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BRAZIL

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SANTA CRUZ THERMAL PLANT EXP.

FY67-75

PUBLIC SAFETY ADMINISTRATION PROJECTS (700 PURPOSE CODES)

NO ABSTRACT ENTERED IN THE DIS SYSTEM

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DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
Washington, D.C. 20523

CAPITAL ASSISTANCE PAPER

Proposal and Recommendations
For the Review of the
Development Loan Committee

BRAZIL: FURNAS (SANTA CRUZ THERMAL PLANT EXPANSION)

512-2-066

512-26-220-274

A.I.D.
Reference Center
Room 1656 NSF
AID-DIC/P-581

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DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
Washington, D.C. 20523

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AID-DLC/P-581
June 1, 1967

MEMORANDUM FOR THE DEVELOPMENT LOAN COMMITTEE

SUBJECT: Brazil: FURNAS (Santa Cruz Thermal Plant Expansion)

Attached for your review are the recommendations for authorization of a loan in an amount not to exceed \$41,200,000 to Central Electrica de Furnas, S.A. (FURNAS) to assist in the financing of the United States dollar costs of materials and equipment, and the United States dollar and Brazilian cruzeiro costs of engineering services and incidental training, related to the construction and placing in operation of a 400 MW addition to the present facilities of the Santa Cruz Thermal Plant located in the State of Guanabara.

This loan proposal is scheduled for consideration by the Development Loan Staff Committee at a meeting on Wednesday, June 7, 1967.

Rachel C. Rogers
Assistant Secretary
Development Loan Committee

Attachments:

Summary and Recommendations
Project Analysis
ANNEXES I-V
Exhibits A-L

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BRAZIL - SANTA CRUZ THERMAL PLANT EXPANSION

June 1, 1967

TABLE OF CONTENTS

	<u>Page</u>
SUMMARY AND RECOMMENDATIONS	1
SECTION I - PLACE OF THE LOAN IN THE PROGRAM	
A. The Power Sector	1
B. The Santa Cruz Project	2
C. The CANAMBRA Report	2
SECTION II - THE BORROWER	
A. Corporate Description	4
B. Ownership	5
C. FURNAS-ELETROBRAS-CHEVAP Relationship. Transfer of Ownership of Santa Cruz Plant	7
SECTION III - DESCRIPTION OF THE PROJECT	
A. Project Items	6
B. Financing and Cost Estimates	8
C. Technical Feasibility	10
D. Complementary Thermal Generation	11
E. Plant Type and Size	12
F. Operation, Maintenance, and Training	13
SECTION IV - ENGINEERING AND IMPLEMENTATION PLAN	
A. Engineering	15
B. Supervision	15
C. Construction	16
D. Equipment	16
E. Schedules	16
F. Cost Estimates	17
G. FAA 611	19

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	<u>Page</u>
SECTION V - ECONOMIC ANALYSIS	
A. Economic Conditions of the South-Central Region	20
B. Demand Forecast, CANAMERA Projections and Justification for Santa Cruz Extension	21
C. Other Economic Issues	30
D. Impact on U.S. Economy	36
SECTION VI - FINANCIAL ANALYSIS	
A. Tariff Legislation, Rates, and Rate Structure	37
B. Revenues	40
C. Analysis of Financial Statements	40
D. Cash Flow Projections and Repayment Capacity	43
E. Source of Required Cruzeiro Financing	43
SECTION VII- ISSUES	
A. Guanabara Frequency Conversion	52
B. Power Pooling and Interconnection Agreements	57

ANNEXES

- I - Statutory Criteria Check List
- II - a. Transfer of CHEVAP Obligations and Responsibilities to FURNAS
- b. History of Santa Cruz First Stage
- III - a. Santa Cruz Site Selection
- b. Portaria
- c. Fuel and Fuel Delivery
- d. Allocation of FURNAS Market Areas
- IV - Memorandum of Conversation with Minister of Mines and Energy
- V - Loan Authorization

EXHIBITS

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BRAZIL - SANTA CRUZ THERMAL PLANT EXPANSION

June 1, 1967

Summary and Recommendations

1. BORROWER: Central Elétrica de Furnas S.A. (FURNAS), a subsidiary of ELETROBRAS, the Government owned corporation responsible for the development of electric power throughout Brazil.
2. GUARANTORS: The Republic of Brazil (Ministry of Finance) and ELETROBRAS.
3. AMOUNT of A.I.D. LOAN: US\$41.2 million, the dollar component of the Project.
4. TOTAL COST OF PROJECT: (US\$ Millions)

Item	Local Currency (US\$ Equivalent)	US Dollar	Total
1. Generating Plant	21.3	28.1	49.4
2. Transmission	3.3	0.2	3.5
3. Substations	0.2	0.2	0.4
4. Engineering	1.3	2.1	3.4
5. Other Costs ^{1/}	<u>11.8</u>	<u>10.6</u>	<u>22.4</u>
Total Construction Cost	<u>37.9</u>	<u>41.2</u>	<u>79.1</u>
Interest During Constr. ^{2/}	7.8	5.5	13.3
Total Project Cost	<u>45.7</u>	<u>46.7</u>	<u>92.4</u>

5. PROJECT DESCRIPTION: The Project consists of the construction and placing in operation of a 400 MW addition to the present 160 MW Santa Cruz thermal plant located 40 miles Southwest of the City of Rio de Janeiro. The present plant, also A.I.D. financed, is expected to be in operation by July 1967.^{3/}

(1) See page 11 and Exhibit H for detailed cost estimates
 (2) See Financial Section for treatment of interest during construction.
 (3) See Annex II b. History of Santa Cruz First Stage.

Included in the proposed project will be the installation of two 200 MW turbine generators, a switchyard and 132 KV substation extension, as well as additional transmission circuits to interconnect with the FURNAS system at Jacarepagua.

6. PURPOSE of PROJECT: The 400 MW thermal addition to the present South Central power supply will serve the following purposes:

- (1) It will complement the predominantly hydro-electric system presently in existence by providing primary generating capacity during dry years. The interconnected system is now comprised of nearly 5,000 MW. Some 600 MW of the present system is thermal power.
- (2) It will firm up an equivalent amount of secondary hydro-electric power.
- (3) It will supply reserve and emergency power in the Guanabara area.
- (4) It will provide flexibility in scheduling major new hydro-electric investments and will act as a contingency source for those hydro projects which are lagging behind schedule.
- (5) It will provide capacity and energy to meet 1972 load demands as forecast by CANAMBRA.

7. CONCLUSIONS:

a) Studies conducted by CANAMBRA and the American firm, Sanderson and Porter, of the market area within the South Central Region, confirm the need for 400 MW of additional generating capacity in 1972. A market analysis is located in the Economic Section of this paper.

b) In order to meet projected 1972 demand and to satisfy the complementation requirements of the system the addition should be of thermal generation. Hydro development which could not perform a comparable function is in any event precluded in view of its more lengthy construction period.

c) Extension of the Santa Cruz Plant provides the best and most convenient alternative for location of additional thermal generating capacity since it is near a major load center (Rio) and has transmission links with the inter-connected system. Moreover, the original plant was designed for expansion and offers the advantage of lower incremental cost for enlarged administrative, operating, and maintenance facilities as well as potential fuel savings through the use of bulk delivery methods.

d) Based on CANAMBRA's recommendation, the two 200 MW units should be oil fired since coal cannot at present be economically justified for thermal generation in the Guanabara area.

e) FURNAS is properly organized and well qualified both in corporate management and operating capability to undertake the construction and operation of the proposed project. Moreover, FURNAS will call upon the consulting and supervisory services of an experienced U.S. engineering firm. By the time the proposed 400 MW come on line, FURNAS will have trained additional operators to handle the enlarged capacity.

f) The benefits of this project will be felt by a major portion of Brazil's industrial sector and a significant percentage of its population.

g) Unlike hydroelectric equipment, much of which can be made in Brazil, the manufacture of specialized thermal equipment of the proposed size is clearly beyond the present capability of domestic industry. Thus, it is not anticipated that U.S. importation will be restricted by the Law of Similarity.

8. OTHER FREE WORLD FINANCING: The IDB, IDB, and Ex-Im Bank have expressed no interest in financing the project.
9. STATUTORY CRITERIA: All statutory criteria have been met satisfactorily (See Annex I).
10. ISSUES: See Section V - Economic analysis, pp and Section VII - Issues, pp
11. BRAZILIAN CLEARANCE: COCAP (the Coordinating Commission for the Alliance for Progress) has indicated approval of the Project.
12. U.S. COUNTRY TEAM CLEARANCE: Embassy/USAID have approved the project.
13. RECOMMENDATIONS: It is recommended that the subject proposal be authorized as follows:

That a loan be extended to Centrais Elétricas de Furnas S.A. not to exceed \$41.2 million to finance the foreign exchange cost of (i) two 200 MW turbine-generator units with boiler and accessory equipment; (ii) transmission and substation material and equipment; (iii) communications and control equipment, and the cost of U.S. and Brazilian consulting engineering services. (iv) Equipment, training, and services to operate and manage the project.

I. Terms:

- (1) Repayment will be made in U.S. dollars within twenty (20) years from the date of first disbursement, including a five (5) year grace period;
- (2) Interest at six (6) percent per annum;

(3) The two-step loan option will be offered to the GOB, with repayment scheduled at forty (40) years including a ten (10) year grace period with interest at one (1) percent during the grace period and two and one-half (2-1/2) percent thereafter.

II. General Conditions and/or Conditions Precedent to Disbursement

- (1) Engineering services shall be provided by a firm or firms satisfactory to A.I.D., and pursuant to A.I.D. approved contracts.
- (2) Equipment, materials and services financed under this loan will have their sources and origin in the United States of America. The single exception may be Brazilian engineering services (should a joint venture be formed).
- (3) GOB approval will be required prior to disbursement to permit importation of United States goods and services financed under the A.I.D. loan.
- (4) FURNAS and GOB will undertake any rate adjustment required to maintain a level of rates sufficient to provide coverage of operating and maintenance costs, allowance for depreciation, amortization, and exchange losses, and include the rate of return (10%) as prescribed by Brazilian law, based on annual revaluation of assets.

III. Covenants of Loan and/or Guarantee Agreements

A. General

- (1) FURNAS shall negotiate contracts and/or enter into agreements for the sale of capacity and energy to assure the efficient and economic use of its facilities.

(2) The GOB shall undertake to construct or provide financing for oil pipeline or some other appropriate delivery method for oil.

(3) A technical group comprised of members from the major interconnected utilities shall be formed to establish criteria and devise an operational system to conduct power pooling and dispatch efficiently.

(4) The GOB shall commit itself to expedite the frequency conversion program in Rio taking whatever measures, including financial assistance, that prove necessary to assure the timely utilization of 60 cycle power as it becomes available.

B. Financial

(1) The Guarantee Agreement shall include an overrun commitment from the GOB (ELETROBRAS) to assure the adequacy of cruzeiro funding.

(2) FURNAS rate schedules shall be so constructed as to induce the maximum utilization of power, while maintaining the required level of revenues.

(3) The amount of long term debt contracted by FURNAS shall be limited to $66\frac{2}{3}$ percent of total fixed assets and ELETROBRAS shall be obligated to convert debt to equity to maintain this ratio.

(4) FURNAS shall be required to obtain A.I.D. approval before undertaking any further major expansion.

C. FURNAS shall obtain the consent of the IBRD (as required by a standard provision of loan contract 403-474BR) to undertake the proposed Santa Cruz addition.

14. PROJECT COMMITTEE:

Loan Officer and Project Chairman - W.W.Wheeler-USAID/B-ADCD
Engineer - W.Reed-USAID/B-ENRP
Legal Officer - J.Heller-USAID/B-LGS
Economist - J.Tendler-USAID/B-DPEC
Drafting Officers -- W.W.Wheeler-USAID/B-ADCD
W.Reed-USAID/B-ENRP
Financial Advisor - Everett Mann-USAID/B-CONT

Approved by:

Stuart H. Van Dyke- DOM - USAID/B _____
William A. Ellis - DDOM - USAID/B _____
Louis V. Perez - ADCD - USAID/B _____

SECTION I - PLACE OF THE LOAN IN THE PROGRAM

June 1, 1967

A. The Power Sector

1.01 - Of the various sectors in the Brazilian economy, electric energy has been the major recipient of capital assistance from international lending agencies. During the years 1961 through 1966 nearly US\$500 million has been lent by A.I.D., IDB, and IBERD for the development of generation, transmission and distribution facilities, an amount representing over 40 percent of their total loans in the country.

1.02 - The reasons for this emphasis are many; but chiefly it resulted from the importance of electric power as a factor of economic development, the past neglect of power investment, the readiness of well-conceived projects, advanced regional planning which established priorities, and finally the inherent magnitude of investments required for such undertakings.

1.03 - In order to carry out its Ten-Year Plan for Economic and Social Development the Government of Brazil will have to commit a significant portion of its public investment program in the power sector. The tentative five year investment program for the years 1967-1971 provides for total federal investments of NCr\$19.3 billion (1966 prices) of which NCr\$2.4 billion, or 12.4 percent, is planned for electric power. The 1967-71 investment plan for all public investment (federal, state and municipal) amounting to NCr\$37.4 billion provides for NCr\$7.0 billion or 18.7 percent for electric energy. It is also estimated that of the NCr\$7.0 billion electric energy investment program, external financing will be required in the amount of NCr\$1.2 billion, or 17.1 percent with 82.9 percent financed from domestic sources.

1.04 - The Government of Brazil also foresees that a large percentage of the external financing required to finance the total public investment program will be in the power sector. External financing comprises NCr\$4.5 billion of the public investment program of NCr\$37.4 billion or 12.1 percent of this program. This external financing is concentrated heavily in

the power sector, which accounts for 27.3 percent of total foreign financing needs - NCr\$1.2 billion (about 550 million) out of NCr\$4.5 billion (about \$2,000 billion)^{1/}

1.05 - It is expected that the utilities themselves will generally continue to finance internally a major portion of the required funds, but substantial external resources will continue to be required. Of the Brazilian utility companies, FURNAS has one of the highest levels of cash generation in part because FURNAS has consistently applied for and received maximum tariff adjustments. As a result, FURNAS intends to finance the cruzeiro costs of the project from its own earnings.

1.06 - As summarized in Exhibit L, A.I.D. currently has twelve dollar and three cruzeiro loans in the power sector, totalling \$152.3 million.

B. The Santa Cruz Project

1.07 - Of the 12 A.I.D. recipient utility companies, six are located in the South Central region and account for nearly \$100 million of A.I.D. loans. Besides FURNAS, these companies, CEMIG, Paulista, Rio Light, São Paulo Light, and CCBFE, will all to some extent benefit from the proposed project. Each is, or will be, purchasing bulk power from FURNAS. With the additional thermal complementation (see Economic Section) these purchasers will be assured of a greater availability of firm power. As distributors, their supply will be more secure; and as producers, they will derive greater operating flexibility in the control of their water reserves.

C. The CANAMBRA Report

1.08 - The expansion of electric power generation and transmission in the South Central region had been carried out, until several years ago, by the individual utilities operating on a local basis. This, however, is no longer the case. Regional planning involving the production and transmission of large blocks of power from major plants to

^{1/} Ministério do Planejamento e Coordenação Econômica "Plano Decenal de Desenvolvimento Econômico e Social" Tome III. Infra-Structure, pages 13-31.

the centers of consumption, and the interconnection of individual systems and power markets are major considerations today. Indeed, it may be said that the present shape and function of the FURNAS company is a direct outcome of this coordinated approach to power development.

1.09 - The goal of the Brazilian Government in its planning efforts was to meet power requirements for the region as a whole with the minimum investment and maximum utilization of available resources. To assist in this endeavor, the United Nations Special Fund approved two grants to the Brazilian Government totalling US\$2,500,000. This amount, in addition to a corresponding amount in cruzeiros, represented an unprecedented investment in Brazil for the performance of planning work in the field of electric power. The contract of these studies was awarded to a consortium formed by Montreal Engineering Company, Ltd, G.E. Crippen and Associates, Ltd. of Canada, and Gibbs and Hill, Inc. of the United States. These three firms organized Canambra Engineering Consultants Ltd. (CANAMBRA) to meet planning objectives by surveying energy resources and establishing a priority list of projects on a technical and economic basis.

1.10 - After more than three years of work, the final report and its recommended program of generation and transmission line construction through 1980 is now completed and approved by the Ministry of Mines and Energy.

1.11 - The projects (and their megawatt capacities) selected for development by CANAMBRA to meet the median load projection for the period 1971 to 1980 appear in Exhibit B. To satisfy this demand forecast the first 200 MW unit at Santa Cruz would be required by the middle of 1971 and the second 200 MW unit by 1972. The load balance, found in Exhibit A, shows the integration of this complementary thermal energy into the overall development program.

SECTION II - THE BORROWER

A. Corporate Description

2.01 - Centrais Elétricas de Furnas S.A., a subsidiary of ELETROBRAS, is a joint public-private corporation. The Company was organized on February 25, 1957 for the specific purpose of harnessing the hydro-electric potential of the FURNAS rapids on the Rio Grande, state of Minas Gerais, in an effort to satisfy the pressing demand for electric power in the South-Central Region in the Country. Subsequently, the scope of FURNAS activities was broadened to include the construction and management of transmission as well as generation facilities. As a result, a gradual transition has been underway since 1964 in which the character of the Company has changed from essentially a construction company to an operating utility. FURNAS now plays a unique role among Brazilian power companies in that it has no distribution facilities and exists only as a producer - purchaser and seller of bulk energy. Its high voltage transmission lines, when completed, and its thermal complementation capacity at Santa Cruz will give it a major responsibility in the coordination of power pooling efforts. In this sense, it will have a regulatory character as well.

2.02 - An internal reorganization of FURNAS was made to permit a better definition of staff and services, to provide better control for the delegation of authority in a day-to-day activity and to permit top executives to devote more time in the approved planning study of policy matters and improve management controls. FURNAS has engaged management consultants, both foreign and Brazilian, to assist in this reorganization and has prepared a comprehensive recruitment and training program to assure itself of the required personnel.

2.03 - The FURNAS system presently includes the FURNAS hydro-electric plant with an ultimate capacity of 1,200 MW with 900 MW currently installed. The Estreito hydro-electric plant, to have a total capacity of 900 MW, is located 14 km down stream from FURNAS on the Rio Grande. Its first stage of development presently under construction will provide 600 MW

capacity. FURNAS has been asked to assume the operation of the Funil hydroelectric plant located in Guanabara state. Funil is under construction by ELETROBRAS and expected to be commissioned in 1969 with three 70 MW units. The FURNAS transmission system, in part (\$16.7 million) A.I.D.-financed, will shortly provide a high voltage interconnecting circuit linking the power sources of Peixoto, Furnas, and Estreito with the Guanabara, Rio, São Paulo, and Belo Horizonte load centers. Other lines (see Exhibit G) presently are or will be a part of the integrated FURNAS transmission system.

2.04 - Central Elétrica de Furnas S.A. is managed by a Board of Directors composed of five members: President, two Vice-Presidents, one of whom is Financial Director and the other Technical Director; and Operation Director and an Administrative Director.

2.05 - The FURNAS President, John R. Cotrim, has been in office since 1957. He and the members of the Board of Directors are considered to be among the outstanding power development and management executives in Brazil and have demonstrated sound financial and administrative abilities.

An organization chart appears as Exhibit K.

B. Ownership

2.06 - As can be seen from the following table, ELETROBRAS owns over 93 percent of FURNAS's voting stock.

CENTRAL ELÉTRICA DE FURNAS S.A.

PRESENT DISTRIBUTION OF CAPITAL STOCK

	<u>Common Stock</u>		<u>Preferred Stock</u>	
	<u>Value in Cruzeiros</u>	<u>Percent of Total</u>	<u>Value in Cruzeiros</u>	<u>Percent of Total</u>
Centrais Elétricas Brasileiras S.A.	73,451,962,000	94.78	70,049,031,000	90.39
Centrais Elétricas de Minas Gerais S.A.	1,807,601,000	2.33	1,807,614,000	2.33
Department of Water and Electric Power - State of São Paulo	2,240,367,000	2.89	2,783,736,000	3.59
São Paulo Light - Serviços de Eletricidade	--	--	1,958,576,000	2.53
Cia. Paulista de Força e Luz	--	--	236,498,000	0.30
Cia. Hidreletrica do Rio Pardo	--	--	664,545,000	0.86
Individuals	70,000	--	--	--
	<u>70,500,000,000</u>	<u>100.00</u>	<u>77,500,000,000</u>	<u>100.00</u>

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C. FURNAS-ELETROBRAS-CHEVAP Relationship

2.07 - FURNAS was authorized by ELETROBRAS on December 2, 1966 to finish construction of the first two units at Santa Cruz and to assume the operating responsibility upon completion.

2.08 - Copies of the instruments transferring the assets and liabilities of CHEVAP to FURNAS are included in Annex II.

SECTION III - DETAILED DESCRIPTION OF PROJECT

A. Project Items

3.01 The project consists of the design, construction and placing in operation of a 400 MW addition to the Santa Cruz thermal electric plant as well as the requisite transmission facilities. It will consist of the following major components:

3.02. Two - 200 MW, tandem compound turbine-generator units located in an extension to the existing turbine hall. Each turbine will be served by its own outdoor oil-fired boiler. Each generator will be connected through a main step-up transformer to an extension of the existing 132 Kv substation.

3.03. The switchyard and substation extension will consist of five additional bays, two for the generators, one for the start-up transformer and three for transmission lines.

3.04. Three additional 132 Kv transmission circuits on double circuit steel towers (one spare position) are included to connect to the FURNAS system at their new Jacarepaguá receiving substation. An extension of three bays is provided at Jacarepaguá for these circuits.

3.05. Engineering and technical assistance required to carry out the project and to operate and maintain the plant once completed is included.

B. Financing and Cost Estimates

3.06. A.I.D. has been requested to finance the dollar costs of the project in the amount of US\$41.2 million. The total cost of the project is US\$92.3 million of which US\$13.3 million is interest during construction.

COST ESTIMATE

	<u>Local Currency</u> <u>US\$ Equivalent</u>	<u>U.S.</u> <u>Dollars</u>	<u>Total</u>
	(million Dollars)		
<u>Direct Costs</u>			
Generating Plant	21.3	28.1	49.4
Transmission	3.3	0.2	3.5
Substations	0.2	0.2	0.4
Improvements & Replacements	<u>0.3</u>	<u>0.2</u>	<u>0.5</u>
Sub-Total Direct Costs	25.1	28.7	53.8
<u>Indirect Costs</u>			
Factory Technicians, Erectors, and Start-up Personnel	0.4	0.8	1.2
Fuel Oil Supply Facilities	2.5	-	2.5
Training Including Operating Manuals	-	0.2	0.2
Freight & Insurance	0.4	1.8	2.2
Escalation	3.5	3.8	7.3
Contingency	2.8	1.7	4.5
Engineering & Procurement Assistance	1.3	2.1	3.4
Administration and Construction Management	<u>1.8</u>	<u>2.1</u>	<u>3.9</u>
Sub-Total Indirect Costs	12.7	12.5	25.2
<u>Total Construction Cost</u>	37.8	41.2	79.0
Interest During Construction	7.8	5.5	13.3
<u>Total Investment</u>	<u>45.6</u>	<u>46.7</u>	<u>92.3</u>

C. Technical Feasibility

Studies and Reports

3.07 - The loan application is based on a feasibility study prepared by Sanderson and Porter Inc. of New York dated February 1967. The study examined the economic and technical feasibility of installing additional thermal generating capacity as recommended by the CANAMBRA report. In addition it developed the preliminary engineering needed to make the cost estimates and the plan for FURNAS to carry out the project.

3.08 - Sanderson and Porter had previously prepared a feasibility study dated April 1965 for CHEVAP, the former owner of the Santa Cruz Plant. Its purpose was to determine the need and location of additional thermal capacity in the area. It recommended a 400 MW addition to Santa Cruz with one 200 MW unit to be constructed immediately and a second unit to follow in 1969. However, nothing was done pending completion of the CANAMBRA report and assignment by the GOB of responsibility to carry out the project. This study included an examination of available alternative site locations and concluded that the present Santa Cruz Plant was the best location for the additional capacity. (See discussion on Plant Site in Annex III).

3.09 - In the interim between the first Sanderson and Porter study and the completion of the CANAMBRA Report, several events transpired, notably the slippage in hydro construction schedules, and an apparent lessening of power-demand, both of which affected the timing and capacity of the required addition. When the final CANAMBRA Report was completed, it recommended the installation of two 200 MW oil fired thermal units at Santa Cruz for operation in 1971-72. The Sanderson and Porter feasibility study was developed from this recommendation.

D. Complementary Thermal Generation

3.10 - The discussion in Section V - Economic Analysis - shows FURNAS' capability to meet the system requirements on a reliable basis and illustrates the role served by the proposed project. However, for purposes of developing the cost and financial projections for combination hydro-thermal systems, the average long-term operations for combination hydro-thermal systems must be estimated. These will fall between the extreme conditions when:

(1) There is adequate water for the hydros to meet system requirements, the thermal plants will firm up transmission lines, provide peaking power and support the system spinning reserves. The hydro plants provide the base load. Under these conditions, the thermal complement may generate only limited KWH energy but must be available for high capacity short duration (KW) operation. Also, available thermal complementation transforms secondary hydro power into primary to an extent somewhat over its rated capacity.

(2) During dry years and time of drought the thermal plants will shift to base load and the hydros provide the peaking power and the spinning reserve. The limited water will be stored during off peak to provide short duration high capacity operation over peak periods. Under these conditions the thermal plants must generate power at high capacity over a long uninterrupted period.

3.11 - For purposes of making financial and economic projections a rational balance between hydro and thermal generation must be used that is between the above described extremes.

3.12 - CANANBRA method was to determine the primary energy capability of the interconnected South-Central System under various hydrological conditions and to utilize existing thermal capacity in a complementary role. The system was then studied with the aid of digital computer which analyzed alternative optimum uses of thermal and hydro facilities at varying cost and load factors. Included in

this analysis was the addition of two 200 MW thermal units as well as other alternative combinations. CANAMBRA calculated the new capability of the system and then determined the average additional thermal power generation for a twenty year period with hydrological conditions matching the past record. It was found that the average lifetime capacity factor of the Santa Cruz Thermal Plant under these conditions would be in the order of 26 percent, which is reasonable in consideration of the characteristics of the system.

3.13 - This is the basis on which the figures used in the Forecast of Earnings Receipts and Expenditures (Table F-7 of the Financial Section) were determined. This forecast considers the present and future plants available to FURNAS, including the 900 MW FURNAS Hydro, 160 MW Santa Cruz Thermal, the proposed 400 MW addition to Santa Cruz as well as Peixoto, Funil and Estreito. These plants are loaded to their expected proportionate share of the total FURNAS load.

E. Plant Type and Size

3.14 - The situation with respect to complementary Thermal power in South-Central Brazil was studied with digital computer programs in which increments of thermal capacity were added. Plants containing two 200 MW, two 300 MW and two 600 MW units were analyzed. It was found that the annual costs declined with plant size. However, CANAMBRA concluded that the size of units used in Brazil should be increased in moderate steps. Large units are being operated near experience limits of temperature and pressure. The larger plants which grow more complex will require more down time especially in the initial years operation. Also Brazil will require time to develop skilled personnel for thermal-electric plants and to condition its industry to the sophistication of thermal electric generating equipment.

3.15 - Accordingly CANAMBRA recommends the next two units for South-Central Brazil be 200 MW, oil fired.

3.16 - Further analysis of plant size and type determination may be found in the Economic Section.

F. Operation and Maintenance

3.17 - The power plant staff will be increased over the staff required for the present plant as indicated below:

	<u>Units</u> <u>1 and 2</u>	<u>Units</u> <u>1, 2, 3 and 4</u>
Plant Superintendent	1	1
Assistant Superintendent	-	1
Operation Section	49	93
Maintenance Section	52	72
Administration Section	<u>18</u>	<u>27</u>
Total Staff	<u>120</u>	<u>194</u>

3.18 - An organization has been set up to operate and maintain the present plant. Job descriptions were established to provide the basis for recruitment. An expert in plant operations was hired by FURNAS to assist in the initial organization.

3.19 - There are very few thermal plants in Brazil that could be a source of trained personnel. For this reason and because thermal plant operation is much more complicated than hydro, FURNAS found it necessary to provide a comprehensive training program. They began recruitment and training about one year ago as part of the A.I.D.-financed first stage project.

3.20 - FURNAS has now recruited and trained most of the required operating staff and about 100 people are at the site doing finish work and becoming acquainted with the plant.

3.21 - Training has been carried out at a special school which FURNAS organized for fundamental thermal plant operation. In some cases, trainees have been sent

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to São Paulo Light's 464 MW Piratininga Thermal Plant. Other key personnel were sent to Puerto Rico or the U.S. for special training.

- 3.22 - There were three key positions where only experienced men can be used. They are the Power Plant Superintendent, Operations Supervisor, and Water Analyst Consultant. These men are being supplied by Sanderson and Porter and will be employed at the plant for a period of one to two years until they train their counterparts.
- 3.23 - Operation and maintenance of the substations and transmission lines will present no problem to FURNAS as they already have an adequate team of experienced personnel performing satisfactorily in their present system.
- 3.24 - During the next four to five years while the proposed plant is being built, there will be a need to replace a normal labor turnover and upgrade certain personnel. Because there is such a limited supply of such personnel in Brazil, this loan request includes \$200,000 for training. A specific program must wait until the project is well underway at which time the plant personnel requirements can be more accurately determined. The amount in the estimate would provide for one or two people to be sent to the U.S., others to Puerto Rico and probably some experts to be brought from the U.S. to provide training in Brazil.
- 3.25 - The critical requirement for operating and maintenance organization and staff will be met by the present program for the initial stage of Santa Cruz.

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SECTION IV - ENGINEERING AND IMPLEMENTATION PLAN

A. Engineering

4.01 - FURNAS will engage an engineering firm with thermal plant experience to perform or assist FURNAS to perform the necessary engineering, design, procurement, and inspection. It will also assist FURNAS in construction management, testing and start-up operations. It is expected these engineering services will be provided by a joint venture contract.

4.02 - Sanderson and Porter are now performing engineering on the first stage of Santa Cruz and also prepared the feasibility study for the proposed second stage.

4.03 - Since one of the major reasons for the delay in the first stage of Santa Cruz was the lack of a unified engineering program (See Annex II, History). USAID proposes that Sanderson and Porter be considered eligible for selection on the next two units.

B. Supervision of Construction

4.04 - Construction will be carried out under the general direction and control of FURNAS assisted as required by the consultants. To insure that all construction phases of the project are properly carried out FURNAS will provide a highly experienced management team to carry out the supervisory responsibility. FURNAS has had wide experience in supervising large power projects. These include the 900 MW FURNAS dam, the 600 MW Estreito Project, and the 345 KV FURNAS Guanabara transmission system. Also they will be given the 210 MW Funil hydro electric project (formerly CHEVAP project) to complete. FURNAS is well staffed and experienced to undertake the supervision of the construction work. Assisted by a qualified engineering firm experienced in thermal plant design they should be able to complete the proposed thermal plant project without undue difficulty.

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C. Construction

4.05 - The construction will be performed by Brazilian construction contractors. There are experienced civil and heavy erection contractors available to undertake the work. They will be selected on the basis of competitive bids, the specifications for which will be prepared by the consultants and approved by A.I.D. These contracts will be financed from FURNAS' own resources.

D. Equipment

4.06 - More than half the direct cost of the plant will be imported equipment financed from this loan. Procurement will be based on competitive bids. Designs and specifications will be prepared by the consultants, and key items approved by A.I.D. The supplier of major equipment will be required to provide an erection engineer to supervise the erection of the equipment as well as the initial stages of its testing and operation.

E. Schedules

4.07 - The load projection (Exhibit A) shows that the first unit should be available for the August peak load in 1971 and the second for 1972. The "Bar Chart" Project Construction Schedule (Exhibit J) meets this schedule. It was based on deliveries quoted in January 1967. However, the turbine-generator deliveries have since lengthened critically. There are only two U.S.A. suppliers of the turbine/generator equipment. General Electric and Westinghouse. Their current (March 1967) quotations for delivery of turbine generators at the factory is 42 months. To this must be added 2 months shipping time, 12 months erection and 2 months check out and test making 58 months for the first unit and the second about 6 months later. They also state that deliveries are becoming worse.

4.08 - With this fast changing and lengthened turbine-generator delivery lead time, the present outlook is for the first unit to be installed in 1972, assuming the order is placed in the second quarter 1967. These factors, developing after the preparation of the feasibility report, indicate that completion dates should be pushed forward about one year.

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4.09 - The next most critical item will be the boilers. As of the time of writing (March 1967), however, deliveries of boilers are within the time required for turbines.

4.10 - The schedule for plans and specifications will be geared to the project requirement. The preliminary and conceptual engineering is completed. Bidding plans and specifications will be scheduled to meet procurement and construction requirements and will be required over the Project construction period. Plans and specifications for procurement of turbine-generators are already under way in anticipation of this requested loan. Due to the long lead time for the major equipment, serious construction at the site will not begin until about 1969.

F. Cost Estimates

4.11 - Preliminary designs, heat balance, single-line diagrams and plant layouts were prepared by Sanderson and Porter, and serve as the basis for cost estimates. Exhibit H shows the detailed breakdown of the project estimates.

4.12 - The land for the plant expansion and the Jacarepagua receiving substation is already owned by FURNAS so that no additional costs are included for these items. Some additional right-of-way will be needed for the three additional transmission circuits as the present right-of-way is not sufficiently wide to accommodate the additional circuits.

4.13 - Estimates have been based to a large extent on the experience of the present plant, adjusted for differences in size and price changes. The direct cost of the present 160 MW plant is about \$150.00/Kw. The proposed 400 MW addition direct cost estimates are about \$140.00/Kw. Taking account of additional costs of the higher pressure design of the proposed addition and price increases, the costs compare favorably.

4.14 - The cost estimate of the proposed transmission lines, substation equipment, and their construction were compared to the cost of the present double circuit line and with similar costs on other projects in Brazil. There have been a considerable number of transmission lines and substations built recently in

Brazil for which costs are known and comparison can be made. It is the intent of FURNAS that items which are manufactured in Brazil and are acceptable from the standpoint of quality and cost, will be purchased in Brazil. Those that cannot be purchased in Brazil will be imported from the USA. As Brazil does not manufacture this size and type of equipment, all the major power plant equipment will be imported. Construction and erection will be by local contractors. (See Engineering Plan for Implementing Project for details). It is on this basis that the division between cruzeiro and dollar costs have been estimated and financial projections made. A.I.D. will finance only the dollar imports. See Exhibit I for schedule of disbursements.

4.15 - As there are so few steam plants of this size in Brazil there is little opportunity to draw upon local experience for operating costs. Therefore, operating costs including labor, maintenance equipment, parts and supplies are based on expected costs developed from staffing charts, labor rates and maintenance plans developed for the present plant and increased proportionately for the proposed plant. Man-hour maintenance takes account of lower production of labor together with lower salaries. Also included are housing and transportation, not usually provided by utilities in the USA.

4.16 - The local cost estimates are based on dollars which were converted at the rate of 2,200 cruzeiros to US\$1.00, the rate at time the estimates were prepared.

4.17 - Estimates were made on then current prices (Feb.1967). Due to the long lead time for equipment deliveries, it is expected that the principal contracts will include escalation provisions. For Brazilian purchases this adjustment includes an adjustment for devaluation of the cruzeiro to the extent that it affects the imported equipment components. Escalation has been allowed for in the cost estimates. FURNAS plans to provide the major part of the local cost financing with funds generated from revenues and from capital available from reversion of dividends by ELEKTROBRÁS. The base on which rates are calculated provides for inflationary adjustments. Any increase in cost, therefore, will more or less be taken care of by the corresponding rate adjustments.

4.18 - Some expenditure for the fuel delivery system will have to be made by PETROBRAS. It is likely that FURNAS will be asked to finance some of this cost. This issue is dealt with at greater length in Annex III.

G. Conclusion FAA 611

4.19 - Necessary technical and financial plans have been completed and a reasonably firm estimate of the cost to the United States has been determined to meet the requirements of FAA 611.

SECTION V - ECONOMIC ANALYSIS

A. Economic Conditions of the South Central Region

5.01 - Brazil has experienced a continuing growth of industry since World War II and wide variety of consumer and industrial products are now of domestic manufacture. Examples are steel, automobiles, and, of particular importance to the power industry, air conditioners, refrigerators, and other electrical appliances as well as industrial machinery and equipment.

5.02 - The Gross National Product of Brazil increased at an average rate of nearly 6 percent from 1947 through 1961. Since then, growth of GNP declined as follows:

<u>Year</u>	<u>GNP^{1/}</u>
1962	5.4%
1963	1.6%
1964	3.1%
1965	4.7%
1966 (USAID est.)	2.3%

5.03 - The slowdown in economic growth was the result of various factors: political instability during 1962-1963, and the rigorous monetary stabilization program from 1964-1966. For the future, the GOB development program is based on a GNP growth of approximately 5 percent in 1967, 5-1/2 percent in 1968-1969 and 6 percent from 1970 on.

5.04 - The South-Central region of Brazil, comprised of the States of Minas Gerais, Rio de Janeiro, Guanabara and São Paulo, includes Brazil's three largest cities -- São Paulo, Rio de Janeiro and Belo Horizonte. It has the highest rate of urbanization and includes virtually all heavy industry and most of the new industries. The South-Central region has achieved an average per capita income of close to 150 percent

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Source: Getúlio Vargas Foundation.

of Brazil's national average. It has for some time accounted for more than 60 percent of Brazil's total income. The region is responsible for 76 percent of the country's industrial activity.

B. Demand Forecast, CANAMBRA Projections and Justification for Santa Cruz Extension

1. Demand Forecast and Construction Program

5.05 - The Santa Cruz expansion is based on the CANAMBRA median forecast of load growth through 1980 for the interconnected systems of the South-Central region. The GOB has accepted the forecast as official policy, as well as the recommended construction program based upon it. The construction program is the basis for the GOB's five-year South-Central power investment program for the 1967-71 period.

5.06 - The CANAMBRA forecast is based on four principal economic assumptions: (1) that the population in South-Central Brazil grows at an annual rate of 3.30 percent during 1960-70, and at 3.29 percent during 1970-80, (2) that the degree of urbanization in South-Central Brazil will increase from 59.7% in 1960 to 75.8% in 1980, (3) that GNP will grow at a rate of 6 percent in 1966 and thereafter and, (4) that some types of power use will be inhibited by the increase in rate levels and the absence of differentiated industrial rates. CANAMBRA also assumes that over the period of the power forecast, rates will not be a deterrent to increased power use because the cheap hydro power available to Brazil is bound to eventually bring about a decrease in the existing level of rates, as well as a more adequately differentiated rate structure.

5.07 - Based on these assumptions, as well as historical data on power consumption and a careful study of current plans for industrial expansion, CANAMBRA has projected a (median) growth rate for power demand of 9.5 percent per annum during the 1965-1980 forecast period. This is composed of a rate of 11.6 percent for 1965-1970, during which time it is assumed that the expansion in capacity will have to meet

repressed demand^{1/} as well as the normal growth of demand for power -- and a rate of 8.5 percent for 1970-1980, when it is assumed that the system will be able to fully meet the demands made upon it at prevailing prices. This compares with a historical growth rate for power consumption of 10.9 percent from 1955 to 1960, when the Brazilian economy was growing at an annual rate of 5.9 percent. Table I below compares the projected rates with historical rates for two other periods in addition to 1955-1960. The latter period includes the effects of the post-1961 slow-down of the Brazilian economy.

TABLE I

Growth Rates for Power Consumption (South-Central Region)
and GDP (Brazil)

<u>Year</u>	<u>Record</u>		<u>Year</u>	<u>Projected</u>	
	<u>Power Cons.</u>	<u>GDP</u>		<u>Power Cons.</u>	<u>GDP</u>
1955-1960	10.9	5.9	1965-1970	11.6	6.0
1957-1962	9.8	6.7	1970-1980	8.5	6.0
1958-1963	7.0	5.6	1965-1980	9.5	6.0

5.08 - Peak demand (MW) and energy (shown as average MW) for FURNAS is shown in Exhibit C, which also shows the power companies supplied by FURNAS^{2/}.

^{1/} CANAMBRA estimates that repressed demand in the Guanabara area alone is of the order of 250 MW owing to inadequate expansion of the distribution system in the past.

^{2/} A detailed description of the FURNAS market area is included in Annex III.

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	<u>1968</u>	<u>1972</u>	<u>1975</u>
FURNAS Hydro	990	990	1,250
Santa Cruz Thermal, First Stage	170	170	170
Santa Cruz Thermal, Second Stage	-	440	440
Peixoto Hydro (FURNAS Shares)	300	300	300
Funil (Owned by ELETROBRAS)	-	195	195
Estreito Hydro	-	1,000	1,000
Marimbondo Hydro	-	-	960
TOTAL	<u>1,460</u>	<u>3,095</u>	<u>4,315</u>
Preventive Maintenance	<u>165</u>	<u>174</u>	<u>174</u>
Capacity in Operation	1,295	2,921	4,141
Spinning Reserve	165	220	220
Self Consumption	<u>4</u>	<u>10</u>	<u>12</u>
Available at Generator Busses	1,126	2,691	3,909
Transmission Losses (8%)	<u>90</u>	<u>215</u>	<u>313</u>
Available at Delivery Busses	1,036	2,476	3,596
System Peak Demand (August)	1,164	2,379	3,416

5.09 - There is a capacity deficit of 71 MW in 1971 and 128 MW in 1968 (latter shown above). The 1967 peak on FURNAS will probably not develop as the FURNAS-Guanabara transmission line will not be ready for the August peak load. The deficit for 1969 will have to be met by deferring maintenance. Also the demand for 1971, 72 and 73 cannot be met unless the two 200 MW thermal units are available to FURNAS. Moreover, as mentioned elsewhere, the hydro construction schedules are slipping and may be expected to continue to slip. This condition will further aggravate the power supply situation for the early 1970's. There are no new hydro projects or one presently under construction, that could be advanced to meet requirements within the time the thermal addition could be completed. Hence the urgency in getting this project underway.

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5.10 - Provided new capacity becomes available to FURNAS as scheduled -- including the proposed Santa Cruz expansion -- the system will have sufficient energy to meet the projected requirements under dry year conditions until 1975, when FURNAS will need an additional source of energy. This is illustrated on the basis of average MW in Exhibit E.

5.11 - The following table shows the energy available for illustrative years under driest year conditions.

ENERGY AVAILABLE - DRIEST YEAR

	<u>Average MW</u>		
	<u>1968</u>	<u>1972</u>	<u>1975</u>
FURNAS Hydro	506	506	506
Santa Cruz Thermal	136	476	476
Peixoto Hydro	196	166	166
Estreito Hydro	-	399	399
Funil Hydro	-	89	89
Marimbondo Hydro	-	-	560
Total:	<u>808</u>	<u>1,636</u>	<u>2,196</u>
Self Consumption	4	10	12
Transmission Losses (6%)	<u>47</u>	<u>95</u>	<u>129</u>
Available at delivery busses	757	1,531	2,055
Annual System Requirements	733	1,499	2,152

5.12 - By 1975 other hydro projects will be coming on line. FURNAS may possibly obtain the concession to develop one or more of these projects. If FURNAS cannot meet load requirements, it will either shift load to other suppliers or purchase power from other companies operating the future generating facilities.

2. Analysis of the CANAMBRA Projections

5.13 - Given the recent performance of the Brazilian economy -- and the growth rate projections of the GOB in its Ten-Year Plan (see Table II below) -- the CANAMBRA median forecast is probably optimistic to the extent that it is based on a 4 percent growth for 1965 and a subsequent 6 percent growth rate for the Brazilian economy. CANAMBRA made a high, median and low projection -- the major variant between the three forecasts being the growth rate for GDP. The low forecast was based on a 5 percent growth rate for GDP, the median forecast on 6 percent and the high forecast on 7 percent (see Table III below).

TABLE II

Forecast Assumptions about GDP Growth Rates

<u>Year</u>	<u>CANAMBRA</u>			<u>GOB</u>	<u>Record (Estimated)</u>
	<u>Low</u>	<u>Medium</u>	<u>High</u>		
1964	s t a g n a t i o n				1.6
1965	3.0	4.0	5.0		4.7
1966	5.0	6.0	7.0		2.4
1967	"	"	"	5.0	
1968	"	"	"	5.5	
1969	"	"	"	5.5	
1970	"	"	"	6.0	

5.14 - The median growth rate is based on assumed stagnation in 1964, a 4 percent GDP growth rate in 1965, and a 6 percent rate from 1966 to 1980. The estimated actual rate for 1965 was 4.7 percent, and for 1966 was 2.4 percent (as estimated by A.I.D.). The median projection for 1966, however, assumes 6 percent. The combined growth over the two years thus falls far short of the CANAMBRA projection. Moreover, the GOB's projection of economic growth -- on which CANAMBRA bases its justification of 6 percent for 1966-1980 -- does not reach that level until 1970. The GOB projects 5 percent in 1967, 5.5 percent in 1968 and 1969, and 6 percent starting in 1970.

5.15 - In light of this information the low forecast seems more reasonable -- where stagnation is assumed in 1964, a 3 percent growth rate in 1965, and a 5 percent growth rate for 1966-1980.

5.16 - Another reason for preferring the low to the median forecast is that it conforms more to the rate of power growth itself. The record growth rates for 1965 and 1966 fell well below the 11.6 percent median forecast rates for 1965 through 1970 -- 4.8 percent in 1965 and 10.0 in 1966 -- or 7.3 percent on an annual compounded basis. Given that the 1965-1970 projected rate is bound to be high because it includes correction for repressed demand, one can look instead at the annual power growth rate projected for the whole period -- 9.5 percent from 1965 to 1980 for the median forecast. This is still above the rate observed in the first two years of the forecast period (see Table III below). The low projection, as can be seen in the table, is more in accordance with the information provided by data on 1965 and 1966 ^{1/}.

TABLE III

Projected and Record Power Consumption Growth Rates - South-Central

<u>Record</u>		<u>Projection</u>		
1955-1960	10.9			
1957-1962	9.8			
1958-1963	7.0			
1965	4.8			
1966	10.0			
		<u>Year</u>	<u>Low</u>	<u>Median</u>
1965-1966	7.3	1965-1970	10.5	11.6
		1965-1980	8.6	9.5

^{1/} There exists an assumption in the forecast that also contributes to its optimistic bias: that rates will eventually go down and become differentiated, because Brazil has cheap hydropower, and that therefore there will be no long-run affect of the current high level of rates on demand for power. That Brazil has cheap hydro potential is not sufficient reason for assuming -- as CANAMBRA does -- that rates are bound to go down. There is no cost-reducing incentive in the Brazilian rate structure. To the contrary, the utilities are guaranteed maximum percentages of profit, depreciation and amortization, regardless of the efficiency of their operations.

5.17 - In light of this new information, it is more within reasonable expectations to base power growth on the low forecast of CANAMBRA, rather than on the median forecast. CANAMBRA, however, considered the low forecast a hypothetical lower limit and therefore worked out complete construction programs to meet projected load growth only for the median and high forecasts. The construction program to meet the low forecast is a "base program" of hydro plants, on top of which CANAMBRA adds -- in order to meet the median and high forecasts-- the Santa Cruz expansion, and anticipates the construction schedules of the base program projects. Santa Cruz is not included at all in this base program -- even in the final years of the forecast. The base program for the low forecast, in other words, is not a working program.

5.18 - Had the low forecast been considered more than hypothetical by CANAMBRA, the Santa Cruz plant would certainly have been included in the construction plan to meet it -- because of the generally recognized need for thermal complementation in this almost completely hydro system. The problem, then, is the existence of a reasonable forecast based on a GDP growth rate of 5 percent, along with a detailed construction program in which Santa Cruz plays a role only for the median and high forecasts.

5.19 - The Santa Cruz Plant can still be justified in terms of the low forecast. It is helpful, first of all, to see the magnitudes of difference between the low and median forecast in relation to the amount of capacity that Santa Cruz will supply to the South-Central system. It can be seen from Table IV below that the discrepancy between the two forecasts in the year for which the plant is scheduled to come on stream (1972) is not much greater than the size of the plant itself. According to the current construction schedule, moreover, the Santa Cruz units 3 and 4 will come on stream almost a year later than was planned -- in late 1972 or early 1973.

TABLE IV

Projected Power Requirements for South-Central Region, 1971-1973

<u>Year</u>	<u>Median</u>	<u>Low</u>	<u>Difference</u>	<u>Santa Cruz</u>
1971				
Peak MW (with 10% reserve)	8464	7993	471	
Avg. Annual MW	4836	4559	270	
1972				
Peak MW	9200	8621	579	
Avg. Annual MW	5257	4917	335	
1973				
Peak MW	10020	9318	602	440*
Avg. Annual MW	5720	5309	409	104**

5.20 - There are reasons why the Santa Cruz extension should be included in a power construction program based on the low forecast. One is that the hydro-based FURNAS system is engineered to meet the driest year on record -- but not a succession of dry years. From a study of streamflow records over the last fifty years, CANAMBRA found that there regularly occurred a series of three or four consecutive dry years in the first half of every decade. Though the hydro system constructed according to the base program could deal with the first of one such dry year -- by drawing down reservoirs below the rule curve -- it would enter the second dry year with no storage capacity for such a contingency. Since there is a good possibility -- according to streamflow records -- that 1972 and 1973 will be the beginning of a succession of drought years, then the FURNAS system, without Santa Cruz, would be completely unprotected against such a contingency. Secondly, the smooth functioning of the power expansion program in the South-Central region is dependent on the coming onstream of the first two units of Ilha Solteira

* The nominal capacity of the plant is 400 MW. Calculations are based on overload capacity, which is 440 MW.

** The average lifetime plant capacity factor is 26%. (400 x .26 equals 104) This figure would actually be closer to 400 during and immediately following the year that the plant comes onstream, assuming these years will be drought years when the plant will operate near 100% capacity.

in 1973 (250 MW) -- according to the forecast -- the next four in 1974 (500 MW), four more in 1975 (500 MW), 375 MW in 1976, and the remaining 125 MW in 1977. There has already been slippage of one year in the Ilha Solteira construction schedule, and there is no guarantee that there will not be further slippage. CANAMBRA has pointed out that if Ilha Solteira completion were delayed, South-Central Brazil would be in danger of severe power rationing. If the plant were as much as two years delayed, for example, it would be necessary to add about 1000 MW of capacity to the system elsewhere. Twenty percent of this requirement might be met by adding units 13 and 14 at Jupia, but the commissioning of units to meet the remaining 800 MW on short notice would present great difficulty. Santa Cruz, therefore, represents a minimum degree of insurance against the slippage that may occur on Ilha Solteira, and/or on any of the other hydro additions to capacity projected during this period.

C. Other Economic Issues

5.21 - The text and cost comparisons of the table presented below are addressed to the following issues:

- a) The selection of thermal over hydro and nuclear power alternatives 1/
- b) The selection of site 2/
- c) The selection of fuel 2/ and delivery system.
- d) The selection of unit size 3/

1/ The technical aspects of thermal complementation are discussed on page 11

2/ Further discussion is included in Annex III

3/ Further discussion is included on page 12

Annual Cost to Brazil of Firm Power Delivered
to Sub-Transmission Systems from Alternative Sources

	<u>Complementary Operation</u>	<u>Base Load with Peaking Hydro</u>	<u>Independent Operation</u>
<u>Oil Fired (Santa Cruz)</u>			
1. 2-200MW Units added to 1970 system	\$28/Kw(2)	\$39.40/Kw	-
2. 2-300MW Units added to 1970	\$25/Kw	\$36.34/Kw	-
3. 2-300MW added following (1) above)	\$25/Kw	\$34.08/Kw	-
4. 2-600MW Units	-	-	\$34.65/Kw
<u>Coal Fired (1)</u>			
5. 2-200MW Units added to 1970 System	\$39.02/Kw	-	-
6. 2-300MW Units added to 1970 System	\$35.62/Kw	-	-
<u>Hydroelectric Power</u>			
7. FURNAS, Peixoto, Estreito, Jaguará	-	-	\$24.41/Kw
8. Ilha Solteira	-	-	\$26.30/Kw
9. Marimbondo, Água Vermelha-São Simão	-	-	\$23.25/Kw
<u>Nuclear Power (3)</u>			
10. 2-200MW Units added to 1970 system	-	\$46.75/Kw	-

(1) Based on a plant located near Santos burning coal from a newly-developed modern mining operation.

(2) Plan selected.

(3) Because the capital cost of a nuclear plant (\$406/Kw) is more than double an oil-fired plant (\$150/Kw), nuclear power, while having a lower fuel cost, can only be justified for base-load operation.

5.22 - The table represents the estimated true costs of firm power to the Brazilian economy excluding the effect of taxes, subsidies, and miscellaneous charges required by law. These figures were derived by CANAMBRA and based on:

- (a) Interest rate (9%), service lives, and cost of fuel.
- (b) Capital costs, operation, maintenance, and administration expenses.

5.23 - Full details of the calculations and assumptions are available in the CANAMBRA report. They have not been included in this paper.

1. The Selection of Thermal over Hydro or Nuclear Power Alternatives

5.24 - It can be seen from the above table that the annual costs of thermal power are slightly higher than the three groups of hydro projects under comparison. They are not alternatives, however, since they are already either finished, under construction, or on schedule. In fact, of the 76 hydro projects studied in detail by CANAMBRA, only 11 (besides the three aforementioned) have an annual cost of firm power lower than \$28/Kw, the calculated annual cost of the additional Santa Cruz units. Of these 11, there are none that meet the other requirements of capacity and timing. It can also be seen that nuclear power, because of its high capital cost, must be operated as a base load plant, where its cost (\$46.75Kw/yr exceeds the cost of a comparable oil-fired plant (\$39.40). Nuclear power is, therefore, not an economical alternative.

5.25 - The proposed thermal investment not only adds 400 MW of new capacity to the system -- as would an equivalent hydro installation -- but it endows

major benefits on the system, which the equivalent hydro investment would not likewise provide. By introducing thermal complementation in an almost completely hydro system, the Santa Cruz project provides a drastically needed minimum level of security to the power supply of the South-Central region. By increasing the degree of certainty about the availability of power, it represents a much more efficient use of Brazil's hydro resources, and raises considerably the value of industry of the existing supply of installed power capacity.

- 5.26 - At the end of 1966, installed capacity in the South Central region was approximately 5,200 MW. Of this, 2,900 average MW represents the primary energy capability or firm power. Thus, 2,300 MW of the total, or 44%, is secondary power capacity. Installed thermal power amounts to about 600 MW, or 12% of the total system capacity. By the end of 1972, after commissioning of the fourth Santa Cruz Unit, secondary hydro power will amount to about 42% of total installed capacity. Thermal power (1,000 MW) will again represent about 12% of the total (9,800 MW). Thus, the inclusion in the program of additional thermal capacity at Santa Cruz will maintain the present proportions of firm and secondary power capacity as well as the hydro-thermal relationship. Given existing cost characteristics of the system, this may be regarded as a satisfactory ratio.
- 5.27 - The increased certainty about future power supply, facilitates an important improvement in the administration of the South-Central region's power system: the contractual sale of power -- a practice that is routine for any normally-functioning utility, but which has not existed in Brazil, partially because of the inability to guarantee given levels of supply into the future due to the variation in the availability of secondary hydro resources. The ability to contract advance sales of this secondary

power not only lessens the uncertainties plaguing the massive investment program required in the electric power sector, but it lessens one of the important uncertainties that affects industrial expansion -- whether or not the enterprise can be assured an adequate supply of power. Contractual agreements, moreover, will also help to eliminate the inefficient diversion of investment resources into purchase by the manufacturing sector of self-owned generators -- which represent high cost sources of power that make no contribution to the expansion of the public power system.

- 5.28 - The Santa Cruz expansion, in sum, provides two important economies -- above and beyond the simple addition of installed capacity: to the power sector, the internal economy resulting from increased certainty about the ability to supply the market and, to the manufacturing sector, the external economy of being able to plan production and expansion on the basis of a guaranteed level of power.

Site Selection

- 5.29 - CANAMBRA recommended that the thermal addition be made in the Guanabara area because of its greater dependence on the upper Rio Grande power, 400 Km. distant. This would also satisfy the dual purpose of complementing the system as a whole and assuring a reliable source of power for the Rio market. At USAID's request, Sanderson & Porter clarified and updated their 1965 site study for additional thermal power in the Guanabara area. They concluded that the two sites originally studied, Santa Cruz and Ponta do Lagarto, represented the best available alternatives in the State and they reconfirmed the original recommendation to locate at Santa Cruz. In addition to a lower initial investment of about

\$3.0 million at Santa Cruz,^{1/} there will be incremental operating savings resulting from the sharing of certain facilities and staff. Even if the \$2.5 million cost of the proposed pipeline to Santa Cruz (See below) is added to the capital cost of the project, the savings in operating costs of the net additional staff of 120 men required at Ponta Lagarto makes the Santa Cruz site clearly the more economic. A detailed discussion of site selection is given in Annex III.

3. Selection of Fuel and Delivery System

5.30 - All units at Santa Cruz will be oil fired. It can readily be seen from the table page 30 that even by-product steam coal is presently non-competitive.

5.31 - The problem of fuel delivery is inseparable from site location. Trucking fuel, while adequate for the first two units, will not be feasible as a delivery system for the combined unit capacity (with the addition) of 560 MW. The two solutions presently under consideration are barge or pipeline delivery. PETROBRAS is interested in building a pipeline from its refinery at Duque de Caxias to Santa Cruz. The estimated cost of such a pipeline is \$2.5 to 3 million. This total expenditure need not be considered as a full capital cost to the project for the following reasons:

(i) PETROBRAS would construct, own, and operate the pipeline (They have pipeline experience with the Piratininga Thermal Plant in São Paulo; and

(ii) The facility would be shared by Volta Redonda and other fuel users.

5.32 - Several additional points should be noted:

(iii) FURNAS may be called upon to help finance the pipeline, perhaps, through a loan to PETROBRAS;

1/ Including transmission as part of capital cost.

- (iv) The cost of the pipeline in any event would not exceed the extra capital investment required to develop the Ponta do Lagarto site.
- (v) This system would minimize fuel transportation costs.

5.33 - Finally, the Minister of Mines and Energy (whose authority embraces both ELETROBRAS and PETROBRAS) has expressed his willingness to commit the GOB to an efficient and economic delivery system which will be completed before the additional capacity is available.

4. Unit Size

5.34 - As can be seen from the table on page 30 costs per Kw decline as unit size increases. There are two fundamental objections, however, to choosing units greater than 200 MW for installation at Santa Cruz. The first is based on the assumption and calculations of market demand found in this section. 400 MW will be the most satisfactory amount of additional capacity from demand point of view. Secondly, the combination of two 200 MW units is superior to one 400 MW unit because the latter would provide less flexibility of operation and impose greater technical difficulties.

D. Impact on the U.S. Economy

5.35 - The impact of this project on the U.S. economy is obviously favorable since it will result in the export of \$41.2 million in U.S. goods and services that otherwise would not have arisen.

SECTION VI - FINANCIAL ANALYSIS

6.01 - Information regarding the financial condition of FURNAS comes for the most part from the following sources: (i) FURNAS, (ii) Arthur Andersen & Co., FURNAS auditors since 1964, (iii) the World Bank appraisal reports, and (iv) the Sanderson & Porter feasibility study. Certain financial statements have been recast and ratios and trends derived by USAID for analytical purposes.

A. Utility Regulation and Present Rate Legislation

6.02 - The regulation of electric utilities as to matters of rates and accounting is vested in the Division of Water of the Department of Mineral Production. This department is in the Ministry of Mines and Energy. Rates of Federal or State, as well as privately owned utilities must be approved by the Division of Water. A procedure is established by law for the calculation of the rate base and allowable earnings thereon and is included in the decree of February 26, 1957 titled Serviços de Energia Elétrica and Decrees 54936, 54937 and 54938 of December 4, 1964. The last mentioned decrees include provision for restatement of the property accounts to compensate for depreciation of the currency.

6.03 - In general the provisions of the regulations provide that the utility shall be entitled to receive:

- (1) An amount per year sufficient to meet all operating expenses.
- (2) A maximum allowance for depreciation of 5 percent on the depreciable plant and property of a hydro system or 8 percent on a thermal system.
- (3) An allowance of not more than 5 percent per annum for amortization of investment made by other than public authorities. Proceeds from this allowance are to be maintained in a sinking fund. The limitation on

the annual rate of accrual was increased from 3 percent to 5 percent by Decree No. 54938.

(4) An amount to be determined by the Fiscal Department of the Division of Water, where concession provisions require indemnity if the property reverts to government ownership.

(5) An allowance of 10 percent as return on the rate base. The rate base is calculated from the value of the plant and property less depreciation and amortization reserves, customers contributions, etc. It includes an allowance for free funds, working capital equivalent to one sixth of the annual revenue from the sale of energy, materials, and supplies in stock and entailed funds.

6.04 - Provision is made for readjustment of tariffs at six month intervals to compensate for changes in the cost of operation. This includes changes in fuel costs and other items such as the rate of exchange. This last item applies particularly to foreign capital invested in the utility.

6.05 - FURNAS is probably the only utility in Brazil which took immediate advantage of the tariff regulations with respect to revaluation of assets. 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 FURNAS 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 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. In June 1966 FURNAS applied for and received further tariff increase including provisions for depreciation charges at 5 percent and amortization charges at 3 percent.

6.06 - To assure that FURNAS continues to readjust its rate levels, USAID recommends that a covenant to the Loan Agreement be considered as outlined below.

6.07 - Until the loan is fully repaid, FURNAS shall promptly take all such action as may be necessary to establish and maintain electricity tariffs to produce the maximum level of revenues permitted by existing electricity tariff legislation. FURNAS and A.I.D. may agree from time to time on a reduced level of electricity tariffs whenever FURNAS revenues substantially exceed its requirements. The GOB shall be committed to the timely approval of such tariff adjustments through provisions in the Guarantee Agreement.

6.08 - USAID, in addition, will recommend that a further covenant of the loan agreement FURNAS rate structure be determined in such manner as to induce the optimum utilization of available power. This covenant, as distinguished from the one mentioned above which affects rate levels, will be concerned the relative pricing of demand and energy charges, the discounting of bulk purchases, and the rates to different categories of buyers. It is felt, therefore, that both covenants will serve the same purpose, e.g. to focus on the strengthening of FURNAS rate policy. FURNAS has consistently demonstrated its competence in rate management and it is expected that any useful recommendations resulting from the present rate study being undertaken by ELETROBRAS will be carefully reviewed.

1. Influence of Santa Cruz on Rate Level

6.09 - The influence of the more expensive steam-electric production at Santa Cruz is estimated to increase the FURNAS rates by only 5 percent. The construction of the additional Santa Cruz units will permit FURNAS to sell its power at the quality required by the ultimate users and to help

the interconnected utilities overcome their energy deficiencies in dry years. By firming secondary power FURNAS will be able to increase its energy sales. These increased power availabilities may permit FURNAS to lower its demand charges without adversely effecting its growth of revenues.

B. Revenues

6.10 - From the Comparative Income Statement (Table F-1) it may be seen that FURNAS revenues and earnings since operations began in 1963 have risen at an accelerating rate of increase. Sales forecasts expressed in KWH are based on the expected sale of power in accordance with contracts signed or to be signed between FURNAS and the buyers enumerated in the preceding Section.

6.11 - Gross revenues, stated simply, are derived from the addition of operating costs, depreciation, amortization, and a 10 percent of return of remunerable investment. The resulting estimate is divided by the number of KWH sold to yield the average rate. This is in accordance to Brazilian legislation. In 1967 the rising trend of revenues is in line with the performance of 1964, 1965, and 1966. However, in 1968 because of a decreasing allowance for depreciation and the elimination of the amortization allowance as shown on line 5.2 of Table F-7, the rate base has been proportionally reduced. The result is a decrease in gross revenues from sales, and an increase in net profit. In the succeeding years, gross revenues from sales are influenced by the initiation of sales from the Estreito plant and later on by sales from the Santa Cruz addition.

C. Analysis of Financial Statements

6.12 - The financial analysis of FURNAS presented herein is based on statements audited by Arthur Andersen & Co., for the years 1964, 1965, 1966 and on projections for the years 1967-80 developed by the Company in conjunction with Sanderson & Porter, consulting engineers. A variety of ratios and trends have been derived from these statements and where they indicated satisfactory performance by FURNAS, no comment has been made.

6.13 - The following remarks then are addressed to those cases in which FURNAS' action or performance would appear contrary to normal practice.

(1) High Dividend Distribution

6.14 - As shown in Table F-5 for year 1964-66 and Table F-6 for years 1967-80, the dividends paid out by FURNAS in 1966 constituted 70 percent of net income. The level of dividend payout is expected to remain relatively high during the life of the loan, although the percentage declines continuously to about 40 percent in 1980. The following reasons explain the seeming paradox of acquiring an interest bearing loan when internally generated funds are available.

(a) The major stockholder (over 90 percent) is ELETROBRAS which reinvests the dividends received from FURNAS as capital additions.

(b) This action is the result of income tax provisions which tax the addition of retained earnings to capital at a rate of 15 percent and the distribution of dividends at 7 percent. Since no tax is due on reinvested dividends, there is a net savings of income tax amounting to 8 percent.

(c) It may be concluded that under this circumstance there is no real cash disbursement for the payment of dividends; the transaction is performed through accounting entries only.

6.15 - The above comments are generally applicable during construction years. It may be noted that after 1971 there is no reinvestment of dividends and that capital remains unchanged. The arrangement between ELETROBRAS and FURNAS, its subsidiary, is that when FURNAS has need of these funds, ELETROBRAS will reinvest the dividends; otherwise it will use them for its own purposes. It is likely that this arrangement will continue as long as it is necessary.

2. Current Ratio

6.16 - From Table F-5 and F-6 it can be seen that the current ratio is around 0.4 during construction years and very high after that. The following remarks are to be considered.

(a) Dividends should be deducted from current liabilities for the above-mentioned reasons.

This improvement in the current ratio is reflected in Table F-6.

(b) Current assets after construction of Santa Cruz include an Amortization and Depreciation Fund. This Fund may be applied to construction of the new hydroelectric plant at Marimbondo, scheduled (by CANAMBRA) to come on line in 1975, should FURNAS receive the concession. The Fund, in any event, should be deducted from current assets since it will be applied on fixed assets.

6.17 - The current ratio recomputed with the aforesaid adjustments is generally 1:1 which is thought to be adequate in view of the virtual absence of inventories (none required) and that free cash held in an inflationary economy is subject to deterioration of value.

3. Return of Investment

6.18 - Tables F-5 and F-6 indicate that net income as a percentage of average net worth shows a decreasing trend. This is due to the fact that in the projections the surplus is not applied to any new revenues producing investment, although if the funds go to construct new facilities, additional revenues will eventually result.

4. Total Long Term Debt as a Percentage of Total Fixed Assets

6.19 - According to the terms of the Loan Agreement between the World Bank and FURNAS dated December 19, 1966, the above ratio may not be permitted to

exceed 66-2/3 percent. The figures in Tables F-5 and F-6 demonstrate that this percentage will not be exceeded. Given the reinvestment of dividend arrangement with ELETROBRAS, the capital base is continuously reinforced. USAID shall recommend the inclusion of a debt/fixed asset ceiling similar to that of the World Bank.

D. Cash-Flow Projections and Repayment Capacity

6.20 - A projection of cash-flow and source and application of funds table has been prepared by FURNAS with assistance from Sanderson and Porter for the years 1967 and 1980. This appears as Table F-7.

6.21 - A review of this information indicates that at no point during those years will FURNAS find itself in a negative cash-flow position. On the contrary, the accumulated cash-flow given in line 27 of Table F-7 never falls below NCr\$ 9.5 million and rises to a constant level of approximately NCr\$ 14.0 million after 1970. Debt service, interest and amortization of principal, has been included for all outstanding long-term liabilities as well as the proposed A.I.D. loan.

6.22 - As shown in line 19 B(2) interest payments begin in year 1971, indicating the assumption that interest will be capitalized during construction. While A.I.D. may consider interest capitalization appropriate for A.I.D. financing; under the two-step arrangement, this should not be necessary as it is expected that the GOB will permit this procedure by allowing deferral of its receipts from FURNAS or by financing from ELETROBRAS resources. Whatever the solution, the cash-flow figures should be substantially unaffected. From these figures FURNAS's ability to repay the proposed A.I.D. loan can be seen.

E. Source of Required Cruzeiro Financing

6.23 - It is estimated (see Detailed Description of the Project) that total project costs for the addition of units 3 and 4 at Santa Cruz will include \$37.9 million of equivalent cruzeiro expenditures.

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6.24 - Line 12 of Table F-7 demonstrates that the accumulated unappropriated surplus for the period of construction 1967-72 will total NCr\$123 million which exceeds the anticipated cruzeiro expenditure by NCr\$20 million. This margin includes provision for estimated escalation of cruzeiro costs.

6.25 - While these projections indicate the ability of FURNAS to manage the required cruzeiro financing from retained earnings, it is USAID intention to secure an over-run commitment from the GOB through a covenant in the Guarantee Agreement.

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TABLE F-1

CENTRAL ELÉTRICA DE FURNAS S.A.
Comparative Income Statement
for the Years Ended December 31, 1964, 1965 and 1966
(In Millions of Cruzeiros)

	<u>1964</u>	<u>1965</u>		<u>1966</u>	
		Cr\$	% Increase over 1964	Cr\$	% Increase over 1964
Operating Revenue	<u>15,791</u>	<u>47,071</u>	198	<u>82,141</u>	420
Operating Expenses	1,111	1,772	60	3,656	229
Exchange Loss	1,628	-	-	-	-
Depreciation	3,224	10,944	240	19,210	492
Amortization	<u>2,284</u>	<u>7,677</u>	236	<u>13,431</u>	488
Total	<u>8,247</u>	<u>20,393</u>	147	<u>36,297</u>	340
Operating Income	7,544	26,678	254	45,844	508
Non Operating Revenue	65	1,350	1,977	2,036	3,032
Interest and Expenses on foreign Debts	3,809	18,389	383	18,713	391
Miscellaneous Expenses	<u>1</u>	<u>734</u>	-	<u>32</u>	-
Income before Income Tax	3,799	3,905	134	29,135	667
Income Taxes					
On profits for the year	814	1,146	41	5,419	566
On monetary restatement	<u>566</u>	<u>1,566</u>	177	<u>1,487</u>	163
Total Income Tax	1,380	2,712	97	6,906	400
Net Income	<u><u>2,419</u></u>	<u><u>6,193</u></u>	156	<u><u>22,229</u></u>	819

CENTRAL ELÉTRICA DE FUERBAS

Comparative Balance Sheet
As of December 31, 1964, 1965 and 1966
(in millions of cruzeiros)

	1964	1965		1966	
	C r \$	C r \$	% Increase over 1964	C r \$	% Increase over 1964
Fixed Assets					
Plant in Service, at cost	121,066	150,649	24	158,930	81
Other Properties, at cost	1	2	100	36	260
Monetary restatement	85,059	179,622	111	265,003	212
Total Fixed Assets	206,126	330,273	60	423,969	106
Less: Depreciation and Amortization	5,866	24,487	317	58,016	889
Net Fixed Assets	200,260	305,786	53	365,953	83
Construction work in progress	28,129	36,246	29	115,451	310
Total Net Fixed Assets	228,389	342,032	50	481,404	111
Current Assets					
Cash	2,633	8,837	236	11,870	351
Other Current Assets	2,858	2,619	92	6,085	112
Total Current Assets	5,491	11,456	109	17,955	227
Other Assets	2,363	1,001	(58)	1,326	(44)
Total Assets					
	236,243	354,489	..	500,685	112
Net Worth					
Capital	37,076	67,380	82	155,000	318
Retained Earnings	1,181	1,553	31	6,579	457
Balance Available for Capital Increase and Legal Reserve	244	574	135	1,686	591
Total Net Worth	38,501	69,507	81	163,265	324
Liabilities					
Long Term Liabilities					
To Major Stockholder	76,828	135,407	78	132,179	72
To Foreign Creditors	108,787	124,677	15	164,203	51
Total Long Term Liabilities	185,615	261,084	41	296,382	60
Current Liabilities	11,153	22,227	99	40,674	265
Other Liabilities	974	1,671	72	362	273
Total Liabilities	197,742	284,982	44	337,418	71
Total Liabilities and Net Worth					
	236,243	354,489	50	500,685	112

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-45-

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Table P-2

TABLE F-3

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CENTRAL ELÉTRICA DE FURNAS S.A.

Comparative Statement of Retained Earnings
for the Years ended December 31, 1964, 1965 and 1966

(In Millions of Cruzeiros)

	<u>1964</u>	<u>1965</u>	<u>1966</u>
Balance - January 1	<u>442</u>	<u>1,181</u>	<u>1,553</u>
Less: Dividends paid	122	232	-
Bonus to employees	215	517	-
Income Tax Adjustments	<u>22</u>	<u>9</u>	<u>-</u>
Total Deductions	<u>359</u>	<u>758</u>	<u>-</u>
Balance	83	423	1,553
Add: Excess provision for bonuses	-	-	71
Excess provision for Income Tax	-	-	162
Exchange profit	-	-	762
Income Tax on dividends	-	-	(187)
Net Income for the year	<u>2,419</u>	<u>6,193</u>	<u>22,230</u>
	<u>2,502</u>	<u>6,616</u>	<u>24,591</u>
Less: Legal Reserve	161	331	1,111
Dividend reserve <u>1/</u>	1,160	3,732	15,575
Bonus reserve <u>1/</u>	<u>-</u>	<u>1,000</u>	<u>1,325</u>
Total Deductions	<u>1,321</u>	<u>5,063</u>	<u>18,011</u>
Balance - December 31	<u>1,181</u>	<u>1,553</u>	<u>6,579</u>

1/ Subject to stockholder approval

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TABLE F-4

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CENTRAL ELETRICA DE FURNAS S.A.
 Source and Application of Funds
 As of December 31, 1965 and 1966

	1965	% of Total	1966	% of Total
(in millions of Cruzeiros)				
Internal Sources				
Capital	30,634	22	88,732	49
Depreciation & Amortization	18,621	14	33,529	19
Retained Earnings	372	-	5,026	3
Total Internal Sources.....	<u>49,627</u>	<u>36</u>	<u>127,287</u>	<u>71</u>
External Sources				
Long Term Liabilities				
To major stockholder	59,579	44	(4,228)	(2)
To foreign creditor	<u>15,890</u>	<u>12</u>	<u>39,532</u>	<u>22</u>
Total long term liabilities	<u>75,469</u>	<u>56</u>	<u>35,304</u>	<u>20</u>
Current Liabilities				
Other Liabilities	11,074	8	18,442	10
	<u>697</u>	<u>-</u>	<u>(1,308)</u>	<u>(1)</u>
Total External Sources.....	<u>87,240</u>	<u>64</u>	<u>52,438</u>	<u>29</u>
TOTAL SOURCES				
	<u>136,867</u>	<u>100</u>	<u>179,725</u>	<u>100</u>
Application				
Fixed Assets	132,264	97	172,901	96
Current Assets	5,965	4	6,499	4
Other Assets	<u>(1,362)</u>	<u>(1)</u>	<u>325</u>	<u>-</u>
TOTAL APPLICATION	<u>136,867</u>	<u>100</u>	<u>179,725</u>	<u>100</u>

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TABLE F-5

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CENTRAL ELÉTRICA DE FURNAS S.A.

Comparative Financial Statements Analysis
for the years ended December 31, 1964, 1965 and 1966

	<u>1964</u>	<u>1965</u>	<u>1966</u>
Current Ratio	.5	.5	.4
Working Capital - millions Cr\$	(5,662)	(10,771)	(22,714)
Average Net Worth		54,004	116,386
Net Income % of Average Net Worth		11.5	19.1
Net Income % of Operating Revenue	15.3	13.2	27.1
Dividends % of Net Income	48.0	60.3	70.1
Dividends plus Bonus % of Net Income	48.0	76.4	76.0
Reinvested Profit %	52.0	23.6	24.0
Total Liabilities % of Total Assets	83.7	80.4	67.4
Long Term Liabilities % of Total Fixed Assets	81.3	76.3	61.6
Current Ratio excluding Dividends	.6	.6	.7

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Central Elétrica de Furnas S. A.

Analysis of Projected Financial Statements
for the years of 1967 through 1980

	<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>	<u>1979</u>	<u>1980</u>
Current Ratio	.5	.4	.4	.4	.9	1.5	2.2	2.9	3.6	4.2	4.9	5.5	6.6	6.8
Working Capital (millions Cr\$)	(19.934)	(23.354)	(29.746)	(28.832)	(5.251)	25.393	57.422	89.722	122.251	155.047	187.229	219.676	272.345	285.760
Average Net Worth	209.420	272.548	316.119	354.340	382.264	407.404	431.802	457.773	485.509	515.128	546.635	579.255	614.395	651.945
Net Income % of Average Net Worth	17.6	14.9	19.6	15.7	14.8	13.2	12.7	12.4	12.1	11.7	11.3	11.0	10.8	10.5
Net Income % of Total Income	31.5	40.2	40.3	37.8	33.0	29.8	30.6	31.5	32.5	33.6	34.3	35.5	36.6	38.2
Dividends % of Net Income	56.3	60.0	42.6	49.1	38.9	51.5	50.2	48.7	47.1	45.6	44.7	43.2	41.7	40.2
Dividend + Bonus % of Net Income	60.6	64.3	45.7	53.0	52.9	55.8	54.3	52.7	51.1	49.4	48.4	46.8	45.2	42.5
% of Reinvested Income	39.4	35.7	54.3	47	47.1	44.2	45.7	47.3	48.9	50.6	51.6	53.2	54.8	57.5
Total Liabilities % of Total Assets	65.3	67.9	66.8	66.2	64.5	62.4	60.0	57.5	54.8	51.9	48.8	45.5	42.0	38.3
Long Term Liabilities % of Total Fixed Assets	61.7	64.6	63.3	62.9	62.6	62.3	61.6	60.7	59.6	58.2	56.5	54.4	51.9	48.8
Current ratio excluding dividends and Amortization and Depreciat. Funds	.8	.9	.8	.9	1.1	1.2	1.1	1.1	1.1	1.1	1.0	1.1	1.0	1.0

TABLE P-7

MILLIONS OF CRUZEIROS

SHEET 1 OF 2

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
A. EARNINGS FROM OPERATIONS														
REVENUE														
SALES (MILLIONS OF KWH)	4,216	4,844	6,344	7,844	8,163	8,438	8,438	8,438	8,438	8,438	8,438	8,438	8,438	8,438
AVERAGE RATE (CR \$ PER KWH)	27.43	20.01	24.05	18.25	20.16	21.31	21.33	-	-	-	-	-	-	-
1 GROSS REVENUE FROM SALES	115,654	96,908	152,559	143,118	164,540	179,776	179,975	179,975	179,975	179,975	179,975	179,975	179,975	179,975
2 OTHER INCOME	1,555	3,656	1,487	4,373	6,216	-	-	-	-	-	-	-	-	-
3 TOTAL INCOME (1-2)	117,209	100,564	154,046	147,491	171,156	179,776	179,975	179,975	179,975	179,975	179,975	179,975	179,975	179,975
COST OF OPERATION, NET INCOME AND PROFIT														
4 OPERATING EXPENSES														
4.1 SANTA CRUZ	5,035	7,621	7,621	7,951	13,802	19,297	19,746	19,746	19,746	19,746	20,644	20,644	20,644	20,644
4.2 OTHER	7,301	7,500	11,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	20,644	20,644	20,644	20,644
5 ALLOWANCES														
5.1 DEPRECIATION	25,642	16,571	27,037	27,521	32,789	36,346	36,346	36,346	36,346	36,346	36,346	36,346	36,346	36,346
5.2 AMORTIZATION	17,443	-	-	-	-	-	-	-	-	-	-	-	-	-
6 INCOME TAXES ACCRUED	6,512	7,143	10,953	9,849	9,970	9,456	9,709	10,011	10,331	10,676	10,894	11,276	11,680	12,077
7 TOTAL COST OF OPERATION BEFORE INTEREST ON LONG TERM DEBT (4 THRU 6)	61,933	38,835	56,611	57,321	68,561	77,099	77,801	78,103	78,423	78,768	79,884	80,266	80,670	81,667
8 NET INCOME BEFORE INTEREST ON LONG TERM DEBT (3-7)	55,276	61,729	97,435	90,170	102,595	102,677	102,174	101,872	101,552	101,207	100,091	99,709	99,305	98,908
9 INTEREST ON LONG TERM DEBT	18,375	21,253	35,370	34,362	46,096	49,096	47,159	45,144	43,009	40,712	38,359	35,814	33,120	31,192
10 NET PROFIT OR LOSS (8-9)	36,901	40,476	62,065	55,808	56,499	53,581	55,015	56,728	58,543	60,495	61,732	63,895	66,185	68,116
11 ALLOCATED TO:														
LEGAL RESERVE	1,845	2,024	3,103	2,970	2,825	2,679	2,751	2,836	2,729	3,025	3,027	3,195	3,309	3,417
BONUS ACCRUED	1,600	1,760	1,940	2,140	2,300	2,300	2,300	2,300	2,300	2,300	2,300	2,300	2,300	2,300
DIVIDENDS ACCRUED	20,760	24,270	26,430	27,420	27,600	27,600	27,600	27,600	27,600	27,600	27,600	27,600	27,600	27,600
12 SURPLUS UNAPPROPRIATED (10-11)	12,696	12,422	30,592	23,778	23,774	21,002	22,364	23,992	25,914	27,570	28,805	30,800	32,976	35,394
B. SOURCES OF FUNDS														
13 NET INCOME BEFORE INTEREST AND INCOME TAXES ACCRUED	61,788	68,872	108,388	100,019	112,565	112,133	111,883	111,883	111,883	111,883	110,985	110,985	110,985	110,985
14 ALLOWANCES (ITEM 5)														
A DEPRECIATION	25,642	16,571	27,037	27,521	32,789	36,346	36,346	36,346	36,346	36,346	36,346	36,346	36,346	36,346
B AMORTIZATION	17,443	-	-	-	-	-	-	-	-	-	-	-	-	-
15 INCREASE IN PAID IN SHARE CAPITAL	19,871	22,500	13,500	3,000	-	-	-	-	-	-	-	-	-	-
16 BORROWINGS														
A: AID LOAN PROPOSED HEREIN (SANTA CRUZ 2ND STAGE)	2,664	6,600	25,308	37,518	20,868	6,882	-	-	-	-	-	-	-	-
B: OTHER LONG TERM BORROWINGS														
AID 512 L - 01	7,421	-	-	-	-	-	-	-	-	-	-	-	-	-
AID 512 L - 023	15,035	4,106	-	-	-	-	-	-	-	-	-	-	-	-
IBRD	61,410	81,592	48,107	15,531	-	-	-	-	-	-	-	-	-	-
ELETROBRAS	22,670	54,733	-	-	-	-	-	-	-	-	-	-	-	-
C: TOTAL BORROWINGS	109,200	147,031	73,415	53,049	20,868	6,882	-	-	-	-	-	-	-	-
17 TOTAL RECEIPTS (13 THRU 16)	233,944	254,974	222,340	183,589	166,222	155,361	148,229	148,229	148,229	148,229	147,331	147,331	147,331	147,331

CONTINUED ON PAGE 2

FORECAST OF EARNINGS, RECEIPTS AND EXPENDITURES
CENTRAL ELÉTRICA DE FURNAS S. A.
PLANT FEASIBILITY STUDY

SANDERSON & PORTER, INC.
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 TABLE P-7

TABLE P-7

MILLIONS OF CRUZEIROS

SHEET 2 OF 2

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
C. USE OF FUNDS														
18 CONSTRUCTION EXPENDITURES														
A. THIS A.I.D. PROJECT (SANTA CRUZ - 2ND STAGE)														
FOREIGN CURRENCY	2,664	6,600	25,308	37,518	20,868	6,882	-	-	-	-	-	-	-	-
LOCAL CURRENCY	272	2,997	24,642	35,742	11,655	1,332	-	-	-	-	-	-	-	-
TOTAL A.I.D. PROJECT	2,886	9,597	49,950	73,260	32,523	8,214	-	-	-	-	-	-	-	-
B. OTHER CONSTRUCTION	180,667	182,220	89,097	20,372	-	-	-	-	-	-	-	-	-	-
C. TOTAL CONSTRUCTION EXPENDITURES	183,553	191,817	139,047	93,632	32,523	8,214	-	-	-	-	-	-	-	-
19 DEBT SERVICE														
A. AMORTIZATION OF PRINCIPAL														
(1) EXISTING A.I.D. LOANS (512 L - 011 AND 512 L - 023)	1,760	3,549	3,549	3,549	3,549	3,549	3,549	3,549	3,549	3,549	3,549	3,549	3,549	3,549
(2) A.I.D. LOAN PROPOSED HEREIN	-	-	-	-	3,764	4,578	4,578	4,578	4,578	4,578	4,578	4,578	4,578	4,578
(3) OTHER BORROWINGS	8,387	9,052	10,943	11,443	16,789	19,974	21,305	22,747	24,333	26,018	27,869	29,765	31,837	33,612
B. INTEREST														
(1) EXISTING A.I.D. LOANS (512 L - 011 AND 512 L - 023)	967	2,800	3,563	3,372	3,172	2,971	2,771	2,570	2,371	2,170	1,970	1,771	1,570	1,310
(2) A.I.D. LOAN PROPOSED HEREIN	-	-	-	-	4,497	5,225	4,973	4,721	4,469	4,217	3,966	3,714	3,462	3,210
(3) OTHER BORROWINGS	17,408	18,453	31,807	30,990	38,427	40,900	39,415	37,853	36,169	34,325	32,423	30,329	28,088	25,672
20 INCOME TAXES PAID	5,419	6,512	7,143	10,953	9,849	9,970	9,456	9,709	10,011	10,331	10,676	10,894	11,276	11,680
21 BONUS PAID	1,260	1,600	1,760	1,940	2,140	2,300	2,300	2,300	2,300	2,300	2,300	2,300	2,300	2,300
22 OTHER EXPENSES	976	926	1,163	-	-	-	-	-	-	-	-	-	-	-
23 TOTAL EXPENDITURES (18 THRU 22)	219,730	234,759	197,975	156,209	114,710	97,631	88,347	88,027	87,780	87,488	87,331	86,900	86,660	85,711
24 ANNUAL CASH SURPLUS (OR DEFICIT) (17 - 23)	14,214	20,215	24,365	27,380	51,512	57,730	59,882	60,202	60,449	60,741	60,000	60,431	60,671	61,420
25 CASH TO DIVIDENDS	15,640	20,760	24,720	26,430	27,420	27,600	27,600	27,600	27,600	27,600	27,600	27,600	27,600	27,600
26 CASH TO FUNDS	-	-	-	-	20,000	30,000	33,000	32,000	33,000	33,000	33,000	32,000	33,000	34,000
27 CASH BALANCE, END OF PERIOD (24 - 25 - 26)	(1,426)	(545)	(355)	950	4,092	170	(718)	602	(151)	141	(600)	831	71	(180)
27A CUMULATIVE CASH BALANCE	10,443(1)	9,898	9,543	10,493	14,585	14,715	13,997	14,599	14,448	14,589	13,989	14,820	14,891	14,711
D. BALANCE SHEET, END OF PERIOD														
ASSETS														
28 FIXED ASSETS	778,610	970,427	1,109,474	1,203,106	1,235,629	1,243,843	1,243,843	1,243,843	1,243,843	1,243,843	1,243,843	1,243,843	1,243,843	1,243,843
29 ACCUMULATED DEPRECIATION	59,442	76,013	103,050	130,571	163,360	199,706	236,052	272,398	308,744	345,030	381,436	417,782	454,128	490,474
30 NET FIXED ASSETS (27 - 28)	719,168	894,414	1,006,424	1,072,535	1,072,269	1,044,137	1,007,791	971,445	935,099	898,753	862,407	826,061	789,715	753,369
31 CASH	10,443	9,898	9,543	10,493	14,585	14,715	13,997	14,599	14,448	14,589	13,989	14,820	14,891	14,711
32 AMORTIZATION AND DEPRECIATION FUNDS	-	-	-	-	20,000	50,000	83,000	115,000	148,000	181,000	214,000	246,000	299,000	313,000
33 OTHER ASSETS	7,411	7,411	7,411	7,411	7,411	7,411	7,411	7,411	7,411	7,411	7,411	7,411	7,411	7,411
34 TOTAL ASSETS (29 THRU 32)	737,022	911,723	1,023,378	1,090,439	1,114,265	1,116,263	1,112,199	1,108,455	1,104,958	1,101,753	1,097,607	1,094,292	1,091,017	1,088,491
LIABILITIES														
35 SHARE CAPITAL	191,000	213,500	227,000	230,000	230,000	230,000	230,000	230,000	230,000	230,000	230,000	230,000	230,000	230,000
36 AMORTIZATION RESERVE	41,659	41,659	41,659	41,659	41,659	41,659	41,659	41,659	41,659	41,659	41,659	41,659	41,659	41,659
37 OTHER RESERVES	3,641	5,665	8,768	11,738	14,563	17,242	19,993	22,829	25,558	28,383	31,610	34,805	38,114	41,536
38 SURPLUS	19,275	31,697	62,289	85,567	109,341	130,343	152,707	176,699	202,613	230,183	258,988	289,788	322,764	358,158
39 LONG-TERM DEBT	443,609	578,039	636,962	674,689	671,455	650,286	620,854	589,980	557,520	523,375	487,379	449,487	409,523	367,784
40 OTHER LIABILITIES	37,838	41,163	46,700	46,786	47,247	46,733	46,986	47,288	47,608	47,953	48,171	48,353	48,957	49,554
41 TOTAL LIABILITIES (34 THRU 40)	737,022	911,723	1,023,378	1,090,439	1,114,265	1,116,263	1,112,199	1,108,455	1,104,958	1,101,753	1,097,607	1,094,292	1,091,017	1,088,491

NOTES: THE RATE OF EXCHANGE USED WAS CS 2.220 U.S.\$ 1.00
(1) INCLUDES CS $\times 10^6$ 11,869 FROM PREVIOUS YEAR.

FORECAST OF EARNINGS, RECEIPTS AND EXPENDITURES
CENTRAL ELÉTRICA DE FURNAS S. A.
PLANT FEASIBILITY STUDY

SANDERSON & PORTER, INC.
NEW YORK

JAN. 20, 1967

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TABLE P-7

SECTION VII - ISSUES

A. GUANABARA FREQUENCY CONVERSION

General

7.01 - The Government of Brazil has established sixty cycles as the standard frequency for Brazil. All new power plants, transmission and distribution projects as well as industrial and other power consuming activities must be designed to utilize 60 cycle power. Only a few areas are seriously affected, the principal being Rio de Janeiro (Guanabara) which is served by the 50 cycle system of Rio Light. Several smaller cities, including Recife and Fortaleza, have already been converted. Experience exists in Brazil to successfully carry out such an undertaking, although Rio, with 3 3/4 million people, will probably be the largest city where changing the frequency of electric power has been attempted.

7.02 - The Plan adopted for Rio is a programmed conversion by districts. The rate of change will be influenced by the rate of availability of sixty cycle power and capability of Rio Light to meet the remaining 50 cycle requirements. Sufficient 50 cycle power must always be available to supply the load growth of a shrinking area until the city is converted. There may be a need for some 50 cycle power for the indefinite future to serve consumers that are uneconomical to convert such as possibly the Volta Redonda Steel Plant.

7.03 - While some positive steps have been made to convert the city, it is only beginning to get under way. At least four years will be required to complete the conversion during which Rio will have two frequencies.

Coordination

7.04 - Frequency conversion of Guanabara requires the careful coordination of three important activities: power supply, distribution system and consumer. The power supply

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will be from the Furnas system and Rio Light generating plants, with an emergency tie to São Paulo. Conversion of the distribution system is being performed by Rio Light.

7.05 - The federal government has given responsibility for the coordination of the frequency conversion to Eletrobrás.

Status

7.06 - The first positive step toward conversion was the arrival in Rio on May 1964 of four 11 MW gas turbines aggregating 44 MW and designed for 50 and 60 cycles. The units provided power to start operation of the new Guandu water supply pumping station in March 1965 which uses 60 cycle power. Also converted to 60 cycles are the communities of Santa Cruz including the Air Force Base, Itaguaí, Ilha da Madeira (zinc smelting plant), Senador Camará and Campo Grande. This represents a peak load of 26 MW and when the power required for water pumping is included, it is about the maximum 60 cycle load that can be served.

7.07 - Rio Light had isolated a 30 MW unit at the Pontes plant and another at Ilha dos Pombos for operation at 60 cycles. This power was to be used to assist the gas turbines for water pumping and allow completion of conversion of the rural Guanabara areas of Realengo, Bangu and Guanabara. A tie was also completed with the 60 cycle CBEE system in the State of Rio de Janeiro to utilize the surplus 60 cycle power from these units. Unfortunately with the disaster of the 330 MW Nilo Peçanha Plant January 23, 1967, these units had to be returned to 50 cycle service to serve the city of Rio de Janeiro. Moreover, further conversion is halted pending normalization after the disaster which will delay further conversion until the first stage (160 MW) of the Santa Cruz thermal plant is available. In the meantime the converted area is subject to severe rationing due to the limited 60 cycle power available from the gas turbines.

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Scheduling

- 7.08 - The first major effort within the city proper will be the Leblon district. It is scheduled for the second half of 1967. This will be followed by Flamengo in the first half of 1968. These are the principal residential sections of the City. This schedule may have been set back about 6 months due to the power supply disaster.
- 7.09 - The north section of the City, where the major industries are located, will follow in 1969. The downtown and Copacabana districts will be among the last districts to be converted due to the high concentration of loads, large buildings and difficult electrical access.
- 7.10 - Present plans foresee the city substantially converted by 1971.

Power Supply

- 7.11 - The primary source of 60 cycle power will be the Rio Grande Development of which the 900 MW Furnas and the 200 MW Peixoto hydro plants are now in service. The power will be transmitted over the Furnas-Guanabara 345 Kv transmission line with a 300 MW capability. This power will be complemented by the 160 MW Santa Cruz Thermal plant in the Guanabara area. These are expected to be available in the third and fourth quarters of 1967.
- 7.12 - The present demand at 50 cycles is being supplied by 765 MW of hydro capacity in four plants belonging to Rio Light Co. The peak demand of the system exceeds this rated capacity and is over 800 MW. The principal plant is the presently inoperative 330 MW Nilo Peçanha Hydro which is designed for either 50 or 60 cycles. While the 100 MW new section of the Fontes plant, the 95 MW Ponte Coberta plant and the 102 MW Ilha dos Pombos plant were designed for 50 cycles, they can with but minor work be converted to 60 cycles. The pumping plants of Santa Cecilia and Vigário which supply water from the Paraíba River to the Nilo Peçanha and Fontes plants, will require rather extensive

conversion which Rio Light will undertake when requirements demand. This work is included in Rio Light's five-year improvement program. In the meantime, however, all of Rio Light's 50 cycle generation is required to serve the present 50 cycle loads. The scheduling of the plant conversions will depend on the rate of frequency conversion in the system and the system growth rate which could reach over 1700 MW by 1971.

Distribution System

7.13 - Rio Light has embarked on a five-year expansion and improvement program for their system which is expected to be completed by 1971. A.I.D. is assisting in financing three years of their program. This is a system-wide undertaking and necessary changes are being made to accommodate the frequency change. This project has slipped about six months but is not out of line with the other frequency change activities. It is on a reasonably coordinated schedule with the sixty cycle power supply.

7.14 - Presently Rio Light's distribution system cannot be easily sectionalized into smaller elements which would facilitate conversion. The system improvements will tend to help this situation but probably not eliminate it. It will become more serious as the conversion moves into the denser areas of the city. Some inconveniences and possibly short duration black out of limited areas will occur.

Consumer Conversion

7.15 - Some positive steps have been made in this area of the conversion activity in the rural areas. However, for the city it is mostly research, education and planning. It is the area where the least progress has been accomplished and least is possible until a firm source of sufficient 60 cycle power is established.

7.16 - The consumer will be required to have electrical equipment on his premises converted at his expense. For the residential and small commercial consumer this is not expected to be a serious burden. A procedure has been set up and tried out with the conversion of Santa Cruz as a pilot project.

7.17 - Surveys were made to establish the expected range of types of appliances. Booklets and pamphlets listing all the popular makes of appliances and indicating the ones which must be converted and others not requiring any changes. Also addresses and phone numbers are published where consumers may get information concerning any appliance not listed. Listing of approved sources for service is also provided. Steps are being taken to prevent exploiting the consumers by service people.

7.18 - From time to time a schedule is published in the local papers to keep consumers alert to the expected timing and order of conversion. Prior to actual conversion announcements are made via radio, newspapers and mailings.

7.19 - The greatest problem for residential consumer is expected to be elevators. Most of Rio's population live in multistory apartments. In the southern district the elevators will number in the thousands. Some require only minor adjustments while others will need extensive modifications. All new structures require elevators suitable for 60 cycle operation. To ease the impact while frequency is being changed, apartment owners are being encouraged to convert one elevator to sixty cycles prior to the frequency change where there is more than one elevator. Sixty cycle elevators can generally operate at fifty cycles.

7.20 - The industrial consumers have a mixed reaction to frequency conversion. Anything that will improve the reliability of their power supply will be welcome. They do not foresee any serious technical problems. However, Brazilian industry is very short of capital and must have some short term financing to convert their equipment. The amount of funds required may be substantial. For example, one factory, the Bangu Textile Co., will require about a million dollars equivalent in cruzeiros to convert their plant. Stone and Webster made a study several years ago for Rio Light, but this is now out of date.

7.21 - A solution to this financing is still pending and is one that must be faced. As the conversion of the

industrial area will follow the residential and rural areas there will be about 12 months grade period for this decision. USAID will require assurances from Brazilian authorities that frequency conversion will be made in time to absorb new sources of 60 cycle power from Furnas' system. This will require a commitment by ELETROBRAS to assist industry by providing financing. It will also be necessary to require that Rio Light carry out most of the technical coordination.

Conclusion

7.22 - The frequency conversion issue was discussed by USAID with ELETROBRAS and the Minister of Mines and Energy on April 28, 1967. A copy of the minutes of that meeting is attached as Annex IV.

7.23 - A Portaria issued by the Ministry in April firmly establishes responsibility for the overall coordination of the program with ELETROBRAS and authorizes it to deal directly with the concessionaries. It specifies also that Rio Light shall have the job of scheduling and implementing the technical details of the program. Moreover, the Minister indicated that ELETROBRAS would provide financial assistance to certain industries upon which the cost of conversion would be most burdensome.

7.24 - With the interest of the new Minister in this problem and the recommended Loan Agreement covenants (Summary and Recommendation) as well as the notable progress to date it may be expected that the frequency conversion program will be carried out in a timely fashion.

B. Power Pooling and Interconnection Agreements

7.25 - Until recently the electric power industry of the South Central Region has been based almost completely on independent operation of the various utilities and auto-producers. The fundamental change toward interconnection and eventual pooling occurred in 1963 with the initial commissioning of the 900 MW FURNAS Generating Station and

and its associated 345 KV transmission lines extending from Belo Horizonte to São Paulo. Also since 1963 FURNAS has been selling power to São Paulo Light.

7.26 - ELETROBRAS has assigned to FURNAS the coordination and responsibility for the power pooling in the area. This is because of their central location. They own and operate the largest source of power and will have the EHV transmission system connecting the region's power sources to the load centers.

7.27 - FURNAS, São Paulo Light, and CEMIG have started pool operation on a limited extent. They have meetings at technical levels to plan and establish operating procedures. They have been gaining experience in this type of operation.

7.28 - Both FURNAS and ELETROBRAS have pointed out that a committee organized on a formal basis might become unmanageable. They fear that all power entities, federal, state, and private would demand and probably obtain membership on the committee. It is felt that many of the representatives would have a greater political, rather than technical interest in the committee's performance. Both FURNAS and ELETROBRAS favor an operating committee made up only of utility people representing the interconnected companies, without third parties. Where agreement cannot be reached at the operating levels the decision would be taken to a higher level.

7.29 - In the fourth quarter of 1967, when the 345 KV transmission lines linking Peixoto, FURNAS and Itutinga hydro plants, and Guarabara are placed in service, the electric systems of the states of São Paulo, Guanabara, Rio de Janeiro, Minas Gerais, Espírito Santo and Goiás may be operated parallel for the first time. Thus about 5,300 MW of hydro power will be interconnected.

7.30 - The power companies which will be interconnected are taking action to provide equipment and facilities to operate in parallel and share load. The major items are

communications and control equipment but technical assistance is also being obtained, mostly from the U.S.A.

7.31 - Cia. Paulista de Fôrça e Luz (Peixoto) have retained an engineer from Zinder and Associates of Seattle, Washington, to study and recommend equipment for communication and load-frequency control for interconnected operation. CEMIG is installing IGE equipment for communications and dispatch and has obtained experts for technical assistance in operations from IGE. FURNAS is proceeding along the same lines, except that they are using Collins equipment. Also FURNAS has retained Commonwealth Associates of Jackson, Michigan, to study the interconnected transmission system and make plans for additional EHV transmission lines. They employed the services of Mr. Charles P. Almen Jr., Director of Operations of TVA, an expert on interconnections, who came to Brazil during February 1967 to advise FURNAS on the problems of interconnection.

7.32 - FURNAS originally planned to enter into power sale contracts with the utilities which it supplies. A copy of such a draft contract was submitted with the Sanderson and Porter feasibility study. However, Mr. Almen recommended that FURNAS use interconnection agreements instead as they would better meet the requirements of the system. FURNAS is currently drawing up such agreements to present to the utilities. The first one will probably be with São Paulo Light with whom they are now having discussions.

7.33 - Among other things, these agreements call for the creation of interconnecting committees between the parties entering into an agreement. These committees will coordinate interconnected operations and systems expansion. FURNAS will coordinate the interconnections with São Paulo Light, Rio Light, CEMIG, Cia. Paulista and all others buying power from FURNAS. At FURNAS' discretion, the utilities may be called to FURNAS for coordination of operations individually or in groups. This will be the start of coordinated interconnected operation.

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7.34 - The interconnection agreements call for selling power on a 20 year basis stating the maximum yearly demand which the utility is contracting from FURNAS. During the period in which FURNAS operates an all hydro system, FURNAS is committed to supply as much energy as is available, recognizing that during critical dry years, FURNAS power will be sold at 55 percent plant factor. Since the load factor of the consumers within the South-Central region is 63 percent, FURNAS will not be supplying sufficient energy with the contracted demand to fulfill the customers requirements.

7.35 - Now that the Santa Cruz Plant is being transferred to FURNAS and is being expanded, FURNAS can guarantee that contracted capacity will be accompanied with sufficient energy to produce a load factor equivalent to the average load factor of the consumers.

7.36 - The area has been chronically short of power (both capacity and energy). The orderly progression of new hydro-electric plants, complemented by the Santa Cruz thermal, should greatly ease this condition until the late 1970's.

7.37 - Also the fact is that the interconnections undertaken and being planned will tie together different watersheds with varying hydrological characteristics. Interconnected operation with the major load centers will lead to a more effective utilization and pooling of resources.

Conclusions

7.38 - FURNAS will negotiate contracts and/or enter into agreements for the sale of capacity and energy to assure the efficient and economic use of its facilities.

7.39 - A technical group comprised of members from the major interconnected utilities shall be formed to establish criteria and devise an operational system to conduct power pooling and dispatch efficiently.

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June 1, 1967

TABLE OF CONTENTS

ANNEX

- I STATUTORY CRITERIA CHECK LIST
- II
 - a. TRANSFER OF CHEVAP OBLIGATIONS AND RESPONSIBILITIES TO FURNAS - 2 LETTERS
 - b. HISTORY OF SANTA CRUZ FIRST STAGE
- III
 - a. SANTA CRUZ SITE SELECTION
 - b. PORTARIA
 - c. FUEL AND FUEL DELIVERY
 - d. ALLOCATION OF FURNAS MARKET AREAS
- IV MEMORANDUM OF CONVERSATION WITH MINISTER OF MINES AND ENERGY

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CHECK LIST OF STATUTORY CRITERIA (ALLIANCE FOR PROGRESS) June 1, 1967

(FAA - Foreign Assistance Act of 1961, as amended
by the Foreign Assistance Act of 1966.)

(App.- Foreign Assistance and Related Agencies
Appropriations Act, 1967.)

1. FAA Section 102. Precautions that have been or are being taken to assure that loan proceeds are not diverted to short-term emergency purposes (such as budgetary, balance of payments, or military purposes) or any other purpose not essential to the country's long-range economic development.

USAID personnel will approve all borrower requests for opening letters of commitment. Since the subsequent letters of credit issued by the designated bank must conform in substance to the letter of commitment, the only funds disbursed will be those required to finance the goods and services of the project.

2. FAA Section 102. Information on measures taken to utilize United States Government excess personal property in lieu of the procurement of new items.

Equipment for this project with few small exceptions is to be custom made. There are no excess 200 MW turbine-generators or boilers.

3. FAA Section 102. Information whether the country permits, or fails to take adequate measures to prevent, the damage or destruction by mob action of United States property.

The GOB does not permit, and takes measures to prevent, the damage or destruction by mob action of U.S. property.

4. FAA Section 201(d). Information and conclusion on legality (under laws of country and U.S.) and reasonableness of lending and relending terms of the loan.

The proposed loan is consistent with the laws of Brazil and the United States and its terms are considered reasonable by both the Borrower and A.I.D.

5. FAA Section 251(a). Manner in which loan will promote country's economic development and contribute to the welfare of its people.

This loan will contribute materially to the development of Brazil's industrial infrastructure and hence will promote the country's economic development.

6. FAA Section 251(b) (1). Extent to which country is adhering to the principles of the Act of Bogota and Charter of Punta del Este and is showing a responsiveness to the vital economic, political, and social concerns of its people, and extent to which country has demonstrated a clear determination to take effective self-help measures.

Account has been taken of Brazil's adherence to the principles of the Act of Bogota and the Charter of Punta del Este, and the GOB's responsiveness to the vital economic, political, and social concerns of its people. A full report of Brazil's efforts to comply with both the Act of Bogota and the Charter of Punta del Este is set forth in the 1966 Country Program Submission.

7. FAA Section 251(b) (2). Information and conclusion on activity's economic and technical soundness.

This activity has been found economically and technically sound (See the relevant sections of this paper).

8. FAA Section 251(b)(3). Information and conclusion on activity's relationship to and consistency with other development activities, and its contribution to realizable long-range objectives.

(See Section: Place of the Loan in the A.I.D. Program).

9. FAA Section 251(b)(4). Information and conclusion on possible effects on U.S. economy, with special reference to areas of substantial labor surplus.

The loan will finance the procurement of \$41.2 million of U.S. equipment, and thus will have positive effects on the U.S. economy (See the Economic Section).

10. FAA Section 251(b)(5). Information and conclusion on the degree to which the country is making progress toward respect for the rule of law, freedom of expression and of the press, and recognition of the importance of individual freedom, initiative, and private enterprise.

The recent inauguration of an elected government marks a return to full constitutionality in Brazilian government. A new constitution has been adopted by the Congress and all the extra-constitutional Institutional Acts have terminated. A number of laws and programs have been instituted in recent years at all levels of government to improve the climate for private enterprise. Press and National Security laws enacted by the previous Brazilian government are more restrictive than previous legislation; it remains to be seen how these laws will be applied by the new Government.

11. FAA Section 251(b)(6). Information and conclusion on the degree to which the country is taking steps to improve its climate for private investment.

Brazil has provided a very broad range of incentives for private investment, domestic and foreign. The national state and municipal level of government offer tax incentives,

tariff concessions and low cost financing for investments in priority sectors and development regions.

12. FAA Section 251(b)(7). Information and conclusion on whether or not the activity to be financed will contribute to the achievement of self-sustaining growth.

The activity will contribute to the achievement of self-sustaining growth through its assistance in identifying exploitable natural resources.

13. FAA Section 251(b)(8). Information and conclusion on the extent to which the activity will contribute to the economic and political integration of Latin America.

The loan is intended to improve the capability of Brazilian institutions. To the extent that these institutions become effective in identifying economically significant resources, the indirect effect of the project could be to increase intra-Latin American trade.

14. FAA Section 251(b). Information and conclusion on availability of financing from other free-world sources, including private sources within the United States.

Other international lenders have been solicited and have expressed no interest in this project. Borrower is a publicly owned power utility and therefore it is unlikely that private U.S. capital would be interested or their participation encouraged.

15. FAA Section 251(b). Information and conclusion on capacity of the country to repay the loan.

The "2-Step" agreement will offer the GOB 40 years to repay the debt on concessional terms which are well within the country's debt servicing capacity.

16. FAA Section 251(b). Information and conclusion on country's efforts to repatriate capital invested in other countries by its own citizens.

Brazil's efforts to stabilize the value of the cruzeiro through measures to counter inflation should contribute to the return of capital invested in other countries by its citizens.

17. FAA Section 251(b). Information and conclusion on reasonable prospects of repayment.

The loan will be repaid by the Government of Brazil. Terms are within Brazil's capacity for repayment.

18. FAA Section 251(c). Information and conclusion on availability of an application together with sufficient information and assurances to indicate reasonably that funds will be used in an economically and technically sound manner.

See Engineering Section.

19. FAA Section 251(g). Information and conclusion on use of loan to assist in promoting the co-operative movement in Latin America.

The loan will have no effect on the cooperative movement in Latin America.

20. FAA Section 251(h). Information and conclusion on whether the activity is consistent with the findings and recommendations of the Inter-American Committee for the Alliance for Progress in its review of national development activities.

The loan is consistent with the findings and recommendations of the Inter-American Committee for the Alliance for Progress in its review of national development activities.

21. FAA Section 252(a). Total amount of money under loan which is going directly to private enterprise, is going to intermediate credit institutions or other borrowers for use by private enterprise, is being used to finance imports from private sources, or is otherwise being used to finance procurements from private sources.

The Borrower is a publically owned utility company. The loan money, however, will finance U.S. imports from private U.S. companies.

22. FAA Section 281. Extent to which the loan will contribute to the objective of assuring maximum participation in the task of economic development on the part of the people of the developing countries, through the encouragement of democratic private and local governmental institutions.

The loan is intended to assist agencies of the Brazilian Government at the national level.

23. FAA Section 601(a). Information and conclusions whether loan will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture, and commerce; and (f) strengthen free labor unions.

This loan will not directly effect any of the above points.

24. FAA Section 601(b). Information and conclusion on how the loan will encourage U.S. private trade and investment abroad and how it will encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).

All of the loan funds will be used for the procurement of goods and services from U.S. private enterprise.

25. FAA Section 601(d). Conclusion and supporting information on compliance with the Congressional policy that engineering and professional services of U.S. firms and their affiliates are to be used in connection with capital projects to the maximum extent consistent with the national interest.

It is expected that engineering and consultant services shall be provided by a joint venture of Brazilian and American firms.

26. FAA Section 602. Information and conclusions whether loan will permit American small business to participate equitably in the furnishing of goods and services financed by it.

To the extent that American small business manufactures the required equipment, it will be notified and invited to participate.

27. FAA Section 604(a); App. Section 108. Compliance with restriction of commodity procurement to U.S. except as otherwise determined by the President and subject to statutory reporting requirements.

Goods and services purchased under this loan will be of U.S. origin.

28. FAA Section 604(b). Compliance with bulk commodity procurement restriction to prices no higher than the market price prevailing in the U.S. at time of purchase.

Will comply.

29. FAA Section 604(d). Compliance with requirement that marine insurance be purchased on commodities if the host country discriminates, and that such insurance be placed in the U.S.

Will comply.

30. FAA Section 604(e). Compliance with requirement that funds not be used for procurement of any agricultural commodity or product thereof outside the United States when the domestic price of such commodity is less than parity.

Not applicable.

31. FAA Section 611(a)(1). Information and conclusion on availability of engineering, financial, and other plans necessary to carry out the assistance and of a reasonably firm estimate of the cost of the assistance to the United States.

See Engineering Section.

32. FAA Section 611(a)(2). Necessary legislative action required within recipient country and basis for reasonable anticipation such action will be completed in time to permit orderly accomplishment of purposes of loan.

All necessary legislation exists.

33. FAA Section 611(b); App. Section 101. If water or water-related land resource construction project or program, information and conclusion on benefit-cost computation.

Not applicable.

34. FAA Section 603(c). Compliance with requirement that contracts for construction be let on competitive basis to maximum extent practicable.

Will comply.

35. FAA Section 612(b) and 636(h). Appropriate steps that have been taken to assure that, to the maximum extent possible, the country is contributing local currencies

to meet the cost of contractual and other services and foreign currencies owned by the U.S. are utilized to meet the cost of contractual and other services.

There are no excess foreign currencies owned by the U.S. that could be used on this project. The borrower will be financing all local cost requirements with the possible exception of local engineering services which might be A.I.D. financed.

36. FAA Section 619. Compliance with requirement that assistance to newly independent countries be furnished through multilateral organizations or plans to maximum extent appropriate.

Not applicable.

37. FAA Section 620; App. Section 107(a) and (b). Compliance with prohibitions against assistance to Cuba and any country (a) which furnishes assistance to Cuba or failed to take appropriate steps by February 14, 1964, to prevent ships or aircraft under its registry from carrying equipment, materials, or supplies from or to Cuba; or (b) which sells, furnishes, or permits any ships under its registry from carrying items of primary strategic significance, or items of economic assistance to Cuba.

No assistance will be furnished under this loan to the present Government of Cuba, nor does Brazil furnish assistance to the present Government of Cuba. Brazil has taken appropriate steps to prevent ships or aircrafts under its registry from engaging in any Cuban trade.

38. FAA Section 620(b). If assistance to the government of a country, existence of determination it is not controlled by the International Communist movement.

The Secretary of State has determined that Brazil is not controlled by the international communist movement.

39. FAA Section 620(c). If assistance to the government of a country, assistance of indebtedness to a U.S. citizen for goods and services furnished or ordered where such citizen has exhausted available legal remedies or where the debt is not denied or contested by such government or the indebtedness arises under an unconditional guaranty given by such government.

Brazil is not known to be indebted to any U.S. Citizen on goods or services furnished or ordered where such a citizen has exhausted available legal remedies or where the debt is not denied or contested by the Borrower or the indebtedness arises under an unconditional guarantee of payment by the Borrower.

40. FAA Section 620(d). If assistance for any productive enterprise which will compete in the U.S. with U.S. enterprise, existence of agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan.

Not applicable.

41. FAA Section 620(e)(1). If assistance to the government of a country, extent to which it (including government agencies or subdivisions) has, after January 1, 1962, taken steps to repudiate or nullify contracts or taken any action which has the effect of nationalizing, expropriating, or otherwise seizing ownership or control of property of U.S. citizens or entities beneficially owned by them without taking appropriate steps to discharge its obligations.

Neither the Government of Brazil nor any governmental agency or subdivision thereof has, on or after January 1, 1962, nationalized expropriated, or seized, ownership or control of property of any U.S. citizen or firm, taken steps to repudiate or nullify contracts with such citizens or firms or imposed or enforced discriminatory taxation or other exactions or restrictive conditions or taken other actions having the effect of nationalizing expropriating or otherwise seizing ownership or control of property owned by U.S. citizen or firms, as specified in this Section of the Act without taking appropriate steps to discharge its obligations as specified in this Section of the Act.

42. FAA Section 620(f); App. Section 109. Compliance with prohibitions against assistance to any Communist country.

Assistance under this loan will not be furnished to any Communist country.

43. FAA Section 620(g). Compliance with prohibition against use of assistance to compensate owners for expropriated or nationalized property.

Assistance under this loan will not be used to compensate for expropriated or nationalized property.

44. FAA Section 620(h). Compliance with regulations and procedures adopted to insure against use of assistance in a manner which, contrary to the best interests of the U.S., promotes or assists the foreign aid projects or activities of the Communist-bloc countries.

Assistance provided by this loan will not be used in a manner which, contrary to the best interests of the U.S., promotes or assists the foreign A.I.D. projects or activities of the Communist-bloc countries.

45. FAA Section 620(i). Existence of determination that the country is engaging in or preparing for aggressive military efforts.

The President has not determined that Brazil is engaging in or preparing for aggressive military efforts.

46. FAA Section 620(i). Information on representation of the country at any international conference when that representation includes the planning of activities involving insurrection or subversion against the U.S. or countries receiving U.S. assistance.

There has been no Brazilian Government representation nor any private Brazilian representation with Brazilian Government sanction at any international conference in which that representation includes the planning of activities involving insurrection or subversion against the U.S. or countries receiving U.S. assistance.

47. FAA Section 620(k). If construction of productive enterprise where aggregate value of assistance to be furnished by U.S. will exceed \$100 million, identification of statutory authority.

Not applicable.

48. FAA Section 620(l). Consideration which has been given to denying assistance to the government of a country which after December 31, 1966, has failed to institute the investment guaranty program for the specific risks of inconvertibility and expropriation or confiscation.

Brazil has signed and instituted such an agreement.

49. FAA Section 620(n); App. 107(b) and 116. Compliance with prohibition against assistance to countries which traffic or permit trafficking with North Viet-Nam.

Brazil does not traffic nor knowingly permit trafficking with North Viet-Nam.

50. FAA Section 620(o). If country has seized, or imposed any penalty or sanction against, any U.S. fishing vessel on account of its fishing activities in international waters, information on the consideration which has been given to excluding the country from assistance.

Brazil has not seized or imposed any penalty or sanction against any U.S. fishing vessel in International water.

51. FAA Section 620(q). Existence of default under any Foreign Assistance Act loan to the country.

No loans to Brazil under the Foreign Assistance Act are in default.

52. FAA Section 621. Information and conclusion on how the loan in providing technical assistance will utilize to the fullest extent practicable goods and professional and other services from private enterprise on a contract basis. If the facilities of other Federal agencies will be utilized, information and conclusion on whether they are particularly suitable, are not competitive with private enterprise, and can be made available without undue interference with domestic programs.

An American engineering/consultant firm or firms shall contract in joint venture with a Brazilian firm to perform the required technical supervision and design work.

53. App. Section 102. Compliance with requirement that payments in excess of \$25,000 for architectural and engineering services on any one project be reported to Congress.

Will comply.

54. App. Section 104. Compliance with bar against funds to pay pensions, etc., for military personnel.

Funds obligated by the loan will not be used to pay pensions, annuities, etc.

55. App. Section 106. If country attempts to create distinctions because of their race or religion among Americans in granting personal or commercial access or other rights otherwise available to U.S. citizens generally, application which will be made in negotiations of contrary principles as expressed by Congress.

No attempts by Brazil to create distinctions because of race or religion among Americans in granting personal or commercial access or other rights otherwise available to U.S. citizens generally are known. If the Host Government attempts to create such distinctions, application will be made in negotiations of contrary principles as expressed by Congress.

56. App. Section 111. Compliance with existing requirements for security clearance of personnel.

Existing requirements for security clearance of personnel will be observed.

57. App. Section 112. Compliance with requirements for approval of contractors and contract terms for capital projects.

The loan agreement will so stipulate.

58. App. Section 114. Compliance with bar against use of funds to pay assessments, etc., of U.N. member.

Loan funds will not be used to make payment to any U.N. member.

59. App. Section 115. Compliance with regulations on employment of U.S. and local personnel for funds obligated after April 30, 1964. (Regulation 7).

Not applicable.

60. App. Section 401. Compliance with bar against use of funds for publicity or propaganda purposes within U.S. not heretofore authorized by Congress.

Loan funds will not be used for publicity or propaganda purpose within the U.S.

ELETRORÁS
Centrais Elétricas Brasileiras S.A.

Circular No. 005/67

Rio de Janeiro, April 24, 1967

Agency for International Development
A.I.D.
Av. Presidente Wilson, No. 147
Rio de Janeiro, GB

Dear Sir:

We wish to inform you that by decision of the Executive Directorate of ELETRORÁS under the Decree No. 60.350 of 10/3/1967 the Administrative Council of Funil and Santa Cruz transferred on April 14, 1967 to Central Elétrica de FURNAS S.A. - FURNAS - the rights and assets associated with the concession and authorization for the Funil and Santa Cruz plants, and have, therefore, closed its associated activities.

We appreciate the cooperation received from you without which we would have not been able to present to the Directorate of ELETRORÁS these positive results.

Sincerely yours,

/s/Engº Orígenes da Soledade Lima
Presidente da Junta de Administração das
Obras das Usinas de Funil e Santa Cruz

Central Elétrica de Furnas S.A.

Rio de Janeiro, May 2, 1967
DP.E.040.67

Mr. Louis V. Perez
U.S.A.I.D.
Rua Melvin Jones, 27 - Rm 2501
Rio de Janeiro, GB

Dear Sir:

1. Among the various companies controlled by ELETROBRAS, was included the Companhia Hidroelétrica do Vale do Paraíba (CHEVAP) created in 1960 for the purpose of constructing a thermal electric plant in the locality of Funil, on the river Paraíba, with the capacity of 210 MW, approximately 160 km from Rio de Janeiro.
2. In 1961, CHEVAP received authorization to construct a thermal electric plant of 150 MW in Santa Cruz on the outskirts of the city of Rio de Janeiro.
3. These two combined electric facilities would ensure the state of Guanabara the addition of generating capacity of 360 MW and were programmed to be in the operation in 1965. However, in view of the political and administrative difficulties both projects proceeded at a rate slower than originally scheduled. After the purchase of these companies by ELETROBRAS from the American and Foreign Power Group, it was decided that CHEVAP should be absorbed by one of the companies of that group which operated in the area, that is, the Companhia Brasileira de Energia Elétrica (CBEE), or otherwise by FURNAS, whose transmission lines to Guanabara were already under construction.
4. Consequently, it was resolved that CHEVAP would disappear as a company and that the works already under construction of these electric plants would be transferred to the federal government and placed under the provisional administration of

ELETROBRAS. Considering, however, the financial and administrative difficulties attendant to CBEE absorbing CHEVAP, ELETROBRAS finally decided that these projects should be incorporated into the FURNAS system.

5. As a result, the federal decree No. 60.350 of March 10, 1967, published in the Official Diary on the 14th of March, here annexed, determined among other things that: FURNAS should be given the charter on concession for the FUNIL plant; FURNAS should be authorized to complete construction and operate the thermal electric plant at Santa Cruz and that all assets and liabilities of these two plants should be transferred to FURNAS.

6. Having in mind the above, on the 15th of April 1967, the transfer of assets and installations associated with the aforementioned constructions was effected to FURNAS from ELETROBRAS and reference was made to the federal decree cited above.

7. We wish to mention that the liabilities of the two works constitute a major part advancements from ELETROBRAS from Loan 512-L-011 from USAID and from suppliers credits.

8. We remain at your disposition to supply whatever further information is required.

Sincerely yours,
CENTRAL ELETRICA DE FURNAS S.A.

/s/ John R. Cotrim
President

HISTORY - SANTA CRUZ FIRST STAGE

There has been a history of power shortages and rationing in the Guanabara area since World War II brought about drought cycles or long dry spells. While simply installing additional thermal power would not have been the entire solution to the power shortage problem, it would have at least provided the flexibility that the all hydro systems need to more effectively utilize limited hydro energy and provide a firm power base during periods of low water.

In the late 50's Rio Light made various studies for thermal addition. It is interesting to note the area of the present Santa Cruz plant was one of the sites seriously considered. However, the lack of adequate resources prevented the undertaking. The Light company did acquire the 30 MW floating power plant from Puerto Rico in 1960 to help alleviate a power crisis. It was originally a U.S. Navy facility built during World War II.

In the early 60's two groups undertook to provide a thermal plant in the area. These were the Federal Government, through ELETROBRAS, and CBEE, a State of Guanabara authority. There had been competition between the federal and local authorities concerning who would construct and own these facilities.

ELETROBRAS in 1961 organized CHEVAP, one of whose responsibilities was the construction of the Santa Cruz thermal plant. Site investigations were made in which International Engineering participated. Two alternate sites in the Santa Cruz area were chosen for later detailed investigation, one of which was approximately the present location. The funding of the project was expected to be undertaken by ELETROBRAS and with supplier credits. Bids were requested for a turnkey project and bidders were to state financing terms which would be included in the evaluation of bids.

Bids were received from European and Japanese Companies as well as one U.S. bid from Westinghouse. General Electric failed to bid as they believed a U.S. firm could not be competitive on basis of the type of specifications which favored European companies. Westinghouse submitted a competitive price partly by ignoring the European standards and proposing a unitized design with a somewhat higher rating, and by citing possible A.I.D. financing terms. Westinghouse included in its turnkey proposal all imported equipment and project management. Engineering designs would be performed by the U.S. firm of Biggs and Hill; civil construction would be by the Brazilian firm of Christiani Nielsen; and the erection by EBE, all three working as sub-contractors to Westinghouse. Westinghouse suggested that A.I.D. financing be considered. The Westinghouse proposal was considered the best offer subject to obtaining the A.I.D. loan.

A.I.D. required a better project study since available studies by CHEVAP consisted primarily of engineering designs and bidding specifications. In their role as representative of CHEVAP, and at CHEVAP's request, Westinghouse prepared and presented to A.I.D. a project study dated December 3, 1962. It proved to be of limited content.

Early in 1963 the Goulart government took steps to change the management personnel of CHEVAP and place their own people in the positions. They succeeded; and since the signing of the Loan Agreement, on October 9, 1963, CHEVAP had five changes in management.

A.I.D. required an independent engineer for engineering services. CHEVAP contracted Sanderson and Porter of New York to provide these services. The contract required one man/year per year of technical supervision together with home office back up for the duration of the project.

From the very beginning CHEVAP organization resisted any condition they felt reduced their direct authority and participation in the project. The employment of Sanderson and Porter was done only to satisfy A.I.D. requirements. The Sanderson and Porter resident engineer received minimal cooperation from CHEVAP authorities. They continually tried to take over contractor's responsibilities for which they were neither staffed, experienced nor equipped.

Westinghouse soon found they were unable to perform on a strictly turnkey basis due to legal and tax problems. As a result, the Christiani-Nielsen and EBE sub-contracts were changed to direct contracts with CHEVAP. There were cross clauses in the contracts making Westinghouse responsible for the quality and scheduling of the work of the other two contractors. The A.I.D. loan provided only the foreign exchange costs of the project which covered the Westinghouse equipment and services and the Sanderson and Porter contract. Although not financed by A.I.D., USAID reviewed the Christiani-Nielsen and EBE contracts for content, scope and responsibility. While they satisfactorily covered the project requirements, the CHEVAP group never managed to achieve a coordinated project effort.

CHEVAP weakened much of the Westinghouse responsibility for managing the two construction contractors and undertook the local procurement themselves. This they attempted to justify as a cost savings. Site delivery of the local equipment was the major reason for the delay of the project along with the slow performance of Christiani-Nielsen. Also Christiani-Neilsen was handicapped by CHEVAP engineering decisions and slow procurement.

The Westinghouse equipment was delivered on time, but the project was a year away from having the plant civil work advanced to a point where the equipment should be erected. Under the terms of the Westinghouse contract, a substantial part of the cost of the equipment fell due on delivery. As

a result, CHEVAP has been paying interest as the funds disbursed (about ten million dollars) for equipment a year in advance of its installation.

Finally conditions became so critical that the GOB, through ELETROBRAS, took over Santa Cruz and Funil and appointed a Junta to manage the project. This proved only partly successful, but it did provide for decision making and coordination previously lacking. The Junta has since been dissolved and the project turned over to FURNAS for completing and operation.

While the A.I.D. loan disbursements were closely supervised, the local currency disbursements were not. CHEVAP could never seem to cope with accounting and budgeting. This always appeared as a deficiency in the A.I.D. quarterly report and accounts in most part for the delays in reporting. It is believed that a considerable part of CHEVAP's overhead which should have been charged to their Funil hydroelectric project may be charged to the Santa Cruz thermal.

While the project is about 18 months behind the original schedules, the delay has not caused serious dislocations in power planning, programming or needs. There has been an abundance of hydroelectric energy available, as the area is in a wet cycle, so that Government authorities have not vigorously pushed the project to an early completion. Also the frequency conversion of Guanabara has not kept up to the unrealistic earlier schedules so the plant was not urgently needed as was the case when the project began. Had it been available, however, during the Rio power disaster last January, it would have been of great value and might have served to accelerate conversion of much of the industrial area.

As the project nears completion, in spite of many set backs and indifferent management, it is a fine power facility that will serve a vital need. Under the control and management of an experienced organization such as FURNAS, the project can be expected to serve its purpose in a creditable manner.

June 1, 1967

A. SANTA CRUZ THERMAL - SITE SELECTIONPlant Site

The proposed project will be built as an addition to the present 160 MW thermal plant. The plant site is located in the vicinity of Santa Cruz in the extreme western part of the state of Guanabara. It is on the São Francisco Canal near the Bay of Sepetiba. The site has been developed for future expansion and many of the plant administrative and service facilities which exist are adequate for supporting additional units.

Rail connections are nearby and shallow draft barges could be brought adjacent to plant site. Dredging would be required for large draft vessels.

Cooling water for the plant is taken from the São Francisco Canal through a screen pump house and discharges into the Santo Agostinho Canal across the site. The first stage plant was originally designed for coal firing as well as oil. Sufficient area was included for coal storage and handling.

The original selection of this site was somewhat influenced by the possibility that a steel plant (COSIGUA) would be built in the vicinity and that the two enterprises could share coal storage and handling facilities. After the thermal plant was started, it became apparent that the steel plant would not be built in the foreseeable future. As coal was uneconomical for fueling only the power plant, the fuel was changed to residual oil.

While the site had many attractive features it had one fault. The subsoil conditions were not the best. However, an adequate system of Franki piles were driven and results so far indicate they form satisfactory foundations for the plant and equipment. The major problem with the piling was that the construction contract permitted pile driving at a leisurely pace so the contractor used only light equipment which dragged out the job of pile driving.

About one year ago Sanderson and Porter was asked to make an analysis of various sites to determine if further expansion of thermal power should be an extension of Santa Cruz or at another site. Two other sites were investigated: Ponta do Lagarto, approximately 10 miles north-northwest of central Rio, and Ilha Bom Jesus, the eastern end of the island approximately 4 miles northwest of central Rio. This last site became unavailable so the study was confined to the first two. There were no other sites as promising as these available.

Both sites were studied in detail, including preliminary plant and site layouts including extensive soil investigations. It was the engineers conclusion that all factors considered, the Santa Cruz site was preferable for the thermal addition. Among the factors considered were:

- a. The first stage of Santa Cruz will have a trained operating staff amounting to about 120 men. This will only need to be slightly increased in the order of 25 persons to accomodate a two-unit 400 MW addition. Another site would require recruiting and training another 120 people plus the added expense of salaries.
- b. Right-of-way for the transmission interconnection of the plant with the Furnas 345 Kv Jacarepaguá substation exists and stringing two circuits nearly complete.
- c. Potential fuel cost savings with the addition of 400 MW will permit consideration of bulk delivery of fuel oil either by barge or pipeline.
- d. Use of common plant facilities which require none or only modest enlargement of such items as

Administration and service facilities
Circulating water system
Fuel oil handling
Air supply

Fire protection
138 Kv substation

- e. In addition to the above factors the development of a new site would increase the plant cost by more than 3.0 million dollars. This added cost more than offsets any economies which might be resulted from locating the 400 MW addition closer to Rio.

Because of the interconnected nature of the system to which the Santa Cruz plant will be connected, it should be theoretically possible to add this thermal capacity at other locations outside the State of Guanabara. Consideration was given to a mine-mouth plant in the Santa Catarina coal fields, for example. However, as the primary purpose is to complement hydro, its average load factor over the life of the plant will be low and this type of capacity should be near the load centers. São Paulo has the 400 MW Piratininga Thermal Plant for similar service.

The CANAMBRA study also supports the installation of complementary power near the load centers. This minimizes capacity and energy losses over transmission lines and provides firming capacity for these lines. The important considerations in site selection are:

- Availability of cooling water
- Fuel supply
- Proximity to load centers

Generally sites on the coast in the vicinity of either Rio de Janeiro or Santos would meet all these requirements. Of the two, Rio is further from the great inland hydro resources. Consequently, the next installation of oil-fired steam power would effect a maximum saving in transmission line costs if located near Rio de Janeiro.

MINISTRY OF MINES AND ENERGY

THE MINISTRY OF MINES AND ENERGY under the authorization conferred upon it by Article 5, item 9, of the Regulation approved by Decree No. 57810, February 14, 1967, published in the Official Diary of February 17, 1967.

Considering the necessity of effectuating a change of frequency within the country as a whole and considering that 50 cycle systems are operated in certain localities of the State of Guanabara, Rio de Janeiro, Espirito Santo and Rio Grande do Sul;

Considering that the National Council of Waters and Electrical Energy by its resolution No. 2999 of March 24, 1965 has already considered this question;

Considering the convenience of delegating to ELETROBRAS the duty to promote and accelerate the conversion of frequency;

Considering in addition, that the responsibility in the contribution of electrical services should fall unequivocally to the electrical companies in their areas of concession;

Considering the opportunity in the industrial establishments of making wherever possible besides the resultant modifications of the new frequency, to improve the power factor and to augment productivity.

Considering as well the convenience of maintaining and expanding the collaboration of private and government entities, federal and state, of technical and financial nature, for the completion of the above programs, it is resolved:

I - To designate ELETROBRAS as the Technical and Financing Organ for the coordination of frequency conversion programs.

II - To authorize ELETROBRAS to make contacts and sign agreements with private and government entities both federal

UNCLASSIFIED
ANNEX III , Page 5 of 14
Exhibit B
Page 2 of 2

III - To attribute to the Concessionaries the responsibility for the elaboration and carrying out of the frequency conversion plans.

/s/ José Costa Cavalcanti

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FUEL AND FUEL SUPPLY

Fuel Supply

There are two sources of fuel for steam plants in Brazil, fuel oil and coal. Fuel oil is produced locally from indigenous and imported crudes. Coal is available in Brazil's three southern states and could also be imported from the USA. Fuels as well as power come under the jurisdiction of the Ministry of Mines and Energy. The first stage of Santa Cruz Thermal Plant was originally intended to burn coal as a means of reducing the large accumulation of steam coal. Early in the implementation state of the project it was found that burning coal could not be economically justified so the plant will be fueled by oil. However, because the mining interests in Brazil continue to press for burning coal in steam plants, we felt a discussion of the fuel situation as it affects the Santa Cruz plant was warranted.

Coal

The coal mined in Brazil is primarily to supply metallurgical coal to the steel industry with steam coal produced as a by-product. The coal in Brazil is a very low quality with high ash content and low calorific value.

Originally by-product coal was used by the railroads but since diesellization of the railroads there is little market for this coal. With the increase in requirements by the metallurgical industry, the amount of this by-product coal is increasing and the stock pile is growing larger. Insofar as the by-product coal is concerned, there is no additional cost to Brazil and it can be considered as available free of charge in the stock pile.

The price that coal could command from the power industry would only equal the cost of power delivered to the load center by hydro or oil-burning steam plants, less the annual fixed charges and operating costs of the coal fired plant and its associated transmission lines. Any higher price would involve a subsidy paid by the power industry in support of the mining industry.

CANAMBRA made a comprehensive investigation of Brazil's coal resources and costs. Relative to steam plant operation they concluded that use of coal fueling for the 160 MW Santa Cruz thermal plant in complementary operation with hydro would result in an increase of US\$1.66

in annual cost per Kw of firm power in comparison to oil firing. This is based on coal free of charge of the site. The above excess cost is due principally to the transportation charges, amortizing investment in coal handling and burning equipment at the plant and increased personnel expenses.

In the case of primary steam coal obtained from a hypothetical optimum mining operation the excess cost is estimated to be US\$6.74 per metric ton at the mine. Since steam power derived from free by-product coal cannot compete with fuel oil it is evident that power from primary steam coal would be even less competitive.

Oil

Brazil relies on imports for about two-thirds of its petroleum requirements; however, it has not had to import fuel oil in recent years because the demand has been supplied from local refineries processing foreign and indigenous crudes.

Petroleum product prices are controlled by the National Council of Petroleum (CNP) a GOB body in accordance with procedures outlined in Decree No. 61 of November 21, 1966. As of January 1967, the cost per metric ton including the charges for marketing to government customers was Cr\$59,832 (US\$26.20).

PETROBRAS is prepared to supply the requirements of the Santa Cruz Thermal Plant including the 400 MW extension. Calculation of delivery charges are based on truck delivery with costs figured on round trip, distance and tonnage. In January 1967 the rate was 34 cruzeiros per ton per kilometer. The delivery to Santa Cruz from the refinery at Duque de Caxias refinery is estimated at 4,760 cruzeiros per metric ton which results in a delivered cost of 64,592 cruzeiros per metric ton. This is equivalent to 69.2 ¢ per millions BTU.

Delivery of Fuel Oil

It is the policy of PETROBRAS to deliver the oil it sells. It is presently trucking bunker "C" fuel oil to the Volta Redonda steel plant from its Duque de Caxias refinery. The operation averages about 30 trucks a day delivering about 450 tons of oil. This operation appears to be performing satisfactorily.

PETROBRAS has agreed to deliver the requirements of the Santa Cruz plant by truck. This will require between 26 and 83 trucks per day depending on normal or maximum operations. Based on Volta Redonda operation, this appears feasible. Trucks are obtained by contracts with trucking organizations.

However, there is a serious question of whether this would be feasible for servicing Santa Cruz with the additional capacity. It is estimated that for normal operations about 160 trucks a day would be required. At full operation, as would be expected during dry periods, the number would increase to 288 trucks a day. This is impractical, so some other scheme is required.

There are two possibilities, a pipeline or barge system from the refinery. The feasibility of a pipeline will probably depend on joint use with another large consumer such as the Volta Redonda Steel Plant. Because of the intermittent nature of fuel requirements there are problems of heating or maintaining sufficient flow to prevent the oil from solidifying in the pipe.

Barges have merit for independent operation but must be able to operate in open sea between Guanabara Bay and Sepetiba Bay, and also have shallow enough draft to enter the São Francisco canal.

The investment in facilities will be by PETROBRAS and to some extent perhaps Furnas, which may recover its expense through fuel prices.

It is planned that the project engineer will investigate and determine the best method for delivering and handling fuel for the Santa Cruz Plant. The engineers recommendations will be the basis on which Furnas will negotiate a firm fuel supply for the second stage.

PETROBRAS could not be expected to enter into a firm agreement for deliveries to begin four to five years from today. Conditions may change to make one arrangement more beneficial to Furnas than another. It is felt that a firm

plan will not be necessary until about 1968.

Notes on Fuel Costs used in the Sanderson & Porter
Feasibility Study

The price of fuel used in the feasibility study is based on truck delivery. Even though the method is impractical, the cost is conservative and can be used for economic and cost studies. The cost of delivering larger bulk amounts of fuel by other means would be expected to be less on a cost per million BTU basis.

The borrower will be required to have their project engineer undertake a study to determine the best arrangement for fuel delivery. An amount of \$1,000,000 in local costs are included to cover partial financing by Furnas of fuel oil delivery facilities for either itself or PETROBRAS.

PETROLEO BRASILEIRO S.A.
Departamento Comercial

Rio de Janeiro, 27th/April/1967

Central Elétrica de Furnos S/A
Rua São José, 90 - 3º andar
Rio de Janeiro, GB

Attention: Dr. Flávio H. Lyra

Dear Sir:

We wish to confirm by this correspondence our verbal understanding regarding the possibility of PETROBRAS constructing a pipeline from the D. de Casimiro refinery to the Santa Cruz Thermal Plant in order to supply the plant with fuel oil upon completion of the planned construction of the 560 MW Santa Cruz Thermal Plant.

We wish to inform you that we foresee no technical difficulty in having such a pipeline in operation by 1971, the date by which the new unit is expected to come into operation. The financial provisions for the execution of this undertaking will be the subject of future discussions.

Sincerely yours,

/s/ Emerson Serbeto de Barros
Superintendente Geral
do
Departamento Comercial

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Annex III, Page 11 of 14

Exhibit D

Page 1 of 4

Allocation of FURNAS Market Areas

CANAMBRA divided the South-Central region into market areas and sub-areas. Serving each area is a small number of companies. It has been assumed that the main company operating in each market area will provide the future increments of load growth. Using CANAMBRA's median forecast for peak requirements for the South-Central Region, Exhibit D was prepared to show the allocation of load to the dominant companies in each market area. Similarly, Exhibit E was prepared to show the allocation of energy requirements to these companies.

Some of the companies operating in the South-Central region do not intend to add new generating facilities to their systems, while others will install some generating facilities but not of sufficient magnitude to meet their load requirements.

It is clear then that these companies will have to cover their deficiencies by purchasing power from bulk suppliers. FURNAS, as a bulk supplier will have its market formed in this way, absorbing the load growth increments of the companies in its area of influence.

During 1966, FURNAS started negotiations for the sale of electric power with these companies. A long term contract with CEMIG was signed in 1966. Long term contracts with the other companies are expected to be signed in 1967. The contracts will be firm for 20 years in order to insure the sale of all energy from 1967 to the end of 1987.

The market for which FURNAS will be responsible is composed of the requirements of each of the following companies:

1. CEMIG

This company has preference for use of 50 percent of the FURNAS plant production. CEMIG has an adequate expansion

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program to supply its market expansion after having contracted in 1966 for the following demands from FURNAS:

1967	30 MW	1971	280 MW
1968	100 MW	1972	300 MW
1969	200 MW	1973	400 MW
1970	250 MW	1974-1975	450 MW

2. São Paulo Light

This company contracted with FURNAS for a demand of 600 MW in 1967. It is estimated that São Paulo Light will depend on FURNAS to supply only 25 percent of its future increments of load, with the remaining requirement absorbed by Centrais Elétricas de São Paulo (CESP).

3. Rio Light

FURNAS is the only bulk supplier connected with this utility. The Furnas-Guanabara 345 KV transmission line is scheduled to be completed by the end of 1967. Rio Light contracted with FURNAS for the supply of 150 MW in 1967. FURNAS will have to assume all future increments of market growth for Rio Light because Rio Light has no plans for new generating facilities.

The Rio Light system operates at 50 cycles but by government action a frequency of 60 cycles will be adopted for generation and distribution of electrical energy throughout the country.

A progressive conversion of the Rio Light 50 cycle system to 60 cycles is contemplated to keep the 50 cycle load within the capability of the 50 cycle generating plants, and ultimately to eliminate it entirely. The conversion program is treated at a greater length in Section VII Issues.

4. CPFL (Paulista)

This company is, like FUCIAS, a subsidiary of ELEKTROBRAS. There is no program for future expansion of generating facilities other than the extension, currently under construction, of the Peixoto plant. As mentioned previously, the output of these new generating units will be delivered to the FURNAS transmission system and FURNAS will negotiate the sale of this power. The contracted demand for 1967 is 30 MW and FURNAS will have to assume the total annual increments of load growth in the CPFL area.

5. CBEE

FURNAS through the Furnas-Guanabara transmission line is the only bulk supplier connected with CBEE and therefore must assume all the annual load increments of this company since no expansion of its generation facilities is contemplated. The contracted demand for 1967 is 42 MW.

6. CELF

Preliminary negotiations have established a program of purchase from FURNAS as follows:

1967	10 MW	1970	25 MW
1968	15 MW	1971	30 MW
1969	20 MW		

Since CELF's concession area has no economical hydro sites to be developed, FURNAS must supply all of its annual load increments after 1971.

7. CCBFE

Cia. Central Brasil de Fôrça Elétrica contracted with FURNAS for 15 MW in 1967 and 1968, 30 MW in 1969 and 1970 and 50 MW in 1971. At that time its Mascarenhas power plant will

be commissioned and will supply the annual load increments through 1973. After 1973 FURNAS will provide the annual load increments based on a rate growth similar to that of the other companies operating in the region.

MEMORANDUM OF CONVERSATION

Date: April 28, 1967

Time: 5:00 pm

Place: Office of the Minister of Mines and Energy

Present: Minister José Costa Cavalcanti - Ministry of Mines and Energy
Mr. Henrique Cavalcanti, Executive Assistant
Mr. John Cotrim, President of FURNAS
Mr. Leo Penna, Technical Director of ELETROBRAS
Dr. Lyra - Technical Director of FURNAS
Mr. L.V. Perez ()
Mr. W. Reed () USAID
Mr. J. Heller ()
Mr. W. Wheeler ()

Subject: Santa Cruz Thermal Plant Addition

This meeting was requested by Mr. Perez to put before the Minister three issues concerning the proposed A.I.D. loan for the Santa Cruz 400 MW addition.

1. Frequency Conversion

Mr. Perez pointed out that the Rio frequency conversion program had evidently lagged behind schedule. He expressed A.I.D.'s concern that additional 60 cycle power which will result from the operation of Santa Cruz stage one (160 MW) and the completion of the FURNAS transmission line (making available 300 MW) might exceed the capacity of the Rio distribution system to absorb this increment. Looking further ahead, he indicated that A.I.D. would require assurances that the frequency conversion would keep pace with future 60-cycle additions, notably Santa Cruz stage two (400 MW).

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The new Minister was well acquainted with this problem and has already taken measures to speed conversion. Dr. Leo Penna, now Technical Director of ELETROBRAS, gave examples of conversion which have already taken place in residential areas and indicated that the conversion program, while behind schedule, is now well under way.

The new Portaria issued by the Ministry in April (included in Annex III) firmly establishes responsibility for the overall coordination of the program with ELETROBRAS and authorizes it to deal directly with the concessionaries. Moreover, the Portaria specifies unequivocally that the concessionaries shall have the job of scheduling and implementing the technical details of the plan.

The Minister stated that ELETROBRAS was willing to provide financial assistance to certain industries upon which the cost of conversion would be most burdensome. He stressed that the progress of the frequency conversion program has his personal attention.

2. Fuel Delivery System

The delivery question was discussed at some length. The Minister had already spoken with the president of PETROBRAS regarding the possible construction of a fuel pipeline from the refinery at Duque de Caxias, either direct or via Volta Redonda, to Santa Cruz.

PETROBRAS is actively considering the project and anticipates no technical difficulties. The Minister questioned Mr. Perez on the likelihood of receiving A.I.D. assistance should U.S. imported components, such as pumps, be required.

The Minister indicated willingness to commit the GOB to the pipeline construction during the negotiations of the Loan Agreement.

3. Rate Policy

Mr. Perez proposed the inclusion of a rate covenant in the Guarantee Agreement (similar to Mascarenhas) to provide for the timely granting of tariff adjustment applications.

The Minister was in accord with the suggestion.

LOAN AUTHORIZATION

Provided from: Alliance for Progress Fund

Brazil: Furnas (Santa Cruz Thermal Plant Expansion)

Pursuant to the authority vested in the Administrator, Agency for International Development (hereinafter "A.I.D.") by the Foreign Assistance Act of 1961, as amended, and the delegations of authority issued thereunder, I hereby authorize the establishment of a Loan pursuant to Part I, Chapter 2, Title VI, Alliance for Progress, of said Act to Central Electrica de Furnas S.A. - "FURNAS" (Borrower), of not to exceed forty one million two hundred thousand dollars (US\$41,200,000) to assist in the financing of the United States dollar costs of materials and equipment, and the United States dollar and Brazilian cruzeiro costs of engineering services and incidental training, related to the construction and placing in operation of a 400 MW addition to the present facilities of the Santa Cruz Thermal Plant located in the State of Guanabara. This project is to include the installation of two 200 MW turbine generators, a switchyard, a 132 KV substation extension, interconnecting transmission circuits and associated system improvements. The Loan authorized herein shall be subject to the following terms and conditions:

1. Interest and Terms of Repayment

- (a) Borrower shall repay the Loan to A.I.D. in United States dollars within 20 years from the first disbursement under the Loan, including a grace period of not to exceed five (5) years. Borrower shall pay to A.I.D. in United States dollars on the disbursed balance of the Loan interest of six percent (6%) per annum.
- (b) If prior to the end of the grace period the Government of Brazil ("Government") so elects, the Borrower shall fulfill its dollar obligations under the Loan by paying

[Handwritten initials]

to Government in currency of Brazil the equivalent, determined as of a time and in a manner satisfactory to A.I.D. of the United States dollar payments payable to A.I.D. under (a) above, and Government shall pay to A.I.D.:

- (i) the equivalent in United States dollars, determined as of the time and in a manner calculated to obtain repayment of all dollars disbursed plus interest, of all amounts paid to Government as follows:
 - a. all interest immediately upon receipt subject to Government's right to retain all payments in excess of one percent (1%) per annum during a grace period of not to exceed ten (10) years from the first disbursement under the loan ("Government grace period") and all payments in excess of two and one-half percent (2-1/2%) per annum thereafter.
 - b. principal within forty (40) years, including the Government grace period.
- (ii) interest in United States dollars of one percent (1%) per annum during the Government grace period, and two and one-half percent (2-1/2%) per annum thereafter on all amounts of outstanding principal paid by Borrower to Government from the respective dates of such payments of principal.

2. Other Terms and Conditions

- (a) Eletrobras (Centrais Eletricas Brasileiras S.A.), a corporation of the Federal Government of Brazil, will furnish a guaranty, as co-obligor, of the indebtedness and obligations of Furnas to A.I.D. under the Loan. Such guaranty shall also include an overrun commitment.
- (b) The Government of Brazil will furnish a guaranty as to the indebtedness and obligations of Furnas to A.I.D. under the Loan.

UNCLASSIFIED

ANNEX V

Page 3 of 3

- (c) Engineering and training services shall be provided by a firm or firms satisfactory to A.I.D. and pursuant to A.I.D. approved contracts.
 - (d) Equipment and materials financed under this loan shall have their source and origin in the United States of America. Engineering and training advisory services financed under the Loan shall have their origin in the United States of America or Brazil.
 - (e) Prior Government of Brazil approval for all projected imports to be financed under the loan shall be required as a condition precedent to disbursements under the loan other than disbursements for engineering services.
 - (f) The Government of Brazil shall agree, that rate adjustments shall be permitted, if and when necessary, to assure FURNAS sufficient earnings to cover operating and maintenance costs, allowances for depreciation, amortization, and exchange losses, and a rate of return on investment of 10%, as provided by Brazilian law.
 - (g) The GOB shall agree to expedite the frequency conversion program in Rio de Janeiro, taking whatever measures are necessary, including financial assistance, to assure the timely utilization of 60 cycle power as it becomes available.
 - (h) As a condition precedent to disbursement for other than engineering services, Petrobras and/or the appropriate government entity(s) will make a firm commitment to FURNAS for the engineering, construction, and financing of a pipeline or other bulk delivery system satisfactory to A.I.D.
 - (i) Such other terms and conditions as A.I.D. may deem advisable.
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Table of Contents

Exhibits

- A - Load Balances --Median Load Projections
- B - Median Program by Units - Capacity
- C - Median Peak and Energy Requirements
- D - Median Peak Requirements
- E - Median Energy Requirements
- F - Principal Power Companies of South-Central Brazil
- G - Transmission System and Map - 1970
- H - Detailed Cost Estimate Unit 3 and 4
- I - Schedule of Project Expenditures
- J - Project Construction Schedule
- K - Organization Chart - Management
- L - A.I.D. Loan in the Power Sector

TABLE 8.4-3

PROGRAM TO MEET MEDIAN LOAD PROJECTION (1971 - 1980)
NUMBER OF UNITS AND CAPACITY IN MEGAWATTS

PROJECTS	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
<u>Base Program</u>	Advanced timing of projects of Base Program									
Jupia 11 & 12	2-100									
Jaguara 3 to 6	2-106		1-106	1-106						
Furnas 7 & 8		2-165								
Estreito 5 & 6			2-150							
Cubatão III 1 to 6								4-75	2-75	
Volta Grande 1 to 4	1-100	2-100		1-100						
Porto Colômbia 1 to 4		1-90	2-90		1-90					
Igarapava 1 to 4			3-60		1-60					
Funil (Grande) 1 & 2			2-70							
São Miguel 1				1-50						
Marimbondo 1 to 8					4-150	4-150				
Água Vermelha 1 to 6								4-150	2-150	
Ilha Solteira 1 to 14		2-125	4-125	4-125	3-125	3-125	1-125			
Cachoeira Dourada 5 to 8	1-50			1-80					1-80	1-80
Escada Grande Storage	x									
Capim Branco 1 to 3								2-140	1-140	
Nova Ponte 1 to 2									2-175	
São Simão 1 to 8						2-165	4-165	2-165		
Queimado 1 to 2						1-60	1-60			
Canoss (a) 1 to 3						3-75				
<u>Additional</u>	Timing of Additional Projects									
Miranda 1 & 2									2-105	
Tupaciguara 1 & 2									2-115	
Anhanguera 1 & 2									2-80	
Itumbiara 1 to 4										4-120
Cerumbá 1 & 2										2-150
Flube da Onça 1 & 2										2-125
Formoso 1 & 2										2-120
Santa Cruz 3 & 4	1-200	1-200								

(a) Full capacity shown; 40% of Canoss capacity and energy is assumed to be allotted to COPEL.

MEGAWATTS

COMPANY	1967 (*)	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
CENTRAIS ELETRICA DE MINAS GERAIS (*)	30	100	200	250	280	300	400	450	450	450	450	450	450	450
SAO PAULO LIGHT (**)	600	647	699	755	810	869	933	1001	1076	1152	1233	1321	1416	1518
RIO LIGHT	150	264	389	526	635	751	876	1011	1156	1303	1503	1699	1908	2139
CIA. PAULISTA DE FORCA E LUZ	30	69	110	154	206	259	316	375	438	517	601	688	781	878
CIA. BRASILEIRA DE ENERGIA ELETRICA	42	54	67	82	95	109	125	141	159	179	201	224	249	276
CENTRAIS ELETRICAS FLUMINENSES (***)	10	15	20	25	30	41	53	65	79	96	114	133	158	178
CIA. CENTRAL BRASILEIRAS DE FORCA ELETRICA (****)	15	15	30	30	50	50	50	54	58	63	68	73	79	86
TOTAL PEAK MW	877	1164	1515	1822	2106	2379	2753	3097	3416	3760	4170	4588	5041	5525
TOTAL ENERGY AV MW	553	733	954	1148	1327	1499	1734	1951	2152	2369	2627	2890	3176	3481

(*) CONTRACTED VALUES WITH CEMIG

(**) 25 PERCENT OF SAO PAULO MARKET INCREASE

(***) ESTIMATED VALUES UP TO 1971; FROM 1971 TO 1980 FIGURES INCLUDE MARKET INCREASES OF ITS AREA OF INFLUENCE

(****) OUTSIDE THE SOUTH CENTRAL REGION; GROWTH RATE ASSUMED SIMILAR TO THAT OF COMPANIES WITHIN THE REGION

(*) CONTRACTED VALUES

**PEAK AND ENERGY REQUIREMENTS-
MEDIAN FORECAST - FURNAS MARKET AREA**
CENTRAL ELÉTRICA DE FURNAS S. A.
PLANT FEASIBILITY STUDY

SANDERSON & PORTER, INC.
NEW YORK

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Exhibit C
Page 1 of 1

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COMPANY	MEGAWATTS													
	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
CIA. PAULISTA DE FORÇA E LUZ	436.6	476.0	517.0	560.7	612.1	665.9	722.5	782.0	844.9	924.0	1007.2	1094.5	1187.1	1284.8
CIA. NACIONAL ENERGIA ELETRICA	10.5	11.1	12.0	12.8	13.9	15.0	16.1	17.3	18.6	19.9	21.2	22.7	24.1	25.7
CIA. HIDROELETRICA DO RIO PARDO	154.0	172.0	192.1	214.2	238.7	266.1	296.6	330.6	368.5	405.5	446.2	491.0	540.2	594.2
SÃO PAULO LIGHT	2183.3	2372.9	2579.6	2804.1	3022.8	3258.8	3513.5	3785.6	4085.4	4388.9	4715.8	5066.8	5446.8	5855.0
USINAS ELETRICAS DO PARANAPANEMA	205.1	229.5	256.5	287.0	318.6	353.6	392.4	440.5	483.3	535.5	593.4	657.6	728.7	807.3
TOTAL SÃO PAULO	2989.5	3261.5	3557.2	3878.8	4206.1	4559.4	4941.1	5356.0	5800.7	6273.8	6783.8	7332.6	7926.9	8567.0
CENTRAIS ELETRICAS FLUMINENSES	77.4	90.6	106.4	126.1	136.2	146.8	158.7	171.6	185.5	201.7	219.7	239.1	263.7	284.1
RIO LIGHT	1049.8	1163.8	1289.2	1426.2	1534.4	1651.1	1776.0	1910.0	2055.8	2202.7	2403.2	2598.9	2807.3	3038.7
CIA. BRASILEIRA DE ENERGIA ELETRICA	122.8	134.6	147.9	162.8	175.6	189.9	205.5	222.2	239.7	259.9	281.5	304.7	329.8	357.0
LOCAL SYSTEMS	2.8	3.2	3.7	4.3	4.8	5.3	5.9	6.5	7.3	8.0	8.7	9.5	10.3	11.3
TOTAL RIO AND GUANABARA	1252.8	1392.2	1547.2	1719.4	1851.0	1993.1	2146.1	2311.1	2488.3	2672.3	2913.1	3152.2	3411.1	3691.1
CENTRAIS ELETRICAS DE MINAS GERAIS	876.2	1001.4	1140.2	1295.1	1440.8	1596.8	1764.1	1943.9	2140.6	2327.7	2523.7	2734.6	2957.1	3194.2
CIA. FORÇA E LUZ DE CATAGUAZES	28.1	30.5	33.1	35.8	40.3	45.0	50.3	56.5	62.2	68.1	74.3	80.7	87.4	94.7
TOTAL MINAS GERAIS	904.3	1031.9	1173.3	1330.9	1481.1	1641.8	1814.4	2000.4	2202.8	2395.8	2598.0	2815.3	3044.5	3288.9
TOTAL SOUTH CENTRAL REGION	5146.6	5685.6	6277.7	6929.1	7538.2	8194.3	8901.6	9667.5	10491.8	11341.9	12294.9	13300.1	14382.5	15547.0

**PEAK REQUIREMENTS - MEDIAN FORECAST
SOUTH CENTRAL REGION OF BRAZIL
CENTRAL ELÉTRICA DE FURNAS S. A.
PLANT FEASIBILITY STUDY**

SANDERSON & PORTER, INC.
NEW YORK

EXHIBIT 11

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Exhibit D
Page 1 of 1

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COMPANY	AVERAGE MEGAWATTS													
	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
CIA. PAULISTA DE FORÇA E LUZ	263.5	287.1	313.7	338.0	369.1	401.7	435.7	471.7	509.6	557.1	606.9	659.6	715.2	773.8
CIA. NACIONAL DE ENERGIA ELETRICA	4.9	5.2	5.6	6.0	6.5	7.0	7.5	8.0	8.6	9.3	10.1	10.9	11.7	12.5
CIA. HIDROLETRICA DO RIO PARDO	80.0	89.4	99.6	111.4	121.2	138.5	154.4	172.0	191.6	210.8	232.1	255.3	281.0	309.1
SÃO PAULO LIGHT	1436.9	1571.4	1718.5	1880.1	2026.9	2185.0	2355.9	2540.2	2739.5	2943.4	3162.5	3398.6	3652.8	3926.0
USINAS ELETRICAS DO PARANAPANEMA	103.1	115.1	128.9	144.1	159.8	177.6	197.0	218.7	242.5	268.6	297.8	329.9	365.4	405.2
TOTAL SÃO PAULO	1888.5	2068.2	2266.3	2479.6	2686.5	2909.8	3150.5	3410.6	3691.8	3989.2	4309.4	4654.3	5026.1	5426.6
CENTRAIS ELETRICAS FLUMINENSES	37.5	44.6	51.4	61.6	66.2	71.4	77.1	83.3	89.8	97.4	105.8	114.8	124.5	135.4
RIO LIGHT	663.5	735.5	817.0	904.6	977.0	1048.5	1128.6	1215.0	1307.8	1415.2	1531.5	1657.6	1794.0	1941.2
CIA. BRASILEIRA DE ENERGIA ELETRICA	74.9	82.0	89.8	98.4	106.0	114.2	122.9	132.5	142.6	153.7	165.7	178.6	192.6	207.6
LOCAL SYSTEMS	0.9	1.0	1.2	1.4	1.6	1.8	2.1	2.3	2.6	2.9	3.3	3.6	3.9	4.3
TOTAL RIO AND GUANABARA	776.8	863.1	959.4	1066.0	1147.8	1235.9	1330.7	1433.1	1542.8	1669.2	1806.3	1954.6	2115.0	2238.5
CENTRAIS ELETRICAS DE MINAS GERAIS	545.5	623.6	711.0	809.5	898.1	993.9	1097.3	1210.0	1333.7	1444.9	1564.5	1692.7	1830.4	1977.1
CIA. FORÇA E LUZ DE CATAGUAZES	16.5	18.1	19.9	21.7	24.4	27.2	30.5	33.2	37.5	41.4	45.0	49.0	53.2	57.6
TOTAL MINAS GERAIS	562.0	641.7	730.9	831.2	922.5	1021.1	1127.8	1243.2	1371.2	1486.3	1609.5	1741.7	1883.6	2034.7
TOTAL SOUTH CENTRAL REGION	3227.3	3573.0	3956.6	4376.8	4756.8	5166.8	5609.0	6086.9	6605.8	7144.7	7725.2	8350.6	9024.7	9749.8

**ENERGY REQUIREMENTS - MEDIAN FORECAST
SOUTH CENTRAL REGION OF BRAZIL
CENTRAL ELÉTRICA DE FURNAS S. A.
PLANT FEASIBILITY STUDY**

SANDERSON & PORTER, INC.
NEW YORK

EXHIBIT 12

UNCLASSIFIED
Exhibit 12
Page 1 of 1

COMPANY	CONCESSION AREA	TYPE	PRINCIPAL GENERATING STATIONS		APPROX. CAPACITY DEC. 1965 MW	REMARKS
			HYDRO	THERMAL		
RIO LIGHT S. A.	GUANABARA & PART OF RIO DE JANEIRO PLUS EXTENSION OF MINAS GERAIS	GENERATION THROUGH DISTRIBUTION	NILO PECANHA FONTES PONTE COBERTA ILHA DOS POMBOS	PIRAQUE	829	- 50 CYCLE SYSTEM WITH 230 KV TIE TO SAO PAULO THROUGH FREQUENCY CHANGER - SUBSIDIARY OF BRAZILIAN TRACTION
SAO PAULO LIGHT S. A.	GREATER SAO PAULO & VICINITY	GENERATION & PURCHASES THROUGH DISTRIBUTION	ITUPARARANGA H. BORDEN PEDREIRA PORTO GOIS	PIRATININGA	1470	- SUBSIDIARY OF BRAZILIAN TRACTION - PRINCIPAL MARKET FOR FURNAS POWER
CIA. PAULISTA DE FORÇA E LUZ S. A. (CPFL)	CENTRAL SAO PAULO	GENERATION THROUGH DISTRIBUTION	JAGUARI AMERICANA AVANHANDAYA PEIXOTO	CARIOBA	330	- FORMER SUBSIDIARY OF AMERICAN FOREIGN POWER - NOW OWNED BY ELETROBRAS (1965)
CIA. BRASILEIRA DE ENERGIA ELETTRICA S. A. (CBEE)	NITEROI AND CENTRAL RIO DE JANEIRO STATE	DITTO	AREAL PIABANHA	SAO GONCALO	69	- DITTO
CENTRAIS ELETTRICAS DE MINAS GERAIS S. A. (CEMIG)	MINAS GERAIS	GENERATION THROUGH DISTRIBUTION & BULK SALES	ITUTINGA CAMARGOS GAFANHOTO TRES MARIAS PIAU SALTO GRANDE II UNDER CONSTRUCTION JAGUARA		518	- MIXED COMPANY SPONSORED BY MINAS GERAIS
CENTRAIS ELETTRICAS FLUMINENSES S. A. (CELFL)	CENTRAL & NORTHERN RIO DE JANEIRO STATE	GENERATION THROUGH DISTRIBUTION	MACABU	UNDER CONSTRUCTION - CAMPOS	42	- 50 60 CYCLES - MIXED COMPANY SPONSORED BY STATE OF RIO DE JANEIRO IN 1963 TO CONSOLIDATE FOUR SEPARATE STATE-OWNED COMPANIES
CIA. HIDROELETTRICA DO RIO PARDO S. A. (CHERP)	NORTHEAST SAO PAULO PLUS EXTENSION INTO MINAS GERAIS	GENERATION & TRANSMISSION ONLY	EUCLIDES DA CUNHA LIMOEIRO BARRA BONITA BARIRI		258	- MIXED COMPANY SPONSORED BY SAO PAULO FOR WHOLESALE POWER SUPPLY TO SMALL UTILITIES
USINAS ELETTRICAS DO PARAMAPANEMA S. A. (USELPA)	SOUTHWESTERN SAO PAULO AND BORDERING AREAS IN PARANA	DITTO	JURUMIRIM SALTO GRANDE I	FLORIDA PAULISTA VOTUPORANGA	185	- MIXED COMPANY SPONSORED BY SAO PAULO FOR WHOLESALE POWER SUPPLY TO OTHER UTILITIES
CENTRAL ELETTRICA DE FURNAS S. A. (FURNAS)		GENERATION & TRANSMISSION - BULK SUPPLY	FURNAS UNDER CONSTRUCTION ESTREITO		918	- MIXED COMPANY SPONSORED BY FEDERAL GOVERNMENT THROUGH ELETROBRAS - 345 KV TRANSMISSION TO SAO PAULO AND BELO HORIZONTE
CENTRAIS ELETTRICAS DE URUBUPUNGA S. A. (CELUSA)			UNDER CONSTRUCTION JUPIA ILHA SOLTEIRA			- MIXED COMPANY PRIMARILY SPONSORED BY SAO PAULO - PLANNING 660 KV TRANSMISSION TO SAO PAULO
CIA. HIDROELETTRICA DO VALE DO PARAIBA S. A. (CHEVAP)			UNDER CONSTRUCTION FUNIL (PARAIBA)	UNDER CONSTRUCTION SANTA CRUZ		- IN LIQUIDATION - SUBSIDIARY OF ELETROBRAS WHICH DELEGATED TO FURNAS THE OPERATION OF STA. CRUZ AND FUNIL
COMISSAO ESTADUAL DE ENERGIA DA GUANABARA (CEE-GB)		GENERATION FOR WHOLESALE & PUBLIC USE		MARECHAL HERMES LAMEIRAO	43.5	- AGENCY OF GUANABARA - WILL ASSIST IN CONVERSION OF FREQUENCY FROM 10 TO 60 CYCLES
CENTRAIS ELETTRICAS BRASILEIRAS S. A. (ELETROBRAS)						- AGENCY OF THE FEDERAL GOVERNMENT - CONTROLS FURNAS & CHEVAP (IN LIQUIDATION) - SHAREHOLDER IN MOST STATE SPONSORED COMPANIES

*COMBINED INTO ONE COMPANY AT THE END OF 1966 CESP - CENTRAIS ELETTRICA DE SAO PAULO

**PRINCIPAL POWER COMPANIES OF SOUTH CENTRAL BRAZIL
CENTRAL ELETTRICA DE FURNAS S. A.
PLANT FEASIBILITY STUDY**

SANDERSON & PORTER, INC.
NEW YORK

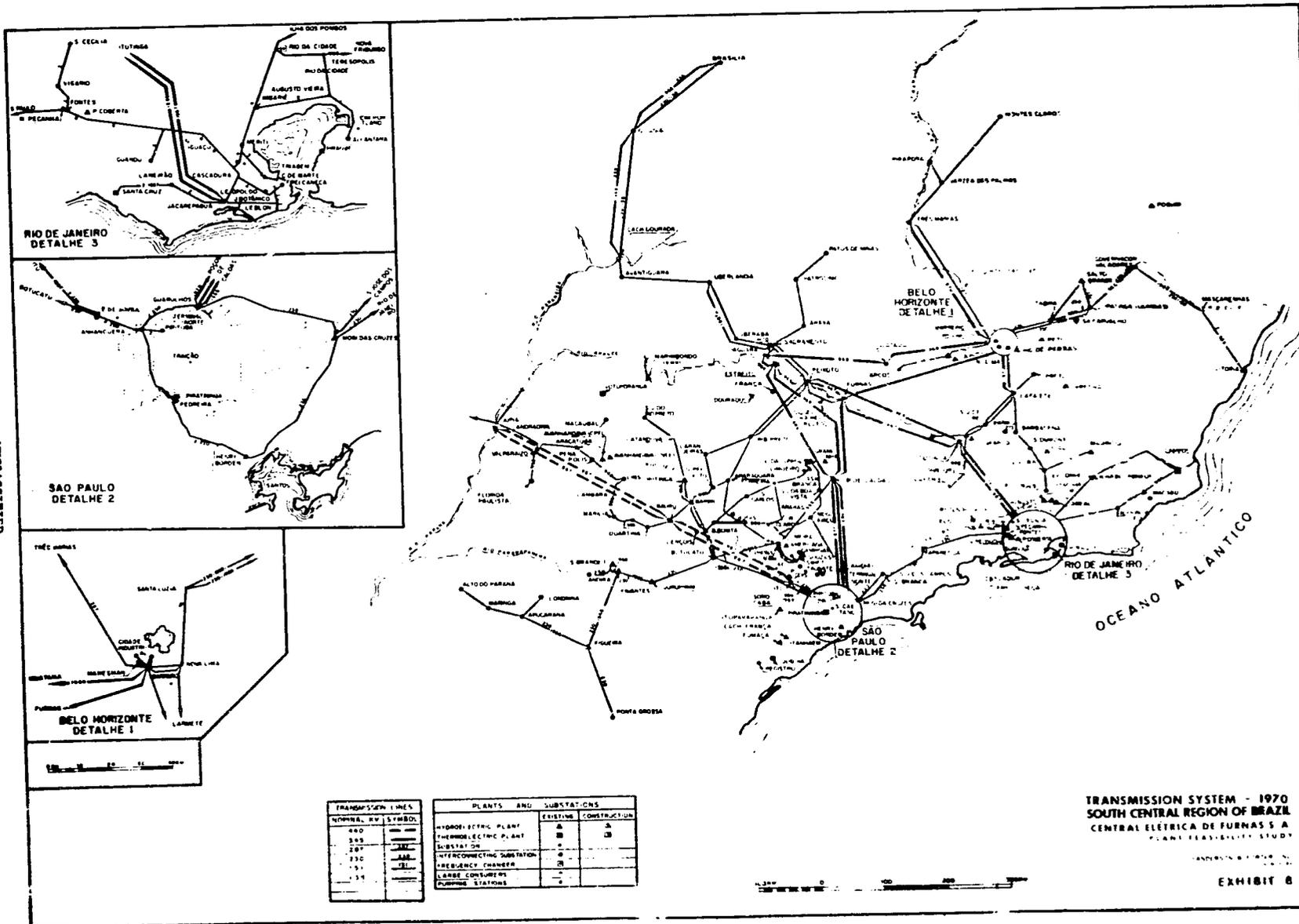
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UNCLASSIFIED
Exhibit 7
Page 1 of 1

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TRANSMISSÃO DE ENERGIA ELÉTRICA
CENTRAL ELÉTRICA DE FURNAS S.A.
PLANO DE VIABILIDADE

EXHIBIT B

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Exhibit B
Page 1 of 1

FEASIBILITY STUDY
 UNITS No 3 AND 4
 SANTA CRUZ EXTENSION

<u>Item</u>	<u>Local Currency (US\$ Equivalent)</u>	<u>U.S. Dollars</u>	<u>Total</u>
1. <u>Generating Plant</u>			
a. Land and Land Rights	-	-	-
b. Structure and Improvements	3,256,000	766,000	4,022,000
c. Fuel Storage and Handling	2,083,000	281,000	2,369,000
d. Cooling Water Supply	1,250,000	414,000	1,664,000
e. Boiler Plant Equip- ment	8,685,000	14,038,000	22,773,000
f. Turbine-generator Plant Equipment	2,639,000	12,236,000	14,875,000
g. Plant Step-up Substation	3,183,000	342,000	3,525,000
h. Misc. Power Plant Equipment	<u>162,000</u>	<u>10,000</u>	<u>172,000</u>
Sub-Total, Generation	21,263,000	28,137,000	49,400,000

FEASIBILITY STUDY
UNRES No 3 AID 4
SANTA CRUZ EXTENSION
(Continued)

<u>Item</u>	<u>Local Currency (US\$ Equivalent)</u>	<u>Dollars</u>	<u>Total</u>
2. <u>Transmission</u>			
a. Right-of-Way Procurement and Clearing	300,000 -	-	300,000
b. Poles, Towers and Fixtures	1,700,000	150,000 -	1,850,000
c. Overhead Conductors	530,000	-	530,000
d. Underground Cable & Conduit	420,000	-	420,000
e. Insulation and Hardware	<u>350,000</u>	<u>-</u>	<u>350,000</u>
Sub-Total, Transmission	3,300,000	150,000	3,450,000
3. <u>Substations</u>			
a. Land and Land Rights	-	-	-
b. Structures	42,000 -	-	42,000
c. Conduit, Wiring & Busses	18,000 -	-	18,000
d. Switchgear and Protective & Auxiliary Equipment	<u>110,000 -</u>	<u>240,000 -</u>	<u>350,000</u>
Sub-Total, Substation	170,000 -	240,000 -	410,000 -

INSTABILITY STUDY
UNITS No 3 AND 4
SANTA CRUZ EXHAUSTION
(Continued)

<u>Item</u>	<u>Local Currency (US\$ Equivalent)</u>	<u>Dollars</u>	<u>Total</u>
4. <u>Improvements & Replaces Items</u>	<u>200,000</u>	<u>150,000</u>	<u>450,000</u>
Total Direct Cost	25,155,000	23,677,000	53,810,000
5. <u>Trainers, Technicians, Operators & Start-up Personnel</u>	400,000	750,000	1,150,000
6. <u>Fuel Oil Facilities</u>	2,500,000	-	2,500,000
7. <u>Administration & Con- struction Management</u>	1,800,000	2,100,000	3,900,000
8. <u>Contingency</u>	2,855,000	1,674,000	4,527,000
9. <u>Engineering & Procurement Assistance</u>	1,300,000	2,100,000	3,400,000
10. <u>Profit & Insurance</u>	400,000	1,840,000	2,240,000
11. <u>Training & Operating Manuals</u>	-	200,000	200,000
12. <u>Escalation</u>	<u>3,500,000</u>	<u>3,808,000</u>	<u>7,308,000</u>
Total Construction Cost	37,886,000	41,149,000	79,035,000
13. <u>Interest during Construction</u>	<u>7,801,000</u>	<u>5,500,000</u>	<u>13,301,000</u>
Total Investment	45,690,000	46,649,000	92,339,000

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EW/BN/yma

May 2, 1967.

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U.S. DOLLARS

YEAR	1967		1968				1969				1970				1971				1972				TOTAL	
	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4		
PLANT SITE	8,000	2,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10,000
FOUNDATIONS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
STRUCTURES	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AUXILIARY FACILITIES	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
STEAM GENERATION	100,000	2,000,000	100,000	2,000,000	100,000	2,000,000	100,000	2,000,000	500,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	750,000	750,000	500,000	43,000	-	-	17,943,000	
POWER GENERATION	-	100,000	50,000	50,000	50,000	50,000	100,000	200,000	600,000	1,100,000	1,786,000	2,286,000	2,575,000	2,575,000	1,286,000	1,036,000	750,000	500,000	500,000	290,000	-	-	15,884,000	
CYCLE AND PIPING	-	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	150,000	400,000	650,000	650,000	650,000	500,000	500,000	400,000	400,000	200,000	87,000	-	-	5,387,000	
ELECTRICAL	-	10,000	10,000	10,000	10,000	30,000	30,000	30,000	30,000	40,000	50,000	50,000	40,000	40,000	30,000	20,000	20,000	15,000	15,000	15,000	-	-	495,000	
SUBSTATIONS	-	-	-	-	-	-	-	-	-	-	100,000	100,000	50,000	45,000	-	-	-	-	-	-	-	-	-	295,000
TRANSMISSION LINE	-	-	-	-	-	-	-	-	-	-	100,000	50,000	20,000	15,000	-	-	-	-	-	-	-	-	-	185,000
ENGINEERING, TESTS AND TRAINING	-	-	-	-	-	-	-	-	-	25,000	25,000	30,000	50,000	70,000	100,000	100,000	100,000	100,000	75,000	75,000	-	-	750,000	
INTEREST DURING CONSTR.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	108,000	2,212,000	260,000	2,160,000	260,000	2,190,000	330,000	2,330,000	1,230,000	2,315,000	3,461,000	4,166,000	4,385,000	4,395,000	2,916,000	2,656,000	2,020,000	1,765,000	1,290,000	510,000	-	-	40,949,000	

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SCHEDULE OF PROJECT EXPENDITURES — U. S. DOLLAR PORTION
SANTA CRUZ EXTENSION UNITS NO. 3 AND 4

CENTRAL ELÉTRICA DE FURNAS S. A.
PLANT FEASIBILITY STUDY

SANDERSON & PORTER, INC.
NEW YORK

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Exhibit I-1
Page 1 of 1

MILLIONS OF CRUZEIROS

YEAR	1967		1968				1969				1970				1971				1972				TOTAL
	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
PLANT SITE	20	20	20	30	30	40	40	40	40	40	40	40	30	30	20	20	15	-	-	-	-	-	515
FOUNDATIONS	-	-	-	-	150	150	295	305	215	313	175	105	75	17	-	-	-	-	-	-	-	-	1,000
STRUCTURES	-	-	-	-	-	-	420	630	850	1,050	1,050	850	850	630	420	200	138	-	-	-	-	-	7,000
AUXILIARY FACILITIES	-	-	-	-	-	-	-	-	250	750	1,750	1,000	1,000	750	750	500	250	175	120	-	-	-	6,303
STEAM GENERATION	-	-	-	-	-	-	200	600	1,200	1,800	1,800	2,400	2,400	2,000	1,800	1,200	600	400	200	101	-	-	16,701
POWER GENERATION	-	-	-	-	-	-	-	-	-	650	900	1,300	1,800	2,000	1,800	1,200	900	300	150	33	-	-	11,033
CYCLE AND PIPING	-	-	-	-	20	20	40	150	450	900	900	1,050	1,050	900	750	450	300	150	150	46	-	-	7,326
ELECTRICAL	-	-	-	-	20	100	200	600	900	1,500	1,200	1,200	900	600	600	450	300	150	150	88	-	-	8,958
SUBSTATIONS	-	-	-	-	-	-	-	-	100	200	100	37	-	-	-	-	-	-	-	-	-	-	437
TRANSMISSION LINE	-	98	120	130	600	600	680	870	1,000	1,102	1,000	1,000	1,000	800	515	-	-	-	-	-	-	-	9,515
ENGINEERING, TESTS AND TRAINING	-	-	-	-	-	-	-	-	-	-	-	-	-	111	111	222	-	111	111	222	-	-	888
INTEREST DURING CONSTRUCTION	13	71	79	83	397	408	774	1,210	1,726	2,592	2,217	2,234	1,989	1,479	1,081	557	260	99	45	12	-	-	12,326
TOTAL	33	189	219	243	1,217	1,318	2,649	4,405	6,731	10,897	10,132	11,216	11,094	9,317	7,847	4,799	2,763	1,385	934	502	-	-	87,890

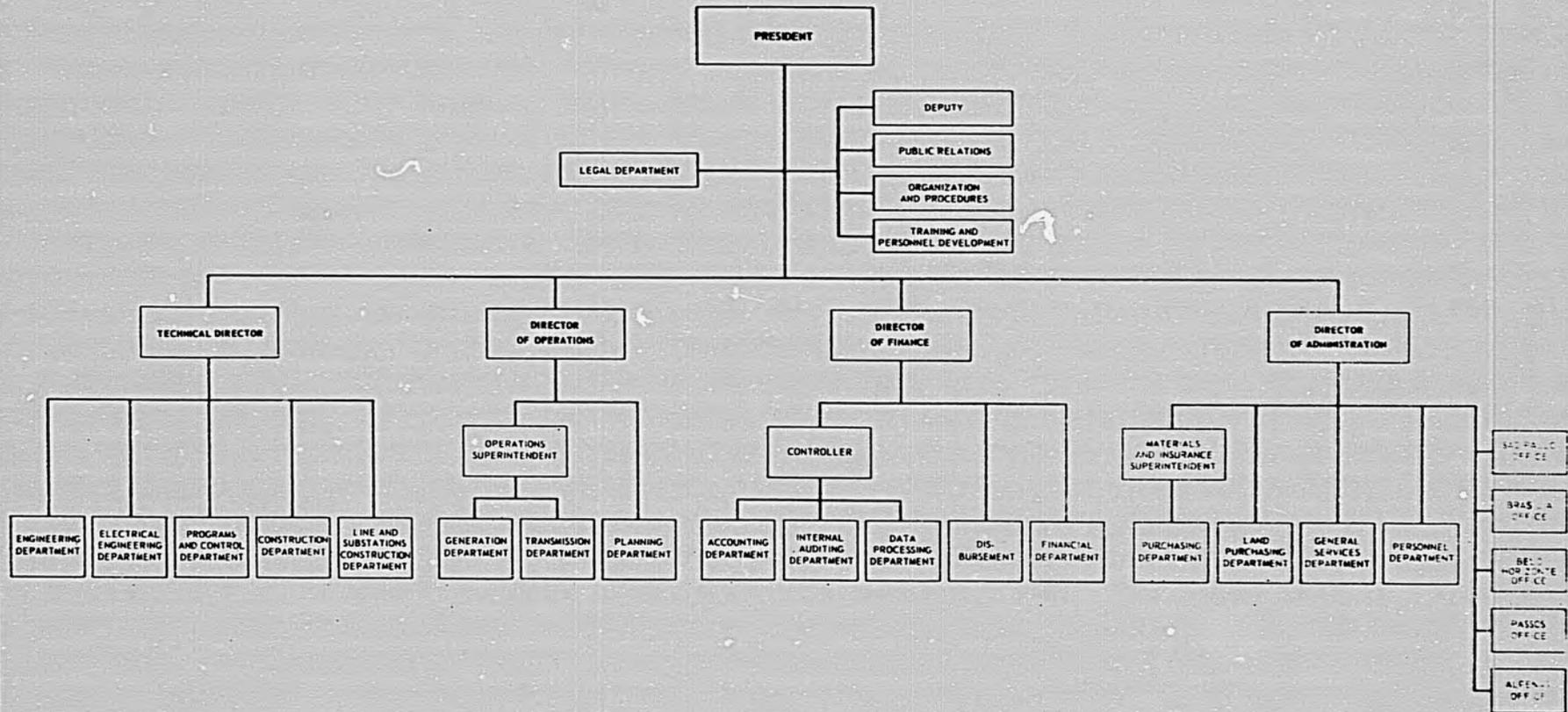
SCHEDULE OF PROJECT EXPENDITURES — CRUZEIRO PORTION
SANTA CRUZ EXTENSION UNIT NO. 3 AND 4
CENTRAL ELÉTRICA DE FURNAS S. A.
PLANT FEASIBILITY STUDY

SANDERSON & PORTER, INC.
 NEW YORK

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 Exhibit I-2
 Page 1 of 1

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ORGANIZATION CHART - MANAGEMENT
CENTRAL ELÉCTRICA DE FURNAS S. A.
PLANT FEASIBILITY STUDY

SANDERSON & POWER, INC.
1968 1000

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Exhibit 8
Page 1 of 1

A.I.D. Loans in the Power Sector

Borrower	Loan Agr. Signature	Project Description	Amount (US\$millions)	% Completion
1. ELETTROBRÁS ²	9/10/63	Santa Cruz Thermal Plant Unit 1 & 2	15,500	75
2. CEMIG ^{1,2}	10/10/63	Transmission Interconnections diesel generators Rural Electrification	7,110	55
3. SUDINE/COMEFOR	10/29/63	Electric Generators	2,315	100
4. CEMAT ¹	6/5/64	General Power System Expansion & Improvement	7,800	64
5. FURNAS ²	10/2/64	Transmission System	16,700	73
6. Cie. Paulista ²	11/27/64	Pefkoto Hydro Plant Expansion	20,400	30
7. CENST	10/9/64	Power Transmission System	7,000	65
8. COPEL ¹	6/9/65	Diesel Generators Transmission Substation Equip. Engineering Services Training	13,210	36
9. Rio Light ²	10/11/65	Distribution	25,000	30
10. S. Paulo ² Light	10/11/65	Distribution	15,000	30
11. COMETE	12/1/65	Transmission System	8,900	24
12. CCTE ²	8/18/66	Mascarenhas Hydro	<u>13,500</u> 152,500	beginning

1 Includes local currency loans.

2 South Central Region Projects

LB 12-066

DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON 25, D. C.

76

A.I.D. Loan No: 512-L-066
(Ref: AID-DLC/P-581)

OFFICE OF
THE ADMINISTRATOR

LOAN AUTHORIZATION

572-26-220-274

Provided From: Alliance for Progress Loan Funds
BRAZIL: Furnas (Santa Cruz Thermal Plant
Expansion)

Pursuant to the authority vested in the Administrator, Agency for International Development (hereinafter "A.I.D.") by the Foreign Assistance Act of 1961, as amended, and the delegations of authority issued thereunder, I hereby authorize the establishment of a loan pursuant to Part I, Chapter 2, Title VI, Alliance for Progress, of said Act to Central Electrica de Furnas S.A. - "FURNAS" (Borrower), of not to exceed forty one million two hundred thousand dollars (US \$41,200,000) to assist in the financing of the United States dollar costs of materials and equipment, and the United States dollar and Brazilian cruzeiro costs of engineering services and incidental training, related to the construction and placing in operation of a 400 MW addition to the present facilities of the Santa Cruz Thermal Plant located in the State of Guanabara. This project is to include the installation of two 200 MW turbine generators, a switchyard, a 132 KV substation, extension, interconnecting transmission circuits and associated system improvements. The loan authorized herein shall be subject to the following terms and conditions:

1. Interest and Terms of Repayment:

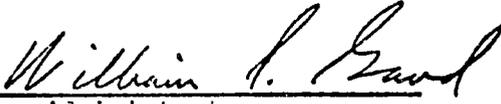
- (a) Borrower shall repay the loan to A.I.D. in United States dollars within 20 years from the first disbursement under the loan, including a grace period of not to exceed five (5) years. Borrower shall pay to A.I.D. in United States dollars on the disbursed balance of the loan interest of six percent (6%) per annum, except that interest accruing during the first five (5) years after the first disbursement ("Borrower Interest Capitalization") may be capitalized as it accrues.
- (b) The Borrower shall fulfill its dollar obligations under the loan by paying to the Government in currency of Brazil the equivalent, determined as of a time and in a manner satisfactory to A.I.D., of the United States dollar payments payable to A.I.D. under (a) above, and Government shall pay to A.I.D.:

- (i) The equivalent in United States dollars, determined as of the time and in a manner calculated to obtain repayment of all dollars disbursed plus interest, of all amounts paid to Government as follows:
 - a. All interest immediately upon receipt subject to Government's right to retain all payments in excess of one percent (1%) per annum during a grace period of not to exceed ten (10) years from the first disbursement under the loan ("Government Grace Period") and all payments in excess of two and one-half percent ($2\frac{1}{2}\%$) per annum thereafter;
 - b. principal within forty (40) years, including the Government grace period.
- (ii) Interest in United States dollars of one percent (1%) per annum during the Government grace period, and two and one-half percent ($2\frac{1}{2}\%$) per annum thereafter on all amounts of outstanding principal paid by Borrower to Government from the respective dates of such payments of principal.
- (iii) Interest in United States dollars of one (1) percent per annum on the disbursed balance of the loan during the Borrower interest capitalization period except to the extent that interest in such amount is payable to A.I.D. pursuant to paragraphs 1(b)(i) and 1(b)(ii) above.

2. Other Terms and Conditions:

- (a) Eletrobras (Centrais Eletricas Brasileiras S.A.), a Brazilian Government corporation will guarantee the loan. The guarantee shall include a cost overrun commitment.
- (b) The Government of Brazil will furnish a guaranty as to the indebtedness and obligations of Furnas to A.I.D. under the loan.
- (c) Engineering and training services shall be provided by a firm or firms satisfactory to A.I.D. and pursuant to A.I.D. approved contracts.

- (d) Equipment and materials financed under this loan shall have their source and origin in the United States of America. Engineering and training advisory services financed under the loan shall have their origin in the United States of America or Brazil. In the event that such services are provided by Brazilian sources, A.I.D. reserves the right to substitute for dollars, any available cruzeiros from PL 480 sales, program assistance loans, or under "two-step" payment agreements. A.I.D. will seek approval from the Government of Brazil on an annual basis that in the allocation of cruzeiro resources, priority will be given to use for financing the local services described above.
- (e) Prior Government of Brazil approval for all projected imports to be financed under the loan shall be required as a condition precedent to disbursements under the loan other than disbursements for engineering services.
- (f) The Government of Brazil shall agree, that rate adjustments shall be permitted, if and when necessary, to assure FURNAS sufficient earnings to cover operating and maintenance costs, allowances for depreciation, amortization, and exchange losses, and a rate of return on investment of 10%, as provided by Brazilian law.
- (g) The GOB shall agree to expedite the frequency conversion program in Rio de Janeiro, taking whatever measures are necessary, including financial assistance, to assure the timely utilization of 60-cycle power as it becomes available.
- (h) As a condition precedent to disbursement for other than engineering services, Petrobras and/or the appropriate government entity(s) will make a firm commitment to FURNAS for the engineering, construction, and financing of a pipeline or other bulk delivery system satisfactory to A.I.D.
- (i) Such other terms and conditions as A.I.D. may deem advisable.



Administrator
JUN 22 1967

Date

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