitalized interest, about 1.5 times, except in 1967, rising to a maximum of 1.8 times by 1970. Total debt service would be covered about 1.4 times or more except in 1967 and 1968, when coverages would fall to 1.23 and 1.35 times.

Future Financial Position

59. Forecast balance sheets as of December 31, 1964 through 1970 are shown in Annex 4. They reflect debt/equity ratios deteriorating gradually from 50/41 in 1964 to 68/32 in 1968, reflecting the considerable amount of debt incurred in the period, and improving thereafter to 64/36 in 1970, as a result of additions to surplus from earnings and amortization payments. This forecast indicates that the local currency portion of the proposed financing plan will have to be slightly revised in 1967 and 1968 to conform with the proposed debt limitation as indicated in paragraph 55.

VII CONCLUSIONS

60. The project consisting of the Estreito hydroelectric plant and connections to the existing transmission grid is technically and economically sound. Its estimated cost and the proposed construction schedule are reasonable.

61. The Borrower, Furnas, a corporation owned principally by the Federal Government, is now completing a similar large hydroelectric plant and has demonstrated its ability to supervise construction and place the plant in operation. Whenever necessary, it has engaged competent outside consulting services on special problems and will do so in the future.

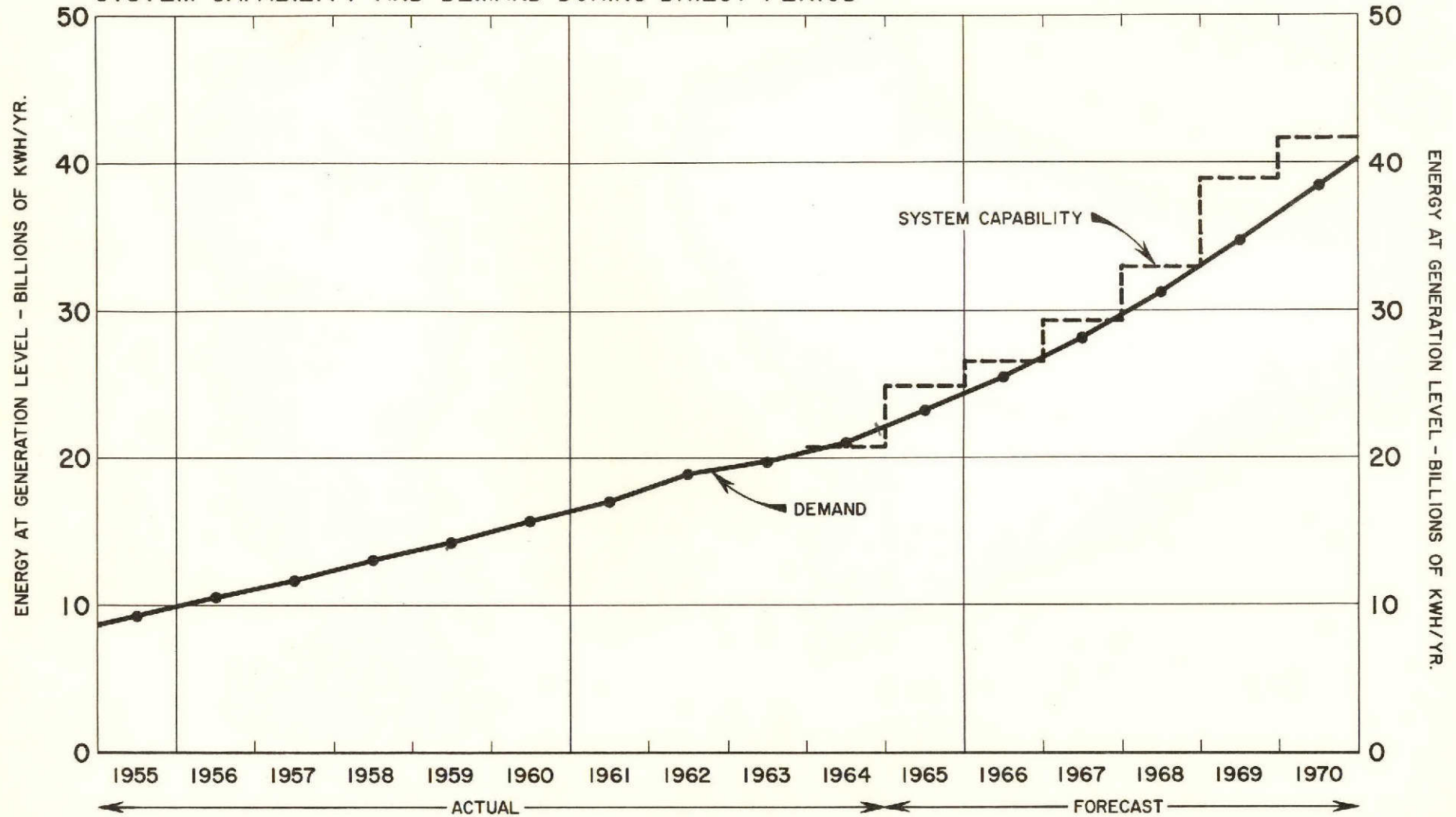
62. Furnas is operating under regulations of the Water Code as administered by the Water Division, Ministry of Mines and Energy. These regulations have been amended recently to permit revaluation of historical cost investments for tariff making purposes. Furnas has completed revaluing its balance sheets accounts through the year 1963, and intends, in mid 1965, to revalue through 1964 after revised coefficients for that year are issued. Furnas has applied for an increase in its tariff based on revaluation through 1963, and it is expected to be approved shortly. It will approximately double the existing tariff and will be slightly in excess of the estimated minimum tariff level for 1965 as agreed upon by the Borrower. Placing the tariff increase in effect is a condition of effectiveness of the proposed loan. Furthermore, two loan covenants covering a rate of return of not less than 10% of average revalued net fixed assets in operation and a debt limitation of 66-2/3% of net revalued fixed assets including revalued work in progress have been agreed upon which are expected to assure that Furnas will maintain a sound financial position during the life of the loan.

63. The first stage of the proposed Estreito project would be suitable for a Bank loan of US\$57 million, including interest during construction, for a term of 25 years including about a six and one half year grace period.

February 12, 1965
IBRD

BRAZIL THE SOUTH CENTRAL ELECTRIC POWER SYSTEM EXPANSION PROGRAM

SYSTEM CAPABILITY AND DEMAND DURING DRIEST PERIOD



(R) IBRD-2497

ANNEX 1

Page 5, para 14

BRAZILCENTRAL ELETRICA DE FURNAS S.A.Income Statements 1964-1970

(in millions of Cruzeiros)

Exchange rate Cr. \$1,500 = US\$1

<u>Year Ending December 31</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u> Estimated	<u>1968</u>	<u>1969</u>	<u>1970</u>
KWH Sales in Billions	3.2	3.9	4.5	4.5	5.0	7.6	7.7
Average per Kwh (Cruzeiros)	5.11	9.42	8.40	8.77	10.02	7.84	8.38
Gross Operating Income	16,350	36,750	37,800	39,450	50,100	59,550	64,500
Cost of Operations							
Operating Expenses	1,800	2,250	2,400	2,700	3,450	3,600	3,750
Depreciation Expense	3,150 ^{3/}	7,350	7,500	8,100	10,200	12,300	13,500
Amortization Quota	2,400	-	-	-	-	-	-
Income Taxes	750 ^{2/}	6,600 ^{4/}	2,850	2,850	3,600	4,350	4,800
Foreign Exchange Expense ^{1/}	1,500	-	-	-	-	-	-
Total Operating Expense	9,600	16,200	12,750	13,650	17,250	20,250	22,050
Net Operating Income	6,750	20,550	25,050	25,800	32,850	39,300	42,450
Income Deductions							
Total Interest Paid	7,350 ^{3/}	13,200	16,500	20,400	22,500	23,100	22,950
Less: Interest Capitalized	(1,200)	(2,100)	(5,550)	(8,850)	(6,600)	(8,100)	(1,200)
Interest Expense	6,150	11,100	10,950	11,550	15,900	15,000	21,750
Net Profit	600	9,450	14,100	14,250	16,950	24,300	20,700
Allocated To:							
Legal Reserve	450	1,350	1,350	1,500	1,800	2,250	2,400
Dividends - Preferred 10%	300	- ^{5/}	-	-	5,100	5,100	5,100
Dividends - Common 6%	150	- ^{5/}	-	-	3,150	3,150	3,150
Surplus Unappropriated	(300)	8,100	12,750	12,750	6,900	13,800	10,050
Rate return based on Average Net Plant in Service before Income Taxes	7.1% ^{6/}	10%	10%	10%	10%	10%	10%

27.150 27.900 28.650 36.450 43.650 47.250

- 1/ Future foreign rate of exchange losses are estimated to be offset by rate increases in conformity with Water Code.
- 2/ Half of principal payments are estimated to be foreign exchange loss.
- 3/ Includes foreign exchange loss on interest paid.
- 4/ Includes 5% income tax on net revaluation of plant.
- 5/ Because of Furnas' cash position it has been assumed that no dividends will be declared during construction period 1965-1967 inclusive.
- 6/ Based on rate of return on historical investment before revaluation.

December 3, 1964

BRAZIL

CENTRAL ELETRICA DE FURNAS S.A.

Sources and Applications of Funds 1964-1970

(in millions of Cr.\$)

Exchange rate Cr.\$1,500 = US\$1

SOURCES OF FUNDS	1964	1965	1966	1967	1968	1969	1970	Total
Internal Cash Generation								
Net Operating Income	6,750	20,550	25,050	25,800	32,850	39,300	42,450	192,750
Depreciation	3,150	7,350	7,500	8,100	10,200	12,300	13,500	62,100
Amortization	2,400	-	-	-	-	-	-	2,400
Total	12,300	27,900	32,550	33,900	43,050	51,600	55,950	257,250
Borrowings								
IBRD Loan 211 BR-Furnas	7,950	-	-	-	-	-	-	7,950
BNDE Loan (3rd) -Furnas	8,250	-	-	-	-	-	-	8,250
U.S. AID Loan - Furnas Transmission	-	7,050	15,600	3,750	-	-	-	26,400
Proposed BNDE Loan-Furnas Transmission	-	7,950	17,400	4,500	-	-	-	29,850
Proposed BNDE Loan Estreito 1st Stage	-	4,500	4,500	7,500	-	-	-	16,500
Proposed IBRD Loan Estreito 1st Stage	-	17,250	18,150	25,350	17,400	7,500	-	85,650
Future BNDE Loan Estreito 2nd Stage	-	-	-	10,500	3,750	750	-	15,000
Future Foreign Loan Estreito 2nd Stage	-	-	6,300	17,700	11,100	2,600	2,250	46,950
Total	16,200	36,750	61,950	69,300	32,250	17,850	2,250	236,550
Share Capital	150	-	-	-	-	-	-	150
Total Sources of Funds	28,650	64,650	94,500	103,200	75,300	69,450	58,200	493,950
APPLICATIONS OF FUNDS								
Additions to Plant (Excluding Capitalized Interest)	-	-	-	-	-	-	-	-
Furnas Power Plant - foreign currency	7,950	-	-	-	-	-	-	7,950
- local currency	8,250	-	-	-	-	-	-	8,250
Furnas Transmission - foreign currency	-	6,750	14,850	3,450	-	-	-	25,050
- local currency	-	7,950	17,400	4,500	-	-	-	29,850
Estreito 1st Stage - local currency	3,450	10,950	8,250	13,800	11,250	2,250	450	50,400
- foreign currency	-	16,500	16,500	22,500	13,500	3,000	-	72,000
Estreito 2nd Stage - local currency	-	-	6,000	16,650	9,450	7,350	1,050	40,500
- foreign currency	-	-	6,000	15,750	9,000	7,500	750	39,000
Total	19,650	42,150	69,000	76,650	43,200	20,100	2,250	273,000
Interest								
IBRD Loan 211 BR - Furnas	6,150	6,000	5,850	5,700	5,550	5,250	4,950	39,450
Existing BNDE Loans	1,200	5,100	5,100	4,800	4,500	4,050	3,750	28,500
Proposed BNDE Loan - Furnas Transmission	-	600	1,950	2,550	2,850	2,700	2,700	13,350
Proposed BNDE Loan Estreito 1st Stage	-	450	750	1,350	1,500	1,500	1,500	7,050
U.S. AID Loan-Furnas Transmission	-	1,300	900	1,500	1,350	1,350	1,350	6,750
Proposed IBRD Loan - Estreito 1st Stage	-	750	1,650	2,700	3,900	4,500	4,650	18,150
Future BNDE Loan Estreito 2nd Stage	-	-	-	750	1,200	1,500	1,500	4,950
Future Foreign Loan Estreito 2nd Stage	-	-	300	1,050	1,650	2,250	2,550	7,800
Total	7,350	13,200	16,500	20,400	22,500	23,100	22,950	126,000
Amortization								
IBRD Loan 211 BR - Furnas	1,500 ^{1/}	3,150	3,450	3,600	3,750	4,050	4,200	23,700
Existing BNDE Loans	450	3,300	3,450	3,450	3,600	3,600	3,600	21,450
Proposed BNDE Loan - Furnas Transmission	-	-	-	-	750	750	900	2,400
Proposed BNDE Loan Estreito 1st Stage	-	-	-	-	450	450	450	1,350
U.S. AID Loan - Furnas Transmission	-	-	-	-	900	1,050	1,050	3,000
Future BNDE Loan Estreito 2nd Stage	-	-	-	-	-	-	300	300
Total	1,950	6,450	6,900	7,050	9,450	9,900	10,500	52,200
Total Debt Service	9,300	19,650	23,400	27,450	31,950	33,000	33,450	178,200
Dividends Paid	150	450	2/	-	-	8,250	8,250	17,100
Total Expenditures	29,100	62,250	92,400	104,100	75,150	61,350	43,950	468,300
Net Cash Accrual or (deficit)	(450)	2,400	2,100	(900)	150	8,100	14,250	25,650
Cash Balance at Beginning of Year	1,050	600	3,000	5,100	4,200	4,350	12,450	1,050
Cash Balance at End of Year	600	3,000	5,100	4,200	4,350	12,450	26,700	26,700
Times annual debt service covered by internal cash generation	1.32	1.42	1.39	1.23	1.35	1.56	1.67	
Times total interest covered by net operating income after taxes	.92	1.56	1.52	1.26	1.46	1.70	1.85	

1/ Half of principal payment charged off as foreign exchange loss expense on income statement.

2/ It has been assumed that no cash dividends would be paid in the years 1966 through 1968.

December 3, 1964

2400

BRAZIL
CENTRAL ELÉTRICA DE FURNAS S.A.

Balance Sheets 1964-1970

(in millions of Cr.\$)

Exchange rate Cr.\$1,500 = US\$1

As of December 31,

FIXED ASSETS

	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>
				Estimated			
Gross Plant in Service	283,400	297,750	312,150	331,200	445,850	560,850	569,250
Less: Reserve for Depreciation	11,660	19,010	26,510	34,610	44,810	57,110	70,610
Net Plant	271,740	278,740	285,640	296,590	401,040	503,740	498,640
Work in Progress	3,450	33,350	93,500	159,950	55,100	8,300	3,350
Total Fixed Assets	275,190	312,090	379,140	456,540	456,140	512,040	501,990

CURRENT ASSETS

Cash	600	3,000	5,100	4,200	4,350	12,450	26,700
Other	1,640	1,640	1,640	1,640	1,640	1,640	1,640
Total Current Assets	2,240	4,640	6,740	5,840	5,990	14,090	28,340
Total Assets	277,430	316,730	385,880	462,380	502,130	526,130	530,330

LIABILITIES

Current Liabilities	3,140	2,690	2,690	2,690	10,940	10,940	10,940
Equity							
Preferred Stock	12,500	51,520 ^{1/}	51,520	51,520	51,520	51,520	51,520
Common Stock	12,500	51,520 ^{1/}	51,520	51,520	51,520	51,520	51,520
Legal Reserve	400	1,750	3,100	4,600	6,400	8,650	11,050
Interest on Equity During Construction	90	-	-	-	-	-	-
Unappropriated Surplus	(20)	8,080	20,830	33,580	40,480	54,280	64,330
Revaluation Reserve	77,950	-	-	-	-	-	-
Amortization Reserve	8,750	8,750	8,750	8,750	8,750	8,750	8,750
Total Equity	112,170	121,620	135,720	149,970	158,670	174,720	187,170
Long-term Debt							
IBRD Loan	106,470	103,320	99,870	96,270	92,520	88,470	84,270
AID Loan	-	7,050	22,650	26,400	25,500	24,450	23,400
Existing BNDE Loans	55,650	52,350	48,900	45,450	41,850	38,250	34,650
Proposed BNDE Loan Furnas Transmission	-	7,950	25,350	29,850	29,100	28,350	27,450
Proposed BNDE Loan Estreito 1st Stage	-	4,500	9,000	16,500	16,050	15,600	15,150
Proposed IBRD Loan Estreito 1st Stage	-	17,250	35,400	60,750	78,150	85,650	85,650
Proposed BNDE Loan Estreito 2nd Stage	-	-	-	10,500	14,250	15,000	14,700
Future Foreign Exchange Loan Estreito 2nd Stage	-	-	6,300	24,000	35,100	44,700	46,950
Total Long-term Debt	162,120	192,420	247,470	309,720	332,520	340,470	332,220
Total Liabilities	277,430	316,730	385,880	462,380	502,130	526,130	530,330
Debt/Equity ratio	59/41	61/39	65/35	67/33	68/32	66/34	64/36

^{1/} Assumption that Stock will be issued for Interest on Equity and Revaluation Reserve

December 31, 1964

ANNEX 4
Page 18, para. 59.

BRAZILCOST ESTIMATES OF ITEMS TO BE FINANCED BY THE PROPOSED LOAN

In planning the probable utilization of loan funds, the following estimates of disbursements have been proposed:

	Local Cost (millions	Foreign Cost of U.S. Dollars	Total
	<u>(millions of U.S. Dollars)</u>		
Turbines, generators and accessory equipment	2.2	13.3	15.5 ✓
Penstocks, gates, valves and related equipment	4.0	3.1	7.1 ✓
Transmission equipment	-	6.3	6.3 ✓
Substation equipment	-	4.8	4.8 ✓
Engineering, Supervision, and Training	-	1.4	1.4 ✓
Contingencies	3.8	2.6	6.4 ✓
Sub-Total	10.0	31.5	41.5
Construction and spare parts equipment	1.5	5.0	6.5 ✓
Total construction expenditures	11.5	36.5	48.0
Interest during construction	-	-	9.0 ✓
Total Proposed Loan			<u>57.0</u>

BRAZIL

CENTRAL ELETRICA DE FURNAS S.A.

Income Statements 1965 - 1970

(in millions of Cruzeiros)

Exchange rate Cr.\$1,500 = U.S.\$1

Based on Remunerable Investment Rate of Return of 10%^{1/}

<u>Year Ending December 31</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>
			Estimated			
KWH Sales (in billions)	3.9	4.5	4.5	5.0	7.6	7.7
Average per KWH (cruzeiros)	13.13	11.28	12.97	15.34	11.76	11.69
Gross Operating Income	51,190	50,770	58,380	76,680	89,370	90,010
<u>Cost of Operations:</u>						
Operating Expenses	2,250	2,400	2,700	3,450	3,600	3,750
* Depreciation Expense 5%	11,910	12,490	13,250	18,440	22,430	22,770
* Amortization Quota 3%	8,930	9,370	9,940	14,580	16,820	17,080
Taxes	6,710	2,650	1,250	4,020	4,650	4,640
Total Operating Expenses	29,800	26,910	29,140	40,490	47,500	48,240
* Net Operating Income	21,390	23,860	29,240	36,190	41,870	41,770
<u>Income Deductions:</u>						
Interest Expense	11,100	10,950	11,550	15,900	15,000	21,750
Net Profit	10,290	12,910	17,690	20,290	26,870	20,020
Allocated to:						
Legal Reserve	1,400	1,320	1,620	2,010	2,320	2,320
Dividends	8,250	8,250	8,250	8,250	8,250	8,250
Surplus Unappropriated	640	3,330	7,820	10,030	16,300	9,450
Rate of Return on Remunerable Investment before Income Taxes	10%	10%	10%	10%	10%	10%





Comparison of Cash Position based on the Two Methods of Computing Rate of Return

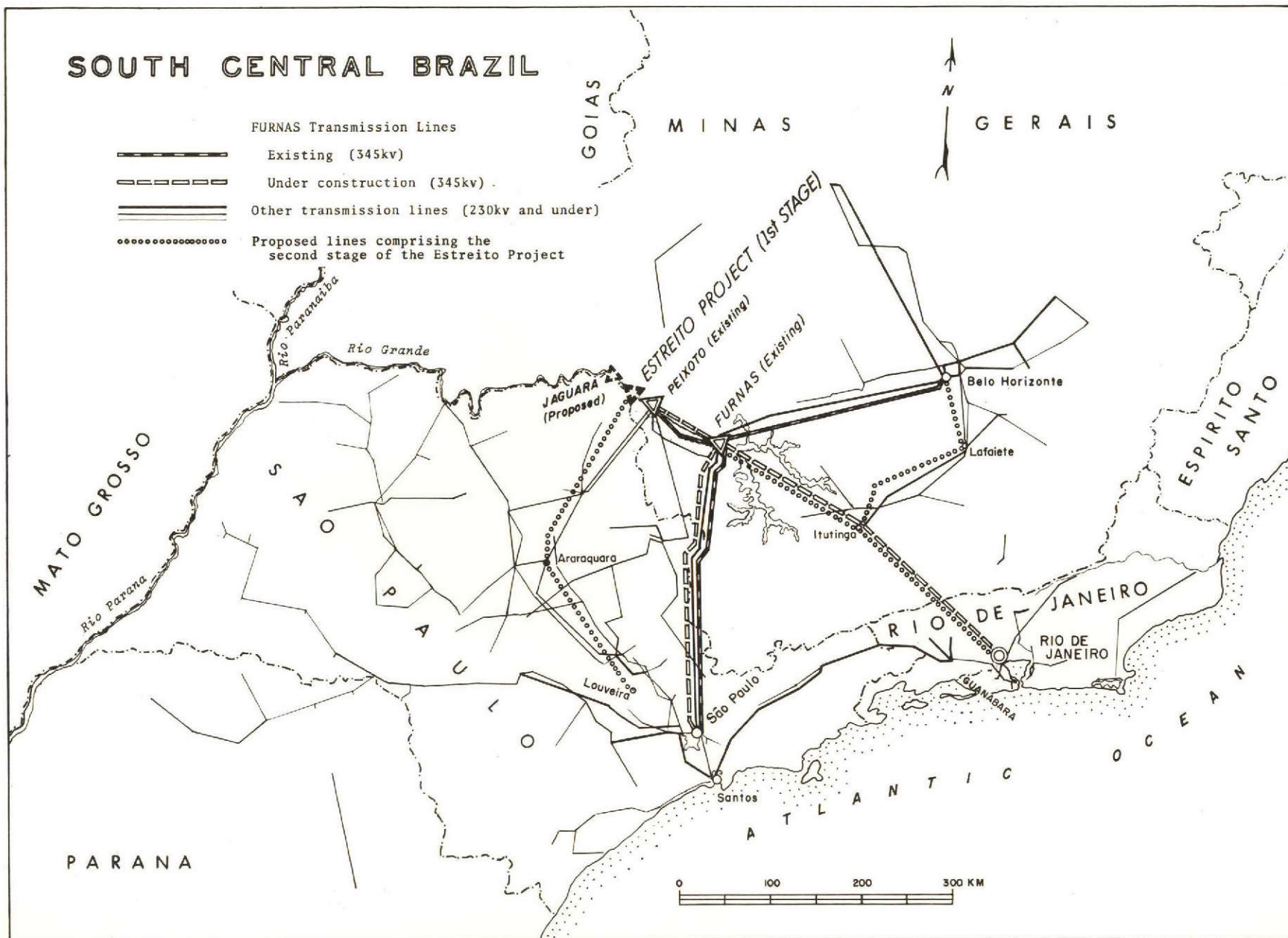
<u>Comparison of Cash Position based on the Two Methods of Computing Rate of Return</u>							<u>Total</u>
Line 3 of Annex 2 Internal Cash Generation based on standard depreciation of 2-1/2%	27,900	32,550	33,900	43,050	51,600	55,950	244,950
* Internal cash generation lines 5,6 and 9 above	42,230	45,720	52,430	69,210	81,120	81,620	372,330
Additional Cash Available	14,330	13,170	18,530	26,160	29,520	25,670	127,360
Dividends could be payable in 1966 thru 1968 inclusive	-	8,250	8,250	8,250	-	-	24,750
Additional cash available for plant investment	14,330	4,920	10,280	17,910	29,520	25,670	102,630
Accumulative	-	19,250	29,530	47,440	76,960	102,630	

^{1/} See paragraph 33 of the report.

SOUTH CENTRAL BRAZIL

FURNAS Transmission Lines

-  Existing (345kv)
-  Under construction (345kv)
-  Other transmission lines (230kv and under)
-  Proposed lines comprising the second stage of the Estreito Project



#565
DECLASSIFIED

MAR 07 2023

WBG ARCHIVES

RESTRICTED

Report No. TO-682a

This report was prepared for use within the Bank and its affiliated organizations. They do not accept responsibility for its accuracy or completeness. The report may not be published nor may it be quoted as representing their views.

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT
INTERNATIONAL DEVELOPMENT ASSOCIATION

APPRAISAL OF THE
PORTO COLOMBIA HYDROELECTRIC PROJECT
OF CENTRAL ELETRICA DE FURNAS S.A.
BRAZIL

September 20, 1968

Projects Department

CURRENCY EQUIVALENTS

US\$1	=	New Cruzeiro \$ (NCr\$) 3.22
NCr\$1	=	US\$0.311
NCr\$1 million	=	US\$310,559

WEIGHTS AND MEASURES

One meter (m)	=	3.28 feet
One kilometer (km)	=	0.6214 mile
One cubic meter (m ³)	=	35.31 cubic feet

Furnas Financial Year Calendar Year

COMPANY NAMES AND ABBREVIATIONS

Eletrobras	-	Centrais Eletricas Brasileiras S.A.
Cemig	-	Centrais Eletricas de Minas Gerais S.A.
Light S.A.	-	Servicos de Eletricidade S.A.
CESP	-	Centrais Eletricas de Sao Paulo S.A.
CPFL	-	Cia Paulista de Force e Luz S.A.
CBEE	-	Cia. Brasileira de Energia Eletrica

BRAZIL

APPRAISAL OF THE PORTO COLOMBIA HYDROELECTRIC PROJECT

CENTRAL ELETRICA DE FURNAS S.A.

TABLE OF CONTENTS

	<u>Page No.</u>
SUMMARY	i
1. INTRODUCTION	1
2. THE BORROWER	2
The Facilities of the Borrower	3
3. SECTOR DEVELOPMENT	3
4. GENERATION EXPANSION PROGRAM	5
5. THE PROJECT	5
Porto Colombia Hydroelectric Station	5
Transmission	6
Estimated Cost	6
Engineering and Construction	8
6. PROCUREMENT AND DISBURSEMENT	8
7. JUSTIFICATION OF THE PROJECT	9
Load Growth - Furnas	9
System Capacity	11
Canabmbra Forecast	12
Internal Rate of Return	12
Alternative Sources of Capacity	13
8. TARIFFS	13
9. PAST OPERATIONS	14
10. PRESENT FINANCIAL POSITION	15
11. PROPOSED FINANCING PLAN	18
12. ESTIMATED FUTURE OPERATIONS	22
13. CONCLUSIONS	23

This report is based on the findings of Bank missions in February 1968 by Mr. D. King and in April/May 1968 by Messrs. D. King, M.J. Reis and F. Rydell.

LIST OF ANNEXES

1. Generation Facilities
2. Project Cost Estimate
3. Actual and Forecast Sales Demand
4. System Capacity and Demand
5. System Energy Capability and Energy Demand
6. Aggregate Capacity and Demand - Furnas and Cemig
7. Aggregate Energy Capability and Energy Demand - Furnas and Cemig
8. Internal Rate of Return
9. Tariffs
10. Actual and Estimated Income Statements, 1965-1975
11. Actual and Estimated Balance Sheets, 1965-1975
12. Schedule of Long-Term Debt, 1965-1975
13. Estimated Source and Application of Funds Statement, 1968-1975
14. Construction Expenditures Excluding Interest During Construction 1968-1975
15. Interest Schedule, 1968-1975
16. Amortization Schedule, 1968-1975

MAP

Brazil High Voltage Transmission System - South-Central Region

BRAZIL

APPRAISAL OF THE PORTO COLOMBIA HYDROELECTRIC PROJECT

CENTRAL ELETRICA DE FURNAS S.A.

SUMMARY

i. This report covers the appraisal of a project of Central Eletrica de Furnas, S.A. (Furnas) consisting of the construction of the 360 Mw Porto Colombia hydroelectric plant and associated transmission in the south-central region of Brazil. The project is estimated to cost a total of US\$69.8 million equivalent and the proposed Bank loan would amount to US\$22.3 million equivalent. The project represents a part of the overall expansion program of Furnas, the total of which is estimated at US\$380 million during the project construction period 1969-1974 inclusive.

ii. The Borrower would be Furnas, an autonomous electric utility company principally owned by the Federal Government. Two previous loans No. 211 BR for US\$73 million in 1958 for the construction of the Furnas hydroelectric station and transmission and No. 403-474 BR for US\$96 million, which was made in two tranches in 1965 and 1966 for the Estreito hydroelectric project, have been made to Furnas. Experience with the two loans has been satisfactory.

iii. The project is technically sound, the estimated cost is reasonable and the arrangements for engineering, procurement and construction are satisfactory. The facilities to be provided are necessary to enable Furnas to meet the expected demands for power. The financing arrangements are satisfactory.

iv. Furnas would be a suitable borrower. Since its inception in 1957 it has operated its organization and properties efficiently and has made good progress in developing its staff and methods.

v. The project would be suitable for a Bank loan of US\$22.3 million equivalent for 25 years including a grace period of six and one half years.

BRAZIL

APPRAISAL OF THE PORTO COLOMBIA HYDROELECTRIC PROJECT

CENTRAL ELETRICA DE FURNAS S.A.

1. INTRODUCTION

1.01 Central Eletrica de Furnas S.A. (Furnas), a corporation owned principally by the Federal Government, has asked the Bank for a loan of US\$22.3 million equivalent to cover the foreign exchange cost of a project with a total cost of US\$69.8 million equivalent. The project would form part of the Furnas development program over the period 1969-1974 inclusive which is estimated to cost a total of US\$380 million equivalent.

1.02 The project would consist of the construction of the 360 Mw Porto Colombia hydroelectric project and associated 345 kv and 138 kv transmission facilities. This would be the third loan to Furnas. The first, No. 211 BR in 1958 for US\$73 million financed the construction of the Furnas hydroelectric station which is operating satisfactorily. The second, No. 403-474 BR, which was made in two tranches in 1965 and 1966 financed the construction of the Estreito hydroelectric station which is to be placed in service in 1969.

1.03 The proposed project, and those previously financed, were studied by Canambra, a consortium of three consulting firms, under a United Nations Special Fund grant for which the Bank acted as Executing Agency, which had as its objective the determination of a long range expansion program for development of the electricity facilities in the south-central region of Brazil.

1.04 The proposed loan to Furnas is one of two companion loans for electric utility development, the second of which is proposed for Centrais Eletricas de Minas Gerais S.A. (Cemig) to finance the 400 Mw Volta Grande hydroelectric project and transmission. Both projects are located on the Rio Grande River and their output would be delivered to the interconnected 345 kv transmission system to supply the south-central region. Because of the closely linked nature of the two projects they are considered jointly in this report where appropriate.

1.05 This report is based on the findings of Bank missions in February 1968 by Mr. D. King and in April/May 1968 by Messrs. D. King, M. J. Reis and F. Rydell.

1.06 Subsequent to the preparation of this report, the official exchange rate was changed on August 27, 1968 to NCr\$3.65 to US\$1 from NCr\$3.22 to US\$1. Since this does not substantially affect the overall financial situation and plan of Furnas in view of the provisions of Brazilian law regarding tariffs as described herein (Annex 9), the financial statements have not been recast. Delay in the preparation of this report has thereby been avoided.

2. THE BORROWER

2.01 The Borrower would be Furnas, an autonomous Government corporation established in 1957, and a subsidiary of Centrais Eletricas Brasileiras S.A. (Eletrobras), a Federal Government limited liability company created in 1961 to implement Federal Government policy in the electric power sector. Eletrobras is a holding company which controls the operation of the federal utilities, administers public funds to expand the federal power systems, assists with the expansion of other electric utilities in need of financing and helps in the financing of power facilities in the less developed areas of Brazil. Furnas is the largest of the federally owned utilities under the control of Eletrobras.

2.02 As of December 31, 1967, total share capital of Furnas was NCr\$300 million divided as follows:

<u>Shareholder</u>	<u>Ordinary</u> <u>%</u>	<u>Preferred</u> <u>%</u>
Centrais Eletricas Brasileiras S.A. ELETROBRAS	96.12	92.88
Centrais Eletricas de Minas Gerais S.A. CEMIG	1.72	1.72
Departamento de Aguas e Energia Eletrica do Estado de Sao Paulo - DAEE	2.16	2.68
Light - Servicos de Eletricidade S.A.	-	1.86
Cia. Paulista de Forca e Luz S.A. - CPFL	-	0.23
Centrais Eletricas de Sao Paulo S.A. - CESP	-	0.63
TOTAL	100.00	100.00
Total Number of Shares	150,000,000	150,000,000

2.03 Furnas is administered by a council of administration of 12 members, six of whom are Directors appointed from within the organization and six Councillors appointed from Government and business circles. The Directors are the President, Vice President-Technical, Vice President-Financial, and heads of the Administration, Operation and Planning, and the Contracts and Tariffs Departments. The Technical Department comprises 830 personnel, 700 of whom are engaged in construction, and the remainder in engineering and supervision. Operations and Planning has 1,100 personnel, including a planning group of ten engineers with responsibility for plant and system operation and maintenance. The Finance Department has a staff of 120 dealing with finance, accounts and internal auditing. The Contract Group numbers 90 and the Administration Group 400 making a total of approximately 2,600 personnel.

2.04 The organization has developed well. Furnas engineers are sent to the United States for post graduate studies at universities and additional training with major utility systems and manufacturing companies. Financial training is also obtained abroad. Operators and maintenance men are trained in Brazil in a technical school operated on a permanent basis by Furnas. Provision is included in the proposed loan for additional training.

2.05 For the design and construction of major projects Furnas employs consulting engineers and hires contractors. With this help and with the development of its staff through experience and training Furnas has been able to administer the large construction program which is underway and to satisfactorily conduct its operations. The organization of Furnas is satisfactory and given the scope of activities the number of personnel it employs is reasonable.

*Industrial
terminal
building*

The Facilities of the Borrower

2.06 As the federal entity, as distinct from state entities, entrusted with generation of power in the south-central region, Furnas has large generating and transmission facilities. Annex 1 lists existing generating stations and those under construction or planned. Present generating capacity is 1,310 Mw. On completion of the generating stations under construction, and of the facility planned for construction under the proposed loan, the total capacity would be increased to 3,330 Mw in 1974.

2.07 The transmission system of Furnas is shown on the map. In operation and under construction is a total of 2,500 km of 345 kv transmission line circuit.

2.08 All power generated by Furnas is sold on a bulk power basis to other utilities for resale to the ultimate consumers. The utilities which purchase Furnas power are listed in Annex 3. They are located within the south-central region, in the States of Guanabara, Sao Paulo, Minas Gerais, Rio de Janeiro, and Espirito Santo, in which also operate three other important utilities, Centrais Eletricas de Sao Paulo (CESP), Cemig, and the Brazilian Power Company subsidiary Light S.A. - Servicos de Eletricidade. In 1967 Furnas energy sales amounted to about 5.5 billion kwh and the demand was over 900 Mw. Total energy sales for that year in the south-central region exceeded 18 billion kwh.

3. SECTOR DEVELOPMENT

3.01 Coordination of the operation and development of electric power facilities in the south-central region, which represents two-thirds of the country's total market, has evolved to the point where the responsibilities of individual companies are fairly well defined. This coordination has been achieved gradually during the past four years, the urging of international lending agencies having been an important factor in this connection. In the State of Sao Paulo which provides the major market, CESP, the state owned utility, now supplies a portion of the market but has underway a very large construction program which will enable it eventually to supply virtually all of the State's future increase in demand. Cemig, also a state owned company, is responsible for the supply of the State of Minas Gerais, another important market area. The city of Rio de Janeiro in the State of Guanabara is supplied by Light S.A. Furnas supplies the generation requirements of the south-central region to the extent they are not provided by the above three main utilities.

Furnas has negotiated contracts, details of which are contained in Annex 3, with the utilities to which it supplies bulk power including Cemig. In addition, CESP has made a contract arrangement with Light S.A. for the supply in future of the city of Sao Paulo.

3.02 The Canambra study established a long-term plan of development and provided a priority list of power development sites based on the unit cost of each development. The main entities concerned, Furnas, CESP and Cemig -- representing the Federal Government and two of the most important states -- have generally followed this priority list in planning their respective expansion programs and the lending agencies which have assisted the development program in the south-central region have used the priority list in orienting their assistance.

3.03 Development of the high voltage transmission system was planned along broad lines in the Canambra report and Furnas and Cemig have made a review in connection with the proposed loans. The major companies in the south-central region have organized a system interconnection committee, the purpose of which is to establish procedures leading to the most efficient operation of the combined systems, collaboration in the release of equipment for maintenance, particularly generating facilities, arrangements for mutual assistance in the event of emergencies, load and frequency control, and coordination of system protection.

3.04 As the south-central power facilities have grown coordination of the planning and operations of the main utilities therein has grown commensurately. This has been essential. While much has been done it will be of prime importance to continue the effort and translate it into operating efficiency as new facilities come in operation.

3.05 Most important has been the development of the distribution systems which ultimately use the power from the new generation facilities. The Bank and other lending agencies are playing an important role in this connection. The Bank financed the rehabilitation and expansion of four of the major distribution systems in the south-central and adjoining regions under Loans 475-478 BR, in December 1966, totalling US\$61.6 million. The work covered systems in the cities of Belo Horizonte and Niteroi and of CPFL, Paulista, in the south-central region. This work should be completed about 1970. AID has financed the rehabilitation and expansion of the distribution systems in the cities of Rio de Janeiro and Sao Paulo in an aggregate amount exceeding US\$40 million. This program is to be completed in 1969 and Light S.A. is seeking financial assistance for further expansion of its distribution facilities.

3.06 Cemig is undertaking a major expansion of the distribution system in the State of Minas Gerais. The State of Sao Paulo and CESP are responsible for distribution in the areas in that state which are not under concession to Light S.A. and CPFL. In general, therefore, there is reasonably adequate provision for the expansion of distribution facilities, but it will be essential to maintain progress in the 1970's so as to keep pace with load growth and fully utilize the new generating facilities being provided.

*Limit
financial
building*

4. GENERATION EXPANSION PROGRAM

4.01 In addition to the proposed project Annex 1 lists generating capacity presently under construction or planned and includes Marimondo, 1,200 Mw capacity, which is in the early planning stages and tentatively scheduled for operation in 1975. To meet this date a start would be necessary in 1970. Further studies are to be made by Furnas to determine the timing of this project.

4.02 Furnas is considering the possibility of installing the remaining two 150 Mw units, Nos. 7 and 8, at the Furnas hydroelectric plant to offset possible delay to Ilha Solteira (paragraph 7.11); a decision may be reached in 1969 to enable the units to be brought into operation in 1974 should this be necessary. Assurances have been received that during the construction period, 1969-1974, Furnas would not undertake any additional major projects other than Porto Colombia and those already under construction as listed in Annex 1, without the approval of the Bank. A similar condition is contained in Loan 403-474 BR. (idiot!)

5. THE PROJECT

5.01 The project proposed for Bank financing represents about 18% of the expansion program of Furnas which during 1969-1974 includes the construction of about two million kilowatts of new capacity as listed in Annex 1. It would consist of the construction of the Porto Colombia hydroelectric station with a capacity of 360 Mw, the construction of a 345 kv transmission line between Porto Colombia and the present terminus of the Furnas system at Estreito and 138 kv transmission facilities between Porto Colombia and Barretos, where they will connect to the Paulista system, and associated 345 kv and 138 kv substation facilities.

Porto Colombia Hydroelectric Station

5.02 The Porto Colombia hydroelectric station would be located on the Rio Grande River nine km upstream from its junction with the Pardo River and approximately 500 km from Sao Paulo, as shown on the map. It would be downstream from the Furnas and Estreito hydroelectric stations. A drainage area of 78,000 sq. km, of which the run-off from 52,000 sq. km are regulated by the Furnas station storage reservoir, would supply water to Porto Colombia. The hydrology of the Rio Grande River was studied in detail by Canabira and the geology of the Porto Colombia site was investigated during the Canabira feasibility studies of potential hydroelectric sites.

5.03 Porto Colombia would be equipped with 4-90 Mw units.^{1/} The plant factor would be 45% providing an annual firm energy capacity of 1.38 billion kwh based on driest season conditions as experienced in the serious drought period of 1953/1956. The station would operate at a head of 21.3 meters utilizing Kaplan type turbines suitable for comparatively low head operation.

^{1/} During the detailed design phase of the project the possibility of substituting a smaller number of machines, that is, 3-120 Mw, to yield the same total capacity will be considered.

5.04 The main feature of the civil works would be the earth-fill dam 25 meters high with a crest length of 1,200 meters and a volume of 4,300,000 cubic meters. Total concrete content of the project would be about 240,000 cubic meters, of which the power station would account for about one-third. The powerhouse would be of the aboveground enclosed type. No major construction problems are anticipated.

Transmission

5.05 The output of the proposed Porto Colombia power station would be delivered to the interconnected system over the new 345 kv and 138 kv transmission lines. The single circuit 345 kv steel tower transmission line between Porto Colombia and Estreito, 150 km in length, would be equipped with twin conductors similar to existing 345 kv circuits. The 138 kv steel tower transmission line 60 km long, from Porto Colombia to Barretos would be double circuit. Power would be transformed from the 13.8 kv generator voltage to 138 kv at Porto Colombia by 133 Mva generator transformers. It would be transmitted directly over the new 138 kv lines to the CPFL system at Barretos and by means of a 150 Mva, 138 kv/345 kv transformer at Porto Colombia, over the new 345 kv line to Estreito.

Estimated Cost

5.06 The estimated cost of the project is given in Annex 2 and is summarized below:

ESTIMATED COST OF PROJECT

	<u>Local</u> <u>Financing</u>	<u>Bank</u> <u>Financing</u>	<u>Total</u>	<u>Local</u> <u>Financing</u>	<u>Bank</u> <u>Financing</u>	<u>Total</u>
	<u>Expressed in</u> Millions of NCr			<u>Expressed in</u> Millions of US\$		
<u>Porto Colombia Station</u>						
Civil Works	93.5	6.9	100.4	29.0	2.2 ^{1/}	31.2
Elect. & Mech. Equipment	10.0	48.3	58.3	3.1	15.0	18.1
Miscellaneous	15.7	-	15.7	4.9	-	4.9
Engineering & Other						
Services	2.8	2.1	4.9	0.9	0.6	1.5
Contingencies	24.2	-	24.2	7.5	-	7.5
Interest	38.7	11.9	50.6			
Subtotal 80%	146.2	57.3	203.5	45.4	17.8	63.2
			254.1			
<u>Transmission</u>						
Structures & Equipment	0.6	14.0	14.6	0.2	4.3	4.5
Construction & Materials	3.0	-	3.0	1.0	-	1.0
Miscellaneous	0.8	0.5	1.3	0.2	0.2	0.4
Engineering	0.3	-	0.3	0.1	-	0.1
Contingencies	2.1	-	2.1	0.6	-	0.6
Interest	1.8	3.0	4.8			
Subtotal 10%	6.8	14.5	21.3	2.1	4.5	6.6
	8.6	17.5	26.1			
TOTAL	153.0	71.8	224.8	47.5	22.3	69.8
<u>Interest During Con-</u>						
<u>struction</u>	<u>40.5</u>	<u>14.9</u>	<u>55.4</u>	<u>12.5</u>	<u>4.6</u>	<u>17.1</u>
GRAND TOTAL	<u>193.5</u>	<u>86.7</u>	<u>280.2</u>	<u>60.0</u>	<u>26.9</u>	<u>86.9</u>

The total cost of the project would be US\$86.9 million equivalent including interest during construction of US\$17.1 million equivalent. The proposed loan of US\$22.3 million equivalent is the estimated cost of equipment to be purchased after international competitive bidding, including contracts won by Brazilian suppliers (paragraphs 6.01, 6.02), exclusive of interest during construction. The proposed loan would represent 26% of the total estimated cost of the project including interest during construction and five per cent of the total construction expenditures planned by Furnas during the 1969-1974 construction period. No reimbursement would be made for expenditures incurred prior to the signing of the proposed loan.

^{1/} Gates and similar equipment which would not be included in the civil works contract and which would be bid upon separately.

5.07 The unit cost of Porto Colombia would be US\$175 per kw, excluding transmission and interest during construction, which places it in the category of low cost hydro. The cost estimate is based on the feasibility study made by Canambra updated by Furnas engineering staff and its consultants. Contingency allowances of 15% for the civil works and other local financing costs and ten per cent for equipment and other Bank financed costs have been included.

5.08 Experience with recent power loans in Brazil has been that the Bank financed portions of the projects were somewhat overestimated, in part due to provision in the estimates for the additional cost of orders which might be awarded Brazilian manufacturers under the 15% preference formula (paragraphs 6.01, 6.02). As it is likely, on the basis of experience, that substantially less than half of the equipment orders would be awarded to Brazilian suppliers, the equipment costs estimated contain in effect built-in contingency amounts. In view of this, and since the proposed loan would not finance civil construction, which is usually the most important source of cost overrun on hydroelectric projects, the loan does not include in it an amount for contingencies. In the cost estimate, paragraph 5.06 and Annex 2, contingency amounts are therefore shown as local financing items.

*In brief,
Bank
financed
part
does not
include
contingencies.*

Engineering and Construction

5.09 The feasibility study made by Canambra provided the necessary information for planning and financing purposes. Detailed design of the hydroelectric station would be carried out by Furnas' consultants, International Engineering Co. of San Francisco and its Brazilian associates, Companhia Internacional de Engenharia e Construcoes. The civil works would be undertaken by a Brazilian contractor of adequate experience chosen on the basis of competitive bidding. As in the case of the Estreito project separate contractors would be employed to erect the penstock and gates and Furnas would construct the powerhouse superstructure. These arrangements are satisfactory. The provisions contained in Loan 403-474 BR requiring the employment of consultants and contractors satisfactory to the Bank would be repeated in the proposed agreement.

5.10 Engineering and design of the project would commence toward the end of 1968. Tenders for major equipment would be called and the main construction contracts awarded during 1969. Construction would begin in the latter part of 1969 with completion of the first generator scheduled for mid-1973 and of the whole plant for the spring of 1974. The construction period is reasonable for a project of this size.

6. PROCUREMENT AND DISBURSEMENT

6.01 Procurement of the goods and equipment financed under the loan would be on the basis of international competitive bidding except in the case of certain minor items for which such bidding would be impractical. As in the previous case of power loans in Brazil, Brazilian suppliers would be eligible to compete in the bidding with the advantage of a 15% preference.

6.02 The method of comparing foreign and domestic bids to be procured under the loan would be as agreed between the Government and Bank in connection with the previous power loans and which is quoted in part as follows:

"The borrower intends to invite firms producing goods in Brazil to participate in the international competitive bidding. In the case of goods produced in Brazil the borrower may award the order to the lowest Brazilian bidder offering satisfactory terms and conditions provided that his offered price does not exceed the offered price of the lowest acceptable foreign bidder by more than 15%. Comparison of bids will be made without taking into account customs or other similar duties. For firms in Brazil the delivery price will comprise the f.o.b. plant cost plus freight, insurance and other delivery costs to the site. For non-Brazilian firms the delivery price will be based on the c.i.f. landed costs, port of entry, before customs duties plus inland freight, insurance and other delivery costs to the site. As the 15% preference allowed firms in Brazil is in lieu of customs duties the 15% will be added to the c.i.f. landed cost (excluding customs duties) of the non-Brazilian goods before inland freight, insurance and other costs. In the case of bids composed of both cruzeiros and foreign currency the cruzeiro portion thereof will be dealt with as a Brazilian bid and the foreign exchange portion as a non-Brazilian bid.

For comparison purposes all bids after evaluation will be converted into cruzeiros at the bid comparison rate of exchange. The bid comparison rate of exchange is understood to be the dollar selling rate of the Banco Central de Republica do Brazil plus the exchange surtax^{1/} (but not to exceed 30%) if any prevailing on the date 30 days prior to the date on which bids are closed. It is further understood that the Bank will on its own initiative or at the request of the borrower or guarantor reconsider and if necessary revise the bid comparison rate of exchange whenever there should be a substantial change in the Brazilian exchange system which would in the judgment of the Bank render such rates unsuitable for bid comparison purposes.

The guarantor will take all such measures as shall be necessary in order to facilitate the importation of goods purchased outside Brazil in accordance with the provisions hereof and of the loan agreement."

7. JUSTIFICATION OF THE PROJECT

Load Growth - Furnas

7.01 Annex 3 gives the actual and forecast sales demand for the period 1965-75. Past sales have been predominantly to Light S.A. for supply to the city of Sao Paulo. Commencing in 1968, sales will be made to a number of

1/ The exchange surtax was discontinued in 1965.

other utilities, the largest of which are Light S.A. (Sao Paulo), Light S.A. (Rio), Cemig and CPFL, in accordance with the arrangements for the supply of the south-central region which have been agreed by the Federal Government, the respective State Governments and the companies involved.

7.02 As noted in Annex 3, page 1, Furnas' commitments for 1968 and for the subsequent years are covered by power contracts with each of the utilities. The contracts are on conventional lines. They provide for the amount of demand in each year, with energy to be normally supplied at 60% load factor or at a higher load factor with the agreement of Furnas if additional energy is available, and stipulate that the contract year is from April 1 to March 31. The contracts stipulate that tariffs will be determined on the basis of the applicable tariff regulations administered by the responsible Federal Government agency.

7.03 Since Furnas has committed itself to the power contracts it must provide adequate capacity to supply them and this is the basis for its proposed expansion program. The demand and energy requirement of each contract are predicated on the load growth prospects of the respective utilities and their requirements for purchased power. A review of the individual situations indicates that the contract amounts stipulated are reasonable.

7.04 In the case of the Light S.A. (Sao Paulo) Furnas undertakes to supply a moderate annual increase until 1970 after which Furnas sales to Sao Paulo would not be increased. CESP, the state owned utility, will bring into service its 1,200 Mw Jupia hydroelectric plant in the period and will supply all increases in the Sao Paulo demand after 1970. In 1967 the energy demand of Light S.A. in the city of Sao Paulo was 9.3 billion kwh and the maximum demand was about 1.8 million kw.

7.05 In the case of Furnas' second largest consumer, Light S.A. supplying the city of Rio de Janeiro, substantial supplies of energy were only initiated in 1967; prior to this the company's own facilities were sufficient. Furnas will supply the entire load growth of Rio in the future as it is the policy of the Federal Government that Light S.A. should not build any new generating stations. In 1967 the demand of Light S.A. in Rio was approximately 4 billion kwh and about 900 Mw. The Furnas contract for Rio de Janeiro and Sao Paulo, together with the CESP contract for the supply of Sao Paulo, provide for a load growth of about nine per cent annually for the two cities which is reasonable given the concentration of industry and population in them.

7.06 When the Furnas hydroelectric station with a capacity of 900 Mw was built, it was agreed that Cemig would have a right to half the total capacity or 450 Mw. Cemig has not exercised its rights to a significant extent to date but in 1968 it will begin to purchase large blocks of Furnas power, reaching its full 50% share by 1975. As considered in detail in the companion appraisal report concerning the proposed loan to Cemig for a new hydroelectric station, the overall expansion program of Cemig is justified and the amounts and timing of the purchases from Furnas appropriate.

Black-out
outages
?!&

7.07 The remaining two largest companies to which Furnas will sell power, CPFL and CBEE are distribution subsidiaries of Eletrobras. Both companies are in the process of substantially expanding and rehabilitating their distribution systems with the assistance of Loan 475-BR in the city of Niteroi and environs, and Loan 477-BR in the CPFL service area covering much of the State of Sao Paulo. A marked increase in demand is expected as the rehabilitation and expansion program progresses since load growth has been severely curtailed by inadequate distribution facilities in the past. The average annual growth rates of the CPFL and CBEE systems are forecast at nine per cent and eight per cent respectively, which would be adequate to absorb the power which Furnas has contracted to supply.

System Capacity

7.08 Annex 1 sets forth a tabulation of existing and planned capacity and Annexes 4 and 5 show in chart form the relationship between system capacity and demand for both the peak and energy requirements. The latter indicate that with the planned expansion program the capacity of the Furnas system with respect to both peak capacity and energy would keep pace with the demand. In the case of energy production the effect of very dry years is taken into consideration and output of the hydroelectric plants and their energy capability is based on the experience in dry years, particularly 1953-56, and for peak capacity, allowance has been made for equipment maintenance and spinning reserve.

7.09 As noted in paragraph 1.04, Furnas and Cemig transport power over 345 kv systems which are fully integrated and supply about 60% of the south-central market. A shortage of capacity experienced by either of these two systems would in practice be compensated for by spare capacity, if available, on the other system. A shortage of capacity in the balance of the south-central systems, particularly the area served by CESP in the State of Sao Paulo, would be made up by any spare capacity available from the combined Furnas-Cemig systems. Annexes 6 and 7 show the total firm capacity and demand of the combined Furnas-Cemig systems.

7.10 These charts show that the capacity and estimated demand of the combined systems are in approximate balance for most of the period to 1975. In 1974 on completion of the proposed project and the project proposed by Cemig, which together would provide 760 Mw, the combined demand would be approximately 4,000 Mw. The firm capacity reserve would be about 150 Mw representing about four per cent of the demand on the combined systems, and the firm energy reserve would be about 1 billion kwh or five per cent of the total energy requirement.

7.11 This firm reserve is modest for a system of this magnitude. It would barely provide for delay in commissioning to full capacity of the Furnas and/or Cemig projects, and in assisting the supply of the remainder of the south-central region in the event of delay to the scheduled start of operations in 1973/74 of the very large Ilha Solteira station of 1,700 Mw capacity which is under construction by CESP. The construction of hydroelectric projects has often been delayed in Brazil by physical, organizational,

and financial difficulties, and there is a possibility of delay to Ilha Solteira, given its very large magnitude. The Federal Government, in view of its predominant position in the power sector and its responsibility for the national economy, and Furnas consider that it may be advisable to bring into operation additional generating facilities by 1974 to safeguard against serious delay to Ilha Solteira, but will wait developments with regard to the progress of construction during the next year before reaching a decision.

7.12 From the standpoint of the combined Furnas-Cemig systems, the possibility of not attaining the demand indicated in Annexes 6 and 7 for 1974 is more than offset by the possibility of delay in commissioning of Porto Colombia, Volta Grande and particularly Ilha Solteira. If the projects are not brought in service as presently planned, there would be a reduction in the amount of load which could be carried on the interconnected south-central system. In the case of Furnas, failure to provide the planned capacity would necessitate an equivalent reduction in the amount of power committed under supply contracts. of Counsel

Canabmbra Forecast

7.13 The Canabmbra study concluded that load growth in the south-central region would develop at an annual rate of between nine per cent and 11% and accordingly it provided a high forecast at an 11% rate, a median forecast at ten per cent and a low forecast at nine per cent for planning purposes. On the basis of the region demand in 1967 and the lowest Canabmbra projection, nine per cent, the expansion program underway, including the proposed Bank projects, would just suffice to meet the 1974 demand when the proposed projects are completed.

7.14 The possibility of this rate of growth being achieved is supported by the Bank's 1968 Brazil Economic Mission which considered that the Gross Domestic Product (GDP) of Brazil could likely increase at an annual rate of approximately five and one half per cent between 1968 and 1970 and six per cent in the following decade. Past experience in Brazil shows that the annual increase in power demand in the south-central region is between one and one half and two times that of the annual increase in GDP and on this basis the annual increase in power demand should be at least nine per cent.

7.15 In view of the foregoing, the Furnas expansion program and the Porto Colombia project are justified on the basis of individual utility forecasts, Furnas contract commitments, the forecast of demand for the region, and in the context of economic growth estimates. Additionally the rate of return on the proposed project is adequate as noted in the following paragraph.

Internal Rate of Return

7.16 Under Brazil tariff regulations utilities are authorized to earn a ten per cent return on assets and are assured continuance of this return when a new asset is placed in service. This has the effect of producing an incremental rate of return in the order of ten per cent on new facilities.

Accurate analytical determination of the incremental return is limited by the fact that given the high rate of inflation experienced in Brazil the book value of assets does not necessarily reflect real cost which raises some question as to the tariff to be used in the calculation. Subject to this limitation, the calculation as described in Annex 8 indicates an incremental rate of return of 11.6% on the project. This is considered satisfactory since the economic rate of return would be expected to be substantially above the internal rate and thus would exceed the opportunity cost of capital in Brazil which for the Canambra report was estimated to be between eight and ten per cent. Moreover, in addition to the power rates charged by the utilities certain taxes are levied on the consumers for investment in the electric power sector (Annex 9).

7.17 In a broader sense, given the relationship between GDP and growth of the power sector (paragraph 7.14), failure to develop the sector to keep pace with expected GDP would result in some deterioration of the economy. This was evident during 1961-64 when political developments and the failure of the Government to allow adequate tariffs to be levied resulted in a virtual cessation of expansion of electric utility facilities leading to the inability of utilities to make an adequate supply of power available to new industry in the south-central region. Partly as a consequence of this, new industrial development was stagnant in the period.

Alternative Sources of Capacity

7.18 The proposed projects represent the most economic form in which additional generating capacity can be provided. Canambra made a study of alternative sources in which it was shown that the ideal alternative, mixed hydro-thermal development, in which minimum cost hydro peaking would be installed at existing stations to complement new thermal plant operated at high load factor to yield power at system load factor at minimum cost, would equalize Porto Colombia at a discount rate of approximately 11%. This is evidence of the low unit cost of Porto Colombia and the comparatively high cost of imported fuel oil, taxes excluded, in Brazil, amounting to US\$0.46 per million Btu and is characteristic of hydroelectric sites in the south-central region recommended for development by Canambra.

8. TARIFFS

8.01 In recent years many changes have occurred in Brazilian legislation relating to tariffs for the power sector. Such changes were brought about because of inflation in Brazil and the past inability of electric utilities to obtain a reasonable rate of return. Thus they were unable to generate a sufficient portion of funds necessary for normal expansion of facilities. A detailed description of the tariff regulations and other related subjects is included in Annex 9.

8.02 Under the present legislation, the system is working well. Most of the major power utilities have been achieving a reasonable rate of return. As a result they are generating funds which are being used for construction purposes and, with the assistance of additional funds from the Government and foreign loans, a broad expansion in the power sector is taking place which is necessary to meet the increasing demands for power.

8.03 Revaluation of assets (see Annex 9, paragraph 4), which reflects inflation, is now mandatory, but applications for tariff increases based on such revaluations remain voluntary. The Bank is protected by three provisions in the existing and proposed Loan and Guarantee Agreements as follows:

- (a) A requirement that Furnas will make applications for rate adjustments, based on revaluations, within five months after the end of every calendar year so that its rates will be sufficient to ensure operations in accordance with sound financial and public utility practice.
- (b) A requirement that the Government of Brazil shall cause agencies with jurisdiction over Furnas' rates to act on rate applications within a period of not more than 30 days after their receipt.
- (c) An event of suspension and cancellation in case the applicable legislation is changed materially and adversely affecting the Borrower's business.

8.04 During the years 1965 through 1968 Furnas promptly filed applications and promptly received authorizations for rate increases based on revalued assets. The rate structure of Furnas which sells power at wholesale is the same for each of its seven customers (Annex 3).

9. PAST OPERATIONS

9.01 Income statements for the three years 1965 through 1967 are shown in Annex 10. During this period kwh sales increased substantially from kwh 2,678 million in 1965 to kwh 4,374 million in 1967. Tariffs were increased each year following revaluation of assets. The average rate per kwh increased from NCr\$0.01758 in 1965 to NCr\$0.02788 in 1967, or an increase of about 59%.

9.02 Operating income of Furnas and the rate of return earned on remunerable investment as defined in Annex 9 (paragraph 2) for the three years were as follows:

<u>Year</u>	<u>Operating Income</u> <u>(thousand NCr\$)</u>	<u>Rate of</u> <u>Return</u>
1965	23,966	7.0%
1966	38,939	10.1
1967	59,019	9.2

9.03 Rates of return calculated in accordance with the test applied by the Bank under Loan 403-474 BR to ascertain whether any changes in legislation materially and adversely affect the financial position of Furnas, show returns of 11.8%, 14.9% and 14.3% for the years 1965, 1966 and 1967 respectively. The Bank's test is based on a minimum rate of return of ten per cent per annum calculated as the percentage of operating income (adjusted for straight-line depreciation at a two and one half per cent rate and excluding income taxes and amortization from cost of service) to the average of the revalued net fixed assets in operation at the beginning and end of the year. Net fixed assets at the beginning of the year are revalued on the basis of the coefficient applicable to the value of such assets at December 31 of the prior year, and net fixed assets in operation at the end of the year are revalued on the basis of the coefficient applicable to December 31 of the current year. The rate of return on remunerable investment calculated by Furnas is less than the return calculated under the Bank's test, primarily because it charged depreciation at five per cent, amortization at three per cent, and included income taxes as a cost of service.

9.04 Interest coverage, which was only 1.3 times in 1965, improved to 2.1 times in 1966 and 2.9 times in 1967 because of higher earnings resulting from increased sales at higher tariffs based on revalued assets.

10. PRESENT FINANCIAL POSITION

10.01 Furnas' financial statements have been audited since 1958 by the Brazilian branch of Arthur Andersen and Company, a United States firm of Certified Public Accountants. These arrangements have been satisfactory. In order to assure that adequate auditing continues in the future, a covenant similar to that contained in existing loans requiring Furnas to employ auditors acceptable to the Bank is included in the proposed Loan Agreement.

10.02 As provided in Schedule 2 of Loan Agreement 403-474 BR, Furnas contracted with Arthur Andersen and Company to reorganize the accounting department, train accounting personnel and supervise the installation of a computerized accounting system. This contract has been completed. All accounting, statistics, and budgeting by areas of responsibility have been computerized. In furtherance of its training program, Furnas intends to send some of its accounting trainees to the United States for advanced training and experience.

10.03 The financial position of Furnas as of December 1967 is shown in Annex 11. The following summary balance sheets, presented below, show the actual audited data and the effect of revaluing Furnas' accounts based on the latest published coefficient and a foreign exchange rate of NCr\$3.22 to US\$1.

Central Eletrica De Furnas S.A.
Summary Balance Sheet
December 31, 1967
(thousand NCr\$)

	<u>Actual</u> ^{1/}	<u>Revalued</u> ^{2/}
<u>ASSETS</u>		
<u>Fixed Assets</u>		
Fixed assets in operation	689,600	887,192
Less reserve for depreciation	62,138	67,420
Net fixed assets in operation	627,462	819,772
Work in progress	309,209	351,991
Total fixed assets	936,671	1,171,763
<u>Current Assets</u>	34,609	34,609
<u>Other Assets</u>	7,499	7,499
TOTAL ASSETS	<u>978,779</u>	<u>1,213,871</u>
<u>CAPITAL AND LIABILITIES</u>		
<u>Capital</u>		
Share capital	300,000	300,000
Surplus	11,146	11,146
Reserves:		
Legal reserve	3,972	3,972
Amortization reserve	46,686	52,205
Reserve for future capital increase	7,713	85,624
Other reserves	196	196
Total capital	369,713	453,143
<u>Long-Term Debt</u>	528,473	674,857
<u>Current Liabilities</u>	80,593 ^{3/}	85,871 ^{4/}
TOTAL CAPITAL AND LIABILITIES	<u>978,779</u>	<u>1,213,871</u>

^{1/} Actual audited balance sheet based on coefficient applicable to December 31, 1966 accounts and on a foreign exchange rate of NCr\$2.22 to US\$1.

^{2/} Revalued balance sheet based on coefficient applicable to December 31, 1967 accounts and on a foreign exchange rate of NCr\$3.22 to US\$1.

^{3/} Includes NCr\$12,902 long-term debt due within one year.

^{4/} Includes NCr\$18,180 long-term debt due within one year.

10.04 In February 1968 the Government issued the coefficient of 1.22 for revaluation purposes and Furnas revalued its assets accordingly in April 1968 and at the same time Furnas revalued its foreign loans on the basis of the exchange rate of NCr\$2.715 to US\$1 as of December 31, 1967.

10.05 The official foreign exchange rate of NCr\$3.22 to US\$1 (see Annex 9, paragraph 4) although published on December 28, 1967 was not effective until January 4, 1968. In order to show in this appraisal report a more realistic financial position as of December 31, 1967 the foreign loans were again revalued based on this exchange rate.

10.06 Total revalued fixed assets at December 31, 1967 amount to NCr\$1,172 million or about 95% of Furnas' total assets. The amount is more than double the total fixed assets at the end of 1966. This large increase consisted of three elements: (1) increase in construction work during the year; (2) revaluation of assets; and (3) acquisition of Companhia Hidreletrica do Vale do Paraiba's (Chevap) assets.

10.07 Chevap was granted a concession by Decree 50,798 dated June 16, 1961 for developing the hydroelectric potential of the Paraiba River including the Funil project, located at the boundary of the States of Rio de Janeiro and Sao Paulo. Additional concessions were granted to Chevap for the construction of the Santa Cruz thermal generation plant in the State of Guanabara in 1963 and for a transmission line from the Funil plant to the Sao Paulo Light system in 1965. However, on August 30, 1965, the Government rescinded these concessions and placed the properties under the control and ownership of Eletrobras. On March 10, 1967, the Government, by Decree 60,350, transferred the former Chevap concessions and assets from Eletrobras to Furnas. Complying with Section 5.11 of Loan Agreement 403-474 BR, Furnas obtained the Bank's consent to absorb the assets and obligations relating to the Chevap concessions.

10.08 Furnas' balance sheet at the end of any year usually reflects a weak current financial position. Actual balance sheets for the years ending in 1965 through 1967, see Annex 11, indicate current ratios of less than 0.50/1.00. Nevertheless Furnas has always been able to meet its current obligations. The working capital position at December 31 generally reflects the worst current position for any 12-month period because many of the current liabilities are not due for payment until six to twelve months later.

10.09 At December 31, 1967, Furnas' total equity was about NCr\$453.1 million, about 37% of the total assets. Included in the equity is about NCr\$85.6 million representing the reserve for future capital increase. This reserve, resulting from revaluation of accounts, will be converted into share capital in 1968 by the issue of additional stock.

10.10 Total debt is NCr\$693.0 million, classified as long-term debt of NCr\$674.8 million, and NCr\$18.2 million as long-term debt due within one year. A detailed schedule of individual loans is shown in Annex 12. Long-term debt at December 31, 1967, was about 59% of the total fixed assets.

This is well within the 66-2/3% debt limitation as provided in Section 5.16 of Loan Agreement 403-474 BR. A similar debt limitation covenant is included in the proposed Loan Agreement.

10.11 Included in long-term debt outstanding at December 31, 1967, is a US-AID loan to partially finance the Furnas/Guanabara Transmission Project including substations and equipment. A particular covenant in this Loan Agreement, number 512-L-023 dated October 2, 1964, is Section 6.3 subparagraph (i) which requires US-AID's prior approval before Furnas may incur any additional debt maturing in more than twelve months. This approval has been received.

11. PROPOSED FINANCING PLAN

11.01 A forecast of the source and application of funds for the eight-year period 1968 through 1975 as shown in Annex 13, and the plan for financing this expansion program over the period are summarized in the following table. As shown in this table total funds required for the eight-year period are estimated at about NCr\$1,976.0 million. Under the present expansion program, estimated construction expenditures excluding interest charged to construction amount to about NCr\$1,693.2 million, or about 86% of the total requirement of funds. The proposed Porto Colombia project is estimated to cost about NCr\$224.8 million or about 13% of the construction expenditures during this eight-year period. A detailed schedule showing the estimated foreign and local costs of the various projects included in the expansion program is shown in Annex 14. The remainder balance of the required funds consists of about NCr\$250.8 million for interest charged to construction and about NCr\$32.0 million for increases in working capital.

Central Eletrica De Furnas S.A.

Summary of Source and Application of Funds Statement

For the Years 1968 through 1975
(thousand NCr\$)

	<u>Amount</u>	<u>%</u>
<u>APPLICATION OF FUNDS</u>		
Construction expenditures		
Foreign expenditures	687,342	34.8
Local expenditures	<u>1,005,825</u>	<u>50.9</u>
Total	1,693,167	85.7
Interest charged to construction	<u>250,833</u>	<u>12.7</u>
Total construction expenditures	1,944,000	98.4
Additions to working capital	<u>32,381</u>	<u>1.6</u>
Total Application of Funds	<u><u>1,976,381</u></u>	<u><u>100.0</u></u>
<u>SOURCE OF FUNDS</u>		
Internal cash generation	1,918,523	
Less: Interest charged to operations	584,742	
Amortization of long-term debt	344,089	
Dividends	488,106	
Bonuses	<u>27,307</u>	
Total deductions	<u>1,444,244</u>	
Net internal cash generation	474,279	24.0
Long-term borrowings		
Foreign loans	740,346	37.5
Local loans	346,864	17.5
Additional share capital	<u>414,892</u>	<u>21.0</u>
Total Source of Funds	<u><u>1,976,381</u></u>	<u><u>100.0</u></u>

11.02 Based on the revenue forecast as shown in the income statements, Annex 10, about NCr\$474.3 million, or 24% of the required funds is expected to be provided from Furnas' internal cash generation after payment of interest charged to operations, amortization of long-term debt, dividends and bonuses. The balance of the required funds is expected to be provided by long-term borrowings and additional equity investment. Annex 13 shows a detailed schedule of the estimated long-term borrowings which is summarized below:

Summary of Long-Term Borrowings
(thousand NCr\$)

	<u>Amount</u>	<u>%</u>
<u>Foreign Loans</u>		
<u>Existing Loans</u>		
IBRD - Estreito Project	277,074	25.5
AID - Santa Cruz Project - Stage I	13,821	1.2
AID - Santa Cruz Project - Stage II	156,787	14.4
AID - Furnas/Guanabara Transmission Project	24,247	2.3
Suppliers Credit - Funil Project	4,076	0.4
Total existing loans	476,005	43.8
<u>Proposed Loan</u>		
IBRD - Porto Colombia Project	71,806	6.6
<u>Future Loan</u>		
Marimbondo Project	192,535	17.7
Total foreign loans	<u>740,346</u>	<u>68.1</u>
<u>Local Loans</u>		
<u>Existing Loans</u>		
Eletrobras - Estreito Project	42,129	3.9
Eletrobras - Funil Project	132,175	12.2
Eletrobras - Minor Works	2,560	0.2
Total existing loans	176,864	16.3
<u>Future Loan</u>		
Eletrobras - Marimbondo Project	170,000	15.6
Total local loans	<u>346,864</u>	<u>31.9</u>
Total Loans	<u><u>1,087,210</u></u>	<u><u>100.0</u></u>

11.03 With the exceptions of the proposed Bank Loan for the Porto Colombia project and the future loans for the Marimbondo project, all borrowed funds for the eight-year expansion program will be provided from existing loans. Total borrowings have been estimated at about NCr\$1,087.2 million of which 68% is expected from foreign sources and 32% from local sources. Estimated yearly drawdowns on these loans are shown in the source and application of funds statements, Annex 13. There is only one small suppliers credit among the existing foreign loans, bearing interest at seven per cent, and which is amortized over a three-year period. The remaining foreign loans from the Bank and AID have extended amortization periods ranging from 15 to 22 years. Interest rates on these loans vary from five and one half per cent to six and one half per cent.

11.04 For the purposes of this report, it has been assumed that the terms of the proposed Bank Loan for the Porto Colombia project would be: six and one half year grace period, 18½ year amortization period, and interest at six and one half per cent. The same terms have been assumed for the future foreign loan in respect to the Marimbondo project.

Future
Bank
project.

11.05 All local borrowings are from Eletrobras. Of these, a small loan for minor works represents Inter-American Development Bank (IDB) funds loaned to Eletrobras and reloaned to Furnas. Terms of this loan to Furnas were six and one fourth per cent interest and an amortization period of 11 years. The other Eletrobras loans have interest rates between eight and one half per cent and 13% and amortization periods of 15 and 20 years. The future Eletrobras loan for the Marimbondo project has been included in the financial projections as a 25-year loan including a six-year grace period with interest at 13% corresponding to the rate charged by Eletrobras during the past few years.

11.06 Detailed schedules of the annual interest and amortization payments for all these loans have been included in Annex 15, Interest Schedule, and Annex 16, Amortization Schedule.

11.07 Additional equity investments during the eight-year period ending December 31, 1975 are estimated at about NCr\$414.9 million. These equity investments represent the reinvestment of 85% of the dividends paid. Furnas intends to declare a five per cent dividend semiannually. Recipients of these dividends are subject to a 15% tax of the amount of the dividend. As a matter of convenience, Furnas pays the tax directly to the Government and records it as part of the cash dividend paid. The balance of the dividend is recorded as paid to the shareholders, who immediately reinvest the amount in Furnas and receive a similar amount in additional shares. Since 85% of the total dividends will be immediately reinvested, Furnas could consider these transactions as stock dividends which would have had no effect on the balance sheet. However, in this event, the summary funds statement on page 19 would show Furnas' net internal cash generation to be about 45.0% of the total capital requirements instead of only 24.0%.

Inst.
Building

11.08 The proposed financial plan is reasonable. Assurances are provided in the proposed Guarantee Agreement that in the event of a shortage of funds the Government would provide Furnas with the necessary funds to carry out the Bank project.

12. ESTIMATED FUTURE OPERATIONS

12.01 Forecast income statements for the eight-year period 1968 through 1975 are included in Annex 10. This forecast is based on the assumption that Furnas achieves the permitted rate of return of ten per cent on its remunerable investment. Foreign exchange expenditures have been cast in terms of the official foreign exchange rate of NCr\$3.22 to US\$1 effective January 4, 1968. Normal increases in operating costs have been considered, but no provision has been made for future loss of value of the cruzeiro as most of the effects are provided for under the tariff arrangements and adjustments for inflation, see Annex 9, (paragraph 3).

12.02 In 1968 Furnas intends to charge five per cent for depreciation and three per cent for amortization and these amounts will be included in the cost of service recovered by increased tariffs. These high rates are being applied because of the need for construction funds in 1968 especially in regard to construction costs relating to the former Chevap properties. Furnas plans to reduce the depreciation rate to four per cent during the years 1969 through 1971 and to three and one half per cent during the years 1972 through 1975. Depreciation at these rates has been included in the forecast income statements. Amortization charges will be discontinued after 1968.

12.03 The estimated kwh sold during the eight-year period are based on the sales contracts with Furnas' consumers as described in paragraph 7.01 and shown in Annex 3. The average rate per kwh is projected to increase from NCr\$0.02788 in 1967 to NCr\$0.03351 in 1968 primarily because of tariff increases resulting from the April 1968 revaluation of assets. The average rate per kwh is expected to increase again in 1969 because of the addition of the Estreito and Funil hydroelectric plants to the rate base. Thereafter, the estimated average rate per kwh generally tends to decrease, reaching its low point of NCr\$0.02335 in 1975. *Optimistic!*

12.04 Projected operating income increases from NCr\$74.2 million in 1968 to NCr\$200.6 million in 1973, and then decreases in 1974 and 1975. Operating income decreases after 1973 because no large plants are placed in service in 1974 and 1975 and the remunerable investment during these years decreases due to the annual depreciation charge. After the large Marimbondo plant, which will have been under construction for several years, is placed in operation and included in the remunerable investment, the operating income will again show a substantial increase. This will be the normal pattern of Furnas' operating income. It will show increases in the years when large plants will be added to plant in service followed by years of decreases.

As a hydroelectric producer and wholesaler with no distribution properties, Furnas engages in major construction projects which make no contribution to operating income until the year in which they are placed in service.

12.05 Interest coverage of 1.2 times in 1968 is very low because of a high depreciation charge and the inclusion of a three per cent amortization charge. Excluding the amortization charge and recording a normal depreciation charge of two and one half per cent, the interest coverage for 1968 would have been about 2 times. The estimated interest coverage is 1.9 times in 1969 and decreases to 1.6 times during the three years 1973 through 1975.

12.06 Operations are expected to result in annual increases in surplus after appropriations for legal reserve, dividends and bonuses. Annexes 10 and 11 show the ending balance of surplus each year, increasing from about NCr\$10.5 million in 1968 to about NCr\$239.7 million in 1975. As indicated in the forecast source and application of funds statements, Annex 13, debt service coverage is about 2.1 times in 1969 and averages about 1.5 during the following six years.

12.07 The percentage of total long-term debt to total fixed assets is expected to reach its highest level of 61.5% by the end of 1969. It remains at about 60% during the next three years, and then decreases annually to an estimated 53.5% by the end of 1975.

13. CONCLUSIONS

13.01 The project is technically sound and will provide facilities necessary to meet the expected demand for power. Estimates of cost are reasonable and arrangements for engineering construction and procurement are appropriate. The financing plans are satisfactory.

13.02 Furnas is operating satisfactorily and has made good progress in improving staff, organization and methods.

13.03 The project would be suitable for a Bank loan of US\$22.3 million equivalent for 25 years including a grace period of six and one half years.

September 20, 1968

BRAZILCENTRAL ELETRICA DE FURNAS S.A.Generation Facilities

<u>Station</u>	<u>Type</u>	<u>Date of Installation</u>	<u>Name Plate Capacity (Mw)</u>
Furnas	Hydro		900
Santa Cruz	Thermal	1968	160 1316
Peixoto <u>1/</u>	Hydro	1968	250
Funil <u>2/</u>	Hydro	1969/70	210
Estreito <u>2/</u>	Hydro	1969/72	1,050 7020
Santa Cruz Extension <u>2/</u>	Thermal	1972/73	400
Porto Colombia <u>3/</u>	Hydro	1973/74	360 75
Marimbondo <u>4/</u>	Hydro	1975/77	1,200 100

NOTES: 1/ Peixoto is owned by Cia. Paulista de Forca e Luz (CPFL - Paulista), but by agreement Furnas has assumed the responsibility for the marketing of the 250 Mw expansion of this plant.

2/ Projects under construction.

3/ Project proposed for Bank loan.

4/ In early planning stage.

July 10, 1968

BRAZIL

ANNEX 2

Page 6, para 5.06

CENTRAL ELETRICA DE FURNAS S.A.

Project Cost Estimate

	<u>Thousands of NCr \$</u>			<u>Thousands of US \$</u>		
	<u>Local</u> <u>Financing</u>	<u>Bank</u> <u>Financing</u>	<u>Total</u>	<u>Local</u> <u>Financing</u>	<u>Bank</u> <u>Financing</u>	<u>Total</u>
<u>PORTO COLOMBIA HYDROELECTRIC STATION</u>						
<u>Civil Works</u>						
Plant and Camp	22,000	-	22,000	6,830	-	6,830
Dam	24,600	-	24,600	7,640	-	7,640
Intake	8,800	2,700	11,500	2,730	860	3,590
Spillway and Tailrace	11,900	4,200	16,100	3,700	1,300	5,000
Land and Structures	24,000	-	24,000	7,450	-	7,450
Miscellaneous	2,200	-	2,200	690	-	690
	<u>93,500</u>	<u>6,900 1/</u>	<u>100,400</u>	<u>29,040</u>	<u>2,160 1/</u>	<u>31,200</u>
<u>Equipment</u>						
Turbines	2,800	17,400	20,200	870	5,400	6,270
Generators	2,900	17,100	20,000	900	5,300	6,200
Electrical Equipment	2,800	12,900	15,700	870	4,000	4,870
Mechanical Equipment	1,500	900	2,400	450	280	740
	<u>10,000</u>	<u>48,300</u>	<u>58,300</u>	<u>3,100</u>	<u>14,980</u>	<u>18,080</u>
<u>Engineering and Administration</u>						
Administration	15,700	-	15,700	4,870	-	4,870
Engineering and Other Services	2,800	2,100	4,900	870	660	1,530
Contingencies - Foreign 2/	5,900	-	5,900	1,830	-	1,830
Local	18,300	-	18,300	5,690	-	5,690
	<u>42,700</u>	<u>2,100</u>	<u>44,800</u>	<u>13,260</u>	<u>660</u>	<u>13,920</u>
<u>TOTAL - PORTO COLOMBIA</u>	<u>146,200</u>	<u>57,300</u>	<u>203,500</u>	<u>45,400</u>	<u>17,800</u>	<u>63,200</u>
<u>TRANSMISSION</u>						
<u>Estreito - Porto</u>						
<u>Colombia 345 kv Line</u>						
Towers	200	3,200	3,400	60	1,000	1,060
Conductors	200	4,800	5,000	60	1,490	1,550
Insulators and Hardware	60	1,640	1,700	20	510	530
Materials and Construction	1,980	-	1,980	620	-	620
Miscellaneous	600	480	1,080	180	150	330
Engineering	100	-	100	30	-	30
Contingencies - Foreign 2/	1,020	-	1,020	300	-	300
Local	460	-	460	140	-	140
	<u>4,620</u>	<u>10,120</u>	<u>14,740</u>	<u>1,410</u>	<u>3,150</u>	<u>4,560</u>
<u>Porto Colombia - Barretos</u>						
<u>Double Circuit 138 kv Line</u>						
Towers	50	1,800	1,850	20	550	570
Conductors	50	2,000	2,050	20	620	640
Insulators and Hardware	20	580	600	10	180	190
Materials and Construction	1,090	-	1,090	340	-	340
Miscellaneous	200	-	200	60	-	60
Engineering	100	-	100	30	-	30
Contingencies - Foreign 2/	450	-	450	140	-	140
Local	220	-	220	70	-	70
	<u>2,180</u>	<u>4,380</u>	<u>6,560</u>	<u>690</u>	<u>1,350</u>	<u>2,040</u>
<u>TOTAL - TRANSMISSION</u>	<u>6,800</u>	<u>14,500</u>	<u>21,300</u>	<u>2,100</u>	<u>4,500</u>	<u>6,600</u>
<u>TOTAL - PROJECT</u>	<u>153,000</u>	<u>71,800</u>	<u>224,800</u>	<u>47,500</u>	<u>22,300</u>	<u>69,800</u>

1/ Gates and similar equipment which would not be included in the civil works contract and which would be bid upon separately.

2/ The 10% allowance for contingencies on the Bank financed component is shown as a local financing item as contingencies are not included in the proposed Loan.

September 13, 1968

BRAZIL

ANNEX 3
Page 1

CENTRAL ELETRICA DE FURNAS S.A.

Page 3, para 2.08.

Actual and Forecast Sales Demand

C o m p a n y	Recorded Sales Demand			Contracted Demand Commitments (1)							
	Thousands of Kilowatts										
	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Centrais Eletricas de Minas Gerais	13	14	33	80	145	225	235	250	330	375	450
Light - Sao Paulo (2)	536	559	670	700	750	900	900	900	900	900	900
Light - Rio (3)	-	-	69	200	250	350	450	570	690	830	970
Cia. Paulista de Forca e Luz (4)	-	-	-	70	90	120	140	180	220	270	320
Cia. Brasileira de Energia Eletrica	-	-	-	65	80	90	105	120	135	150	170
Centrais Eletricas Fluminenses (5)	-	-	-	10	15	20	30	40	50	65	80
Espirito Santo Centrais Eletricos	-	-	5	20	25	30	35	40	50	50	50
TOTAL SALES DEMAND	549	573	777	1,145	1,355	1,735	1,895	2,100	2,375	2,640	2,940

- (1) Furnas contracted demand for the supply of the various utilities. The contract year begins April 1st in most cases at which time the demand for the following 12 months comes in force. Furnas is obligated to sell power at 60% load factor, although the purchaser may take and pay for less energy or purchase more energy if available. The annual demand charge is determined by the contracted demand.
- (2) After 1970 growth of Sao Paulo Light demand will be supplied by CESP, the State owned utility in the State of Sao Paulo.
- (3) Amounts of Rio Light contract established up to and including 1971: contract amounts for subsequent years will be set in 1969/70. Demand shown in 1972-75 based on median growth rate of Rio Light estimated by Canabara study. Eletrobras, Furnas and Rio Light have agreed that all additional power required by Rio Light in the future will be supplied by Furnas.
- (4) Eletrobras, Furnas, CESP and Paulista have agreed that Furnas will supply 75% of Paulista growth and CESP 25%; Furnas-Paulista contract prepared on this basis.
- (5) Contract under negotiation for amounts shown.

BRAZIL

ANNEX 3
Page 2

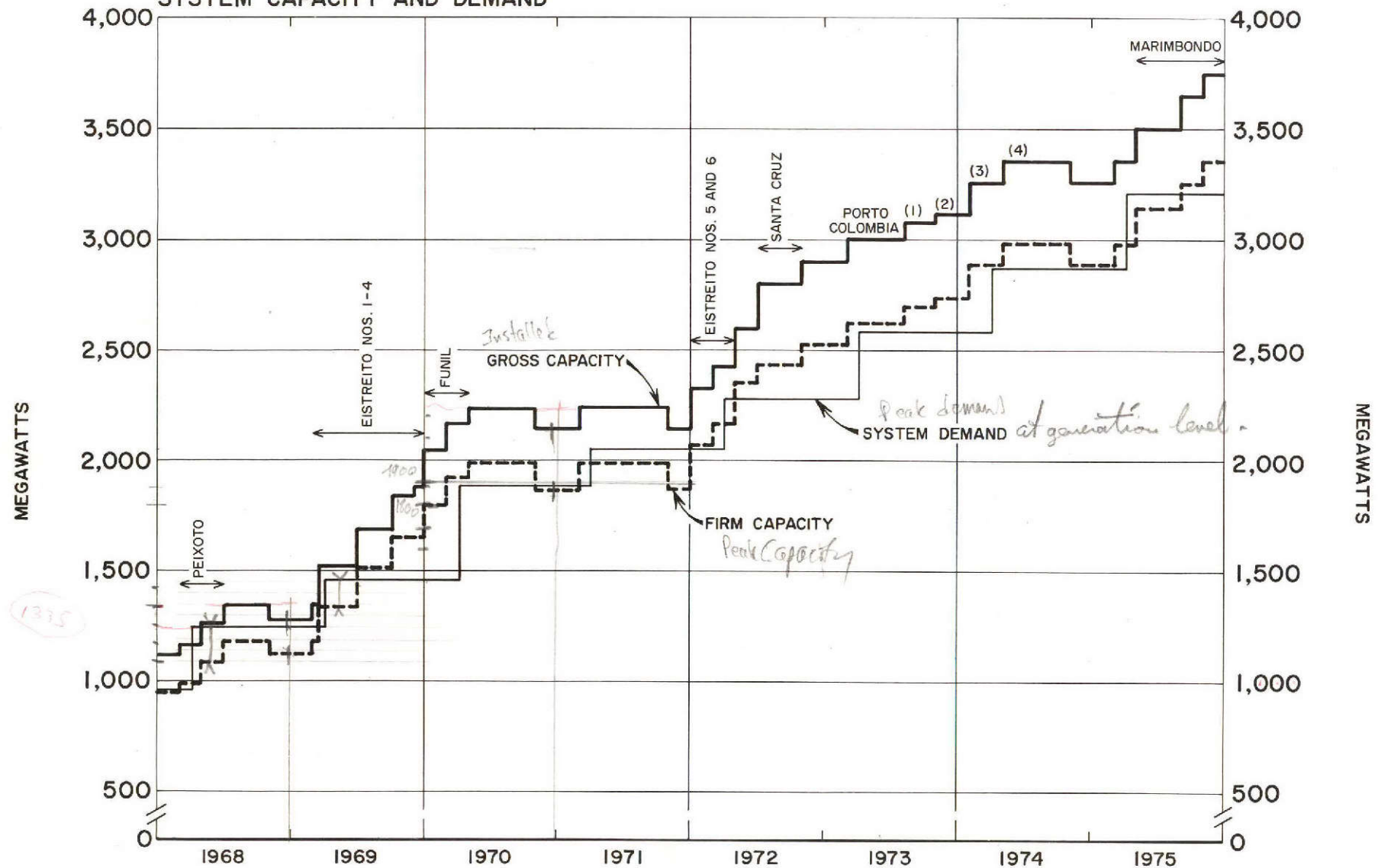
CENTRAL ELETRICA DE FURNAS S.A.
Recorded and Estimated Energy Sales
(Millions of kwh)

Company	Recorded Energy Sales			Estimated Energy Sales (1)							
	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Centrais Eletricas de Minas Gerais	38	81	113	356	678	1,079	1,222	1,295	1,631	1,913	2,268
Light - Sao Paulo	2,640	3,624	4,164	3,674	3,877	4,536	4,730	4,730	4,730	4,730	4,730
Light - Rio	-	-	96	941	1,249	1,710	2,236	2,840	3,471	4,181	4,917
Cia. Paulista de Forca e Luz	-	-	-	185	473	631	736	946	1,156	1,419	1,682
Cia. Brasileira de Energia Eletrica	-	-	-	172	420	473	552	631	710	788	894
Centrais Eletricas Fluminenses	-	-	-	26	79	105	158	210	263	342	420
Espirito Santo Centrais Eletricas	-	-	1	79	125	151	177	204	250	263	263
<u>TOTAL ENERGY SALES</u>	<u>2,678</u>	<u>3,705</u>	<u>4,374</u>	<u>5,497</u>	<u>6,901</u>	<u>8,685</u>	<u>9,811</u>	<u>10,856</u>	<u>12,211</u>	<u>13,636</u>	<u>15,174</u>

(1) Based on contract demands, given on page 1 of this annex, at contract load factor of 60%.

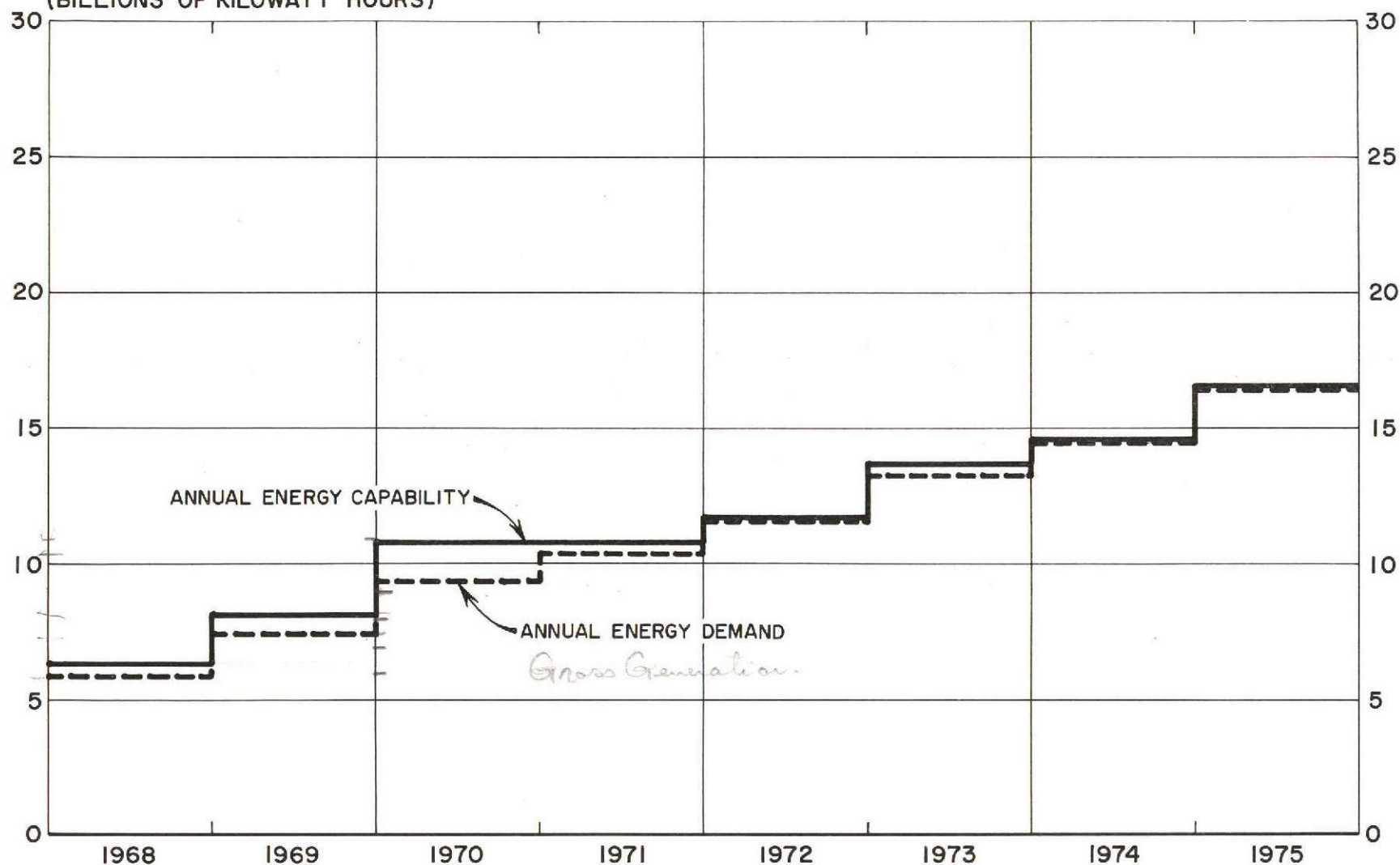
July 2, 1968

BRAZIL: CENTRAL ELECTRICA DE FURNAS, S.A. **SYSTEM CAPACITY AND DEMAND**



NOTES: GROSS CAPACITY - System capability seasonally adjusted for loss in output during dry years.
FIRM CAPACITY - Gross capacity less provision for outages, maintenance and spinning reserve.
SYSTEM DEMAND - Total contract demand plus transmission losses and plant use.

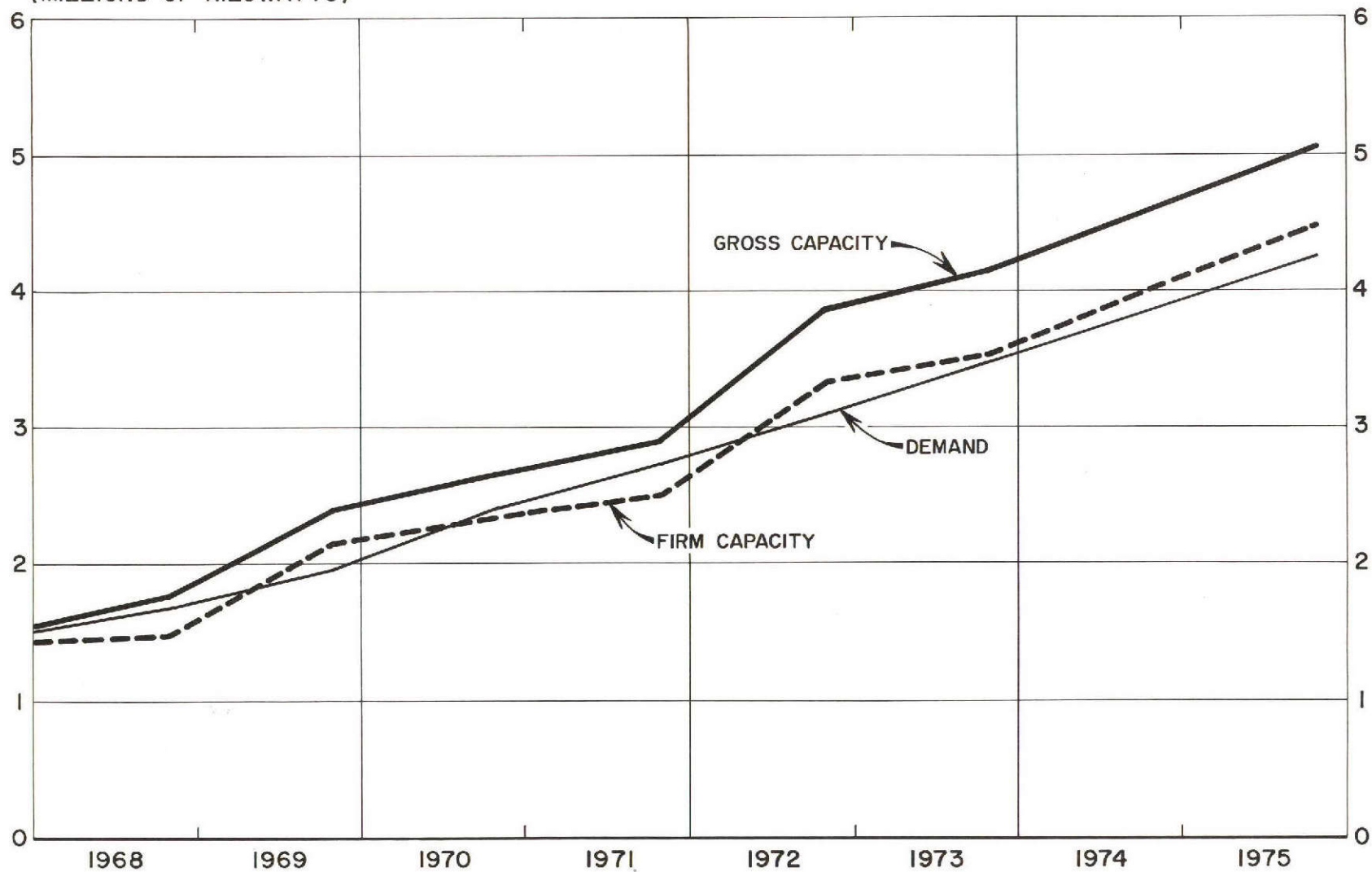
BRAZIL: CENTRAL ELECTRICA DE FURNAS, S.A.
SYSTEM ENERGY CAPABILITY AND ENERGY DEMAND
 (BILLIONS OF KILOWATT HOURS)



NOTES: ANNUAL ENERGY CAPABILITY - System energy capability during driest year, Santa Cruz thermal station operating at 65% plant factor.
ANNUAL ENERGY DEMAND - Total contract energy sales at contract load factor of 60% plus transmission energy losses and plant use.

(R)IBRD-3938

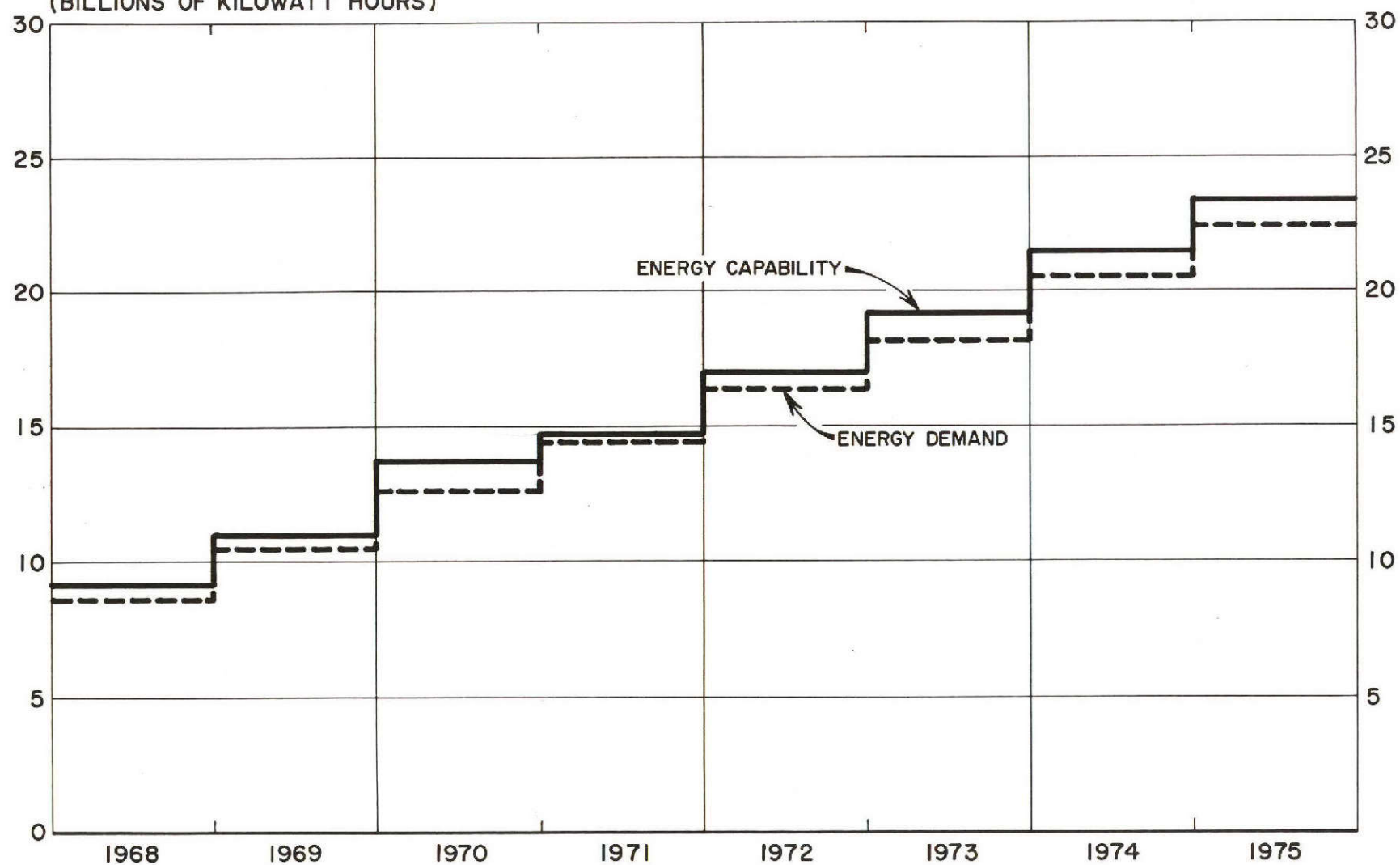
BRAZIL: FURNAS AND CEMIG
AGGREGATE CAPACITY AND DEMAND
 (MILLIONS OF KILOWATTS)



BRAZIL: FURNAS AND CEMIG

AGGREGATE ENERGY CAPABILITY AND ENERGY DEMAND

(BILLIONS OF KILOWATT HOURS)



(R)IBRD-3940

ANNEX 7

Page 11, para 7.09

BRAZILCENTRAL ELETRICA DE FURNAS S.A.PORTO COLOMBIA PROJECTInternal Rate of Return

1. The internal rate of return of the Porto Colombia project was determined as follows, and is the discount rate at which the present worth of the cost of the project equals the present worth of the revenue produced by it over its life.
2. For this purpose the pertinent information is as follows:
 - A. The capital cost of the project is shown in Annex 15.
 - B. The life of the project is 40 years.
 - C. The annual net revenue is the annual gross revenue less operating costs. Annual gross revenue is equal to the annual kilowatt hours sales attributed to the project multiplied by the applicable tariff.
 - D. The annual kilowatt hours figure was determined by apportioning the total sales of Furnas to the respective plants in accordance with the estimated operating conditions and is estimated at 1.28 billion kwh for Porto Colombia. This would involve operation at about the firm plant factor of Porto Colombia and is conservative given that during normal hydrological years the output would be somewhat higher.
 - E. The tariff employed is 0.023 NCr. per kilowatt hour corresponding to that estimated in 1975, the first year of full operation. This is substantially less than that in the immediately preceding years, the reduction being due primarily to the effect on tariffs of the large asset changes resulting from the almost continuous construction program. The tariff is conservative therefore. Annual gross revenue amounts to 29.4 million NCr. Gross operating expenses were determined as 3.3 million NCr. annually.
3. On the basis of the above it was determined that the present worth of capital costs would equal the present worth of the revenues over a forty year period at a discount rate of 11.9%.

BRAZILCENTRAL ELETRICA DE FURNAS S.A.Tariffs

1. Regulations governing tariffs are contained in the Water Code of 1934, subsequent amendments and decrees including decrees dated February 26, 1957 and November 4, 1964 and Law 5,073 enacted on August 18, 1966. Prior to 1964, tariffs were based on the use of the historic value of investment, thereby not reflecting the substantial inflation that occurred in Brazil. The 1964 decree allows utilities to revalue their investment to reflect changes in price levels. The 1966 legislation made yearly revaluations of assets mandatory.
2. Under the existing regulations, tariffs are reviewed and approved by the Waters Division of the Ministry of Mines and Energy every three years or at shorter intervals at the initiative of the Waters Division or the utility. Utilities are permitted to apply for tariffs which would yield revenues covering (a) operating costs including income taxes; (b) straight-line depreciation of gross fixed assets in operation, excluding land and land rights, at annual rates of up to eight per cent for thermal plants and up to five per cent for all other facilities including hydro plants, but with no minima in either case; (c) a reversion provision of three per cent or an amortization provision of up to five per cent, on the total gross fixed assets in operation; and (d) a return of ten per cent on the remunerable investment. Remunerable investment is defined as the book value of the estimated end of year gross plant in service (excluding assets acquired through contributions in aid of construction) less depreciation and reversion or amortization reserves, plus reversion or amortization funds and an end-of-year allowance for working capital consisting of materials and supplies, receivables equivalent to two months' billings, and cash (up to the value of the reserve for depreciation balance) excluding cash representing contributions in aid of construction. In principle, shortfalls in achieving the return of ten per cent in the three-year tariff period may be recovered in the subsequent three-year period. However, another provision in the regulations permits tariff adjustments for recovering shortfalls at more frequent intervals.
3. Without advance approval of the Waters Division surcharges between tariff revisions may be added by utilities to current tariffs to cover compulsory increases in wages, social benefits, cost of fuel and purchased power, and for increases in foreign debt service due to changes in the foreign exchange rate. Effective with the billings for the month of January, 1968 Furnas adjusted its rates to reflect the increased cost of interest and amortization on foreign loans based on the latest official exchange rate of NCr\$3.22 to US\$1.
4. Tariff adjustments on account of revaluation of balance sheet accounts can be made as often as economic correction factors (coefficients) showing the variations in the price level are published. The coefficients are issued annually about one or two months after the end of each year for

the use of industry in general. The coefficients are applied by utilities to update the values of plant in service, depreciation and amortization or reversion reserves, and certain local currency loans of the National Development Bank and Eletrobras. Increased tariffs resulting from revaluation of assets based on coefficients do not, however, completely offset the effects of inflation. In any given year construction expenditures incurred in the immediate prior year are not revalued. Furthermore, the effects of inflation in the current year are not recognized because utility plant is revalued as of the beginning of that year. In addition, no price level adjustment is made for shortfalls in earnings which are to be recovered in succeeding years. Foreign currency components of the book value of fixed assets are converted into local currency at the rate of exchange in effect at the time the assets are acquired. At the same time as the application of the coefficient, but in lieu of the use of the coefficient, Furnas, as is permitted, adjusts its assets constructed with foreign currency to changes in exchange rates as applied to its foreign debts. This adjustment as of December 31, 1967 did not reflect in remunerable investment the full impact of changes in the official exchange rate because the rate of NCr\$3.22 to US\$1 although published on December 28, 1967 was not effective until January 4, 1968. However, the higher debt service on foreign loans was provided for in a surcharge. As offsets to these factors, it must be recognized that cost of service for a given year is related to remunerable investment as of the end of the year and that both cost of service (which includes taxes on income) and remunerable investment are based on estimated projections. Furnas in its tariff applications makes adjustments to reflect the fact that rates for a given period do not go into effect until some four or five months after the close of the calendar year. Furthermore, as indicated in paragraph 2 above, liberal allowances are permitted for depreciation and amortization.

5. In addition to a basic tariff and surcharges, consumers pay three other charges. The Federal Government levies two charges to raise additional resources for the financing of power development, a tax called the Imposto Unico (sole tax), which varies among consumer classes, and the Emprestito Compulsorio (compulsory loan), which is equal in amount to the sole tax. These amount to some 20-25% of the charge for service except for certain groups (such as rural users) who are exempt. The proceeds of the sole tax, which was first imposed in 1954, are distributed, after retention of five per cent by the Ministry of Finance, as follows: 39% to the Federal Electrification Fund, administered by Eletrobras; 50% to the States; ten per cent to the municipalities; and one per cent to the Ministry of Mines and Energy to cover collection costs. The compulsory loan, introduced in 1962 and scheduled to be discontinued at the end of 1973, is administered by Eletrobras and invested in power projects as share capital or as loans generally with a 13% effective rate of interest. Consumers receive debt certificates for the amount of the compulsory loan they pay; the certificates are revalued annually, pay six per cent interest, and are repayable in 20 years. Finally, the total rate for power includes a social security tax amounting to ten per cent of the charge for service.

BRAZIL
CENTRAL ELETRICA DE FURNAS S.A.
Actual and Estimated Income Statements
(thousand NCr\$)

Year Ending December 31	Actual			Estimated ^{1/}							
	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Sales (million of kwh)	2,678	3,705	4,374	5,497	6,901	8,685	9,811	10,856	12,211	13,636	15,174
Average price per kwh (new cruzeiro)	0.01758	0.02217	0.02788	0.03351	0.04026	0.03279	0.02924	0.03067	0.02907	0.02635	0.02335
→ Operating Revenues <i>(Not to company)</i>	47,071	82,141	121,961	184,194	277,808	284,743	286,881	332,956	365,917	359,303	354,361
Operating Expenses											
Operating expenses	1,772	3,656	7,700	24,073	29,070	33,200	40,156	53,162	54,965	57,100	58,100
Depreciation	10,944	19,210	26,304	45,238	67,173	70,018	72,708	74,517	83,494	83,810	83,982
Amortization	7,677	13,431	18,479	29,524	-	-	-	-	-	-	-
Income taxes	2,712	6,126	9,200	8,881	24,168	17,671	15,751	21,055	23,387	21,356	21,501
Dividend taxes	-	779	1,462	2,298	2,496	2,714	2,949	3,205	3,483	3,785	4,114
Total operating expenses	23,105	43,202	62,942	110,014	122,907	123,595	131,564	151,939	165,329	165,051	167,697
Operating Income	23,966	38,939	59,019	74,180	154,901	161,148	155,317	181,017	200,588	194,252	186,664
Net Other Income	1,351	2,036	70	-	-	-	-	-	-	-	-
Gross Income	25,317	40,975	59,089	74,180	154,901	161,148	155,317	181,017	200,588	194,252	186,664
Interest Charges											
Total interest - Annex 15	19,123	18,745	20,093	64,166	83,383	95,465	110,173	119,687	121,869	120,637	120,195
Less interest charged to constructions	-	-	6,380	41,080	59,281	21,674	36,954	49,917	40,491	32,738	42,947
Net interest charges	19,123	18,745	13,713	23,086	24,102	73,791	73,219	69,770	81,378	87,899	77,248
Net Income	6,194	22,230	45,376	51,094	130,799	87,357	82,098	111,247	119,210	106,353	109,416
Surplus - Balance Beginning of Year	1,181	1,553	6,579	11,146	10,541	81,467	106,589	122,005	159,985	199,965	221,682
Total Surplus	7,375	23,783	51,955	62,240	141,340	168,824	188,687	233,252	279,195	306,318	331,098
Less: Prior year's adjustments	758	(807)	147	-	-	-	-	-	-	-	-
Legal reserve	331	1,111	2,342	2,555	6,540	4,368	4,105	5,569	5,969	5,327	5,480
Dividends	3,733	15,575	29,233	45,944	49,933	54,267	58,977	64,098	69,661	75,709	82,280
Bonuses	1,006	1,325	2,707	3,200	3,400	3,600	3,600	3,600	3,600	3,600	3,600
Reserve for future capital increase	-	-	6,380	-	-	-	-	-	-	-	-
Surplus - Balance End of Year	1,553	6,579	11,146	10,541	81,467	106,589	122,005	159,985	199,965	221,682	239,738
Times total interest covered by operating income	1.3	2.1	2.9	1.2	1.9	1.7	1.4	1.5	1.6	1.6	1.6
Rate of return based on remunerable investment	7.0%	10.1%	9.2%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%

^{1/} Estimates are based on a constant exchange rate of NCr\$3.22 to US\$1.

September 11, 1968

ANNEX 10
Page 44, para. 9.01.

BRAZIL

CENTRAL ELETRICA DE FURNAS S.A.

Actual and Estimated Balance Sheets
(thousand NCr\$)

	Actual					Estimate/							
December 31	1965 2/	1966 3/	1967 4/	1967 5/	1968	1969	1970	1971	1972	1973	1974	1975	
ASSETS													
Fixed Assets													
Fixed assets in operation	330,273	423,269	689,600	887,192	952,377	1,767,707	1,842,359	1,913,369	2,241,104	2,511,099	2,520,607	2,525,761	
Less reserve for depreciation	14,370	33,800	62,138	67,420	112,658	179,831	249,841	322,549	397,066	480,560	564,370	648,352	
Net fixed assets in operation	315,903	390,169	627,462	819,772	839,719	1,587,876	1,592,518	1,590,820	1,844,038	2,030,539	1,956,237	1,877,409	
Work in progress	36,246	115,451	309,209	351,991	657,336	144,818	361,665	582,647	503,704	397,803	553,937	731,671	
Total fixed assets	352,149	505,620	936,671	1,171,763	1,497,055	1,732,694	1,954,183	2,173,467	2,347,742	2,428,342	2,510,174	2,609,080	
Current Assets													
Cash	8,837	11,869	21,432	21,432	21,911	63,533	7,515	11,477	12,866	20,298	27,605	38,739	
Materials and supplies	1,051	3,382	5,055	5,055	5,714	10,606	11,054	11,480	13,447	15,067	15,124	15,155	
Accounts receivable	1,432	2,312	6,022	6,022	11,689	17,651	26,624	27,288	27,493	31,908	35,067	34,433	
Other	136	391	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	
Total current assets	11,456	17,954	34,609	34,609	41,414	93,890	47,293	52,345	55,926	69,373	79,896	90,427	
Other Assets	1,001	1,326	7,499	7,499	7,499	7,499	7,499	7,499	7,499	7,499	7,499	7,499	
Total assets	364,606	524,900	978,779	1,213,871	1,545,968	1,834,083	2,008,975	2,233,311	2,411,167	2,505,214	2,597,569	2,707,006	
CAPITAL AND LIABILITIES													
Capital													
Share capital	67,379	155,000	300,000	300,000	469,001	509,714	553,961	602,048	654,310	711,109	772,838	839,925	
Surplus	1,553	6,579	11,146	11,146	10,541	81,467	106,589	122,005	159,985	199,965	221,682	239,738	
Reserves:													
Legal	519	1,630	3,972	3,972	6,527	13,067	17,435	21,540	27,109	33,078	38,405	43,885	
Amortization	10,117	24,216	46,686	52,205	81,729	81,729	81,729	81,729	81,729	81,729	81,729	81,729	
Future capital increase	-	-	7,713	85,624	-	-	-	-	-	-	-	-	
Other reserves	154	167	196	196	196	196	196	196	196	196	196	196	
Total capital	79,722	187,592	369,713	453,143	567,994	686,173	759,910	827,518	923,329	1,026,077	1,114,850	1,205,473	
Long-Term Debt - Annex 12	270,696	305,048	541,375	693,037	914,973	1,066,180	1,170,101	1,324,959	1,397,628	1,382,222	1,383,134	1,396,749	
Less debt due within one year	9,612	8,660	12,902	18,180	20,967	32,128	43,232	44,246	57,564	61,013	66,814	75,151	
Net long-term debt	261,084	296,388	528,473	674,857	894,006	1,034,052	1,126,869	1,280,713	1,340,064	1,321,209	1,316,320	1,321,598	
Current Liabilities													
Long-term debt due within one year	9,612	8,660	12,902	18,180	20,967	32,128	43,232	44,246	57,564	61,013	66,814	75,151	
Accounts payable and accruals	6,477	7,565	22,900	22,900	24,045	25,007	26,007	27,047	28,129	29,254	30,424	31,641	
Provision for taxes	2,979	7,795	12,851	12,851	12,306	27,837	21,659	20,085	25,765	28,506	26,919	27,547	
Dividends payable	3,732	15,575	29,233	29,233	23,450	25,486	27,698	30,102	32,716	35,555	38,642	41,996	
Bonus payable	1,000	1,325	2,707	2,707	3,200	3,400	3,600	3,600	3,600	3,600	3,600	3,600	
Total current liabilities	23,800	40,920	80,593	85,871	83,968	113,858	122,496	125,080	144,774	157,928	166,399	179,935	
Total liabilities	364,606	524,900	978,779	1,213,871	1,545,968	1,834,083	2,008,975	2,233,311	2,411,167	2,505,214	2,597,569	2,707,006	
Assets test: Percentage of long-term debt including long-term debt due within one year to total fixed assets	76.9%	60.3%	57.8%	59.1%	61.1%	61.5%	59.9%	61.0%	59.5%	56.9%	55.1%	53.5%	

1/ Estimate is based on coefficient applicable to December 31, 1967 accounts and a constant foreign exchange rate of NCr\$3.22 to US\$1.
 2/ Based on coefficient applicable to December 31, 1964 accounts and a foreign exchange rate of NCr\$1.85 to US\$1.
 3/ Based on coefficient applicable to December 31, 1965 accounts and a foreign exchange rate of NCr\$2.22 to US\$1.
 4/ Based on coefficient applicable to December 31, 1966 accounts and a foreign exchange rate of NCr\$2.22 to US\$1.
 5/ Based on coefficient applicable to December 31, 1967 accounts and a foreign exchange rate of NCr\$3.22 to US\$1.

September 11, 1983

BRAZIL

CENTRAL ELETRICA DE FURNAS S.A.

Schedule of Long-Term Debt
(thousand NCr\$)

	Actual				Estimate ^{1/}								
December 31	1965 2/	1966 3/	1967 4/	1967 1/	1968	1969	1970	1971	1972	1973	1974	1975	
Local Loans													
Eletrobras: Furnas Project	123,509	96,130	98,845	120,591	116,304	111,693	106,796	101,518	95,860	89,753	83,194	76,106	
Estreito Project	17,898	39,120	54,371	60,847	80,983	102,976	100,293	97,278	93,891	90,085	85,808	81,003	
Funil Project	-	-	135,326	158,396	218,372	290,571	283,000	274,493	264,934	254,194	242,126	228,567	
Santa Cruz - Stage I	-	-	1,326	1,326	1,291	1,253	1,212	1,168	1,120	1,068	1,012	951	
Minor works	-	-	15	15	15	2,463	2,239	2,015	1,791	1,567	1,343	1,119	
Others ^{2/}	-	-	36,119	39,409	-	-	-	-	-	-	-	-	
Marimbondo Project	-	-	-	-	-	-	-	130,000	170,000	170,000	170,000	170,000	
Total local loans	141,407	135,250	326,002	380,584	416,965	508,956	493,540	606,472	627,596	606,667	583,483	557,746	
Foreign Loans													
IBRD Loan No. 211-BR - Furnas Project	126,477	147,803	142,486	206,669	198,509	189,873	180,731	171,055	160,818	149,979	138,510	126,374	
IBRD Loan No. 403/474-BR - Estreito Project	153	5,510	21,911	32,046	157,704	209,930	279,375	286,556	290,766	280,784	270,238	259,081	
AID Santa Cruz Project - Stage I	-	-	24,975	35,949	46,760	43,750	40,740	37,730	34,720	31,710	28,700	25,690	
AID Santa Cruz Project - Stage II	-	-	-	-	39,733	52,677	110,499	135,619	156,787	146,671	136,555	126,439	
AID Furnas - Guanabara Transmission System	2,499	16,485	24,950	36,250	49,687	55,121	52,433	49,745	47,057	44,369	41,681	38,993	
Suppliers Credit - Allmanna Svenska Elektriska Aktiebolaget	160	-	-	-	-	-	-	-	-	-	-	-	
Suppliers Credit - Funil Project	-	-	1,051	1,539	5,615	3,743	1,871	-	-	-	-	-	
Proposed IBRD Loan - Porto Colombia Project	-	-	-	-	-	2,130	10,912	37,782	63,588	68,359	71,806	69,891	
Future foreign loan - Marimbondo Project	-	-	-	-	-	-	-	-	16,296	53,683	112,161	192,535	
Total foreign loan	129,289	169,798	215,373	312,453	498,008	557,224	676,561	718,487	770,032	775,555	799,651	839,003	
Total loans	270,696	305,048	541,375	693,037	914,973	1,066,180	1,170,101	1,324,959	1,397,628	1,382,222	1,383,134	1,396,749	

^{1/} Based on coefficient applicable to December 31, 1967 accounts and a foreign exchange rate of NCr\$3.22 to US\$1.

^{2/} Based on coefficient applicable to December 31, 1964 accounts and a foreign exchange rate of NCr\$1.85 to US\$1.

^{3/} Based on coefficient applicable to December 31, 1965 accounts and a foreign exchange rate of NCr\$2.22 to US\$1.

^{4/} Based on coefficient applicable to December 31, 1966 accounts and a foreign exchange rate of NCr\$2.22 to US\$1.

^{5/} Converted into share capital in 1968.

September 11, 1968

ANNEX 12

Page 17, pma - 10.10.

BRASIL

CENTRAL ELETRICA DE FURNAS S.A.

Estimated Source and Application of Funds Statements
(thousand NCr\$)

Year Ending December 31	1968	1969	1970	1971	1972	1973	1974	1975	Eight-Year Total 1968-1975
SOURCE OF FUNDS									
Internal Cash Generation									
Operating income	74,180	154,901	161,148	155,317	181,017	200,588	194,252	186,664	1,308,067
Depreciation	45,238	67,173	70,010	72,708	74,517	83,494	83,810	83,982	580,932
Amortization	29,524	-	-	-	-	-	-	-	29,524
Total internal cash generation	148,942	222,074	231,158	228,025	255,534	284,082	278,062	270,646	1,918,523
Borrowings									
Foreign Loans									
IBRD Loans No. 403 474-BR - Estreito Project	125,658	52,226	69,445	16,100	13,645	-	-	-	277,074
AID Santa Cruz Project - Stage I	13,821	-	-	-	-	-	-	-	13,821
AID Santa Cruz Project - Stage II	39,733	12,944	57,822	25,120	21,168	-	-	-	156,787
AID Furnas/Guanabara Transmission Project	16,125	8,122	-	-	-	-	-	-	24,247
Suppliers Credit - Ansaldo San Giorgio	4,076	-	-	-	-	-	-	-	4,076
Proposed IBRD loan - Porto Colombia Project	-	2,130	8,782	26,870	25,806	4,771	3,447	-	71,806
Future foreign loan Marimbondo Project	-	-	-	-	16,296	37,387	58,478	80,374	192,535
Total foreign borrowings	199,413	75,422	136,049	68,090	76,915	42,158	61,925	80,374	740,346
Local Loans									
Eletrobras - Estreito Project	20,136	21,993	-	-	-	-	-	-	42,129
Eletrobras - Furnil Project	59,976	72,199	-	-	-	-	-	-	132,175
Eletrobras - minor works	-	2,560	-	-	-	-	-	-	2,560
Eletrobras - Marimbondo Project	-	-	-	130,000	40,000	-	-	-	170,000
Total local borrowings	80,112	96,752	-	130,000	40,000	-	-	-	346,864
Total borrowings	279,525	172,174	136,049	198,090	116,915	42,158	61,925	80,374	1,087,210
Share Capital	43,968	40,713	44,247	48,087	52,262	56,799	61,729	67,087	414,892
Total Source of Funds	472,435	434,961	411,454	474,202	424,711	383,039	401,716	418,107	3,420,625
APPLICATION OF FUNDS									
Construction Expenditures (excluding interest during construction) - Annex 14									
Foreign expenditures	192,385	62,325	117,656	60,921	69,598	42,158	61,925	80,374	687,342
Local expenditures	137,065	181,206	152,169	194,117	129,277	81,445	70,979	59,567	1,005,825
Total expenditures	329,450	243,531	269,825	255,038	198,875	123,603	132,904	139,941	1,693,167
Debt Service									
Amortization - Annex 16	18,180	20,967	32,128	43,232	44,246	57,564	61,013	66,759	344,089
Interest - Annex 15	64,166	83,383	95,465	110,173	119,687	121,869	120,637	120,195	835,575
Total debt service	82,346	104,350	127,593	153,405	163,933	179,433	181,650	186,954	1,179,664
Increase or (Decrease) in Net Working Capital (excluding cash)									
Accounts receivable	5,667	5,962	8,973	664	205	4,415	3,159	(634)	28,411
Materials and supplies	659	4,892	148	426	1,967	1,620	57	31	10,100
Accounts payable and accruals	(1,145)	(962)	(1,000)	(1,040)	(1,082)	(1,125)	(1,170)	(1,217)	(8,741)
Provision for taxes	545	(15,531)	6,178	1,574	(5,680)	(2,741)	1,587	(628)	(14,696)
Total increase or (decrease) in net working capital	5,726	(5,639)	14,599	1,624	(4,590)	2,169	3,633	(2,448)	15,074
Dividends Paid	51,727	47,897	52,055	56,573	61,484	66,822	72,622	78,926	488,106
Bonuses Paid	2,707	3,200	3,400	3,600	3,600	3,600	3,600	3,600	27,307
Total Application of Funds	471,956	393,339	467,472	470,240	423,302	375,627	394,409	406,973	3,403,318
Net Cash Accrual or (Deficit)	179	41,622	(56,018)	3,962	1,409	7,412	7,307	11,134	17,307
Cash Balance Beginning of Year	21,432	21,911	63,533	7,515	11,477	12,886	20,298	27,605	
Cash Balance End of Year	21,911	63,533	7,515	11,477	12,886	20,298	27,605	38,739	
Times annual debt service covered by internal cash generation	1.8	2.1	1.8	1.5	1.6	1.6	1.5	1.4	

BRAZIL

CENTRAL ELETRICA DE FUERNAS S.A.

Page 18, para 11.01

Construction Expenditures Excluding Interest During Construction
(thousand NC\$)

PROJECTS	1968	1969	1970	1971	1972	1973	1974	1975	Total 1968-1975
Furnas									
Foreign	-	-	-	-	-	-	-	-	-
Local	5,836	-	-	-	-	-	-	-	5,836
Total	5,836	-	-	-	-	-	-	-	5,836
Estreito									
Estreito (Original)									
Foreign	119,787	35,381	41,637	-	-	-	-	-	196,805
Local	69,918	41,436	16,955	-	-	-	-	-	128,311
Total	189,705	76,817	58,592	-	-	-	-	-	325,116
Estreito (5 & 6 Units)									
Foreign	-	3,220	7,728	6,440	935	-	-	-	18,323
Local	-	2,245	2,618	2,611	-	-	-	-	7,474
Total	-	5,465	10,346	9,051	935	-	-	-	25,797
Estreito (Additional Transmission)									
Foreign	-	3,220	6,440	9,660	13,910	-	-	-	33,230
Local	-	-	5,368	10,731	10,734	-	-	-	26,833
Total	-	3,220	11,808	20,391	24,644	-	-	-	60,067
Total Estreito									
Foreign	119,787	41,821	55,805	16,100	14,845	-	-	-	246,358
Local	69,918	43,683	24,941	13,342	10,734	-	-	-	168,648
Total	189,705	85,504	80,746	29,442	25,579	-	-	-	414,906
Furnas-Guanabara Transmission									
Foreign	16,125	8,122	-	-	-	-	-	-	24,247
Local	4,837	2,761	-	-	-	-	-	-	7,598
Total	20,962	10,883	-	-	-	-	-	-	31,845
Santa Cruz - Stage I									
Foreign	13,821	-	-	-	-	-	-	-	13,821
Local	2,042	-	-	-	-	-	-	-	2,042
Total	15,863	-	-	-	-	-	-	-	15,863
Santa Cruz - Stage II									
Foreign	38,576	10,252	53,069	17,951	12,651	-	-	-	132,499
Local	2,325	17,498	24,382	44,013	27,977	-	-	-	116,195
Total	40,901	27,750	77,451	61,964	40,628	-	-	-	248,694
Punil									
Foreign	4,076	-	-	-	-	-	-	-	4,076
Local	38,681	42,423	-	-	-	-	-	-	81,104
Total	42,757	42,423	-	-	-	-	-	-	85,180
Porto Colombia (Plant)									
Foreign	-	2,130	8,782	22,710	17,487	2,996	3,211	-	57,316
Local	2,430	12,868	33,490	66,909	23,226	6,525	740	-	146,168
Total	2,430	14,998	42,272	89,619	40,713	9,521	3,951	-	203,504
Porto Colombia (Transmission)									
Foreign	-	-	-	4,160	8,319	1,775	236	-	14,490
Local	-	-	-	1,893	3,786	1,083	-	-	6,762
Total	-	-	-	6,053	12,105	2,858	236	-	21,252
Total Porto Colombia									
Foreign	-	2,130	8,782	26,870	25,806	4,771	3,447	-	72,806
Local	2,430	12,868	33,490	68,802	27,012	7,608	740	-	152,950
Total	2,430	14,998	42,272	95,672	52,818	12,379	4,187	-	224,756
Marimbondo (Plant)									
Foreign	-	-	-	-	16,296	18,228	20,160	22,092	76,776
Local	1,022	35,547	56,513	63,349	58,943	56,726	40,628	16,956	329,604
Total	1,022	35,547	56,513	63,349	75,239	74,954	60,788	39,048	406,380
Marimbondo (Transmission)									
Foreign	-	-	-	-	-	19,159	38,318	58,282	115,759
Local	-	-	-	-	-	12,500	25,000	38,000	75,559
Total	-	-	-	-	-	31,659	63,318	96,282	191,318
Total Marimbondo									
Foreign	-	-	-	-	16,296	37,387	58,478	80,374	192,535
Local	1,022	35,547	56,513	63,349	58,943	69,226	65,628	54,956	405,184
Total	1,022	35,547	56,513	63,349	75,239	106,613	124,106	135,330	597,719
Other Constructions									
Foreign	-	-	-	-	-	-	-	-	-
Local	9,974	26,426	12,843	4,611	4,611	4,611	4,611	4,611	78,297
Total	9,974	26,426	12,843	4,611	4,611	4,611	4,611	4,611	78,297
Total Construction Expenditures									
Foreign	192,358	62,325	117,656	60,221	69,596	42,158	61,925	80,374	627,519
Local	137,665	181,206	152,169	194,117	129,277	81,445	70,279	59,567	1,015,625
Total	329,023	243,531	269,825	254,338	198,873	123,603	132,204	139,941	1,643,144

1/ Forecast based on a constant foreign exchange rate of NC\$3.22 to US\$1.

September 11, 1968

BRAZIL
CENTRAL ELETRICA DE FURNAS S.A.

Interest Schedule
(thousand NCr\$)

	Rate of Interest	<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>Local Loans</u>									
Eletrobras: Furnas Project (four loans)	Various ^{1/}	10,412	10,025	9,612	9,170	8,697	8,189	7,641	7,051
Estreito Project	13%	7,866	11,572	12,791	12,445	12,057	11,621	11,131	10,580
Funil Project	13	21,295	29,776	36,092	35,117	34,021	32,791	31,408	29,854
Santa Cruz Project - Stage I	10	129	127	123	120	117	112	109	104
Minor projects ^{2/}	6½	-	84	156	142	127	113	98	84
Guarantee charge - BNDE	-	846	960	915	868	817	764	707	647
Future - Marimbondo Project	13	-	-	-	11,900	19,500	22,100	22,100	22,100
Total local interest		<u>40,548</u>	<u>52,544</u>	<u>52,689</u>	<u>69,762</u>	<u>75,336</u>	<u>75,620</u>	<u>73,194</u>	<u>70,420</u>
<u>Foreign Loans</u> ^{3/}									
IBRD Loan No. 211-BR - Furnas Project	5-3/4	11,768	11,292	10,788	10,255	9,691	9,094	8,461	7,792
IBRD Loan No. 403/474-BR - Estreito Project	Various ^{4/}	5,871	10,405	13,640	15,865	17,335	16,719	16,145	15,539
AID Santa Cruz Project - Stage I	5-3/4	2,422	2,645	2,473	2,299	2,126	1,953	1,780	1,607
AID Santa Cruz Project - Stage II	6	1,157	2,692	4,753	7,169	8,517	9,256	8,648	8,042
AID Furnas/Guanabara Transmission Project	5½	2,400	2,919	2,995	2,847	2,699	2,551	2,403	2,255
Suppliers Credit - Ansaldo San Giorgio	7	-	719	229	98	-	-	-	-
Proposed IBRD Loan - Porto Colombia Project	6½	-	167	898	1,878	3,453	4,332	4,616	4,637
Future - Marimbondo Project	6½	-	-	-	-	530	2,274	5,390	9,903
Total foreign interest		<u>23,618</u>	<u>30,839</u>	<u>35,776</u>	<u>40,411</u>	<u>44,351</u>	<u>46,179</u>	<u>47,443</u>	<u>49,775</u>
Total interest		<u>64,166</u>	<u>83,383</u>	<u>88,465</u>	<u>110,173</u>	<u>119,687</u>	<u>121,869</u>	<u>120,637</u>	<u>120,195</u>

^{1/} Interest rate on two loans is 8½% and on remaining two loans it is 10%.

^{2/} Inter-American Development Bank loan to Eletrobras relet to Furnas.

^{3/} Foreign interest is based on a rate of exchange of NCr\$4.22 to US\$1.

^{4/} Interest rates: first tranche 5½%, second tranche 6%, and third tranche 6½%.

September 11, 1968

ANNEX 15
Page 21, Para 11.06

BRAZIL
CENTRAL ELETRICA DE FURNAS S.A.

Amortization Schedule
(thousand NCr\$)

	<u>Amortization Period (Years)</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>Local Loans</u>									
Eletrobras: Furnas Project (four loans)	Various ^{1/}	4,287	4,611	4,897	5,278	5,658	6,107	6,559	7,088
Estreito Project	15	-	-	2,683	3,015	3,387	3,806	4,277	4,805
Furnil Project	15	-	-	7,571	8,507	9,559	10,740	12,068	13,559
Santa Cruz Project	20	35	38	41	44	48	52	56	61
Others - Minor works ^{2/}	11	-	112	224	224	224	224	224	224
Total local amortization		<u>4,322</u>	<u>4,761</u>	<u>15,416</u>	<u>17,068</u>	<u>18,876</u>	<u>20,929</u>	<u>23,184</u>	<u>25,737</u>
<u>Foreign Loans</u> ^{3/}									
IBRD Loan No. 211-BR - Furnas Project	20	8,160	8,636	9,142	9,676	10,237	10,839	11,469	12,136
IBRD Loan No. 403/474-BR - Estreito Project	20	-	-	-	8,919	9,435	9,982	10,546	11,157
AID Santa Cruz Project - Stage I	17	3,010	3,010	3,010	3,010	3,010	3,010	3,010	3,010
AID Santa Cruz Project - Stage II	15	-	-	-	-	-	10,116	10,116	10,116
AID Furnas/Guanabara Transmission Project	22 -	2,688	2,688	2,688	2,688	2,688	2,688	2,688	2,688
Suppliers Credit - Ansaldo San Giorgio	3	-	1,872	1,872	1,871	-	-	-	-
Proposed IBRD Loan - Porto Colombia Project	19	-	-	-	-	-	-	-	1,915
Future - Marimondo Project ^{4/}	19	-	-	-	-	-	-	-	-
Total foreign amortization		<u>13,858</u>	<u>16,206</u>	<u>16,712</u>	<u>26,164</u>	<u>25,370</u>	<u>36,635</u>	<u>37,829</u>	<u>41,022</u>
Total amortization		<u>18,180</u>	<u>20,967</u>	<u>32,128</u>	<u>43,232</u>	<u>44,246</u>	<u>57,564</u>	<u>61,013</u>	<u>66,759</u>

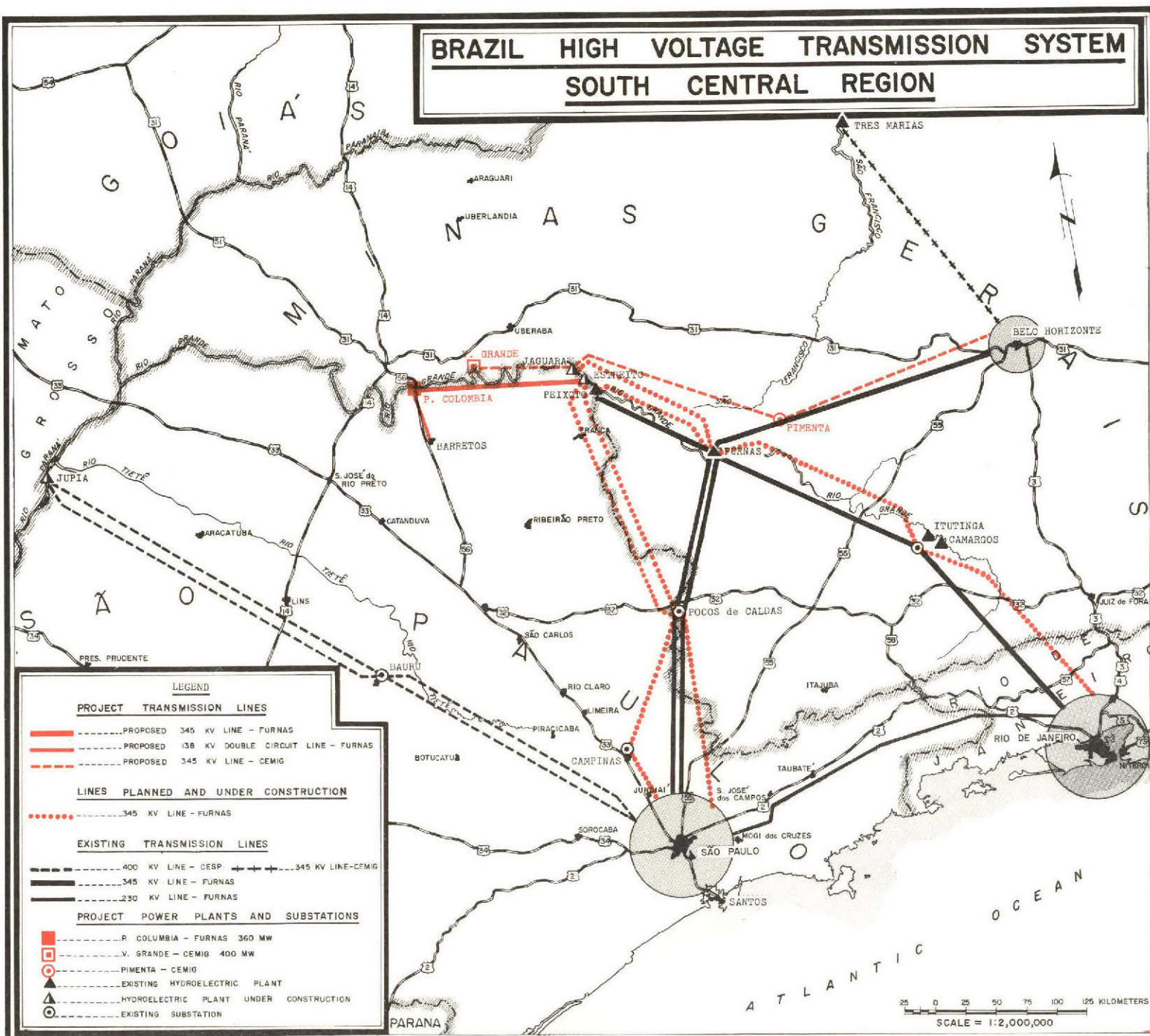
^{1/} Two loans amortized in 20 years and two loans amortized in 15 years.

^{2/} Inter-American Development Bank loan to Eletrobras relent to Furnas.

^{3/} Amortization of foreign loans is based on a rate of exchange of NCr\$3.22 to US\$1.

^{4/} Amortization commences in 1977.

September 11, 1968



#211
DECLASSIFIED

MAR 07 2023

WBG ARCHIVES

RESTRICTED

Report No. TO-1842

This report was prepared for use within the Bank. In making it available to others, the Bank assumes no responsibility to them for the accuracy or completeness of the information contained herein.

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

APPRAISAL OF FURNAS HYDROELECTRIC PROJECT

BRAZIL

September 9, 1958

CURRENCY EQUIVALENTS

(May 1958)

At the special rate of exchange:

US \$ 1	=	55 Cruzeiros
1 Cruzeiro	=	US\$ 0.02
1 million Cruzeiros	=	US\$ 18,200

At the estimated free market rate:

US\$ 1	=	130 Cruzeiros
1 Cruzeiro	=	US\$ 0.01
1 million Cruzeiros	=	US\$ 7,700

APPRAISAL OF FURNAS HYDROELECTRIC PROJECT - BRAZIL

TABLE OF CONTENTS

	<u>Page</u>
SUMMARY	1
I. INTRODUCTION	1
II. THE BORROWER	1
III. THE POWER MARKET	2
General	2
Growth of Demands	3
Generating Resources	4
IV. THE FURNAS PROJECT	6
Development of the Rio Grande	6
Description of the Project	7
Hydrology	8
Present Status of the Project and Construction Schedule	8
Estimated Capital Costs	9
Economic Justification	11
V. FINANCIAL ASPECTS	12
Sources of Funds	12
Electricity Regulations in Brazil	14
Financial Forecasts	15
VI. CONCLUSIONS	17
Annex 1 - System Requirements and Existing Plant Capacity, 1957	
" 2 - 1957 Sales in Consumer Categories	
" 3 - Estimated Peak Requirements, 1958 to 1970	
" 4 - Peak Generation Capabilities, 1958 to 1970	
" 5 - Power Surpluses and Deficits, 1958 to 1970	
" 6 - Estimated Rate of Expenditures for First and Second Stages	
" 7 - Comparison of Furnas with a Thermal Alternative	
" 8 - Capital Subscription Statement	
" 9 - Brazilian Electricity Regulations (Decree 41,019)	
" 10 - Bill to regulate the economic and financial operation of electrical utilities	
" 11 - Forecast of Income Statement and Cash Flow - First Stage only	
" 12 - Forecast of Income Statement and Cash Flow - Total Capacity	
" 13 - Pro-forma Balance Sheets for 1963-72 - First Stage	
" 14 - Pro-forma Balance Sheets for 1963-72 - Total Capacity	

Map

APPRAISAL OF FURNAS HYDROELECTRIC PROJECT - BRAZIL

SUMMARY

The Bank has been asked to consider a loan to cover the foreign exchange costs of constructing the first stage of an 1,100 MW hydroelectric project at Furnas on the Rio Grande. The first stage of the project would have a capacity of about 460 MW and its total cost would be about \$210 million^{1/}, of which \$73 million would be in foreign currencies. This total cost is equivalent to \$455 per kilowatt. The corresponding figure for the complete scheme (1,100 MW) is estimated to be \$276 per kilowatt. These costs are reasonable and the economics of Furnas compare favorably with a high efficiency thermal alternative.

The project would be built and operated by the Furnas Company, which was formed in February 1957 for this purpose, and the Company would be the borrower. The local expenditures would be financed by long-term loans from the National Development Bank (BNDE) and the Federal Electrification Fund and by capital contributions from the BNDE, the State of Sao Paulo and from private and state controlled utilities. The total capital contributions would be Cr\$ 6 billion and the long-term loans would amount to about Cr\$ 11 billion. Satisfactory assurances that this financing will be made available as necessary for the construction of the first stage of the project would be required as a condition of effectiveness of the loan.

The project would comprise a large earth and rock fill dam, a concrete spillway and an open air type powerhouse. The plant for the first stage would consist of five 92 MW or four 110 MW vertical generating units, the size depending on the weights to be transported over the railroads. The net operating head would be about 91 meters. The usable reservoir storage provided by damming the river would be about 14 billion cubic meters and this would be sufficient to provide year to year regulation. It is planned to commission the first unit in October 1962 and to complete the first stage by June 1963.

The executive management of the Furnas Company is of high calibre and the arrangements made for the engineering and supervision of the construction of the project are satisfactory. The civil works contract has been let, following satisfactory procedure, and the contracts for the main plant items should be placed by the end of 1958 or early in 1959.

Power market studies show that the output of the first stage is likely to be absorbed as it is brought into commission and that the second stage should follow on immediately so that the complete station (1,100 MW) would be in service by mid 1965. By that time further new generating capacity would be required in service to satisfy the demand in the supply area, which comprises the central and southern part of the State of Minas Gerais, the State of Sao Paulo and part of the State of Rio de Janeiro. The studies also show that

^{1/} Local expenditures are here converted to dollars at the approximate free market rate of Cr\$ 130 = US\$ 1.

after 1965 major and rapid development of the hydro potential on the main rivers in the area would be necessary, involving very high capacity transmission to bring the additional power and energy to the load centers. Sound development, both technically and economically, will only be assured, however, if all the utilities concerned cooperate in jointly planning the generation and transmission expansion required to meet the future needs, and the establishment of a joint planning board under the leadership of the National Development Council is being discussed with the Government.

The Electricity Regulations governing rates in Brazil are such as to assure adequate revenues to Furnas irrespective of the actual volume of sales. The permitted return is based on the historic cost of assets, however, and with the rapid depreciation of the cruzeiro, public utilities are not attractive for the investment of either Brazilian or foreign capital. This difficulty in raising money could seriously interfere with the future sound development of the electricity supply industry in Brazil. A bill now before Congress would permit the periodic revaluation of assets to allow for changes in the purchasing power of the cruzeiro and this should be pressed through as quickly as possible. The Government's assurance that it will do all in its power to expedite the legislation would be a condition of effectiveness of the loan.

The future financial position of the Furnas Company has been considered over the first 10 years of its commercial operation on the assumption that it would earn revenues assessed in accordance with the current Regulations. The estimates show that the Company would be financially sound with either one stage only or the complete project in service. With only Stage I operating, debt service coverage would average 1.8 through the period while the debt/equity ratio would fall from 68/32 in 1963 to 50/50 in 1972. With the complete project in service, debt service coverage would average 2.0 and the debt/equity ratio would be 73/27 in 1963 declining to 53/47 in 1972.

The report concludes that the project is sound and, subject to satisfactory assurances on the points enumerated in paragraph 86 of Chapter VI, suitable for a Bank loan equivalent to \$73 million. Having regard to the nature of the project, a loan period of 25 years would be appropriate with repayment starting after 5 years.

I. INTRODUCTION

The Bank has been asked to lend \$73 million to help finance the first stage of the Furnas hydroelectric project on the Rio Grande in Brazil. The location of the project is shown on the map at the back of this report which also shows the areas of supply of the utilities in central-southern Brazil. The project would have an ultimate capacity of about 1,100 MW, of which about 460 MW would be installed in the first stage, and its output would be purchased in bulk by various utilities in the States of Sao Paulo and Minas Gerais.

2. Much of the preliminary design work and geological studies were done by Cobast, the management company of Brazilian Traction, and detailed specifications for the civil works contract were prepared in the autumn of 1957 by the consultants, International Engineering Inc. of San Francisco. In April 1958 a Bank mission went to Brazil to appraise the project.

II. THE BORROWER

3. The borrower would be the Central Eletrica de Furnas S.A., which would also construct, own and operate the project. This company was registered in Rio de Janeiro on February 28, 1957 and in accordance with Decree 41.019 (Annex 9) was granted a 30 year concession in July 1957 to utilize hydraulic power from the Rio Grande at Furnas Rapids.

4. Furnas' shareholders and their ultimate participations in the common and preferred stock are as follows:

	Common Stock %	Participating Preferred Stock %
National Economic Development Bank <u>1/</u>	51.0	-
Centrais Eletricas de Minas Gerais, CEMIG <u>2/</u>	25.0	25.0
Sao Paulo State Department of Water & Electrical Energy <u>3/</u>	24.0	15.0
Sao Paulo Light Company <u>4/</u>	-	50.6
Companhia Paulista de Forca e Luz <u>5/</u>	-	9.4
	100.0	100.0
	3000	3000

1/ Government controlled.

2/ Controlled by the State of Minas Gerais - CEMIG has received an IBRD loan for \$7.3 million (Itutinga 76-BR).

3/ The State of Sao Paulo through the Department of Water & Electric Energy owns the majority of the shares of USELPA, an IBRD borrower under Loans 93-BR (Salto Grande) and 187-BR (Jurumirim) totalling \$23.4 million.

4/ Controlled by Brazilian Traction, to which the IBRD has already made loans totalling \$108.8 million (11-BR and 95-BR).

5/ Controlled by American and Foreign Power.

5. It is intended that the capital will be 50% common and 50% preferred stock and that subscriptions will be made in the above proportions to a total of Cr\$ 6 billion for the first stage of construction. The preferred stock does not carry voting rights and the Federal Government, through the BNDE, therefore has a controlling interest. At December 31, 1957 subscribed capital amounted to Cr\$ 775 million common and Cr\$ 775 million preferred, or a total of Cr\$ 1,550 million. Of this Cr\$ 701.2 million had been paid up.

6. This is the first time that official Brazilian agencies have entered into a joint venture with private foreign-owned power companies. Three of the four entities joining with the Brazilian Government to finance and own Furnas are already directly or indirectly IBRD borrowers. Together they own 91% of the preferred stock and 49% of the common.

7. The Deed of constitution of the Furnas Company lays down that the electricity produced by the Company will only be sold to the above shareholders. It also stipulates that 50% of the output will be assured for supply in the State of Minas Gerais and 50% for supply in the State of Sao Paulo, but clearly, if the pattern of demand necessitated a departure from this, suitable arrangements could be made.

8. The Board of the Company comprises three full-time executive directors and four part-time members: the President is John Cotrim, formerly with CEMIG and the head of the power section of the Development Council; the Technical Director is Flavio Lyra da Silva, who is also a member of the administrative council of CEMIG; and the Financial Director is Benedicto Dutra, also Director of Central Eletrica do Piau, an associate of CEMIG. The four part-time members are Lucas Lopes, Chairman, Minister of Finance, Mario Lopes Leao, President of USELPA (State of Sao Paulo), Mauricio Chagas Bicalho of CEMIG and Joao da Silva Monteiro Filho of Brazilian Traction.

III. POWER MARKET

General

9. The map at the back of this report shows the location of Furnas in relation to the principal supply systems in the States of Sao Paulo, Rio de Janeiro and Southern Minas Gerais. As already mentioned, the output of Furnas can only be sold to the shareholders of the Company which, in the case of the Sao Paulo State, would include all electricity supply utilities in that State. Furnas can therefore sell direct to:

The State of Sao Paulo

Sao Paulo Light S.A.

? - Usinas Eletricas do Paranapanema (USELPA))
Cia Paulista Forca e Luz (CPFL)) In the State of Sao Paulo
? - Cia Hidroeletrica do Rio Pardo (CHERP))

Cia Eletrica de Minas Gerais (CEMIG) - In the State of Minas Gerais

10. The Sao Paulo Light Company is interconnected with the Rio Light Company (both Brazilian Traction subsidiaries) which is in turn interconnected with the Companhia Brasileira de Energia Eletrica (CBEE - an American and Foreign Power subsidiary) to the east of Rio de Janeiro. The area to which Furnas will contribute will therefore include the supply areas of these eight electricity supply undertakings, together with a number of smaller companies in Minas Gerais which receive bulk supplies from CEMIG and other small companies in the State of Sao Paulo which will receive supplies from USELPA, CHERP and from the Barra Bonita hydro project (ultimate capacity 132 MW) now under construction by the State of Sao Paulo. In the studies which follow the small companies in Minas Gerais (including the Cia Forca e Luz de Minas Gerais (CFLMG), another subsidiary of American and Foreign Power, which serves the city of Belo Horizonte) have, together with CEMIG, been labelled "Central and Southern Minas Gerais", and those in the State of Sao Paulo have been included under the headings "USELPA", "CHERP" and "Barra Bonita" as appropriate. Electrically isolated companies have been excluded.

11. Annex 1 gives the 1957 MW demands, kwh supplies (including losses) and the existing plant capacity for the area to which Furnas will contribute. This shows that the aggregate demand in 1957 amounted to nearly 2,200 MW and that the average load factor of the supplies was 61%.

12. The approximate split of the kilowatt hour sales into the various consumer categories in 1957 is given in Annex 2. The table does not include the smaller companies for which the subdivision is not available but gives a good indication of the relative proportions of the various categories in the area. It will be noted that the sales in the two categories, Industrial and Commercial, amounted to nearly 60% of the total.

13. The largest industrial concentration is in the neighbourhood of the city of Sao Paulo but industry is rapidly expanding northwards and in the State as a whole agriculture is highly developed. In Minas Gerais, in the region around Belo Horizonte, are the richest mineral deposits of Brazil, including iron ore, manganese and bauxite, and the mining and steel industries constitute the region's chief source of wealth.

14. Some 78% of Brazil's industrial production, 69% of the chief agricultural products and nearly one-third of the country's livestock come from the area to be served by Furnas.

Growth of Demands

15. The estimated future demands are set out in Annex 3 for the years 1958 to 1970. The estimates for the Sao Paulo Light Company (line 1), the Rio Light Company (line 2) and USELPA (line 6) are those included in the Bank's recent technical reports TO-168a (Brazilian Traction) and TO-158a (Jurumirim). These were re-examined with the Companies concerned and the conclusion was reached that they should remain unaltered. Estimates for the remaining five utilities, CPFL and CBEE of American and Foreign Power, Central & Southern Minas Gerais, CHERP and Barra Bonita, were prepared by the utilities themselves and were accepted with the exception of CPFL, which had assumed a compound rate of growth

of 13% throughout the period. This was considered to be a little optimistic for the later years and the rate has therefore been reduced to 11% after 1960, which is more in line with the other well-established utilities.

16. The compound rates of growth assumed are based on past experience, so far as this is available, together with the immediate known prospects of major industrial developments. The rates of growth are as follows:

Sao Paulo Light	12% to 1961 and 10% thereafter
Rio Light	9.6% to 1961 and 8% thereafter
CPFL	13% to 1961 and 11% thereafter
CBEE	9%
Central & Southern Minas Gerais	11% plus individual metallurgical loads
USELPA	13.6% to 1966 (average), 11% thereafter
CHERP	12%
Barra Bonita	13.9%

17. The growths assumed for the first four of these utilities are based on well-established long-term trends. The last four are relatively new undertakings which should remove shortages of electricity and make possible much more rapid development than hitherto. With the exception of CEMIG, their demands are at present small so that individual industrial loads can be expected to produce high rates of growth.

18. It will be seen from Annex 3 that the total demand in the area to which Furnas will contribute is expected to increase from some 2,500 MW in 1958 to some 8,700 MW in 1970, a total increase of about 6,200 MW.

19. In practice there would be some diversity between the demands of the various utilities but the daily and seasonal load patterns of the utilities are very similar and the diversity would therefore be small. In the consideration of the generating resources which follows, no allowance is made for the risk of plant outage and such diversity of demand as there would be could be regarded as a small provision against this risk.

Generating Resources

20. Besides Furnas, two other major hydroelectric projects are under construction. These are Peixoto of the Paulista Company and Tres Marias of CEMIG, with ultimate capacities of about 400 MW and 480 MW respectively. At Peixoto 80 MW of plant is already in service (two 40 MW units) and a further 80 MW is on order for commissioning in 1959. The initial installation at Tres Marias will comprise two 60 MW units which are expected to come into service in 1962 and 1963 respectively. It would clearly be desirable that these two stations, in

addition to the plant already under construction by the various utilities, should be completed in accordance with the present programs and this has been assumed in the preparation of Annex 4 which shows the generating resources expected to be available to each utility from 1958 to 1970. In Annex 5 the surpluses and deficits resulting from the comparison of Annexes 3 and 4 are brought together and this indicates the probable pattern of the future power transfers which it will be necessary to make. It also shows that the output of the first stage of Furnas is likely to be fully absorbed as it is built; the second stage should follow immediately on the first and not only would the output of the complete project be absorbed by 1965 but further new projects would have to be started early enough to bring additional capacity into service by that year.

21. The transmission planned for the first stage of Furnas comprises high capacity transmission lines to Sao Paulo (already interconnected with Rio de Janeiro by a 230 KV line) and to the vicinity of Belo Horizonte in the CEMIG area. It will be seen from Annex 5 that the largest deficits must be expected on these three systems. By 1964 the deficit on the Rio Light system would fully load the existing 230 KV line between Sao Paulo and Rio de Janeiro. The Rio Light system is the only one operating at a frequency of 50 cycles per second (the remainder of the area operates at 60 cycles per second) and additional frequency changers would be necessary to enable this line to be fully loaded. The Rio Light Company will at some time have to face the cost of a change in frequency and the Company have had this in mind for some years, all their modern plant being designed to operate at either frequency. Facing a changeover to 60 cycles per second, however, it would seem that the Company should plan to bring additional new plant into commission in 1964.

22. The last line of Annex 5 shows that, if the demands follow the present estimates, the generating resources in the Furnas area would have to be increased by a further 3,000 MW by 1970. It is clear that extensive and rapid development of the hydro potential of the Rio Grande below Furnas and Peixoto, and perhaps of the Rio Parana (into which the Rio Grande flows), will be required between 1965 and 1970 and that a major high capacity grid system will be necessary to transmit the power and energy to the load centers. Any major transmission lines planned now should conform with the ultimate pattern required and should be designed to operate at one common voltage, which should be the highest practicable in the present state of technical knowledge. The lines to be provided for the first stage of Furnas are being planned with this in mind.

23. The National Development Council keeps the future electricity requirements of the country under review and has recently published its "program of targets" which reviews the requirements of all the basic industries. The section dealing with electricity supply compares the estimated demands up to 1966 with the expected plant capacities, taking into account all the projects, including Furnas, Tres Marias and Peixoto, which are in hand or immediately contemplated, and concludes that further capacity will be required before the end of the period.

24. With the exception of Furnas, which is the first cooperative venture of its kind in Brazil, new plant projects are being promoted by individual utilities

with the main object of supplying their own requirements and by State sponsored organizations formed expressly to develop certain reaches of the main rivers (USELPA, CHERP and "Barra Bonita") which the small companies operating in the vicinity are not equipped to do.

25. At present, therefore, development is largely parochial and there is no fully coordinated long-term plan for the development of electricity supplies in central-southern Brazil. In view of the magnitude of the task ahead, joint planning is now urgently needed and all the utilities concerned should cooperate fully to ensure sound and economic development. With full coordination it would be possible to concentrate on the best projects and to build complete stations, instead of following the present practice of providing the civil works for a number of projects and installing plant piecemeal in each as required to meet the local demand. This would reduce idle capital to a minimum and ensure the best use of funds.

26. To this end the utilities should set up a joint planning board, preferably under the leadership of the National Development Council. A fully coordinated development plan should be prepared covering the additional generating and transmission capacity required for the area as a whole over, say, 15 years and this should be reviewed and extended periodically in the light of actual load development. The joint planning board should have the responsibility of recommending to the Council each project to be put in hand, its timing, the arrangements for its construction and for its financing. Each project should, of course, form part of the long-term plan of development.

27. A bill to establish a new Federal Agency - "Electrobras" - is under consideration by Congress. Electrobras would be a stock company with the duty of carrying out that part of the development of electricity supplies which would be the responsibility of the Federal Government. If this agency were formed it would, clearly, have to play a part in any joint planning. It is doubtful, however, whether it should be given the responsibility of organizing and leading in this matter in view of its strictly federal responsibilities.

IV. THE FURNAS PROJECT

Development of the Rio Grande

28. The site of the project is on the Rio Grande in the State of Minas Gerais about 320 kilometers almost due north of the city of Sao Paulo (see Map at the back of this report). The Rio Grande rises near the border between the States of Minas Gerais and Rio de Janeiro and 19 km. above the Furnas rapids the river is joined by the Rio Sapucaí, of about the same size. The total catchment area above Furnas is about 52,000 square kilometers. The Rio Grande for the greater part of its length flows approximately east to west and it finally joins the Rio Parana about 500 km. downstream from Furnas.

29. Two hydroelectric stations have already been constructed on the Rio Grande. About 180 km. upstream from Furnas is the 25 MW Itutinga plant of CEMIG (ultimate capacity 50 MW) which the Bank helped to finance (Loan 76-BR).

100 km. downstream is the Peixoto station of the Paulista Company (American and Foreign Power) which now has 80 MW of plant installed and will have an ultimate capacity of about 400 MW. A third station, Camargos, immediately above Itutinga, is under construction. It will have a capacity of 40 MW and should be commissioned in 1960. The total potential of the river, including Furnas and the existing stations, is about 7,500 MW.

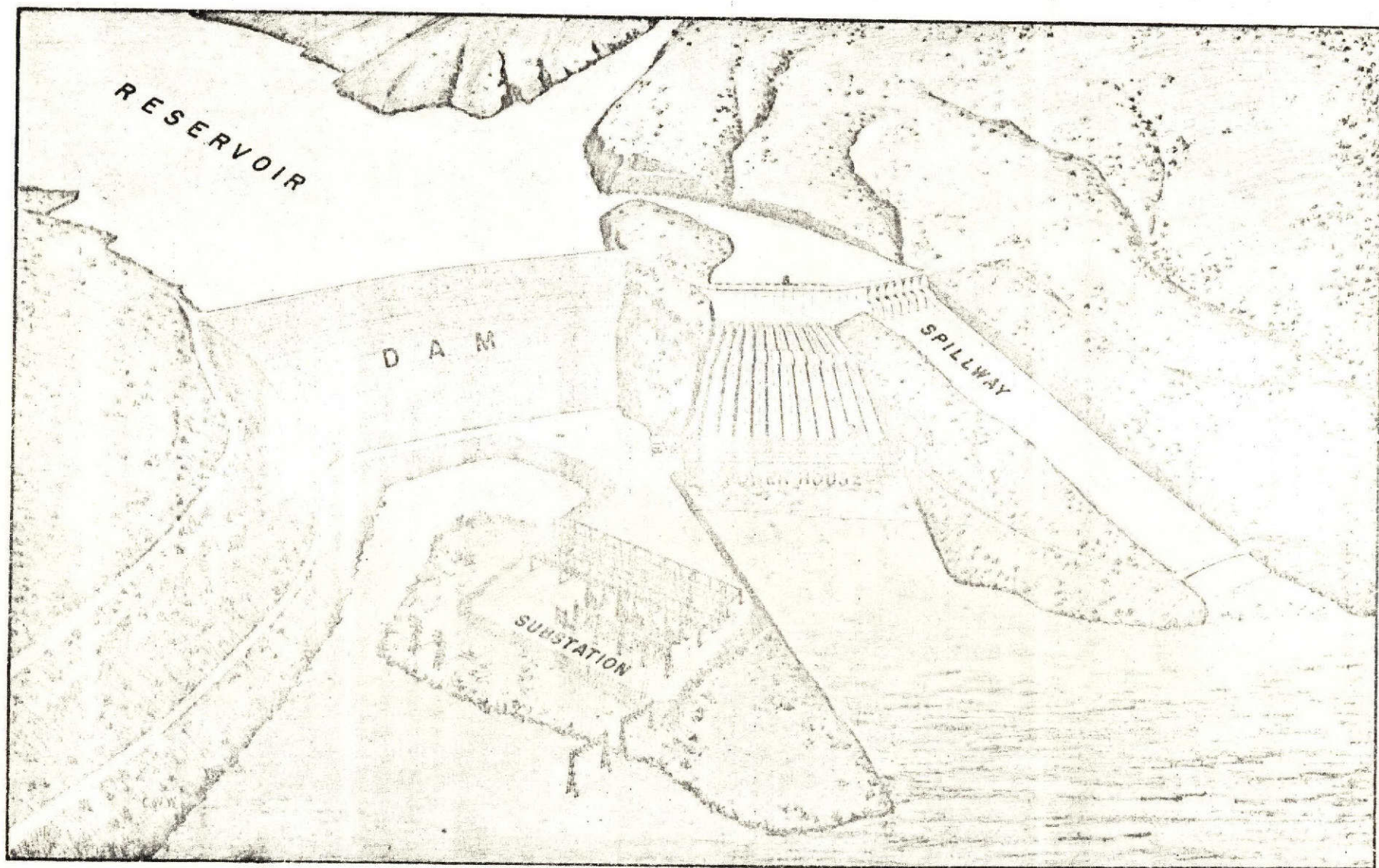
Description of the Project

30. The Furnas project will be large by any standards. Its total ultimate capacity of about 1,100 MW will be equivalent to half the demand in the supply area in 1957 and will approach that of Kariba in Rhodesia (1,200 MW). The installation will comprise twelve 92 MW or ten 110 MW generating units, the size depending on the weights to be transported over the Brazilian railroads. The units will be vertical shaft machines driven by Francis turbines operating with an average net head of 91 meters. The project will be constructed in two stages. The first, to which the present loan application relates, will comprise the civil works and five 92 MW (or four 110 MW) generating sets. The second stage is expected to follow quickly on the first.

31. The main dam will be of the earth and rock fill type, 120 meters high and 500 meters long. The dam will be slightly arched in the upstream direction and will have a total volume of about 10 million cubic meters. The spillway will be excavated in the left abutment, where the rock is reasonably sound, and will be designed to pass 13,000 cubic meters of flood water per second with a three meter reservoir surcharge. Between the spillway and the main dam a relatively small concrete dam (42 meters high and 225 meters long) embodying the intake works will be constructed and steel penstocks will supply water to the open air type power station which will be constructed immediately below. The low voltage switchgear and the 13.8/380 KV unit transformers will be positioned on the power station platform.

32. The high voltage transmission switching station will be built on Sapo island immediately downstream and it is planned to build 380 KV transmission lines to interconnect Furnas with Sao Paulo, the major load center 320 km. to the south, with Lafaiete, a smaller load center 260 km. to the east (and 80 km. south of Belo Horizonte), and with Peixoto, the Paulista Company's hydro station 100 km. downstream from Furnas. The general layout of the project is shown on the sketch following this page.

33. The Furnas reservoir will have a surface area of about 1,330 square km. and a usable storage of 14 billion cubic meters with a drawdown of 16 meters. It will extend some 240 km. up the Rio Grande and about 170 km. up the Rio Sapucaí. The storage will be sufficient to provide year to year regulation. It will also be necessary to construct a small earth dam 35 meters high to seal off the reservoir from the upper reaches of the Rio Pium-i, one of the tributaries of the Rio Grande, in order to prevent water from the reservoir spilling over a low saddle in the hills into the Rio Sao Francisco. The alternative to this small earth dam would be a very much more costly dam across the saddle. The local authority have undertaken to deepen the cut across the saddle to ensure the free flow of the upper Pium-i into the Rio Sao Francisco.



THE FURNAS HYDROELECTRIC PROJECT
RIO GRANDE, BRAZIL

Hydrology

34. River flows have been recorded since 1930 at Sao Jose da Barra, a few kilometers upstream from Furnas. Dry periods occurred in 1933 and 1934 and from 1952 to 1956 inclusive. Examination of rain gauge recordings indicates that the last previous prolonged dry spell was about 50 years ago. It was, however, much less severe than the 1952 to 1956 dry period. Based on the 1952-56 dry period it is estimated that the minimum annual energy production at Furnas would be 4 billion kwh. The average annual output is expected to be 5.7 billion kwh and, with the large Furnas reservoir, this could be closely maintained in all years except during a severe prolonged dry spell. With only the first stage in service the estimated average annual output is 3.2 billion kwh.

35. The largest flood on record occurred in 1947 when the maximum daily flow at Furnas was about 6,600 cubic meters per second. In 1929, however, a more serious flood occurred in which, although the peak flow was less than in 1947, the duration was much longer. It is understood that at that time there was heavy rainfall covering the whole of the catchment area for several weeks and that the damage caused was severe, bridges being carried away and many houses destroyed. Another major flood occurred in 1906 but no measurements were then available from which the flow at Furnas could be assessed. It was, however, no more severe than the 1929 flood. Based on this experience, the spillway is being designed to pass 13,000 cubic meters per second continuously with a reservoir surcharge of three meters, at which level no land not covered by the reservoir clearance will be flooded. Provision is also being made to permit in emergency an additional two meters surcharge without damage to the dam and at this level the spillway would handle rather more than 15,000 cubic meters per second continuously.

Present Status of the Project and Construction Schedule

36. The site has been extensively surveyed by borings. Except for the left abutment and the river bed the rock is poor, much of it being highly jointed, friable or weathered. The two diversion tunnels, each 13 meters equivalent diameter, will therefore be driven in the left abutment and the spillway, intake works and powerhouse will also be located on this side.

37. Bidding for the civil works contract was invited on an international basis and the contract has now been placed with George Wimpey, of England, in association with the Brazilian firm Construtora Nacional S.A. The contract is on a target price basis and is satisfactory. Work started on the diversion tunnels in June 1958.

38. The management of the Furnas Company has been drawn from the electricity supply industry in Brazil and is composed of men with extensive experience in this field. They are fully competent to organize the construction of the project and its subsequent operation. The International Engineering Company of San Francisco have been appointed consultants for the work and have established an office in Rio de Janeiro where the bulk of the design drawings will

be prepared. Cobast, the management company of Brazilian Traction in Brazil, have been engaged to supervise the work on site on behalf of the Furnas Company. These arrangements are satisfactory.

39. Over the last 12 months good site service roads have been constructed and the permanent buildings comprising the camp, stores and maintenance depot are nearing completion. A road bridge is under construction to give access to the right bank. About 1,200 men are engaged on this work and will be transferred to the construction of the project in due course.

40. In the reservoir area about 1,800 square km. of land and nearly 1,700 houses have to be purchased. Two field offices, one at Guape and one at Alfenas have been established to serve as headquarters for teams engaged on survey, valuation and negotiation of purchases. A detailed aerial survey has been completed, all properties have been listed and plotted, and the detailed surveys of the individual properties are proceeding well. 100 kilometers of roads have to be relocated and two major bridges built, one of which will be paid for by the State of Minas Gerais. All this work is well programmed and it is expected that it will be completed in phase with the project construction so that the reservoir can be filled to schedule. It is intended, however, to obtain an undertaking from the Government to give every possible assistance to avoid delays.

41. The cost estimates also include provision for relocating 110 km. of the Rede Mineira de Viacao (State owned) railroad between Varginha and Jureia. The traffic on this section of line is very small, however, and it is understood that the section runs at a loss. There is reasonable expectation, therefore, that the section will be closed permanently and the relocation avoided.

42. Contracts for the main plant items are expected to be placed by the end of 1958 or early in 1959 and it is planned to commission the first unit in October 1962, the second in December 1962 and the remaining three units of the first stage by June 1963.

Estimated Capital Costs

43. The estimated costs of the first stage of the Furnas project are as follows:

Construction Cost Estimates
(in millions)

	<u>Local Currency</u> <u>Costs in Cr\$</u>	<u>Foreign Currency</u> <u>Costs in US\$</u>	<u>Total Cost</u> <u>in Cruzeiros</u>
Land Acquisition	1615 1,404	-	1,404
Civil Works & Construction	4871 4,428	15.8 14.8 - 18.9 .502	5,242
Equipment	428 388	20.2 18.9 -	1,428
Plant and Equipment			
Relocation of Roads, Villages, etc.	943 820	-	820
Transmission System & Terminal Substations	634 576 .067	14.3 13.4 - 13.4 .350	1,313
Provision for increases in costs of labor and materials	4,801	2.3	4,927
Subtotal	12,417	49.4	15,134
Contingencies	873	3.3	1,054
Engineering, Administration, Contractor's Fee	937 .101	5.3 5.3 .141	1,229
Interest during construction and other charges	3,593	14.4 27.6	4,385
Total	17,820	72.4	21,802

44. In calculating the total cost in cruzeiros shown in the above table, a rate of exchange of Cr\$ 55 to US\$ 1 has been used. This was approximately the official rate applicable in May 1958 for the purchase of dollars for expansion of electricity services.

45. In assessing the total cost of the Furnas project in terms of dollars, however, it is more appropriate to use the free rate of exchange which in mid-May was about Cr\$ 130 to the US dollar. At this rate, the total cost of the first stage expressed in dollars would be \$209.5 million, which is equivalent to \$455 per KW installed.

46. The dollar cost estimates for equipment and materials contain provision for freight, insurance and erection at the site. Provisions for contingencies and for cost increases have been made as follows:

	<u>Local Currency</u>	<u>Foreign Currency</u>
Contingencies:		
(a) on Civil Works, Plant, and Transmission facilities	10%	7%
(b) on Land Acquisition and rehabilitation	15%	-
Provision for cost increases (per year)	20%	4% ^{1/}

^{1/} Up to the date of placing orders.

With these allowances, the estimates are considered reasonable.

47. The second stage of the project should follow immediately on the first and the whole project should be in service by June 1965. Allowing for price increases and contingencies as stated above, the estimated cost of the second stage, including interest during construction, is Cr\$ 5,073 million and \$55 million. The total cost expressed in cruzeiros using the special exchange rate of Cr\$ 55 = US\$ 1 would therefore be Cr\$ 8,075 million. Expressed in US dollars, using the free rate of exchange of Cr\$ 130 = US\$ 1, the total cost of the second stage would be \$94 million and the cost for the whole project \$303.5 million. The estimated cost per kilowatt of the complete project would therefore be \$276. 2-C

48. The dollar costs per kilowatt quoted above are probably high since the use of the present free rate of exchange is not consistent with the assumption of 20% per annum increase in costs of labor and materials for the local currency expenditures. Excluding the allowance for cost increases, the cost of the first stage would be equivalent to \$360 per kilowatt and for the complete project \$210 per kilowatt. Bearing in mind that the project will operate at high load factor (about 60%) these costs are remarkably low.

49. The approximate rates of expenditures for the first and second stages are shown in Annex 6.

Economic Justification

50. In Annex 7 the Furnas project is compared with a thermal alternative. The estimated capital costs of the thermal plant have been based on the estimates for the two 125 MW oil fired steam units now being installed at the Piratininga station near Sao Paulo and the thermal efficiency assumed corresponds to the expected performance of these units which will operate at 1,800 lbs. per square inch and 1,000° F, with reheating to 1,000° F. The fuel costs and other operating costs of the thermal plant have been assessed from the actual costs incurred with the existing plant at Piratininga. The capital and operating costs at Furnas are the Furnas Company's estimates, excluding provision for increases in costs of labor and materials.

51. The estimates indicate that with Stage I only of the Furnas project the savings in operating costs would represent a return of about 9% on the additional investment. This return would increase to about 17% for the completed project. The additional expenditure is, therefore, clearly justified. Moreover, the completed project would avoid the importation of nearly 1½ million tons of oil fuel in an average year.

52. Nearly 80% of Brazil's industry is situated in the area to which the project will contribute and the demand for industrial power and energy must be expected to grow very rapidly, the intention being to substitute home-produced goods for imported goods as quickly as possible. This development is proceeding and includes the manufacture of motor cars, trucks and tractors of various types, chemical production, metallurgical production, oil refineries and many other branches of industry. In 1957 nearly 60% of the energy sales in

the area went to industry and commerce and this proportion may be expected to increase in future. The Furnas project is therefore very important to the development of Brazil.

V. FINANCIAL ASPECTS

Sources of Funds

53. The construction expenditures in the years 1958-63 inclusive, for the first stage, in the years 1961-65 inclusive for the second stage, and the sources of the funds, are estimated to be:

Expected Sources of Funds

	<u>1st Stage</u>	<u>2nd Stage</u>	<u>Total</u>
<u>Foreign currency</u> ^{Thousands} (millions)	<u>\$ 72,400</u>	<u>\$ 55,000</u>	<u>\$ 127,400</u>
<u>Local currency</u> (millions)			
Loans from the National Development Bank (BNDE)	Cr\$ 3,603	Cr\$ 881	Cr\$ 4,484 ✓
Loans from the Federal Electrification Fund (FFE)	7,412	1,608	9,020 ✓
Share Capital	6,805	-	6,805 ✓
Retained Earnings (Auto-financing)		2,584	2,584
Total Cruzeiro expenditure	<u>Cr\$ 17,820</u>	<u>Cr\$ 5,073</u>	<u>Cr\$ 22,893</u>

54. Foreign and local currency costs of the first and second stages of the project include interest during construction. The agreed total capital contribution is Cr\$ 6,000 million and, according to the Furnas Company's articles, interest on the capital during construction will accrue at 6%, amounting in total to Cr\$ 805 million. This will be credited to Furnas shareholders by the issue of additional shares.

55. As a condition of effectiveness of the proposed loan, assurances regarding the subscription and paying in of capital will be obtained from the shareholders. With the present regulations governing power rates, however, it may be impracticable to obtain stronger assurances than expressions of intent and the BNDE will be required, also as a condition of effectiveness, to undertake (a) to make good any shortfall of capital and (b) to cover the remainder of the local currency expenditures for the first stage by long-term loans from their own portfolio and from the Electrification Fund (FFE) which they administer. (111)

56. In the event therefore there may be more participation by the Government and less by the private companies than is envisaged in the present plans for financing the project. This may be unavoidable but it would be desirable that the share capital should not be less than the Cr\$ 6 billion at present contemplated and this point will be covered in the BNDE undertaking.

57. The proposed Bank loan for Furnas has, for the purpose of calculation, been assumed to bear interest at $5\frac{1}{2}\%$ per annum and to have a term of 25 years, including a grace period of about 5 years. Amortization by equal semi-annual payments of combined principal and interest is assumed to begin in April 1964 and end in October 1983.

58. The Company expects that the following conditions will apply to the local currency loans: The BNDE loan would include an initial commitment charge of 1% of the whole loan and would bear interest at $9\frac{1}{2}\%$. In addition, a commission of 1% during the construction period and $\frac{1}{2}\%$ thereafter would be payable. The FFE loan would have no commitment charge and would bear interest at 8%. The term of the BNDE loan would be 20 years and that for the FFE loan 25 years. Each loan would be amortized by equal annual payments after a five year period of grace. The BNDE wishes to have security for its loan. Satisfactory security for the Bank loan would be a condition of effectiveness.

59. Annex 8 shows a breakdown of equity participation throughout the period 1957 to 1964 when it will be finally raised to Cr\$ 6 billion, comprising three million common shares and three million preferred shares, each with a par value of Cr\$ 1,000. The relative participation in each category of stock by the five shareholders is given in paragraph 4 of Chapter II of this report. The preferred stock has preference over the common as to repayment of capital (liquidation) and is entitled to cumulative dividends at the rate of 10% per year starting with the date on which the installation goes into effective production (assumed in this report to be 1963). The cumulative feature does not become effective, however, until the first fiscal year in which net profits allow the payment of 10% on the preferred shares.

60. The participation of the BNDE will be made with resources of the Federal Electrification Fund in accordance with Article 7 of Law No. 2944 of November 8, 1956 which provides that the corresponding shares will be transferred later to Electrobras if and when that agency comes into being (see paragraph 27, page 6). The Fund is expected to have ample resources for this purpose.

61. CEMIG's participation is to be made with the State of Minas Gerais quota of the Federal Electricity Tax (Imposto Unico de Eletricidade) - 60% of which is distributed among the States (see paragraph 66) - supplemented by resources from the State taxes allocated for electrical development and from its own operating profits.

62. The Department of Water of the State of Sao Paulo also plans to meet its commitments to Furnas with resources of the State of Sao Paulo's quota of the Federal Electricity Tax supplemented by funds from the State taxes allocated for electrical development.

63. Although there are no definite plans for the financing of the second stage, the assumptions shown in paragraph 53 have been made by the Furnas Company in order to obtain a proper evaluation of the Company's future financial position. It will be noted from the table that, of the total estimated cruzeiro expenditures (Cr\$ 5,073 million) for Stage II of the project, rather more than half would be provided from revenue.

Electricity Regulations in Brazil

64. The Regulations at present governing electricity supplies in Brazil are set out in Decree 41.019 which was issued in February 1957. A summary of the main provisions of this Decree is given in Annex 9. As regards rates the Regulations are in principle good, the permissible revenues covering all costs, including provision for "amortization"^{1/} as well as depreciation, and providing a 10% return on the investment.

65. The rate base, however, is assessed from the historical cost of the assets and, with the cruzeiro depreciating at about 20% per annum, public utilities are not attractive for the investment of either Brazilian or foreign capital. Regarding the latter, foreign investment registered with SUMOC (Superintendencia da Moeda e do Credito) is entitled to a return of 8% in cruzeiros. Until August last year the special rate fixed by the Government (at present about Cr\$ 55 = US\$ 1) applied to the conversion of the return into dollars but this privilege was then removed and foreign currency remittances must now be purchased at the free market rate of exchange (about Cr\$ 130 = US\$ 1 in May 1958).

66. To provide for expansion of electricity supply services a tax is levied by the Government on all electricity consumed. 40% of this tax is deposited in a Federal Electrification Fund (established in August 1954) and the remaining 60% is distributed among the various States. The tax amounts to 20 centavos per kwh on domestic and commercial supplies and 10 centavos per kwh for industrial supplies, the latter decreasing as the proportion of the electricity supply costs to total industrial production costs increases, and reaching zero when the proportion amounts to 25%. In addition, customs duty equivalent to 0.5% of the value of all imported goods except fuel and lubricants is credited to the Federal fund, together with 4% of the total revenue from the Federal excise tax on goods sold on the home market. The money in this fund is at present administered by the National Development Bank and it is understood that loans are made for a maximum term of 25 years, with an interest rate of 8%.

67. Annex 9 also summarizes the present provisions regarding concessions. The Furnas concession, granted for a 30 year period by Presidential Decree in

^{1/} This provision for "amortization" is intended to pay off the whole investment over the concession period. It is not based on actual debt repayments. (See paragraph 11 of Annex 9.)

July 1957, must in due course be evidenced by a contract to be signed by the Division of Waters and by the Furnas Company. The Company has complied with the requirements of the law by submitting full details of the Furnas scheme to the Division of Waters and it now rests with the Division of Waters to prepare the concession contract. There is no certainty when this will be done but delay in doing so would seem advantageous since the period of the concession will start only when the contract is signed. The Company intends to apply for an extension of its 30 year concession period to 40 years but, without this extension, a 25 year period for a Bank loan (which would seem appropriate in the case of Furnas) would be well within the concession period. The concessionaire apparently has the right to choose whether the provision for reversion of the property to the State at the end of the concession period will be with or without indemnity. It is evident from Annex 9 that reversion without indemnity gives greater freedom to the concessionaire to use retained earnings and the Company intend to select this basis.

68. A bill is now before Congress which would provide for the revaluation of assets to take account of changes in the purchasing power of the cruzeiro and in addition might increase the maximum permissible return on the investment from 10% to 12%. The main changes proposed in this bill are summarized in Annex 10. There is at present no indication when this bill might become law and the revenue estimates in the financial studies included in this report are therefore based on the current regulations.

69. If this new bill became law the use of depreciation funds, as well as reversion funds, for reinvestment would be subject to the approval of the Government which approval, however, should be readily given.

Financial Forecasts

70. Statements of earnings, estimated sources and application of funds, and revenue cover for debt service for the years 1963 to 1972, inclusive, are given in Annexes 11 and 12. These statements are based on the Company's estimates and are considered realistic. Annex 11 takes into consideration the first stage of construction only and assumes that no further expansion will be undertaken thereafter. In Annex 12 it has been assumed that the Furnas Company will be able to complete the construction of both stages of the project by the end of 1965.

71. Operating expenses are based on detailed forecasts and annual increases of the order of 10% have been made to cover expected increases in price levels in Brazil. The recent rate of price increases of about 20% per annum has been assumed to continue through the construction period of the project but it was considered unduly pessimistic to assume that the same high rate would continue indefinitely. The assumption of 10% after 1962 is of course arbitrary.

72. The Company will provide depreciation in accordance with the regulations of Decree 41.019 of February 26, 1957 at the rate of 5% per annum on the depreciable assets. This is not as high as would appear at first sight, since the depreciable assets represent only 41% of the total fixed assets for the first stage and 57% in the case of the complete project.

73. The Company has also assumed that "amortisation" (see footnote page 14) at the rate of 3% per annum on the total fixed assets, which is the maximum permitted under the regulations of Decree 41.019, will be included in the allowable expenses on which its bulk supply tariff will be based. These quotas are accordingly shown as expenses in the income statements.

74. Net income from operations for the first stage before making allocations to the amortization reserve and before financial charges and provision for legal reserve should average about Cr\$ 2,500 million between 1963 and 1972, which represents a return on average net fixed property (gross property less depreciation) of about 11.7% per annum.

75. Net profits available for dividends for the first stage are expected to average about Cr\$ 982 million between 1963 and 1972, equivalent to a return on share capital of about 14.4%. The Company should be able to pay 10% dividend on the preferred shares and 12% on the common from the first year of operation in 1963. The Company has assumed that in 1965 dividends would be increased to 12% and 14% respectively and that in 1970 dividends would be again increased to 14% and 16% respectively. This may be too optimistic since it would represent a high dividend pay-out (92% on a cumulative basis).

76. Cash receipts from operations for the first stage should cover debt service by an average of 1.8 times, the range being 1.6 to 1.93, and this is satisfactory.

77. In Annex 13 is given the pro-forma Balance Sheets for the first stage of the Furnas project for the 10 year period 1963-72. Total long-term debt expressed as a percentage of net fixed property (gross property less depreciation) should be about 72% in 1963 and would fall to 47% in 1972. The ratios of long-term debt to equity are expected to be 68/32 and 50/50 in 1963 and 1972 respectively.

78. For the complete project (both stages) net income from operations, before making allocations to the amortization reserve and before financial charges and provision for legal reserve, should average about Cr\$ 3,305 million between 1963 and 1972, which represents a return on average net fixed property of about 11.6% per annum.

79. Net profits available for dividends are expected to average about Cr\$ 1,337 million between 1963 and 1972, equivalent to a return on share capital of about 19.6%, and the Company should be able to increase its dividends to 16% on the preferred shares and to 18% on the common by 1969.

80. Cash receipts from operations for the total capacity should cover debt service by an average of at least 2 times during the 9 year period 1964-72, the range being 1.88 to 2.47 times.

81. In Annex 14 is given the pro-forma Balance Sheets of Furnas' total capacity for the 10 year period 1963-72. Total long-term debt expressed as a percentage of net fixed property should be about 74% in 1963 and 55% in 1972. The ratios of long-term debt to equity are expected to be 73/27 and 53/47 in 1963 and 1972 respectively.

82. From the foregoing it is evident that the existing regulations governing rates will permit the Company to operate under sound financial conditions.

VI. CONCLUSIONS

83. The Furnas project is technically and economically sound and is required to meet the rapidly growing demand for electricity in central-southern Brazil. The Furnas Company is under capable management and the arrangements made for engineering the project are satisfactory. Existing Regulations governing rates should assure adequate revenues to maintain the Furnas Company in a sound financial position.

84. Subject to the points listed below, the project is suitable for a Bank loan equivalent to \$73 million. Having regard to the nature of the project a loan term of 25 years would be appropriate with repayment starting after 5 years.

85. Assurances on the following points are required before the loan would become effective:

- (1) The capital and long-term loans must be made available as required for the expeditious construction of the project.
- (2) The Company should seek to obtain the maximum revenues permitted under the relevant regulations.
- (3) If the BNDE insists on security for its loan to the Furnas Company, at least equal security must be given for the Bank loan.
- (4) Every possible assistance should be given by the Government to avoid delays in the purchase of properties in the reservoir basin.
- (5) The enactment of legislation on the lines of the new bill now before the Congress, revising the regulations governing rates, should be pressed through as quickly as possible by the Government.

86. The question of setting up a joint planning board, on which all the major utilities in central-southern Brazil would be represented, will be discussed with the Government and appropriate action urged.

FURNAS Area of InfluenceSystem Requirements and Existing Plant Capacity. 1957

System	System Requirements			
	MW	Million Kwh	Load Factor %	Plant Capacity MW
① Sao Paulo Light	898 ^(a)	5,243	67	990
② Rio Light	544	2,868	60	650
③ Cia. Paulista F.L.	177	935	60	225
④ Cia. Brasileira E.E.	59	309	60	52
⑤ Central & Southern Minas Gerais ^(b)	380	1,770	53	377
⑥ USELPA ^(b)	40	175	50	40
⑦ CHERP ^(b)	60	262	50	60
⑧ Barra Bonita ^(b)	30	130	50	30
TOTAL	2,188	11,692	61	2,424

(a) The Sao Paulo demand in 1957 was artificially low due to strikes. 1,000 MW was exceeded early in May 1958.

(b) Accurate figures for the small companies included in these groups are not available and the figures shown are, in part, estimated.

FURNAS Area of Influence1957 Sales in Consumer CategoriesMillion Kwh

Consumer Classification	S. Paulo Light (a)	Rio Light (b)	CPFL (c)	CBEE (d)	CEMIG (e)	CFLMG (f)	TOTAL 6 companies
1. Residential ✓	696	516	179	70	7	135	1,603 ✓
2. Commercial ✓	569	552	87	32	3	59	1,302 ✓
3. Industrial	2,402	728	235	114	299	27	3,805 ✓
4. Rural ✓	-	-	108	-	2	-	110 ✓
5. Street Lighting ✓	45	90	-	-	-	-	135 ✓
6. Other Utilities (Electric) ✓	27	50	99	3	103	-	282 ✓
7. Public Authorities ✓	162	206	102	37	5	32	544 ✓
8. Electric Traction ✓	428	230	-	-	-	-	658 ✓
9. Interdepartmental	7	29	-	-	11	-	47
10. Associated Companies	168	8	-	-	-	-	176 ✓
11. Others	-	-	-	-	10	-	10
TOTAL	4,504	2,409	810	256	440	253	8,672

NOTES (1) The above information is not available for the small utilities which will take supplies from the USELPA, CHERP and Barra Bonita Systems, and for the utilities other than CEMIG and CFLMG (Belo Horizonte) in Central and Southern Minas Gerais.

(2) Item 7 for companies (d) and (f) includes urban electric traction.

(3) The total for 6 companies covers more than 90% of the area to which FURNAS will contribute. ←

FURNAS Area of Influence

Estimated Peak Requirements, 1958 to 1970 - MW

Area	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
1 Sao Paulo Light	1,080	1,210	1,355	1,520	1,700	1,380	2,070	2,280	2,500	2,750	3,030	3,330	3,660
2 Rio Light	600	650	720	790	850	920	990	1,070	1,150	1,250	1,350	1,450	1,570
3 C P F L	200	230	260	290	322	357	396	440	488	542	602	668	741
4 C B E E	63	68	74	80	87	94	102	111	121	132	144	157	171
5 Central & Southern Minas Gerais	1943	2158	2409	2680	2959	3251	3558	3901	4259	4674	5126	5605	6142
	460	540	610	700	780	950	1,130	1,250	1,350	1,470	1,590	1,730	1,880
6 U S E L P A	65	77	87	96	111	126	144	165	180	200	222	246	274
7 C H E R P	68	78	89	101	115	132	150	171	195	218	244	273	306
8 Barra Bonita	34	39	44	50	57	65	74	84	96	109	124	141	161
T O T A L	2,570	2,892	3,239	3,627	4,022	4,524	5,056	5,571	6,080	6,671	7,306	7,995	8,763

FURNAS Area of Influence

Peak Generation Capabilities, 1958 to 1970 - MW*

System	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
1 Sao Paulo Light	990	990	1,370	1,370	1,370	1,370	1,370	1,370	1,370	1,370	1,370	1,370	1,370
2 Rio Light	650	675	765	765	765	765	765	765	765	765	765	765	765
3 C P F L	225	305	305	425	545	545	545	545	545	545	545	545	545
4 C B E E	52	74	96	96	96	96	96	96	96	96	96	96	96
5 Central & Southern Minas Gerais	478	535	555	555	615	675	735	795	915	975	1,035	1,035	1,035
6 U S E L P A	74	100	100	185	185	185	185	185	185	185	185	185	185
7 C H E R P	60	74	123	137	162	186	186	186	186	186	186	186	186
8 Barra Bonita	30	30	30	96	162	162	162	162	162	162	162	162	162
T O T A L	2,559	2,783	3,344	3,629	3,900	3,984	4,044	4,104	4,224	4,284	4,344	4,344	4,344
						4160	4160	4160	4160	4160	4160	4160	4160
						4160	4160	4160	4160	4160	4160	4160	4160

* Based on existing plant plus projects in hand (May 1958) plus expansion to ultimate capacities of PEIXOTOS & TRES MARIAS hydro plants. The capacity of Furnas is not included.

FURNAS Area of Influence

Power Surplus and (Deficit) Table, 1958 to 1970 - MW

Area	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
1 Sao Paulo Light	(90)	(220)	15	(150)	(330)	(510)	(700)	(910)	(1130)	(1380)	(1660)	(1960)	(2290)
2 Rio Light	50	25	45	(25)	(85)	(155)	(225)	(305)	(385)	(485)	(585)	(685)	(805)
3 C P F L	25	75	45	135	223	188	149	105	57	3	(57)	(123)	(196)
4 C B E E	(11)	6	22	16	9	2	(6)	(15)	(25)	(36)	(48)	(61)	(75)
5 Central and Southern Minas Gerais	18	(5)	(55)	(145)	(165)	(275)	(395)	(455)	(435)	(495)	(555)	(695)	(845)
6 U S E L P A	9	23	13	89	74	59	41	20	5	(15)	(37)	(61)	(89)
7 C H E R P	(8)	(4)	34	36	47	54	36	15	(9)	(32)	(58)	(87)	(120)
8 Barra Bonita	(4)	(9)	(14)	46	105	97	88	78	66	53	38	21	1
Surplus or (Deficit)	(11)	(109)	105	2	(122)	(540)	(1012)	(1467)	(1856)	(2387)	(2962)	(3651)	(4419)
FURNAS Capability						460	736	1104	1104	1104	1104	1104	1104
Net Surplus or (Deficit)	(11)	(109)	105	2	(122)	(80)	(276)	(363)	(752)	(1283)	(1858)	(2547)	(3315)

FURNAS

Estimated Rate of Expenditures for First and Second Stages
(in millions of Cruzeiros)

<u>First Stage</u>	<u>1957</u>	<u>1958</u>	<u>1959</u>	<u>1960</u>	<u>1961</u>	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>Total</u>
Foreign Currency ^{1/}	-	810.8	1.522.4	896.3	389.9	239.6	123.0	-	-	3.982.0
Local Currency	<u>174.7</u>	<u>2.840.5</u>	<u>2.688.6</u>	<u>3.294.1</u>	<u>3.823.8</u>	<u>2.733.4</u>	<u>1.527.2</u>	<u>737.5</u>	<u>-</u>	<u>17.819.8</u>
Total	174.7	3.651.3	4.211.0	4.190.4	4.213.7	2.973.0	1.650.2	737.5	-	21.801.8
<u>Second Stage</u>										
Foreign Currency ^{1/}	-	-	-	-	649.4	931.0	613.9	509.4	298.3	3.002.0
Local Currency	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>85.3</u>	<u>800.0</u>	<u>1.581.2</u>	<u>1.611.3</u>	<u>995.5</u>	<u>5.073.3</u>
Total	-	-	-	-	734.7	1.731.0	2.195.1	2.120.7	1.293.8	8.075.3
Grand Total	174.7	3.651.3	4.211.0	4.190.4	4.948.4	4.704.0	3.845.3	2.858.2	1.293.8	29.877.1
							↑	↑	↑	

^{1/} U.S.\$ converted to Cr\$ at Cr\$.55 = U.S.\$1. The estimated foreign currency expenditures, expressed in millions of U.S.\$, would be:

Stage 1	-	14.7	27.7	16.3	7.1	4.4	2.2	-	-	72.4
Stage 2	-	-	-	-	11.8	16.9	11.2	9.3	5.4	54.6
Total	-	14.7	27.7	16.3	18.9	21.3	13.4	9.3	5.4	127.0

Handwritten:
Total: 303.1
FX: 127.0
L.C.: 176.1

COMPARISON OF FURNAS WITH A THERMAL ALTERNATIVE

(Costs expressed in millions of cruzeiros)

	First Stage - 460 MW			Complete Project - 1,100 MW		
	Furnas	Thermal	Difference	Furnas	Thermal	Difference
1. Output, kwh millions	3,200	3,200		5,700	5,700	
2. Capital cost <u>1/</u>	27,200	8,900	18,300	39,400	21,300	18,100
Operating costs:						
3. Fuel <u>2/</u>	-	1,630		-	2,910	
4. Other	110	150		150	200	
5. Depreciation <u>3/</u>	130	130		190	320	
6. Total	240	1,910	1,670	340	3,430	3,090

Return on additional investment (lines 6 and 2)

First Stage
Complete Project9.1%^A

17.1%

$$= \frac{1,670}{18,300}$$

$$= \frac{3,090}{18,100}$$

- 1/ Dollar expenditures have been converted to cruzeiros at the rate of Cr\$ 130 = \$US 1. The capital costs of the thermal plant (\$149 per KW) are based on the estimated costs of the two 125 MW units now being installed at Piratininga.
- 2/ The fuel costs of generation by the thermal plant are based on the expected thermal efficiency of the new Piratininga plant and the present cost of heat delivered to that station (Cr\$ 50.38 per million Btu). It is believed that this cost does not fully reflect the recent rapid depreciation of the cruzeiro and to that extent the fuel costs are understated, favoring the thermal alternative.
- 3/ Depreciation is calculated on a 5% Sinking Fund basis assuming 30 years life for the thermal installation and 50 years life for the hydro installation.

FURNAS

Capital Subscription Statement
(in millions of Cruzeiros)

<u>Shareholders</u>	<u>1957</u>	<u>1958</u>	<u>1959</u>	<u>1960</u>	<u>1961</u>	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>Total</u>
National Development Bank	435.4	74.6	-	255.0	255.0	191.3	191.2	127.5	1,530.0
Centrais Eletricas de Minas Gerais, CEMIG	83.8	166.2	250.0	250.0	250.0	187.5	187.5	125.0	1,500.0
Sao Paulo State Department of Water & Electrical Energy	65.3	129.7	195.0	195.0	195.0	146.2	146.3	97.5	1,170.0
Sao Paulo Light Company	106.0	172.0	278.0	284.0	280.0	210.0	220.0	150.0	1,700.0
Companhia Paulista de Forca e Luz	<u>10.7</u>	<u>11.3</u>	<u>22.0</u>	<u>16.0</u>	<u>20.0</u>	<u>15.0</u>	<u>5.0</u>	<u>-</u>	<u>100.0</u>
Total	701.2	553.8	745.0	1,000.0	1,000.0	750.0	750.0	500.0	6,000.0
Cumulative Total	-	1,255.0	2,000.0	3,000.0	4,000.0	4,750.0	5,500.0	6,000.0	-

BRAZILIAN ELECTRICITY REGULATIONSDecree 11.019 dated February 26, 1957

1. These Regulations are at present in force and cover development of electricity supplies, concessions, technical standards of supply, tariffs, accountancy and provision for reversion of property to the Union (or to the State if the services are provided within one State and the river concerned is under State jurisdiction) at the end of concession periods.
2. The Federal administration of electricity supply services is performed by the National Council of Waters and Electrical Energy and by the Water Division of the National Department of Mineral Production of the Ministry of Agriculture. The National Council has the responsibility for coordination of development of hydro resources and electricity supplies generally, maintenance of statistics, recommendations on taxation and international matters affecting electricity production and supply and, when necessary, for rationing schemes.
3. The Water Division is responsible for the detailed implementation of the regulations, including the fixing of concession conditions and preparation of concession contracts.

Concessions

4. Concessions are granted by Presidential Decree and must be evidenced by contract. The normal concession period is 30 years and this starts when the contract is signed. All the property acquired by the concessionaire for the exploitation of the concession will revert to the Government at the end of the concession period which may, however, be extended with the agreement of the Government. (Art. 89)
5. The Reversion may be with or without indemnity. (Art. 90)

Reversion with indemnity

6. In this case the concessionaire will show in his accounts annual contributions at the rate of 3% of the total investment in a Reversion Reserve and will pay corresponding amounts into a Reversion Fund deposited with either the Bank of Brazil or the National Economic Development Bank. (Arts. 33 and 170)
7. The Reversion Fund will earn Bank interest (which must also be credited to the Reversion Reserve) but may only be used by the concessionaire with the approval of the Water Division and then only for expansion or amortization of loans for expansion. (Art. 33)
8. Any sums so used from the Fund will, of course, increase the investment. Corresponding amounts will be segregated from the Reversion Reserve and this segregated Reserve will not be deductible from the rate base (defined at the end of this Annex). The rate base will thus increase by the amount of the

reinvestment from the Fund. The money used from the Reversion Fund will attract interest at 6%, repayable by the concessionaire. The interest will be credited annually to the segregated Reversion Reserve account and a corresponding amount deposited in the Reversion Fund at the Bank. (Art. 35)

9. As the Reversion quotas cannot be used for amortization of debt incurred in respect of the initial or existing installations, Reversion with indemnity would be unattractive unless a large proportion of the capital was in the form of equity.

10. At the end of the concession period the Government will pay indemnity equal to the total investment at historical cost less the balances of the Depreciation and Reversion reserves and the Profits Compensation account (this account is explained later). After the indemnity has been paid and the property has reverted, any balances remaining in the Reversion Fund and the Profits Compensation Fund (both on deposit) will be freely available to the concessionaire. (Art. 91)

Reversion without indemnity

11. In this case the concessionaire must amortize the whole of the investment over the concession period. For this purpose the concessionaire will show in his accounts agreed annual contributions, not exceeding 3% of the total investment (excluding any grants or consumers' capital contributions) to an Amortization Reserve. These amortization quotas may be deposited with one of the Government controlled banks (referred to above) in which case the sums deposited (the Amortization Fund) would earn Bank interest (which must also be credited to the Amortization Reserve). (Arts. 92, 169, 33)

Depreciation

12. Depreciation at the rate of 5% on all depreciating assets (except thermal for which the rate is 8%) is credited to a Depreciation Reserve, which is debited with the costs of replacements and renewals and with the cost of removals (less salvage). (Arts. 168, 32)

Tariffs

13. These are fixed by the Water Division and are so designed that they cover the costs of services incurred by the concessionaire, including a return on the investment. (Art. 164)

The costs of service comprise:

Operating expenses, including taxes, administration expenses, welfare and electricity purchases.

Depreciation.

Amortization or Reversion quota.

10% return on the remunerable investment. (*de dividendes*)

Excess foreign debt service due to revaluation of currency.

(Art. 165)

14. The tariffs must be reviewed every three years having regard to the past three years' results and to estimates for the next three years. Monthly adjustments are made to cover variations in fuel costs and compulsory wage increases. The adjustments for excess foreign debt service are made every six months. (Arts. 172 to 176)

Profits Compensation

15. The differences between actual returns on investment and the permitted return of 10% are entered in a Profits Compensation account. At each tariff revision the balance is taken into account in fixing the new permissible revenue. Each year sums corresponding to any credit balance in this account must be deposited in a Profits Compensation Fund at one of the two Government controlled banks. Deficiencies in returns on investment may be withdrawn from this Fund, and normally therefore the balances in the Fund and the account should be the same. (Art. 162)

Availability of funds and reserves for reinvestment

16. In the case of Reversion with indemnity the sums in the Reversion Fund could be used for expansion only if the Water Division gave its approval. As explained in paragraph 8 of this Annex, the concessionaire would obtain a net 4% return on the amounts so used from the Fund.

17. In the case of Reversion without indemnity the concessionaire would presumably agree with the Water Division an amortization quota sufficient over the period of the concession to amortize all debt and buy out any shareholders. The concessionaire would therefore have at his disposal any part of this quota which was not required for amortization of debt. In this case, however, the whole of the amortization Reserve is deductible from the rate base and to the extent that the Reserve is not balanced by cash deposited in a Fund at the Bank (which would be added to the rate base) the rate base would be reduced. It follows that money invested from the Amortization quotas would not increase the rate base and so would bring no return.

18. The depreciation quotas would also be available for expansion of the utility but here again the whole of the Reserve is deductible from the rate base so that reinvestment of the quotas would bring no increase in the rate base.

Remunerable Investment

In the assessment of tariffs a 10% return is allowed on the Remunerable Investment, which is the total original investment^{1/} at historical cost (and rate of exchange) with the following adjustments:

Additions

1. Cash at Bank (not deposited in any Fund) up to the value of the Depreciation Reserve balance.
2. Working capital (two months invoicing).
3. Value of stocks.
4. Amortization or Reversion Fund.
5. Profits Compensation Fund.

Deductions

1. Depreciation Reserve Balance.
2. Amortization or Reversion Reserve balance.
3. Profits Compensation account balance.
4. Balance of Works in Progress account.
5. Works for future use - while not earning revenue.

(Arts. 157, 158)

^{1/} Interest during construction must be capitalized and will be included in the total original investment (Art. 159). This includes interest on amounts invested from share capital.

BILL
TO REGULATE THE ECONOMIC
AND FINANCIAL OPERATION OF ELECTRICAL UTILITIES

There are two versions of this Bill, the original, which was introduced in 1956, and a substitute draft resulting from various committee discussions. The original version is by no means clear and the substitute sets out to clarify the issues. It is understood that there is opposition to each version and the final Bill may differ considerably from each of the present drafts.

It is believed, however, that the general provisions contemplated in the present drafts will form the basis of the final legislation. Probably the mechanics of application will follow closely the Decree 41.019, maintaining the broad principle that any reinvestment from revenues should not result in any increase in the tariffs.

The main changes from the provisions of Decree 41.019 are expected to be as follows:

1. The establishment of Depreciation and Amortization Deposit Funds with either the Bank of Brazil or the National Development Bank would be compulsory. Money from the Depreciation Fund could only be used for reinvestment with the approval of the Government. (The Amortization Fund, however, could still be freely used for amortization or reinvestment.)
2. Every three years, or whenever the value of the cruzeiro changed by more than 20% since the last review, the rate base would be adjusted to allow for variations in the internal purchasing power of the cruzeiro. The adjustments would not be subject to Income Tax.
3. The permitted return on the investment may be raised from the present 10% to 12%.
4. In cases where loans have been obtained from the National Development Bank, the Bank of Brazil, the Electrification Fund, or in foreign currency if guaranteed by the National Treasury or the National Development Bank, additional amortization quotas may be allowed for repayment of the debt. In such cases preference shares to the value of the additional annual quotas would be issued each year by the concessionaires to the public authority granting concessions. These shares would be without voting rights and would be entitled to a fixed cumulative dividend at a rate equal to the permitted return on the investment. The authority would have the right to sell the shares at not less than par value and the proceeds would then be paid into the Electrification Fund.

FURNAS

Forecast of Income Statement and Cash Flow for the First Stage only
(in millions of Cruzeiros)

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
1. Sales in millions of KWH's	2.200	3.200	3.200	3.200	3.200	3.200	3.200	3.200	3.200	3.200
2. Average rate per KWH (Cr\$)	1.26	1.26	1.26	1.18	1.18	1.18	1.18	1.18	1.18	1.12
<u>Forecast Income Statement</u>										
3. Gross Revenue from Sales	2.772.0	4.032.0	4.032.0	3.776.0	3.776.0	3.776.0	3.776.0	3.776.0	3.776.0	3.584.0
Cost of Operations:										
4. Operating Expenses	262.2	263.1	286.5	312.3	342.5	374.0	408.7	446.8	448.8	535.0
5. Depreciation	331.5	414.0	450.0	450.0	450.0	450.0	450.0	450.0	450.0	450.0
6. Allowable Amortization Quota ^{1/}	582.4	631.9	654.0	654.0	654.0	654.0	654.0	654.0	654.0	654.0
7. Provision for Taxes	-	362.0	553.7	623.6	406.4	410.5	417.0	427.3	421.0	419.6
8. Total	1.176.1	1.671.0	1.944.2	2.039.9	1.852.9	1.888.5	1.929.7	1.978.1	1.973.8	2,058.6
9. Net Income from Operations	1.595.9	2.361.0	2.087.8	1.736.1	1.923.1	1.887.5	1.846.3	1.797.9	1.802.2	1,525.4
10. Less: Interest on Proposed IBRD Loan	-	217.5	211.2	204.5	197.4	190.0	182.1	173.8	165.1	155.8
11. Interest on Other Loans	-	939.9	886.2	832.5	778.9	725.2	671.5	617.9	564.2	510.5
12. Total Interest	-	1,157.4	1,097.4	1,037.0	976.3	915.2	853.6	791.7	729.3	666.3
13. Net Profit	1.595.9	1.203.6	990.4	699.1	946.8	972.3	992.7	1,006.2	1,072.9	859.1
14. Legal Reserve ^{2/}	79.8	60.2	42.5	35.0	47.3	48.6	49.6	50.3	53.6	43.0
15. Balance Available for Dividends	1,516.1	1,143.4	940.9	664.1	899.5	923.7	943.1	955.9	1,019.3	816.1
16. Dividends: On Preferred Shares	340.3	340.3	408.3	408.3	408.3	408.3	408.3	476.4	476.4	476.4
17. On Common Shares	408.3	408.3	476.4	476.4	476.4	476.4	476.4	544.5	544.5	544.5
18. Total Dividends	748.6	748.6	884.7	884.7	884.7	884.7	884.7	1,020.9	1,020.9	1,020.9
19. Surplus	767.5	394.8	56.2	(-)220.6	14.8	39.0	58.4	(-) 65.0	(-) 1.6	(-)204.8
20. Cumulative Surplus	767.5	1,162.3	1,218.5	997.9	1,012.7	1,051.7	1,110.1	1,045.1	1,043.5	838.7
<u>Forecast Cash Flow</u>										
<u>Receipts</u>										
21. Net Income from Operations	1.595.9	2.361.0	2.087.8	1.736.1	1.923.1	1.887.5	1.846.3	1.797.9	1.802.2	1,525.4
22. Depreciation Allowance	331.5	414.0	450.0	450.0	450.0	450.0	450.0	450.0	450.0	450.0
23. Amortization Allowance	582.4	631.9	654.0	654.0	654.0	654.0	654.0	654.0	654.0	654.0
24. Cash Receipts from Operations	2,509.8	3,406.9	3,191.8	2,840.1	3,027.1	2,991.5	2,950.3	2,901.9	2,906.2	2,629.4
Borrowing:										
25. a) withdrawals from proposed IBRD loan	123.0	-	-	-	-	-	-	-	-	-
26. b) withdrawals from local loans	642.2	-	-	-	-	-	-	-	-	-
27. Share Capital	765.0	517.5	-	-	-	-	-	-	-	-
28. Total Borrowing and Capital	1,530.2	517.5	-	-	-	-	-	-	-	-
29. Total Receipts	4,040.0	3,924.4	3,191.8	2,840.1	3,027.1	2,991.5	2,950.3	2,901.9	2,906.2	2,629.4
<u>Expenditures</u>										
30. Construction Expenditures	1.650.2	737.5	-	-	-	-	-	-	-	-
Debt Service:										
31. a) IBRD - Interest	-	217.5	211.2	204.5	197.4	190.0	182.1	173.8	165.1	155.8
Repayment	-	113.4	119.8	126.4	133.5	140.9	148.8	157.1	165.8	175.1
32. b) Other Loans - Interest	-	939.9	886.2	832.5	778.9	725.2	671.5	617.9	564.2	510.5
Repayment	-	611.0	611.0	611.0	611.0	611.0	611.0	611.0	611.0	611.0
33. Total Debt Service	-	1,831.8	1,828.2	1,774.4	1,720.8	1,667.1	1,613.4	1,559.8	1,506.1	1,452.4
34. Legal Reserves	79.8	60.2	49.5	35.0	47.3	48.6	49.6	50.3	53.6	43.0
35. Dividends Payments	748.6	748.6	884.7	884.7	884.7	884.7	884.7	1,020.9	1,020.9	1,020.9
36. Total Expenditures	2,478.6	3,428.1	2,762.4	2,694.1	2,652.8	2,600.4	2,547.7	2,631.0	2,580.6	2,515.3
37. Net Annual Cash Accrual = 29-36	1,561.4	496.3	429.4	146.0	374.3	391.1	402.6	270.9	325.6	113.1
38. Cash Balance - Beginning of Year	341.2	1,902.6	2,398.9	2,828.3	2,974.3	3,348.6	3,739.7	4,142.3	4,413.2	4,738.8
39. Cash Balance - End of Year	1,902.6	2,398.9	2,828.3	2,974.3	3,348.6	3,739.7	4,142.3	4,413.2	4,738.8	4,851.9
40. Debt Service Coverage (lines 24:33)	-	1.81	1.75	1.60	1.76	1.79	1.83	1.86	1.93	1.86
41. Interest Coverage (lines 9+6:12)	-	2.59	2.50	2.30	2.64	2.78	2.93	3.10	3.37	3.27

1/ Maximum permitted amortization quota at the rate of 3% per annum on the total fixed assets, which the Company will include in its allowable expenses on which its bulk supply tariff will be based.

2/ At the rate of 5% on the net profit, up to a limit of 20% of the Share Capital.

Forecast of Income Statement and Cash Flow for the Total Capacity
(in millions of Cruzeiros)

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
1. Sales in millions of KWH's	2.200	4.400	4.600	5.700	5.700	5.700	5.700	5.700	5.700	5.700
2. Average rate per KWH (Cr\$)	1.18	1.18	1.18	.97	.97	.97	.97	.97	.97	.97
<u>Forecast Income Statement</u>										
3. Gross Revenue from Sales	2,596.0	5,192.0	5,428.0	5,546.0	5,546.0	5,546.0	5,546.0	5,546.0	5,546.0	5,546.0
Cost of Operations:										
4. Operating Expenses	262.2	263.1	315.2	358.6	391.1	425.2	462.3	503.9	549.4	599.0
5. Depreciation	454.8	647.0	790.0	850.0	850.0	850.0	850.0	850.0	850.0	850.0
6. Allowable Amortization Quota ^{1/}	656.4	771.7	857.5	896.3	896.3	896.3	896.3	896.3	896.3	896.3
7. Provision for Taxes	-	276.1	771.7	906.2	795.5	823.0	836.0	870.0	880.0	887.0
8. Total	1,373.4	1,957.9	2,674.4	3,011.1	2,932.9	2,995.5	3,064.6	3,120.2	3,175.7	3,212.2
9. Net Income from Operations	1,222.6	3,234.1	2,753.6	2,534.9	2,613.1	2,549.5	2,481.4	2,425.8	2,370.3	2,303.3
10. Less: Interest on Proposed IRRD Loan	-	217.5	211.2	204.5	197.4	190.0	182.1	173.8	165.1	155.5
11. Interest on Foreign currency loan	-	-	-	165.2	160.4	155.3	150.0	144.3	138.3	132.0
12. Interest on other loans	-	99.9	886.2	913.8	986.3	920.3	854.3	788.4	722.4	655.5
13. Total Interest	-	1,157.4	1,097.4	1,283.5	1,344.1	1,265.6	1,186.4	1,106.5	1,025.8	944.4
14. Net Profit	1,222.6	2,076.7	1,656.2	1,251.4	1,269.0	1,283.9	1,295.0	1,319.3	1,344.5	1,359.9
15. Legal Reserve ^{2/}	61.1	103.8	32.3	62.3	63.4	64.2	64.7	66.0	67.2	67.7
16. Balance available for Dividends	1,161.5	1,972.9	1,573.4	1,189.1	1,205.6	1,219.7	1,230.3	1,253.3	1,277.3	1,292.2
17. Dividends: On Preferred Shares	340.3	340.3	476.4	476.4	476.4	476.4	476.4	476.4	476.4	476.4
18. On Common Shares	408.3	408.3	344.2	344.2	344.2	344.2	344.2	344.2	344.2	344.2
19. Total Dividends	748.6	748.6	820.6	820.6	820.6	820.6	820.6	820.6	820.6	820.6
20. Surplus	412.9	1,224.3	752.8	368.5	384.7	399.1	409.7	432.7	456.9	471.6
21. Cumulative Surplus	412.9	1,637.2	2,389.7	2,758.2	3,142.9	3,542.0	3,951.7	4,384.4	4,841.3	5,312.9
<u>Forecast Cash Flow</u>										
<u>Receipts</u>										
22. Net Income from Operations	1,222.6	3,234.1	2,753.6	2,534.9	2,613.1	2,549.5	2,481.4	2,425.8	2,370.3	2,303.3
23. Depreciation Allowance	454.8	647.0	790.0	850.0	850.0	850.0	850.0	850.0	850.0	850.0
24. Amortization Allowance	656.4	771.7	857.5	896.3	896.3	896.3	896.3	896.3	896.3	896.3
25. Cash Receipts from Operations	2,333.8	4,652.8	4,401.1	4,281.2	4,359.4	4,295.8	4,227.7	4,172.1	4,116.6	4,049.6
Borrowing:										
26. a) Withdrawals from Proposed IRRD Loan	123.0	-	-	-	-	-	-	-	-	-
27. b) Withdrawals from Foreign Currency Loan for 2nd Stage	313.9	509.4	298.3	-	-	-	-	-	-	-
28. c) Withdrawals from Local Loans	1,138.4	912.2	192.5	-	-	-	-	-	-	-
29. Share Capital	765.0	577.5	-	-	-	-	-	-	-	-
30. Total Borrowing and Capital	2,440.3	1,999.1	490.8	-	-	-	-	-	-	-
31. Total Receipts	4,774.1	6,651.9	4,891.9	4,281.2	4,359.4	4,295.8	4,227.7	4,172.1	4,116.6	4,049.6
<u>Expenditures</u>										
32. Construction Expenditures	3,645.3	2,858.1	1,293.8	-	-	-	-	-	-	-
Debt Service:										
33. a) IRRD - Interest	-	217.5	211.2	204.5	197.4	190.0	182.1	173.8	165.1	155.5
Repayment	-	113.4	119.8	126.4	133.5	140.9	148.8	157.1	165.8	175.0
34. b) Foreign Currency Loan, 2nd Stage - Interest	-	-	-	165.2	160.4	155.3	150.0	144.3	138.3	132.0
Repayment	-	-	-	86.2	91.0	96.0	101.4	107.1	113.0	119.0
35. c) Other Loans - Interest	-	999.9	886.2	913.8	986.3	920.3	854.3	788.4	722.4	655.5
Repayment	-	611.0	611.0	669.6	743.8	749.8	749.8	749.8	749.8	749.8
36. Total Debt Service	-	1,831.8	1,828.2	2,170.7	2,318.4	2,236.3	2,136.4	2,036.5	1,936.6	1,836.7
37. Legal Reserve	61.1	103.8	32.3	62.3	63.4	64.2	64.7	66.0	67.2	67.7
38. Dividend Payments	748.6	748.6	820.6	820.6	820.6	820.6	820.6	820.6	820.6	820.6
39. Total Expenditures	4,455.0	5,592.3	4,225.7	3,253.9	3,402.7	3,357.4	3,192.1	3,043.5	2,878.5	2,733.3
40. Net Annual Cash Accrual	319.1	999.6	666.2	1,027.3	956.7	938.4	819.6	828.6	838.0	836.0
41. Cash Balance - Beginning of Year	344.2	663.3	1,662.9	2,329.1	3,356.4	4,313.1	5,271.5	6,091.1	6,919.7	7,757.7
42. Cash Balance - End of Year	663.3	1,662.9	2,329.1	3,356.4	4,313.1	5,271.5	6,091.1	6,919.7	7,757.7	8,593.7
43. Debt Service Coverage (Lines 25+36)	-	2.47	2.41	1.97	1.88	1.91	1.93	1.97	2.00	2.04
44. Interest Coverage (Lines 9+6+13)	-	3.46	3.29	2.66	2.61	2.72	2.85	3.00	3.18	3.39

NOTE: Comparing line 30 and line 32, it is evident that the Company has assumed that the reinvestment from earnings will be as follows: Cr\$ 1,205 million in 1963, Cr\$ 914 million in 1964, and Cr\$ 803 million in 1965. The cash balance shown on line 42 is more than required for working capital in these 3 years and on the basis of these estimates the local borrowing could probably be further reduced by Cr\$ 1,250 million approximately.

1/ Maximum permitted amortization quota at the rate of 3% per annum on the total fixed assets, which the Company will include in its allowable expenses on which its bulk supply tariff will be based.

2/ At the rate of 5% on the net profit, up to a limit of 20% of the Share Capital.

FURNAS - First Stage

Pro-Forma Balance Sheets for the Years 1963-1972
(in millions of Cruzeiros)

	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>
<u>ASSETS</u>										
1. Fixed Assets <i>(Cost of project, p. 10)</i>	21,064	21,802	21,802	21,802	21,802	21,802	21,802	21,802	21,802	21,802
2. Less: Depreciation Reserve	<u>332</u>	<u>746</u>	<u>1,196</u>	<u>1,646</u>	<u>2,096</u>	<u>2,546</u>	<u>2,996</u>	<u>3,446</u>	<u>3,896</u>	<u>4,346</u>
3. Net Fixed Assets	20,732	21,056	20,606	20,156	19,706	19,256	18,806	18,356	17,906	17,456
4. Cash, Banks, and other Current Assets										
Net	1,400	2,049	2,605	2,869	3,381	3,919	4,477	4,833	5,212	5,368
5. Blocked Account (Amortization Fund) ^{1/}	<u>582</u>	<u>490</u>	<u>413</u>	<u>329</u>	<u>239</u>	<u>141</u>	<u>35</u>	<u>-</u>	<u>-</u>	<u>-</u>
6. Total Assets	22,714	23,595	23,624	23,354	23,326	23,316	23,318	23,189	23,118	22,824
<u>LIABILITIES</u>										
7. Common Shares	3,144	3,403	3,403	3,403	3,403	3,403	3,403	3,403	3,403	3,403
8. Preferred Shares	3,144	3,403	3,403	3,403	3,403	3,403	3,403	3,403	3,403	3,403
9. Surplus	767	1,162	1,218	998	1,012	1,052	1,110	1,045	1,043	838
10. Legal Reserve	<u>80</u>	<u>140</u>	<u>190</u>	<u>224</u>	<u>272</u>	<u>320</u>	<u>370</u>	<u>420</u>	<u>474</u>	<u>517</u>
11. Equity	7,135	8,108	8,214	8,028	8,090	8,178	8,286	8,271	8,323	8,161
12. Amortization Reserve	582	1,214	1,868	2,522	3,176	3,830	4,484	5,138	5,792	6,446
Long-Term Debt:										
13. Foreign Currency (Proposed IBRD Loan)	3,982	3,869	3,749	3,622	3,489	3,348	3,199	3,042	2,876	2,701
14. Local Currency Loans	<u>11,015</u>	<u>10,404</u>	<u>9,793</u>	<u>9,182</u>	<u>8,571</u>	<u>7,960</u>	<u>7,349</u>	<u>6,738</u>	<u>6,127</u>	<u>5,516</u>
15. Total Long-Term Debt	<u>14,997</u>	<u>14,273</u>	<u>13,542</u>	<u>12,804</u>	<u>12,060</u>	<u>11,308</u>	<u>10,548</u>	<u>9,780</u>	<u>9,003</u>	<u>8,217</u>
16. Total Liabilities	22,714	23,595	23,624	23,354	23,326	23,316	23,318	23,189	23,118	22,824
17. Debt/Equity Ratio (lines 11 and 15)	68/32	64/36	62/38	61/39	60/40	58/42	56/44	54/46	52/48	50/50

^{1/} If the second stage were built, there would not be any cash accumulation in this fund, since any excess of the cumulative amortization quotas over actual debt repayment would be reinvested.

FURNAS - Total Capacity

Pro-Forma Balance Sheets for the Years 1963-1972
(in millions of Cruzeiros)

	<i>1,222</i> <u>1963</u>	<i>3,234</i> <u>1964</u>	<i>2,756</i> <u>1965</u>	<i>3,535</i> <u>1966</u>	<i>2,613</i> <u>1967</u>	<i>2,549</i> <u>1968</u>	<i>2,487</i> <u>1969</u>	<i>2,426</i> <u>1970</u>	<i>23,310</i> <u>1971</u>	<u>1972</u>
<u>ASSETS</u>										
1. Fixed Assets	25,725	28,583	29,877	29,877	29,877	29,877	29,877	29,877	29,877	29,877
2. Less: Depreciation Reserve	<u>455</u>	<u>1,102</u>	<u>1,892</u>	<u>2,742</u>	<u>3,592</u>	<u>4,442</u>	<u>5,292</u>	<u>6,142</u>	<u>6,992</u>	<u>7,842</u>
3. Net Fixed Assets	25,270	27,481	27,985	27,135	26,285	25,435	24,585	23,735	22,885	22,035
4. Cash, Banks, and other Current Assets Net	<u>724</u>	<u>1,828</u>	<u>2,578</u>	<u>3,667</u>	<u>4,688</u>	<u>5,710</u>	<u>6,595</u>	<u>7,489</u>	<u>8,394</u>	<u>9,298</u>
5. Total Assets	25,994	29,309	30,563	30,802	30,973	31,145	31,180	31,224	31,279	31,333
<u>LIABILITIES</u>										
6. Common Shares	3,144	3,403	3,403	3,403	3,403	3,403	3,403	3,403	3,403	3,403
7. Preferred Shares	3,144	3,403	3,403	3,403	3,403	3,403	3,403	3,403	3,403	3,403
8. Surplus	413	1,637	2,190	2,353	2,538	2,736	2,810	2,906	3,026	3,160
9. Legal Reserve	<u>61</u>	<u>165</u>	<u>248</u>	<u>310</u>	<u>373</u>	<u>437</u>	<u>502</u>	<u>568</u>	<u>635</u>	<u>703</u>
10. Equity	6,762	8,608	9,244	9,469	9,717	9,979	10,113	10,280	10,467	10,669
11. Amortization Reserve	<u>656</u>	<u>1,428</u>	<u>2,285</u>	<u>3,132</u>	<u>4,078</u>	<u>4,975</u>	<u>5,871</u>	<u>6,767</u>	<u>7,664</u>	<u>8,560</u>
Long-Term Debt:										
12. Foreign Currency Loans	6,176	6,572	6,751	6,538	6,314	6,077	5,827	5,563	5,284	4,989
13. Local Currency Loans	<u>12,400</u>	<u>12,701</u>	<u>12,283</u>	<u>11,613</u>	<u>10,864</u>	<u>10,114</u>	<u>9,364</u>	<u>8,614</u>	<u>7,864</u>	<u>7,115</u>
14. Total Long-Term Debt	18,576	19,273	19,034	18,151	17,178	16,191	15,191	14,177	13,148	12,104
15. Total Liabilities	25,994	29,309	30,563	30,802	30,973	31,145	31,180	31,224	31,279	31,333
16. Debt/Equity Ratio (lines 10 and 14)	73/27	69/31	67/33	66/34	64/36	62/38	60/40	58/42	55/45	53/47

