Document of

The World Bank

FOR OFFICIAL USE ONLY

Report No. 1852

PROJECT PERFORMANCE AUDIT REPORT

BRAZIL: JAGUARA AND VOLTA GRANDE HYDROELECTRIC PROJECTS

(Loans 442-BR and 566-BR)

January 13, 1978

Operations Evaluation Department

PROJECT PERFORMANCE AUDIT REPORT

BRAZIL: JAGUARA AND VOLTA GRANDE HYDROELECTRIC PROJECTS
(Loans 442-BR and 566-BR)

Table of Contents

Table of Contents

Project Completion Report B: (Continued)

PROJECT PERFORMANCE AUDIT REPORT

BRAZIL: JAGUARA AND VOLTA GRANDE HYDROELECTRIC PROJECTS
(Loans 442-BR and 566-BR)

Preface

This report presents the performance audit of Jaguara and Volta Grande Hydroelectric Projects for which loans 442-BR and 566-BR were made in 1966 and 1969 respectively. They are the third and fourth loans to the state-owned utility Centrais Eletricas de Minas Gerais (CEMIG). A fifth loan (829-BR) was made to CEMIG in 1972.

The audit memorandum is based on: the attached Project Completion Reports (PCRs) prepared by the Bank's LAC Regional Office; a review of project appraisal reports and other documents; and discussions with Bank staff, and with officials of CEMIG, ELECTROBAS, Centrais Eletricas de FURNAS and the Government during a brief OED mission to Brazil in August 1977. The generous help given by the Government and by the officials of CEMIG, ELETROBRAS and FURNAS in the preparation of this report is gratefully acknowledged.

The audit memorandum summarizes the analysis and conclusions of the PCRs and also develops some points not covered in them.

PROJECT COMPLETION AUDIT BASIC DATA SHEET (1)

BRAZIL: JAGUARA POWER PROJECT
(Loan 442-BR)

Key Project Data

Item	Appraisal Expectation	Actual or Current Estimate
Total Project Cost (US$ million)	83.2[1]	106.9[1]
Overrun (%)		28.0[1]
Loan Amount (US$ million)		49.0
Disbursed)		49.0
Cancelled) [2]		-
Date Physical Components Completed	early 1971	mid-1971
Proportion Completed by Above Date (%)[2]		n.a.
Proportion of Time Overrun (%)[2]		11
Incremental Financial Rate of Return (%)	n.a.	23
Financial Performance	Satisfactory	Good
Institutional Performance	Satisfactory	Good

1/ Excludes the cost of transmission lines (US$35.8 million) which were subsequently added to the project. All costs exclude interest during construction.
2/ The main part of the project, i.e., the power station.

Other Project Data

Item	Original Plan	Revisions	Actual or Est. Actual
First Mention in Files			11/12/64
Government's Application			7/14/65
Negotiations			1/17/66
Board Approval			3/08/66
Loan Agreement Date			3/15/66
Effectiveness Date	8/1/66	10/31/66	5/29/67
Closing Date	4/30/71		12/31/74
Borrower			Centrais Eletricas de Minas Gerais, S.A.
Executing Agency			" " " "
Fiscal Year of Borrower			Calendar year
Follow-on Project			Volta Grande Hydroelectric Project
Loan Number			566-BR
Amount (US$ million)			22.6
Loan Agreement Date			Oct. 23, 1968

Mission Data

	Month Year	No.of Weeks	No. of Persons	Manweeks	Date of Report
Pre-appraisal	8/65	1	2	2	8/19/65
Appraisal) *	9/65	4	2	8)	2/25/66
Appraisal) *	11/65	n.a.	1	n.a.)	
Supervision I *	3/67	n.a.	1	n.a.	5/01/67
Supervision II	10/67	n.a.	2	n.a.	12/21/67
Supervision III*	2/68	1	1	1	3/07/68
Supervision IV	6/68	n.a.	n.a.	n.a.	7/23/68
Supervision V *	8/70	n.a.	3	n.a.	n.a.
Supervision VI *	10/71	2	2	4	11/23/71
Sub Total					

* The mission was also involved with other Bank assisted power projects

Country Exchange Rates

Name of Currency: Cruzeiro

Year	Exchange Rate (Ave.)	Wholesale Price Index Total	Constr.
1965	$1 = Cr.1.75	100	100
1966	$1 = Cr.2.17	137	138
1968	$1 = Cr.3.18	212	250
1970	$1 = Cr.4.49	312	349
1972	$1 = Cr.5.30	446	481
1975	$1 = Cr.8.20	854	-

PROJECT COMPLETION AUDIT BASIC DATA SHEET (2)

BRAZIL: VOLTA GRANDE POWER
(Loan 566-BR)

Key Project Data

Item	Appraisal Expectation	Actual or Current Estimate
Total Project Cost (US$ million)	95.3	218.9 1/
Overrun (%)		130 1/
Loan Amount (US$ million)	26.6	26.6
Disbursed		26.2
Cancelled		0.4
Date Physical Components Completed 2/	early 1974	mid-1975
Proportion Completed by Above Date (%) 2/		n.a.
Proportion of Time Overrun (%) 2/		18
Incremental Financial Rate of Return (%)	10	10
Financial Performance	Satisfactory	Good
Institutional Performance	Satisfactory	Good

1/ Includes the cost of transmission lines (US$25 million) which were transferred to the Jaguara project (Loan 442-BR).
2/ Major part of the project, i.e., the power station.

Other Project Data

Item	Original Plan	Revisions	Actual or Est. Actual
First Mention in Files		-	5/5/67
Government's Application		-	6/01/67
Negotiations		-	Sept.'68
Board Approval		-	10/15/68
Loan Agreement Date		-	10/23/68
Effectiveness	10/23/68	-	2/27/69
Closing Date	1/31/75	-	6/30/76
Borrower		Centrais Eletricas de Minas Gerais, S.A.	
Executing Agency		" " " "	
Fiscal Year of Borrower		Calendar Year	
Follow-on Project		Sao Simao Hydroelectric Project	
Loan Number		829-BR	
Amount (US$ million)		60.0	
Loan Agreement		June 14, 1972	

Mission Data

Item	Month, Year	No. of Weeks	No. of Persons	Manweeks	Date of Report
Preappraisal *)	11/67	1)	1) 2	2	12/05/67
Preappraisal *)	2/68	1)	1)		3/07/68
Appraisal *)	4/68	(3	2	(	5/31/68
Appraisal *)	-	(	1	7/9 (	
Sub Total					
Supervision I	8/70	3	1	3	2/24/71
Supervision II *	10/71	2	2	4	11/23/71
Supervision III *	1/73	3	2	6	3/06/73
Supervision IV	6/76	1	1.5	1.5	6/29/76
Sub Total				17.5	

* The mission was also involved with other Bank-assisted power projects

Country Exchange Rates

Name of Currency: Cruzeiro

Year	Exchange Rate (Ave.)	Wholesale Price Index Total	Constr.
1965	$1 = Cr.1.75	100	100
1966	$1 = Cr.2.17	137	138
1968	$1 = Cr.3.18	212	250
1970	$1 = Cr.4.49	312	349
1972	$1 = Cr.5.30	446	481
1973	$1 = Cr.8.20	854	-

PROJECT PERFORMANCE AUDIT REPORT

BRAZIL: JAGUARA AND VOLTA GRANDE HYDROELECTRIC PROJECTS
(Loans 442-BR and 566-BR)

Highlights

The two projects were successfully implemented and achieved the original objectives of meeting the envisaged growth in electricity demand. Some unexpected difficulties with the foundation of the dams led to cost and time overruns on the two projects, but the construction delays did not affect the electricity supply of the borrower's system. Through 1976, the borrower achieved very good operating results, a reflection of the quality of its management, and its financial performance was better than expected at appraisal. The incremental financial rates of return on the two projects are now estimated to be 23% on Jaguara and 10% on Volta Grande. However, mainly because of an unusual funds flow system in the Brazilian power sector, the borrower's net internal cash generation contributed less than expected towards its construction expenditure in the last three years.

The following points may be of particular interest:

- reasons for cost and time overruns, and the latter's effect on load growth (paras. 3, 9-11, 24 and 25, and PCRs paras. A15, A19.1-A20.4 and B19.01-B20.04);

- roles of ELETROBRAS and the consumers in the development of Brazilian power sector (paras. 7, 15, 17-21 and 27); and

- reasons for the very low contribution by the borrower's net internal cash generation towards its construction expenditure (paras. 7, 15-17, and 26, and PCRs paras. A23.1-A24.5 and B24.01-B24.05).

PROJECT PERFORMANCE AUDIT MEMORANDUM

BRAZIL: JAGUARA AND VOLTA GRANDE HYDROELECTRIC PROJECTS
(Loans 442-BR and 566-BR)

SECTION I

Project Summary

1. The Brazilian power sector has been the major recipient of Bank's financial assistance to the country. Through June 1977, the sector received 28 loans amounting to US$1,162 million, out of a total of 70 loans cummulatively amounting to US$3,240 million to the country.

2. Loans 442-BR of 1966 and 566-BR of 1969 were the twelfth and twentieth loans to the power sector 1/, and the third and fourth loans to Centrais Eletricas de Minas Gerais (CEMIG), the utility owned mainly by and operating in the State of Minas Gerais. The loans of US$49.0 million and US$26.6 million respectively, were to finance the potential foreign exchange costs 2/ of two hydroelectric projects, Jaguara (4x100 MW) and Volta Grande (4x100 MW), and the associated 345 KV transmission lines and substations. These projects are located on the Rio Grande, downstream of two large hydroelectric projects completed earlier, FURNAS and Peixoto 3/ owned by Centrais Eletricas de FURNAS, a Federal utility.

3. Both projects were executed largely as planned 4/ but had problems with dam foundations which are discussed in Section II. The problems created minor delays in the completion of projects but the delays did not affect the electricity supply of the borrower's system. The problems also contributed to increase in the civil works costs of Jaguara by 130% and of Volta Grande by 175%. The total cost overruns of Jaguara and Volta Grande were 28% and 130% respectively, all costs in current US$ equivalent (Annexes 5/A and 5/B). Jaguara units (114 MW/106 MW - maximum/nominal capacity) are operating successfully, but Volta Grande units (100 MW/100 MW - maximum/nominal capacity) have had technical problems which are in the process of being resolved.

1/ PPAR on projects financed by 15th - 18th loans was distributed to the Board on September 4, 1975. A combined Completion Report on projects financed by 13th, 14th and 19th loans, made to FURNAS, is expected shortly; a PPAR will then be prepared.

2/ Local suppliers were given the standard 15% price preference on Bank financed equipment.

3/ Estreito Hydroelectric Project (Loan 403-BR of 1965) located upstream of Jaguara and downstream of Peixoto was constructed between 1965-70.

4/ Because of savings on Jaguara and overruns on Volta Grande in the foreign exchange costs, the transmission component of Volta Grande was transferred to Jaguara. No explanation has been forthcoming on two different sets of costs (in US$ equivalent) for this component, for which some changes were subsequently made.

4. Over the six-year period 1970-76, CEMIG's growth rate in energy sales averaged just over 14% p.a., about the same as the appraisal forecasts (Appendix 1). Its industrial sales constituted about 70% of total energy sales, the metallurgical industries alone accounting for about 50% of the total. By way of contrast, the Southeastern Region, which includes the State of Minas Gerais, had a growth rate in energy sales of about 11% p.a., over the same period, and industry accounted for about 55% of the total energy sales in 1975. The Southeastern Region is economically the most developed part of the country; nevertheless the State of Minas Gerais, despite its large mineral resources, presently is not as well developed as some other states in the Region.

5. CEMIG's large proportion of industrial sales reflects the success of the state's objectives. These are to promote its economic development by attracting industries, particularly metallurgical, for processing (and thereby increasing the value added to) its mineral resources within the state. The state's objectives, in turn, create the need for CEMIG to provide adequate and highly reliable power supply at a minimum cost. For the next several years CEMIG expects a growth rate of about 17% p.a., in its energy sales. To meet this growth rate, CEMIG has presently underway a large investment program, some of which is Bank financed. The effect of this program on CEMIG's financial situation is discussed in para. 7.

6. A comparison between CEMIG's actual annual purchases of energy and FURNAS' expected sales to CEMIG suggests that CEMIG was able to purchase the balance of its energy requirements over and above its own capability at any time without any difficulty (Annex 4/A and Appendix 1). The question of the timing of the two CEMIG projects should therefore be viewed from the standpoint of the interconnected system (para. 13). Actually it appears that, from this standpoint, the two projects were completed just at the time when they were most needed (details in Section II). Furthermore, they were, and are, despite cost overruns, the least cost alternatives to meet the envisaged and actual load growth. The audit accepts the ex-post incremental financial rates of return of 23% for Jaguara and 10% on Volta Grande as calculated in the respective PCRs. 1/ (PCRs paras. A17.2 and B17.02-17.03).

7. The financial performance of CEMIG from 1972 has been good and better than expected at the time of appraisal of the projects. CEMIG achieved rates of return on average net fixed assets in operation of over 15% (around 12% estimated) during this period 2/. However, CEMIG's net internal contribution towards its investment program was very low in 1974, 1975 and particularly in 1976. This was for two reasons. First, the investment program during this period was much greater than originally estimated

---

1/ Reversion, a form of tax on utility's assets, and sole tax were added to sales revenues in the calculation of incremental financial returns.

2/ Using Bank criteria. For these calculations, reversion was considered as part of operating income. (See PCRs paras. A23.1-24.5 and B23.01-B24.05).

(almost three times in constant cruzeiros), while the net fixed assets in operation were lower than expected, hence the permitted return on net assets produced less cash than expected. Second, CEMIG's annual debt service to ELETROBRAS increased substantially during this period. In this process ELETROBRAS collected the advances (e.g. compulsory loan), and most of the direct taxes on utilities' assets and energy sales (e.g. reversion and consumer contributions) from the utilities and returned these funds to the utilities almost entirely as medium-terms loans 1/. Since a large portion of the loans to CEMIG were from funds generated within the sector from consumers of power, the assessment of CEMIG's financial position and proposals for actions affecting it must obviously take its relationship with ELETROBRAS and the latter's source of funds into account.

8. Judging by the standard efficiency indicators (e.g., operating ratio, customers per employee, and sales volume per employee; Appendix 1), CEMIG has shown a steady improvement in its overall performance despite the burdens of the large investment program, and thus reinforced the generally held opinion that it is one of the best-managed entities in the Brazilian power sector. The number of Bank project supervision missions was therefore adequate.

SECTION II

Points of Interest

Problems with Dam Foundations

9. These problems affected not only the two projects, Jaguara and Volta Grande, but also an earlier project, Peixoto 2/ of Companhia Paulista Forca e Luz, some 60 km upstream of Jaguara. Construction of Peixoto dam had started apparently without adequate preliminary investigations of the river bed. Subsequently, serious flaws were found in this river bed, which necessitated major design changes to the dam.

10. The Jaguara appraisal report, reflecting the opinion of the consultants which included an eminent authority on soil mechanics, stated that the site for the dam was expected to have a minimum of foundation problems. Nevertheless, preliminary investigations had included plans to drill test holes in the river bed during low river flow. However, according to CEMIG, drilling of test holes had to be abandoned because of earlier than expected rains. When the dam construction was already underway, a weak schist layer

---

1/ ELETROBRAS had agreed to maintain and has maintained its share of equity in CEMIG at 16%.

2/ Now owned by FURNAS. This project was not financed by the Bank.

was uncovered, and this led to the need for a change in the axis of the dam by some 50 meters downstream. The result was delays as well as increase in costs due to quantity increases, engineering design changes, and contractor's remobilization, all of which might have been avoided.(PCR paras. A19.1-20.4).

11. On the other hand, investigations seemingly adequate for the size and complexity of the project were carried out in the case of the Volta Grande project. However, during the course of construction, substantially greater than envisaged unevenness was found in the river bed, and this required relocation of the powerhouse. The result here also was some delays as well as increase in costs due to quantity increases, engineering design changes and contractor's remobilization. Quantity increases would have been almost the same even with additional investigations but the cost increases, albeit relatively small, arising from the other two factors might have been avoided. (PCR paras. B19.01-20.04, and B28.02).

Electricity Service to Urban and Rural Population

12. The two projects achieved the original Bank objectives of meeting the envisaged growth in electricity demand. However, measured by the Bank's current emphasis on social objectives, the projects provided very limited increase in electricity service to the rural population between 1970-76, even after taking into account the 1974 re-classification of urban and rural areas. It will be seen from Appendix 2 that the urban population with electricity service increased from 3.4 million to 5.3 million (respectively 55% and 66% of total urban population, which itself had increased from 6.2 million to 8.0 million) over the 6-year period. On the other hand, there has been little change in the percentage of rural population served with electricity 1/.

Justification of Timing of the Projects

13. The power systems in the Southeastern region are interconnected by high voltage transmission lines. This interconnection is continuously extended and improved, and has resulted in savings in capital costs to the utilities through having to carry a lower reserve plant capacity. Furthermore, the operation of the system is integrated and has resulted in more efficient operation of individual generating plants, reduction in the use of thermal generation, and optimum use of the large (multiannual) energy storage in the FURNAS' reservoir. And lastly, the hydrology of the Region has affected different parts of the Southeast Region in different ways during the same period. For instance, a dry spell in 1971 and delays in the rain in 1975 severely reduced the energy potential of the hydroelectric plants of CEMIG and FURNAS, but not the plants owned by CESP (Centrais Eletricas de Sao Paulo) on Rio Parana.

1/ CEMIG has plans for a large investment in rural electrification in the coming years.

14. Taking the above factors into account, the audit accepts the justification of the timing of the two projects; in fact, each one came on stream at the critical time 1/. Any further commissioning delay in the projects most probably would have resulted in a power shortage in the CEMIG system, besides increasing the thermal generation on the interconnected system.

CEMIG's Financial Situation and Roles of ELETROBRAS and the Consumers

15. CEMIG achieved an excellent rate of return on net fixed assets in operation through 1976. However, its net internal cash generation contributed only a very low proportion towards its annual construction expenditure in 1974, 1975 and particularly in 1976, in comparison with that expected. This seemingly low level of performance is due to a large investment program and high debt service payments, particularly to ELETROBRAS.

16. The large investment program arose mainly because of substantial increase in size and unit costs of the current projects, and their longer construction period - the smaller and the more economical hydro sites having already been exploited (Appendix 3). CEMIG's annual capital expenditure over the last three years has been between 30-40% of its net fixed assets in operation and between 2.5-3.5 times its net operating income. It is clear that CEMIG's asset base 2/ is almost totally inadequate to generate the necessary amount of internal funds in order to make any significant contribution towards an investment program of this size.

17. Not included in CEMIG's internal cash generation were the advances (compulsory soft term loans) and direct taxes (Reversion and Sole Tax) collected by CEMIG on its energy sales and assets and then channeled mainly to ELETROBRAS. Reversion and Sole Tax amounted to over 15% of CEMIG's construction expenditure in each one of the three years.

18. On the other hand ELETROBRAS has the responsibility to provide overall direction and coordination in the development of the power sector, to approve the investment program of each utility, and to allocate it the necessary funds in the form of loans and equity contributions. Given this role of ELETROBRAS, it seems appropriate as well as necessary to also review the

---

1/ The audit, however, did not examine in-depth the potential of CESP to supply the necessary power to CEMIG through inter-utility power transfers, nor the potential of the interconnected system to deliver this amount of power in 1971 and 1975.

2/ As normally defined by the Bank for rate of return covenant, i.e. average net fixed assets in operation. Where large investment program over a long period is involved, the asset base could include some proportion of works in progress. The law imposes the upper limits on the earnings of an entity.

investment program and the financial situation of the whole sector including ELETROBRAS, rather than to confine such a review exclusively to single utilities.

19. Appendix 4 indicates that the funds generated exclusively within the sector contributed 56% of its total capital requirements during the period 1971-75. It can be concluded that the financial condition of the sector, in terms of its ability to finance over half of its investment program out of earnings, has been satisfactory.

20. This satisfactory condition of the sector in the past is the aggregate outcome of each utility's financial situation, and therefore the low level of contribution made by any one utility to its investment program should be examined in this perspective. Over 50% of the funds generated by the sector originate mainly from advances and direct taxes on utilities' sales and assets. These funds are channeled in part to ELETROBRAS and subsequently returned to the utilities mainly as medium-term loans which, in turn, generate the individual utility's large debt service.

21. It may also be noted that the utilities' financial contribution to the investment program reflects the burden directly imposed upon the present consumers to finance future expansion. In Brazil, the consumers as a whole seem to have borne a fair share of this burden through 1975. It will, therefore, be misleading to conclude that the tariffs, in general, should have been substantially increased, based on the review of the financial situation of any single utility in isolation.

Bank Role

22. Bank evaluation procedures and reporting requirements were generally found useful and constructive by the borrower. In the opinion of the borrower, Bank involvement in the projects enabled it to obtain funds from overseas sources readily and at terms more attractive than would otherwise have been the case.

SECTION III

Conclusions

23. The two projects were successfully executed and became operational when they were most required. They appeared at the time to be the best alternatives to meet CEMIG's load growth. In retrospect, this view is confirmed.

24. Problems with dam foundations on an earlier hydroelectric project on the Rio Grande might have suggested extra care in investigating the foundation conditions at Volta Grande and Jaguara. In retrospect, the decision to go ahead with construction, on balance, turned out favourably in both cases. While additional investigations could have resulted in savings in re-engineering and remobilization costs on both projects, and additionally reduced the actual quantities in the case of Jaguara, they could have also delayed the completion of the projects. The consequences of these delays in terms of power shortage on the borrower's system, would probably have been much more expensive than the savings which might have yielded as a result of additional investigations.

25. The large proportion of the industrial load, particularly metallurgical, suggests that the projects undoubtedly contributed to the industrial expansion within the state and consequently to the economic development of the state as a whole. The projects also contributed towards an adequate increase in electricity service to the urban population, but disproportionately little towards the rural population. In future loans for power generation, the Bank and the borrower might like to consider setting some predetermined targets for electricity service to rural population.

26. The operating results of the borrower have been good through 1976, but during the last three years, its net internal cash generation contributed only a very small proportion towards the large investment program. However, this does not take into consideration the indirect contribution from advances and taxes on CEMIG's sales and assets. The advances and a major proportion of the taxes are channelled to ELETROBRAS. They are returned to CEMIG largely as medium term loans rather than equity contributions, thus substantially reducing CEMIG's internal contribution to construction expenditure.

27. ELETROBRAS had agreed to maintain its 16% share of equity in CEMIG. But, because of CEMIG's large investment program relative to its earnings base, a more realistic approach from the accounting standpoint would have been to additionally link ELETROBRAS equity contribution to a proportion of CEMIG's investment program or total net fixed assets.

Key Indicators and Other Information
(all figures are actual, unless otherwise indicated)

		1970	1971	1972	1973[a/]	1974	1975	1976
Total Installed Capacity (MW)		671	676	1,117	1,148	1,229	1,516	1,515
System Peak Demand (MW)		770	831	949	1,070	1,195	1,386	1,628
Growth Rate p.a. (%)			8	14	13	12	16	17
Load Factor (%)		68	74	71	69	71	71	71
Total Energy Sales (GWh)	est. (Jaguara)	4,497	5,163	5,900	6,717	7,622	n.a.	n.a.
	est. (Volta Grande)	4,100	4,880	5,650	6,377	7,201	7,998	8,770
	act.	4,153	4,904	5,352	5,920	6,788	7,839	9,180
Growth Rate p.a. (%)			18.1	9.1	10.6	14.7	15.5	17.1
Industrial Sales (% of Total)		67	68	69	71	72	73	74
Metallurgical Industries (% of Total)		48		50	48	47	50	50
Average Tariff (current ¢/KWh)			7.36	9.61	12.06	15.65	20.82	27.09
Operating Ratio (%)		51	52	38	39	38	37	37
General Price Index		100	120	141	162	208	266	376
Customers/Permanent Employee		n.a.	n.a.	91	117	121	122	125
Sales/Permanent Employee (MWh)		n.a.	938	1,019	876	971	1,033	1,127
Purchase from FURNAS								
Demand (MW)	est. (Contracted)	225	235	250	330	375	450	450
	act.	240	285	250	333	375	450	491
Energy (MWh)	est. (Porto Colombia)	1,078	1,222	1,295	1,631	1,913	2,268	2,350
	act.	953	1,661	686	816	664	678	1,925
Total Energy Purchased (GWh)		960	1,854	250	647	655	658	2,448

a/ Companhia Forca e Luz de Minas Gerais was integrated with CEMIG.

Electricity Service to Urban and Rural Population in the State of Minas Gerais (SOMG)

	1970 mill.	(%)	1972 mill.	(%)	1974 a/ mill.	(%)	1976 mill.	(%)	1978 b/ mill.	(%)
1. Total Population of SOMG	11.82		12.31		12.81		13.34		13.89	
of which in CEMIG's area	8.39		8.78		9.18		9.60		10.05	
2. Total Urban Pop. of SOMG c/	6.22	(53)	6.77	(55)	7.35	(57)	7.97	(60)	8.62	(62)
of which in CEMIG's area	4.94		5.40		5.90		6.42		6.98	
3. Total Rural Pop. of SOMG c/	5.61	(47)	5.54	(45)	5.46	(43)	5.37	(40)	5.27	(38)
of which in CEMIG's area	3.46		3.37		3.28		3.18		3.07	
4. Total Pop.of SOMG with Elec.Service	3.52	(30)	3.97	(32)	4.52	(35)	5.37	(40)	6.36	(46)
a. of which CEMIG supplied	2.84		3.23		3.70		4.32		5.30	
b. % supplied in CEMIG's area		(30)		(37)		(40)		(45)		(53)
5. Total Urban Pop.with Elec.Service	3.40	(55)	3.83	(57)	4.35	(59)	5.27	(66)	6.23	(72)
a. of which CEMIG supplied	2.75		3.11		3.55		4.34		5.18	
b. % supplied in CEMIG's area		(56)		(58)		(60)		(68)		(74)
6. Total Rural Pop.with Elec.Service	.117	(2)	.140	(3)	.170	(3)	.095	(2)	.129	(2)
a. of which CEMIG supplied	.096		.119		.147		.083		.116	
b. % supplied in CEMIG's area		(3)		(4)		(4)		(3)		(4)

CEMIG's Distribution Network (km)

1.	Urban	9,677	11,665	12,543	14,249	16,749
2.	Rural	4,946	7,158	20,840	29,440	42,840

CEMIG's Investment in Distribution (Million Cruzeiros)

1.	Current Prices	33.010	16.068	102.582	320.321	962.899 d/
2.	Constant Prices	33.010	11.396	49.318	85.110	n.a.
	General Price Index	100	141	208	376	n.a.

---

a/ In 1973 Companhia Forca Luz de Minas Gerais (almost entirely a distribution company in the City of Belo Horizonte and recipient of Bank loan 478-BR for US$6.3 million in 1966) was integrated with CEMIG.

b/ Estimated

c/ There was a re-classification of Urban and Rural areas in 1974.

d/ Mid-1977 prices.

Source: CEMIG. (The audit has not examined the validity of the criteria used in arriving at the number of people served with electricity).

Financial and Costs Aspects

(All figures in billion Cruzeiros at '67 prices, unless stated otherwise)

CEMIG		1974	1975	1976
Net Fixed Assets in Operation	- est.	1,438	1,519	n.a.
	act.	1,032	1,203	1,154
Capital Expenditure	- est.	118	108	
	act.	320	500	500
Capital Exp. as % of net Fixed Assets in Operation	- est.	8	7	
	act.	31	41	43
Net Operating Income	- est.	152	163	
	act.	128	135	140
as % of Capital Exp.	act.	40	27	28
Work in Progress as % of Net Fixed Assets in Oper.	act.	44	55	84
Reversion	act.	33	48	50
as % of Capital Exp.	act.	10	9.5	10
Sole Tax	act.	35	38	43
as % of Capital Exp.	act.	11	7.7	8.5
Debt Service				
Sector				
Other				

Appraisal Estimates	Jaguara (400 MW + 200 MW) a/	Volta Grande (400 MW)	Sao Simao (1,000MW + 1,500MW) a/
Unit Cost/KW (Generation Capacity) b/	US$152	US$152	US$301
Total Capital Cost (incl. Transmission)	US$90 mill.	US$95 mill.	US$396 mill.
Completion Time (years)	5 years	5 years	6-7 years

a/ To be installed at a later stage.

b/ Excluding interest during construction.

APPENDIX 4

Projected Sources and Application of Funds for the Power Sector (1976-80)

(Cr x 10^9 at mid-1976 price levels).

	Sources	1975[a/]	as % of Investment Sub-Total	1976-80	as % of Investment Sub-Total
1.	Concessionaires				
	Internal Cash generation	3.98	17	41.45	20
2.	State and Municipalities				
	Sole Tax	1.32	6	13.41	
	Dividends Reinvested	1.27		14.83	7
3.	Eletrobras				
	Sole Tax	.85	4	5.09	
	Compulsory Loan	2.02		19.27	
	Reversion	1.44		25.70	
	Other	3.03		26.33	
4.	Sector Sub-Total (Gross)	13.91	61	146.06	71
	Sector Sub-Total (Net)*	10.37 *	45 *	128.84*	62*
5.	Federal & State Govt. Budget	2.48		5.94	
6.	Banks, etc. (National)	4.31		8.49	
7.	Foreign Loans	5.80	25	8.57	4
8.	(Deficit)	nil		(67.5)	
	TOTAL SOURCES	26.50		236.58	
	Applications				
9.	Investment (excl. IDC)	20.77		202.98	
10.	Inventory & Cash Changes	2.19		2.36	
	Investment Sub-Total	22.96		205.34	
11.	Amortization	1.47		16.38	
12.	Interest, etc.	2.07		14.86	
13.	Debt Service (Ext. Sector) Sub Total	3.54 *		31.24 *	
	TOTAL APPLICATIONS	26.50		236.58	

a/ Estimate. For the 5-year period 1971-75 the Sector's Sub-Total (net) was 56%.

* After deduction of Debt Service (item 13) external to the Sector.

Source: ELETROBRAS: Orcamento Plurianual do Setor de Energia Eletrica (1976-1980).

Attachment

BRAZIL: JAGUARA POWER PROJECT

LOAN 442-BR

PROJECT COMPLETION REPORT

1.	Borrower:	Centrais Eletricas de Minas Gerais S.A. (CEMIG)
2.	Guarantor:	The United States of Brazil
3.	Loan amount:	US$49.0 million equivalent
4.	Date loan signed:	March 15, 1966
		1st amendment: December 19, 1966
		2nd amendment: April 27, 1971
		3rd amendment: October 31, 1973
5.	Effective date:	May 1, 1967
6.	Closing date:	Original: April 30, 1971
		Actual: December 31, 1974
7.	Period of grace:	5 years
8.	Term of loan:	25 years
9.	Interest rate:	6.0% p.a.
10.	Commitment charge:	3/8 of 1%
11.	Amortization:	semi-annually beginning October 1, 1971 and ending April 1, 1991
12.	Exchange rate:	at time of appraisal: 1US$ = Cr$2.220 December 30, 1974 1US$ = Cr$7.435 October 30, 1976 1US$ = Cr$11.55
13.	Appraisal report:	TO-514b dated February 25, 1966
14.	Fiscal year:	Calendar year

15. Identification and Preparation of the Project

15.1 An in-depth study of 6 major basins in the South-Central region of Brazil was started in 1962 by CANAMBRA, a consortium of consulting firms led by Montreal Engineering Co. (Canada), under a United Nations Special Fund grant, for which the Bank acted as Executing Agency. It was aimed primarily at identifying the most economical ways of meeting the power demand of the seventies in this entire region.

15.2 CANAMBRA completed in 1964 an interim report proposing an investment program for the next 4 years, in which the Jaguara Hydroelectric Project had the second highest priority (after the Estreito Project that the Bank also financed by loan 403-474 BR, dated February 26, 1965). A Bank mission appraised the project in September-October 1965 and, in March 1966, CEMIG received a Bank loan of US$49 million towards a total cost originally estimated at US$90 million.

15.3 Preparation of the project by the consultants was considered adequate by both the Bank and the Borrower. However, in spite of their detailed geological surveys a weak schist layer was subsequently uncovered during construction (para. 28.2); it was deemed by CEMIG's cautious management to involve a possible risk and the initially proposed layout was revised.

16. Project Description

16.1 The Jaguara Power Project originally consisted of:

(a) a rockfill dam, 40 m. in height on the Rio Grande;

(b) a power house with 4 generating units of 100 MW each and provisions for 2 future units of 100 MW;

(c) a concrete spillway with tainter gates;

(d) a substation in Belo Horizonte and 390 km of 345 KV transmission lines joining Jaguara with the Estreito plant and the city of Belo Horizonte (Taquaril); and

(e) a section bay at the Estreito plant.

16.2 As there were substantial savings on certain Bank-financed items (para. 20.4) the project was modified in April 1971 (by means of an amendment to the loan), to include three 345 kV transmission lines totalling 475 km between the Volta Grande plant and the city of Belo Horizonte (through Jaguara), which were taken out of Loan 566-BR (Volta Grande Project) at the same time.

17. Objective and Justification

17.1 The main sector objective of the Jaguara Project was to allow CEMIG to contribute to satisfy the power demand of the seventies in the South-Central region of Brazil most economically, according to the recommendations of the CANAMBRA study. On the basis of this study, the appraisal report forecast a fast growth in CEMIG's market for the beginning of the period (18.2% increase from 1966 to 1967) gradually slowing down during the years 1967-1974 (to 13.5% increase from 1973 to 1974). (Annex 4). CEMIG's actual growth did not meet these market forecasts mainly because the growth of the residential consumers' market was slower than initially projected while the growth of the industrial market barely kept up with expectations. As a result,purchases of power by CEMIG from other utilities,(principally FURNAS) have been substantially lower than expected (655 GWh instead of 2,400 GWh forecast for 1974).

17.2 As already noted, the project was ranked second in the list of priority projects identified by CANAMBRA (on the basis of an index of investment cost per kilowatt installed at the system's load factor) for meeting the market requirements of the Region. Due to the very low estimated investment cost per kilowatt of the project (US$165, excluding transmission), and the backing of the CANAMBRA findings, the calculation of the equalizing discount rate with a thermal alternative or of an economic rate of return was not included in the appraisal report. Although the actual investment cost per kilowatt (excluding transmission) was US$267, substantially higher than expected in current terms, it was in fact slightly lower in constant 1965 prices 1/, and the project is even more attractive than anticipated by the CANAMBRA study when compared with a thermal alternative. Also, an ex-post analysis shows that the project as appraised would have had a return on investment of 23% (Annex 8). A similar analysis, based on actual costs incurred and actual tariffs

1/ Brazil's general price index (Get. Vargas Foundation) has been used to deflate actual figures.

(both in constant 1965 prices) , gives a return of 28%; the difference is due to the fact that, in constant prices,investment costs have been slightly lower, while tariffs increased since 1972 slightly faster than forecast.

18. Closing Date

18.1 The closing date was first extended from April 30, 1971 to April 30, 1973 to enable CEMIG to complete the additional transmission lines newly included in the loan (para. 16.2) as well as to allow for the construction delays due to initial foundation defects, and for the payment of retention amounts on several purchases.

18.2 The closing date was finally extended to December 31, 1974, to provide sufficient time for the issuance of Final Acceptance Certificates on defective equipment and the payment of retention amounts on purchases of some electrical equipment.

19. Construction Schedule

19.1 In spite of substantial initial lay-out difficulties due to foundation problems, which led to a change in the axis of the dam,the construction of the dam and spillway as well as the installation of the first four generating units were completed with a delay of only 7 months. Given the type of difficulty encountered, this is a remarkable performance for which full credit should be given to CEMIG.

19.2 Although the Taquaril substation (first stage), also a part of the original project, was not completed until January 1973, due to difficulties in procuring equipment conforming to required specifications, the use of existing CEMIG transmission lines and of the FURNAS system through interconnection proved sufficient for carrying the energy generated by the Jaguara plant during the intermediary period (February 1971 to December 1972).

19.3 Of the 3 additional transmission lines subsequently covered by Loan 442-BR, only two, namely Volta Grande-Jaguara and Jaguara-Pimenta, had been completed by the time the last unit of the Volta Grande plant was installed, i.e. August 1975. The third section, Pimenta-Barbacena-Taquaril was expected to be completed by November 1976 only, due to late delivery of transformers for the Barbacena substation and

other minor equipment as well as terrain difficulties; in spite of this delay, however, the energy generated by the Volta Grande plant has been adequately transmitted through CEMIG and FURNAS existing facilities. A temporary shift in load dispatch in the Central and Southern part of the State of Minas Gerais was required. A map of transmission lines is given in Annex 9.

19.4 In conclusion, it appears that the various delays that occurred in the completion of transmission lines did not adversely affect the distribution of the energy generated by the Volta Grande and Jaguara plants. The Jaguara plant itself went into operation approximately within the original schedule.

20. Project Costs

20.1 The original cost estimate for the Project was US$90 million (including interest during construction of US$ 6.8 million on the IBRD loan and providing only for physical contingencies);total actual costs incurred on the final project as of October 1976 were US$151.44 million and include the cost of additional Volta Grande transmission lines as well as interest capitalized on local financing (which was not included in the appraisal estimate). Excluding Volta Grande lines and financial charges (Annex 5), the cost overrun represents only 28%, explained mostly by cost increases in civil works and engineering, partially offset by a decrease in the cost of electrical and mechanical equipment.

20.2 The very significant increase in engineering costs (287%) is due to:

(a) revision of the initial lay-out due to foundation problems;

(b) reclassification under the engineering category of the supervision of electrical equipment installation and of the engineering work undertaken for the transmission system (including additional Volta Grande lines).

20.3 The substantial increase in civil works costs (130%) is due to:

(a) local inflation coupled with the increasing lag between rising local construction costs and foreign exchange parity readjustments;

(b) special excavation and additional concrete filling required by the change in lay-out;

(c) the extra effort in labor and equipment CEMIG devoted to making up for the delay.

20.4 The 23% decrease in the cost of electrical and mechanical equipment is due to:

(a) unusually favorable international market conditions at the time of contracting of foreign equipment of this type (years 1970-1971);

(b) reclassification of related engineering work (para. 20.2).

21. Allocation of the Proceeds of the Loan (in US$ equivalent)

21.1		Original	Final
A.	Civil Works	5,600,000	9,449,458
B.	Electrical and Mechanical equipment	18,500,000	13,567,277
C.	Transmission and substation equipment and materials	12,200,000	16,815,053
D.	Construction and operating equipment and spare parts	1,900,000	(in categ. A)
E.	Consulting services (engineering)	500,000	2,360,064
F.	Unallocated	3,500,000	-----
G.	Interest capitalized	6,800,000	6,808,148
	TOTAL	49,000,000	49,000,000

21.2 The loan was intended to be disbursed against the following goods and services to be procured on the basis of international competitive bidding:

(a) the cost of all permanent equipment for the project;

(b) construction equipment;

(c) other direct or indirect foreign exchange components of the cost of the main civil works contract.

21.3 It was estimated that about US$ 6 million, i.e 12% of the loan would finance local materials and equipment. Overall, however, it appears that the loan fell slightly short of the total foreign exchange component of the project, i.e. US$ 53.7 million, (based on CEMIG's estimates revised by the Bank). (Annex 5).

22. Procurement

22.1 The main contracts were awarded to the following companies:

(a) Civil works: Constructora Jose Mendes Jr. (Brazil)

(b) Turbines and governors: Mitsubishi (Japan)

(c) Generators: Siemens (Germany)

(d) Transformers: Asea (Sweden)

(e) Gates: Riva Calzoni (Italy) and Krupp (Germany)

22.2 The procurement of goods to be financed by the Bank loan was through international competitive bidding and local firms were given a 15% margin of preference for equipment and materials.

22.3 Foreign bidders for civil works had to associate themselves with an experienced Brazilian firm, as required by the Brazilian Government. The Government committed itself, by means of the Guarantee Agreement, to alleviate legal and administrative obstacles to the importation of construction and permanent equipment by power projects contractors. Since then, those obstacles have been greatly reduced.

23. Operating Results

23.1 Over the entire period 1966-1974, CEMIG's net operating income fell short of original expectations by 10% in constant 1965 prices due mainly to a total shortfall in sales of 3,700 GWh (para. 17); although operating expenses for administration and operation were higher than forecast by 56% in constant prices due mainly to a rise in the cost of labor, this was more than offset by a lower cost of purchased power (in constant prices).

23.2 During the period considered, CEMIG's earnings record has been quite satisfactory: its financial rate of return (defined as net operating income as a percentage of average net revalued fixed assets in operation)was, on the whole, substantially higher than forecast, ranging from a low of 11.8% in 1969 to a high of 14.9% in 1972; this was permitted by the Brazilian law which provided, for all power companies, for a minimum rate of return of 10% on remunerable investments (defined on a different basis so that it is not directly comparable with the returns mentioned above).

24. Financing Plan

24.1 A summary of the financing sources of the whole expansion program for the 1966-1974 period is shown below and demonstrates the greater emphasis on borrowings than had been originally forecast (detailed Funds Statements are given in Annex 3).

	Actual		Appraisal Estimate	
	Constant 1965 Cr$ 10^6	%	Constant 1965 Cr$ 10^6	%
- Borrowings	548	58	228	30
- IBRD (442-BR)	68[1/]	8	110	14
- ELETROBRAS (Jaguara)	40	4	21	3
- Others 2/	440	46	97	13
- Internal cash generation	80	8	275	36
- State and ELETROBRAS equity funds	262	28	210	27
- Other equity funds	57	6	54	7
TOTAL	947	100	767	100

24.2 CEMIG's construction expenditures in constant prices during the period 1966-74 were higher than forecast in the appraisal report by 24% (Annex 3); the overrun was incurred mainly in the last 3 years of this period and is due to:

(a) the addition to the construction program of the Igarapé thermal plant (125 MW) (para. 27.2);

(b) an increase in the size of the Sao Simao project (from 1000 MW originally forecast to 1,620 MW);

(c) cost overruns in real terms on Volta Grande and Sao Simao projects due to the fact that construction costs have been rising faster than general prices.

1/ Corresponds to 49 millions of current US dollars.
2/ Including IBRD and ELETROBRAS loans for projects other than Jaguara.

24.3 This significant increase in constant 1965 prices in the construction program has not been paralleled by an increase in constant prices of CEMIG's gross internal cash generation, which, on the contrary, was, for the same period 1966-74, lower than forecast by 23%; this shortfall is due to the slower than expected growth of CEMIG's market, although tariffs, in constant 1965 prices have on the average substantially kept up with the original projections.

24.4 The increase in the construction program was not offset either by higher capital contributions which, in constant prices, were in accordance with the appraisal figures, after adjustment for the reinvestment of stock dividends by ELETROBRAS and the State Government. In the same manner, the aggregate of contributions in aid of construction and federal grants, corresponds roughly to the appraisal estimate.

24.5 As a result, the need for additional financing brought about by higher construction expenditures and lower internal cash generation had to be filled with borrowings in amounts significantly higher (by 140% in constant prices for the entire period) and at harder terms (particularly on ELETROBRAS loans, characterized by short grace periods), than had been forecast in the appraisal report, which themselves entailed an increase of 25% of the debt service over the period (and will increase heavily CEMIG's debt service burden over the next decade). On the whole, while debt was forecast to finance only 30% of the investment program for the period, it actually represented 58% of CEMIG's financing resources. For the year 1974, 70% of CEMIG's investments were financed through borrowings, mainly from ELETROBRAS and foreign private banks. Reflecting this evolution, both the debt/assets ratio and the debt service coverage ratio have deteriorated since 1971(Annex 7), reaching levels of 45.3% and 1.8 in 1974 and finally 51.2% and 1.3 in 1975.

25. Forecast Financial Performance

25.1 CEMIG's future earnings will be supported by the combination of two positive factors:

(a) the company's proven operating efficiency;

(b) good market growth prospects

25.2 However, CEMIG's future overall financial structure may be affected by two negative factors:

(a) while optimistic projections have been made on the basis of a 12% rate of return (maximum allowed), the federal authorities may only allow CEMIG the minimum 10% (as was the case in 1975);

(b) the rate of increase of construction costs may continue to be higher than the rate of increase of tariffs permitted by the Government.

As a result, CEMIG may need more borrowings than it expects if equity financing is not raised adequately, in one form or another, in order to satisfy its heavy investment requirements of the coming years; if no remedy is found, CEMIG's indebtedness may very well soon reach excessive levels, marked by a debt service coverage ratio well below 1.5 (paragraph 26.2).

26. Covenants

26.1 The Government and the State of Minas Gerais have complied with all their undertakings under the Guarantee Agreement and the Project Agreement respectively (Annex 6). In particular the interconnected operation of power utilities in the South-Central region is now efficient; the creation of a Coordinating Group for Interconnected Operations (GCOI) in 1973 has led to substantial progress in the coordinated allocation of reserve capacity.

26.2 CEMIG has complied with all of its obligations under the Loan Agreement (as amended). Since 1975, CEMIG has been unable to meet the debt service coverage test defined in the loan covenant, whereby the company cannot incur any new debt without the Bank's agreement when net revenues for the last 12 months do not cover 1.5 times the debt service requirements on all outstanding debts (including the debt to be incurred) in any succeeding year (Annex 6);it complied, however with the covenant, by asking for the Bank's agreement before incurring any new debt. As mentioned earlier (para. 25.2); there is a good possibility that this situation will continue in the coming years and the Bank should act to help prevent CEMIG's potential financial structure problems by encouraging the Federal and/or State Authorities to increase substantially their contribution to CEMIG's capital and soften the terms of their loans, in the context of the preparation of any new project to be considered by the Bank.

26.3 It can be noted that under the debt limitation covenant in its original form (before amendment), which only limited the Borrower's debt to 66-2/3% of its total fixed assets, the Bank would not have been able to review CEMIG's borrowings, since its indebtness never reached that level. This tends to prove the inadequacy of this type of debt limitation covenant in this case.

27. Organization and Management

27.1 CEMIG was incorporated in 1952 as an autonomous corporation where the majority shareholder is the State of Minas Gerais and an important minority shareholder is ELETROBRAS (a Federal Government holding company). It had, at the end of 1975, an installed capacity of 1,522 MW. Its share capital went up from Cr$70 million at the time of appraisal to Cr $2,820 million as of December 1975, but its composition has not changed significantly, as shown below:

	July 31, 1965	December 31, 1975
State of Minas Gerais	65.6%	65.8%
ELETROBRAS	15.5%	17.4%
Others	18.9%	16.8%

27.2 ELETROBRAS complied with the obligation it had undertaken as a condition of effectiveness of the loan, to keep its participation level above 16%.

27.3 CEMIG is and has been competently managed and staffed and its operating personnel has been adequately trained to operate the project. However, the very cautious attitude of the management, as illustrated at the engineering stage of the Jaguara Project (para. 15.3), has also led CEMIG to somewhat stray away from the concept of a Region-oriented (rather than State-oriented) development of the power sector, embodied in the CANAMBRA study (para. 15.1); in particular, its investment in the Igarapé thermal plant appeared to be based more on self-sufficiency considerations than on economic analyses; CEMIG was responsive, however, to Bank advice and limited its investment thereon (125 MW instead of 400 MW orginally planned). Thereafter the Bank went on to amend the major expansion loan covenant which now requires CEMIG to ask for the Bank's agreement on any major generation expansion project which would depart from a specifically agreed-upon program (Annex 6).

28. Consultants

28.1 CEMIG retained ELETROPROJETOS, a Consortium formed by the firms Electrowatt (Switzerland) and Eletroprojetos and Geotecnica (Brazil) for preliminary studies and all the necessary engineering (including supervision of construction) of the project. During the construction period, CEMIG also had the assistance of individual consultants such as Professor A. Casagrande and V. Mello for specific assignments.

28.2 The Bank and the Borrower were satisfied with the performance of both the Consortium and the individual consultants. The fact that the geological studies failed to detect the weak shist layer should not be construed as an indication of poor performance by the consultants as geological studies cannot be expected, in the absence of a complete removal of the top strata, to completely indicate the nature of the underlying ones; the overrun in consulting fees was reasonable in view of the consequent need for additional work. (para. 20.2).

29. Lessons to be Learned

29.1 A lesson can be learned from the experience of this project, on the inadequacy of certain types of covenant:

(i) the insufficiency of the original major expansion covenant (based merely on the financial capacity of the firm to implement new projects) might have led the Borrower to undertake investment aiming at self-sufficiency rather than at a Region-oriented (instead of State-oriented) development of the power sector; this was prevented by a modification of the covenant (by way of an amendment to the loan), which now requires the Borrower to ask for the Bank's agreement on any major departure from a specifically agreed-upon program;

(ii) the original formulation of the debt limitation covenant (limiting the Borrower's debt to 66-2/3% of its total fixed assets) proved a posteriori similarly inadequate since it would not have enabled the Bank to review CEMIG's borrowings, which the amended covenant (debt service coverage test) now permits.

29.2 Also, it appears that the difficulty to estimate the effects of future local and worldwide inflation in CEMIG's financial forecasts, has led to a significant divergence between its forecast and actual financial situation. It is clear that in a country where, during the project implementation period, the lags increased between local construction costs and foreign exchange parity readjustments, as well as between the revaluation index replacement costs, a realistic evaluation of a firm's future financial situation cannot be made without taking into account those effects.

Latin America and the Caribbean Regional Office
December 28, 1976

BRAZIL

CENTRAIS ELETRICAS DE MINAS GERAIS S.A. (CEMIG)

LOAN 44[illegible]-BR

Balance Sheets - Appraisal Estimate Compared with Actual (in Constant 1965 Cruzeiros*)

(millions of Cruzeiros)

	1966		1967		1968		1969		1970		1971		1972		1973		1974	
	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate
ASSETS																		
Fixed Assets																		
Fixed Assets in operation	163.15	285.22	230.28	325.11	240.68	359.94	282.34	389.51	322.13	485.75	391.43	579.55	515.65	699.80	725.65	783.23	870.08	886.11
Less Depreciation reserve	13.43	20.64	21.57	30.20	27.20	40.78	35.69	52.24	39.84	66.52	53.22	83.56	67.77	104.13	96.35	127.15	110.85	153.20
Net fixed assets in operation	149.72	264.58	208.71	294.91	213.48	319.16	246.65	337.27	282.29	419.23	338.21	495.99	447.88	595.67	629.30	656.08	759.23	732.91
Work in progress	52.80	37.54	41.74	81.03	59.89	142.67	108.87	188.32	170.95	176.72	168.00	157.68	159.28	114.87	265.91	116.82	284.07	100.58
Total fixed assets	202.52	302.12	250.45	375.94	273.37	461.83	355.52	525.59	453.24	595.95	506.21	653.67	607.16	710.54	895.21	772.90	1,043.30	833.49
Investments	4.62	2.44	8.76	2.44	8.00	2.44	6.51	2.44	7.06	2.44	7.14	2.44	5.38	2.44	8.84	2.44	8.60	2.44
Current Assets																		
Cash and Banks	4.90	20.26	3.43	16.08	4.73	8.71	6.10	9.67	5.65	21.34	6.89	33.13	17.36	44.01	5.88	41.70	12.86	35.88
Inventories	13.71	3.84	18.43	3.96	12.39	4.20	15.74	4.44	17.58	4.68	13.65	4.92	13.21	5.16	16.04	5.40	24.55	5.64
Accounts Receivable	5.39	2.95	6.40	3.43	15.81	5.10	11.00	6.40	12.20	7.60	12.89	8.20	18.79	9.60	23.58	12.00	19.39	12.80
Other Current Assets	10.56	7.88	9.49	7.88	5.61	7.88	8.27	7.88	8.01	7.88	27.34	7.88	4.68	7.88	12.35	7.88	13.21	7.88
Total Current Assets	34.56	34.93	37.75	31.35	38.54	25.89	41.11	28.39	43.44	41.50	60.77	54.13	54.04	66.65	57.85	[illegible]	70.01	62.20
Other Assets	7.48	-	5.39	-	13.72	-	8.75	-	7.93	-	5.53	-	3.86	-	3.57	-	7.74	-
TOTAL ASSETS	249.18	339.49	302.35	409.73	333.63	490.16	411.89	556.42	511.67	639.89	579.65	710.24	670.44	779.63	965.47	842.32	1,129.65	898.13
LIABILITIES																		
Equity																		
Share Capital	160.87 1/	201.60	199.49 1/	236.05	161.43	277.94	172.95	320.71	165.94	377.97	231.57	424.25	212.13	479.45	246.98	536.99	259.80	599.05
Contribution in aid of construction	2.[illegible]	1.63	12.30	1.63	7.81	1.63	7.92	1.63	9.30	1.63	9.17	1.63	7.92	1.63	10.73	1.63	11.29	1.63
Legal Reserve	1.12	1.80	1.91	2.83	2.65	4.02	3.46	5.34	4.16	7.08	4.96	8.93	6.20	11.34	7.57	14.04	8.16	16.89
Surplus	.07	.21	.62	1.00	1.27	1.65	4.74	1.47	10.32	1.58	15.50	2.84	24.27	70	32.64	.31	40.11	.31
Revaluation Reserve	-	.48	-	.48	22.88	.48	60.29	.46	89.16	.48	59.25	.48	95.96	.48	157.95	.48	217.56	.48
Amortization Reserve	4.83	3.94	4.61	3.94	4.[illegible]	3.94	4.75	3.94	4.73	3.94	5.82	3.94	5.86	3.94	7.67	3.94	9.05	3.94
Other Reserves	-	-	-	-	18.57	-	.93	-	3.44	-	8.13	-	31.60	-	47.28	-	33.81	-
Government Grants	16.64	32.37	6.29	39.57	-	44.37	-	47.97	-	51.31	-	54.65	-	57.97	-	61.29	-	63.51
Total Equity	186.47	242.03	225.22	285.50	219.10	334.03	255.04	381.54	287.05	436.9[illegible]	334.40	496.72	383.94	555.51	510.82	615.68	579.78	685.81
Long-Term Debt	47.76	85.39	53.65	111.99	70.57	142.79	104.21	160.41	168.11	185.71	193.46	[illegible]	22[illegible].71	201.67	378.10	[illegible]	472.18	190.54
Less Current Maturities	6.01	10.46	4.27	9.91	4.49	9.38	[illegible]	9.76	7.54	11.37	19.28	12.54	22.30	11.70	[illegible]	9.39	31.82	11.41
Net Long-term debt	41.75	74.93	49.38	102.08	66.08	133.41	[illegible]	150.65	160.57	174.34	174.18	183.45	207.41	[illegible]	[illegible]	1[illegible]0.54	440.36	179.13
Current [illegible]																		
Current [illegible] of Long-term Debt	6.01	10.46	4.27	9.91	4.49	9.38	5.73	9.76	7.54	11.37	19.28	12.54	22.30	11.70	35.68	[illegible].39	31.82	11.41
Accounts Payable	9.44	6.42	15.39	6.59	30.41	7.69	28.00	8.82	29.54	11.54	29.02	11.88	23.11	16.80	46.84	18.06	37.23	16.13
Other Current Liabilities	3.08	5.65	5.17	5.65	4.81	5.65	10.65	5.65	11.89	5.65	11.50	5.65	6.1[illegible]	5.65	12.33	5.65	23.54	5.65
Total Current Liabilities	18.53	22.53	24.83	22.15	39.71	22.72	44.38	24.23	48.97	28.56	59.80	30.07	51.54	34.15	95.05	33.10	92.59	33.19
Other Liabilities	2.43	-	2.92	-	8.74	-	13.99	-	15.08	-	11.27	-	27.50	-	17.38	-	16.92	-
TOTAL LIABILITIES	249.18	339.49	302.35	409.73	333.63	490.16	411.89	556.42	511.67	639.89	579.65	710.24	670.44	779.63	965.47	842.32	1,129.65	898.13

* To take inflation into account, actual figures have been adjusted according to the variations of the Brazil general price index (Getulio Vargas Inst., at the end of each year, to the time of appraisal (Oct. 1965) (Oct. 1965 100, Dec 1966 143, 1967 178, 1968 223, 1969 268, 1970 320, 1971 383, 1972 445, 1973 512, 1974 68[illegible])

1/ includes revaluation reserve

September 1[illegible]

ANNEX 17A

BRAZIL

CENTRAIS ELETRICAS DE MINAS GERAIS S.A. (CEMIG)

LOAN 442-BR

Income Statements - Appraisal Estimate Compared with Actual (in Constant 1965 Cruzeiros*)

(millions of Cruzeiros)

	1966		1967		1968		1969		1970		1971		1972		1973		1974	
	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate
kWh Sales (millions)	2,353	2,424	2,595	2,865	3,150	3,354	3,542	3,806	4,153	4,497	4,904	5,163	5,353	5,900	5,902	6,717	6,788	7,622
Average price per kWh (centavos)	1.5	1.9	1.8	1.8	1.9	2.1	2.0	2.3	2.1	2.4	2.1	2.1	2.3	2.3	2.6	2.5	2.5	2.4
OPERATING REVENUES	35	45	48	52	60	71	71	90	87	108	102	106	125	138	151	171	171	183
OPERATING EXPENSES																		
Operation, Maintenance, Adm.	8	9	12	10	16	11	18	12	19	14	28	14	24	16	31	18	36	19
Purchased power	1	-	3	2	7	16	16	32	23	36	24	22	23	38	28	61	29	62
Exchange difference	2	-	1	-	1	-	1	--	1	-	1	-	2	-	-	-	2	-
Depreciation	5	8	8	10	8	11	7	11	7	14	10	17	15	21	16	23	16	26
Others	4	-	2	-	2	-	2	-	2	-	2	-	-	-	-	-	-	-
Total operating expenses	20	17	26	22	34	38	44	55	52	64	65	53	64	75	75	102	83	107
OPERATING INCOME	15	28	22	30	26	33	27	35	35	44	37	53	61	63	76	69	88	76
Reversion	-	-	-	-	-	-	-	-	-	-	-	-	(7)	-	(18)	-	(18)	-
Other income	1	-	-	-	-	-	-	-	-	-	-	-	(2)	-	-	-	(4)	-
INTEREST																		
Interest paid	4	5	4	7	6	9	8	9	17	11	18	13	21	12	20	12	23	12
Less interest charged to const.	(2)	(1)	(3)	(2)	(4)	(3)	(6)	(4)	(11)	(6)	(16)	(2)	(14)	(3)	(12)	(3)	(13)	-
Interest charges	2	4	1	5	2	6	2	5	6	5	2	11	7	9	8	9	10	12
Income tax	-	4	-	5	-	4	-	4	-	4	-	5	1	6	1	6	1	7
Other deductions	-	-	-	-	-	-	-	-	3	-	4	-	3	-	2	-	1	-
NET INCOME	14	20	21	20	24	23	25	26	26	35	31	37	34	48	47	54	54	57
Allocated to																		
Legal reserve (5%)	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3
Dividends declared in cash (private)	2	6	4	6	4	7	4	9	4	12	6	12	7	17	7	18	7	16
Stock dividends to ELETROBRAS	2		3		4		3		3		3		4		6		6	
Stock dividends to State Government	9	12	12	12	14	14	13	16	12	21	14	22	17	31	19	33	22	38
Surplus retained	-	1	1	1	1	1	4	-	6	-	6	1	4	(2)	13	-	16	-

* To take inflation into account, actual figures have been adjusted according to the variations of the Brazil general price index (Getulio Vargas Inst.) - yearly average, from the time of appraisal (Oct. 1965) (Oct. 65 100, Dec. 1966 129, 1967 165, 1968 205, 1969 246, 1970: 297, 1971: 357, 1972: 418, 1973. 481, 1974. 631).

ANNEX 4/A

October 1976

BRAZIL

CENTRAIS ELETRICAS DE MINAS GERAIS S.A. (CEMIG)

LOAN 442-BR

Fund Statements - Appraisal Estimate Compared with Actual (in Constant 1965 Cruzeiros*)

(millions of Cruzeiros)

	1966		1967		1968		1969		1970		1971		1972		1973		1974		TOTAL	
	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate
SOURCES OF FUNDS																				
Internal cash generation																				
Operating income (after reversion and taxes)	15	24	22	25	26	29	27	31	35	40	37	46	53	57	57	63	69	69	341	386
Amortization	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-
Depreciation	5	8	8	10	8	11	7	11	7	14	10	17	15	21	16	23	16	26	92	141
Net other income	1	-	-	-	-	-	-	-	-	-	-	-	(2)	-	-	-	(4)	-	(5)	-
Total Gross Internal Cash Generation	23	32	30	35	34	40	34	42	42	54	47	63	66	78	73	86	81	95	430	527
Dividends	6[1]	3	12[1]	6	10[1]	7	16[1]	8	14[1]	9	14[1]	12	29[1]	12	24[1]	17	26[1]	18	151[1]	92
Debt service																				
Interest not capitalized	4	4	4	5	5	6	7	5	13	4	12	10	9	10	14	9	21	12	89	65
Amortization	7	10	7	11	4	10	8	9	6	10	8	11	20	12	25	12	25	9	110	94
Total debt service	11	14	11	16	9	16	15	14	19	14	20	21	29	22	39	21	46	21	199	159
Total net internal cash generation	6	15	7	13	15	17	3	20	9	31	13	32	8	44	10	48	9	56	80	275
Borrowing																				
IBRD loan 442-BR (Jaguara)	-	12	2	22	3	32	10	25	25	19	12	-	6	-	9	-	1	-	68	110
ELETROBRAS loan (Jaguara)	6	4	9	6	11	9	9	2	3	-	2	-	-	-	-	-	-	-	40	21
Other local loans	2	4	8	-	6	-	15	-	27	-	20	-	42	-	95	-	73	-	288	4
Other foreign loans	8	18	7	9	2	-	2	-	25	16	13	22	8	18	18	10	69	-	152	93
Total borrowing	16	38	26	37	22	41	36	27	80	35	47	22	56	18	122	10	143	-	548	228
Contributions in aid of construction	3	-	3	-	-	-	2	-	5	-	2	-	2	-	6	-	4	-	27	-
Federal grants	1	7	-	7	2	5	-	4	-	3	-	3	1	3	2	3	1	2	7	37
Capital contributions	22[1]	18	15[1]	22	21[1]	28	26[1]	26	19[1]	29	55[1]	31	37[1]	24	44[1]	24	46[1]	24	285[1]	226
TOTAL SOURCES OF FUNDS	48	78	51	79	60	91	67	77	113	98	117	88	104	89	184	85	203	82	947	767
APPLICATIONS OF FUNDS																				
Construction Expenditures																				
Jaguara plant	7	24	12	43	23	60	33	32	52	22	28	2	6	-	1	-	2	-	164	183
System expansion	31	44	36	38	27	33	35	28	37	39	22	38	39	35	77	38	55	45	359	338
Future plants	-	-	-	-	-	-	3	11	26	18	36	33	64	39	109	44	119	42	357	187
Total construction expenditures	38	68	48	81	50	93	71	71	115	79	86	73	109	74	187	82	176	87	880	708
Interest capitalized	-	1	1	2	1	3	2	4	4	6	6	2	12	3	6	3	2	-	34	24
Additions to working capital	10	9	2	(4)	-	(5)	(6)	2	(6)	13	25	13	(17)	12	(9)	-	25	(5)	33	35
TOTAL APPLICATIONS OF FUNDS	48	78	51	79	60	91	67	77	113	98	117	88	104	89	184	85	203	82	947	767

* To take inflation into account actual figures have been adjusted according to the variations of Brazil's General price index (Getulio Vargas Inst.) - yearly average, from the time of appraisal (Oct. 1965) (Oct. 1965 100, Dec. 1966: 143, 1967 178, 1968 223, 1969 268, 1970 320, 1971 383, 1972 445, 1973 512, 1974 684).

1/ Includes dividends reinvested by the State Government and ELETROBRAS.

ANNEX 3/7A

BRAZIL

CENTRAIS ELETRICAS DE MINAS GERAIS S.A. (CEMIG)

LOAN 442-BR

Energy Sales - Appraisal Estimate Compared with Actual

	Appraisal Estimate		Actual					
	Total Sales (GWh)	Annual Rate of Increase (%)	CEMIG Generation (GWh)	Purchased Energy (GWh)	Station Use and Losses (GWh)	Total Sales (GWh)	Annual Rate of Increase (%)	% of Sales to Industrial Consumers
1966	2,424	9.9	2,501	30	178	2,353	15.7	71
1967	2,865	18.2	2,766	107	277	2,596	10.3	66
1968	3,354	17.1	3,156	301	307	3,150	21.3	66
1969	3,896	16.2	3,027	808	293	3,542	12.4	66
1970	4,497	15.4	3,539	960	346	4,153	17.3	67
1971	5,163	14.8	3,490	1,854	440	4,904	18.1	68
1972	5,900	14.3	5,644	250	542	5,352	9.1	69
1973	6,717	13.9	5,778	647	523	5,902	10.3	70
1974	7,622	13.5	6,745	655	612	6,788	15.0	72

ANNEX 4 /A

October 1976

BRAZIL

CENTRAIS ELETRICAS DE MINAS GERAIS S.A. (CEMIG)

LOAN 442-BR

Project Costs-Actual and Appraised
(US$ Equivalent)

	Appraised			Actual			Difference	
	Local	Foreign	Total	Local	Foreign1/	Total	Amount	%
Civil works	17.36	5.50	22.86	36.90	15.81	52.71	+29.85	+130%
Overhead costs	7.85	-	7.85	8.56	-	8.56	+ .71	+ 9%
Elect. & Mech. Equipment	5.42	16.36	21.78	9.09	7.75	16.84	- 4.94	- 23%
Engineering	.97	.50	1.47	3.22	2.47	5.69	+ 4.22	+287%
Contingencies	5.15	3.88	9.03	-	-	-	- 9.03	-100%
Transmission Lines & Substations								
- Jaguara	10.53	9.68	20.21	12.73	10.42	23.15	+ 2.94	+ 8%
- Volta Grande	-	-	-	14.63	10.39	25.02	+25.02	
TOTAL (before interest)								
- excluding V.G. lines	47.28	35.92	83.20	70.50	36.45	106.95	+23.75	+ 28%
- including V.G. lines	x	x	x	85.13	46.84	131.97	+48.77	+ 59%
INTEREST CAPITALIZED	-	6.80	6.80	12.66	6.81	19.47	+12.67	+186%
TOTAL COST (interest included)	47.28	42.72	90.00	97.79	53.65	151.44	+61.44	+ 68%

1/ Includes foreign component of local expenditures, as estimated by CEMIG and revised by the Bank.

October 1976

ANNEX 5/A

BRAZIL

Loan 442 - BR

Principal Undertakings in Loan Documents

1. Loan Agreement

(a) Under Section 5.02(a) and (b) and Supplementary Letter on Consultants, competent consultants and contractors acceptable to the Bank, shall be employed.

(b) Section 5.05 provides that certified consolidated annual accounting reports and financial statements are to be forwarded to the Bank within four months after the close of each calendar year.

(c) Major expansion covenant: Under Section 5.12 of the original loan agreement, neither CEMIG nor its subsidiaries were to undertake any major expansion project (costing over US$1 million) not included in the proposed program unless such a major expansion project would be made in accordance with a financing plan satisfactory to the Bank. The amending agreement of October 31, 1973 altered the definition of a major project, now deemed a project or acquisition costing more than 1% of the gross fixed assets in operation plus work-in-progress. Under this amendment, CEMIG has to furnish the Bank evidence that any proposed major generation expansion project (i) is in accordance with the new development program described in the Sao Simao project (Loan 829-BR) Guarantee Agreement of June 14, 1972 and (ii) can be carried out with adequate financial resources.

(d) Tariff adjustments and assets revaluation covenants:

Under Section 5.14 of the loan agreement as restated in the amending agreement of October 31, 1973, CEMIG shall (i) take any necessary action to cause its tariffs to be set and maintained so as to produce revenues, as provided by existing federal tariff regulations, sufficient to ensure its continued operation in accordance with sound financial and public utilities practices (i.e. providing for a return on remunerable investment between 10% and 12%), and (ii) revalue its assets at least once every calendar year and apply for the corresponding rate adjustments.

(e) Debt limitation covenant: Section 5.13 of the original loan agreement and first amendment provided that the maximum amount of consolidated debt of CEMIG and its subsidiaries would be limited to 66-2/3% of its total fixed assets (debt including also short-term debt other than incurred in the ordinary course of business). The amending agreement of October 31, 1973 stipulates instead that CEMIG or any of its subsidiaries shall not incur any debt without the Bank's agreement unless the net revenues of the CEMIG group for the last 12 months shall cover 1.5 times the debt service requirements on all outstanding debts (including the debt to be incurred in any succeeding year). Under this amendment, (i) "debt" means all debt except debt of less than 1 year term incurred in the ordinary course of business, and (ii) "revenues" means gross revenues adjusted for tariff rates at time of the debt incurrence, less all operating expenses but before depreciation and interest charges.

(f) Acquisition of companies covenant: Under Section 5.15 and Side Letter, neither CEMIG nor its subsidiaries are permitted to acquire or control any company or business with assets of over US$500,000 unless such acquisition is agreed by the Bank.

(g) Amendment of Laws: Section 1.02(d) of the first amending agreement stipulates that any change in existing tariff laws or regulations which, in the judgment of the Bank, would adversely affect CEMIG's operation, would be a default of the loan. A Bank standard of judgment is set out unilaterally in a Bank letter of December 19, 1966.

2. Guarantee Agreement

(a) Under Section 3.06(b) (First Amending Agreement), the Government covenants that it will take action on CEMIG's tariff applications within a 30-day period to provide it with sufficient revenues as stipulated in Section 5.14 of the Loan Agreement.

(b) Under Section 3.08, the Government is required to take all such action to encourage effective coordination by 1970 of an integrated system and also take necessary action to expand the transmission and distribution facilities in order to ensure that power generated will efficiently reach the ultimate consumer.

(c) Under Section 3.09, the Government is required to promptly carry out a study of its legislative and administrative practices in order to enable construction contractors on power projects to bring into and take out of Brazil construction equipment and to import permanent equipment for installation on such projects. After completion of the study it shall implement its recommendations as soon as possible.

3. Project Agreement

(a) Under Section 2, the State of Minas Gerais confirms that CEMIG's expansion program has the highest priority in the allocation of the development funds of the State as provided in State laws.

(b) Under Section 4, the State undertakes, as required by its laws, to reinvest in capital stock of CEMIG 80 percent of all dividends paid to it by CEMIG and to pay ERMIG the remainder of such dividends for use in its rural electrification program. The State also undertakes to pay CEMIG all other funds stipulated by State law for the expansion of electric power in the State.

(c) Under Section 5, the State undertakes to transfer to CEMIG all funds received from the Federal Government or ELETROBRAS for use in carrying out the expansion program.

BRAZIL

CENTRAIS ELETRICAS DE MINAS GERAIS S.A. (CEMIG)

LOAN 442-BR

Financial Indicators

	1966		1967		1968		1969		1970		1971		1972		1973		1974	
	Actual*	Appraisal Estimate	Actual*	Appraisal Estimate	Actual*	Appraisal Estimate	Actual*	Appraisal Estimate	Actual*	Appraisal Estimate	Actual*	Appraisal Estimate	Actual*	Appraisal Estimate	Actual*	Appraisal Estimate	Actual*	Appraisal Estimate
L-T Debt/Total fixed assets (%)	23.6	28.3	21.4	29.8	25.8	30.9	29.3	30.5	37.1	31.2	38.2	30.0	37.8	28.4	42.2	25.9	45.3	22.9
Depreciation charges/Average gross fixed assets (%)	3.8	3.1	4.3	3.1	7.1	3.1	5.4	3.2	2.2	3.2	2.9	3.2	3.4	3.2	2.6	3.1	2.1	3.1
Rate of return 1/ (%)	12.3	9.5	12.6	9.2	12.5	9.6	11.8	9.6	13.4	10.4	12.1	10.3	14.9	10.6	14.0	10.0	13.2	9.9
Gross Debt service coverage by gross internal cash generation (times) 2/	2.07	2.11	2.68	2.04	3.38	2.16	2.07	2.26	1.87	2.61	1.85	2.75	1.64	3.15	1.66	3.60	1.73	4.43
Net Debt service coverage by gross internal cash generation (times) 3/	2.07	2.27	2.83	2.25	3.74	2.57	2.30	2.94	2.23	3.74	2.39	2.96	2.30	3.53	1.93	4.17	1.82	4.43
Average outstanding billings at year end (days)	63	27	53	26	104	28	61	26	55	28	50	30	58	27	61	27	45	27

* Calculated from non-deflated figures.
1/ Net operating income as % of average net fixed assets in operation.
2/ Capitalized interest included in debt service.
3/ Capitalized interest deducted from debt service.

December 1976

ANNEX 7/A

BRAZIL - Loan 442-BR

Jaguara Project

Economic Rate of Return

I. Based on appraisal data (in millions of constant 1965 Cr$)

	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976-2015
Construction costs 1/	24	43	60	32	22	2	-	-	-	-	-
Contribution to costs of system expansion 2/	-	-	-	-	39	38	36	38			
Operating costs	-	-	-	-	-	2	2	2	2	2	2
Revenues 3/	-	-	-	-	-	87	92	98	95	95	95

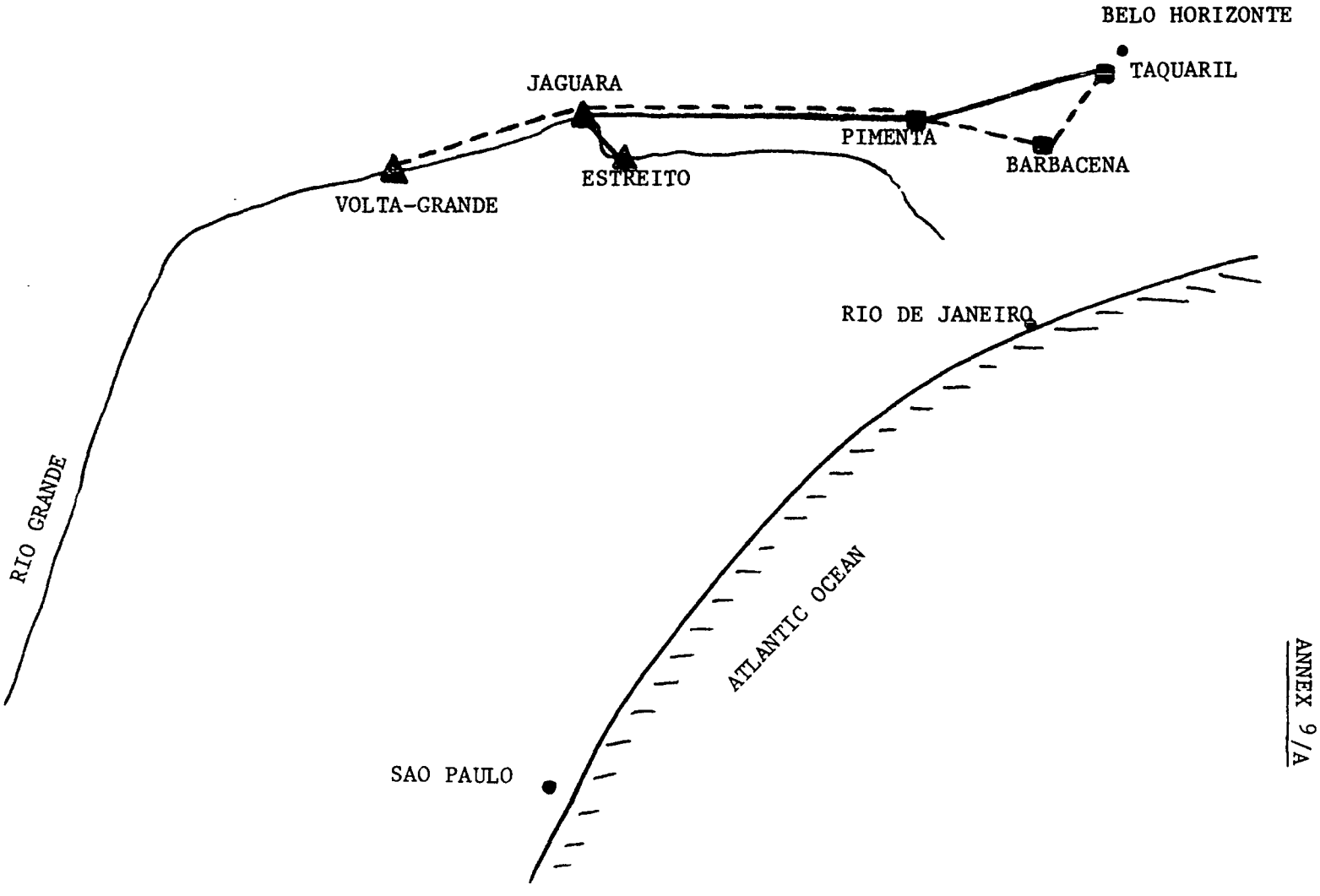
II. Based on actual data (in millions of constant 1965 Cr$)

	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976-2015
Construction costs	7	12	23	33	52	28	6	1	2	-	-
Contribution to costs of system expansion 2/	-	-	-	-	37	22	39	77	-	-	-
Operating costs	-	-	-	-	-	8	8	8	8	8	8
Revenues 3/	-	-	-	-	-	84	93	101	98	112	112

1/ Including associated transmission expenditures.
2/ Assumed equal to total CEMIG expenditures for system expansion between 1970 and 1973.
3/ Based on an average annual generation of 2.8 billion kWh.

____ Lines originally included in Loan 442-BR

---- Additional lines (originally included in Loan 566-BR)



ANNEX 9/A

PROJECT COMPLETION REPORT

BRAZIL

Loan 566-BR, Volta Grande Power Project

1.	Borrower:	Centrais Electricas de Minas Gerais S.A. (CEMIG)
2.	Guarantor:	The Federal Republic of Brazil
3.	Loan Amount:	US$26,600,000
4.	Date loan signed:	October 23, 1968
		Amended October 31, 1973 (to fix debt service coverage at 1.5 times)
5.	Effective Date:	February 27, 1969
6.	Closing Date:	Original January 31, 1975
		Actual June 30, 1976
7.	Period of Grace:	6-1/2 years
8.	Term of Loan:	25 years
9.	Interest Rate:	6-1/2% p.a.
10.	Commitment Charge:	3/4 of 1% p.a.
11.	Amortization:	38 semi-annual installments starting February 15, 1975 through August 15, 1993
12.	Exchange Rate:	At time of appraisal 1 US$ = Cr$3.22
		June 1976 1 US$ = Cr$10.765
13.	Appraisal Report:	TO-683a dated September 23, 1968
14.	Fiscal Year:	Calendar Year

15. Identification and Preparation of the Project

15.01 An in-depth study of six major basins in the South Central region of Brazil was started in 1962 by CANAMBRA, a consortium of consulting firms led by Montreal Engineering. Co. (Canada) under a United Nations Special Fund grant, for which the Bank acted as Executing Agency. It was aimed primarily at identifying the most economical ways of meeting the power demand of the seventies in the entire region of South Central Brazil.

15.02 The CANAMBRA study concluded that load growth in the South Central region would develop at an annual rate of between 9 and 11%. On the basis of the regional demand in 1967 and the lowest CANAMBRA projection (of 9%) the expansion program underway, including Volta Grande and the Furnas Porto Colombia project (which was appraised simultaneously) would just suffice to meet the 1974 demand. This growth rate was supported by the Bank's 1968 Brazil Economic mission which considered that the Gross Domestic Product (GDP) of Brazil could increase at an annual rate of approximately 5.5% between 1968 and 1970 and 6% p.a. in the following decade. Experience had shown that the annual increase in power demand in the south-central region of Brazil is between 1-1/2 and 2 times the annual increase in the GDP. Volta Grande was the first new plant in the sequence recommended by CANAMBRA (which also included additions to existing plants).

15.03 The preliminary engineering and exploration work for Volta Grande was started around 1958 by the Sao Paulo Light Co. This work was extended by CANAMBRA, which prepared the feasibility study on which the appraisal was based.

15.04 A Bank mission appraised the project in April 1968 and a loan of US$26.6 million was approved in October of the same year.

16. Project Description (see Annex 10)

16.01 The Volta Grande project consisted of:

(a) an earthfill dam of about 30 meters in height on the Rio Grande,

(b) a powerhouse with 4 generators with rated capacity of 100,000 kVA,

(c) a concrete spillway with tainter gates,

(d) 1475 km of 345 kV transmission lines,

(e) substations at Volta Grande, Jaguara, Pimenta and Belo Horizonte.

16.02 The transmission lines between the Volta Grande plant and the city of Belo Horizonte, originally included in the Volta Grande project (16.01(d)), were financed by Loan 422-BR (Jaguara project). The transfer

of the Volta Grande lines to Loan 442-BR was made possible by substantial savings on the Jaguara project (i.e., a 23% decrease in the cost of electrical and mechanical equipment). However, the original plan was changed, with the Bank's agreement, to add a loop through Barbacena. The Bank did not finance the additional lines from Pimenta to Barbacena to Taquaril (Belo Horizonte). The Volta Grande total project lines are shown by the dotted line in Annex 9.

17. Objective and Justification

17.01 The principal sector objective of the Volta Grande project was to allow CEMIG to supplement the Jaguara project in order to assist in satisfying the power demand of the South Central region during the seventies (see Para. 15.02). Though CEMIG's sales did not meet appraisal forecasts between 1972 and 1975 because the industrial market was slightly below forecast and other sales were well below expectations, sales have grown rapidly in 1974-76 and exceeded appraisal forecasts in the latter year (Annex 4). CEMIG should therefore have no difficulty in selling the output of the Volta Grande Project. The peak load in CEMIG's system grew at a somewhat slower rate after 1971 than expected at the time of appraisal. However, the delays in commissioning of Volta Grande (Section 19) offset the reduction in growth. CEMIG was able to maintain adequate reserves through its purchases from FURNAS.

17.02 The proposed project represented the most economic form in which additional generating capacity could be provided. For this conclusion consideration was given to the low unit cost of Volta Grande production compared to generation based on imported fuel. CANAMBRA's calculations showed that an investment program including Volta Grande was more economic than the next best alternative (a mixed hydro-thermal program) at discount rates of up to 11%. This calculation was based on a price for fuel oil of US$2.47/bbl. (including local handling), and on the costs for hydro plants estimated by CANAMBRA. The actual cost and construction period for the Volta Grande exceeded the original estimates by a sizeable margin (see Sections 19 and 20 below). However, since fuel prices increased by 300% over the project's construction period, it is probable that CANAMBRA's recommendation would continue to be correct at present-day prices.1/

17.03 The appraisal report stated that the project's internal rate of return was 10.2%, based on a very conservative estimate of the benefits (which only credited the project with revenues based on the dry-year generation and in addition excluded power sales taxes from the benefits). On this basis, the internal rate of return would be 7.8% for the project as actually carried out (see Annex 8). If the calculation is based on average-year generation and power sales taxes and other surcharges are included in the benefits (in line with current Bank practice) and on the actual cost of the project, the rate of return would increase to 9.9%. Since the opportunity cost of capital in Brazil is currently estimated at 11%, this would indicate that current tariffs are on average slightly lower than would be required to cover the marginal cost of expanding CEMIG's system, as represented by the project.

1/ Because of the complexity of the analysis carried out by CANAMBRA, it was not possible to quantify this conclusion.

The National Department of Water and Electric Energy (DNAEE), which is responsible for establishing power tariffs, is currently carrying out a study of the marginal cost of service which should provide a basis for judging whether this problem is due to low tariffs. However, the high ex-post return on CEMIG's Jaguara project 1/ would tend to indicate that the low return is due to the relatively high cost of the project.

18. Closing Date

18.01 The closing date was extended from January 31, 1975 to June 30, 1975 to enable CEMIG to compensate for the time lost in the dam foundation changes (Annex 11).

18.02 The closing date was finally extended to June 30, 1976 to allow for completion of the final unit which went into service in August 1975 (Annex 11) and to allow for payment of contract retentions, minor construction on the buildings, etc. An undisbursed balance of US$415,454 was cancelled at the closing date.

19. Construction Schedule

19.01 The detailed construction schedule had not been worked out at the time of appraisal, but award of the major contracts was expected to take place in 1969 and completion of the first generator in mid-1973. The entire plant was expected to be completed in mid-1974. Initiation of the works was somewhat delayed when subsurface investigations led to a relocation of the power house to achieve better foundation conditions. The first detailed schedule, prepared in January 1970, was substantially similar to that given in the appraisal report, since it was expected that the initial delays could be made up. However, further problems were experienced during construction which necessitated increased excavation to remove low-quality rock and placement of additional concrete (Annex 10, page 3). In addition, there were certain delays in the overall equipment shipment by suppliers so that the four generating units suffered delays of approximately one year. Under the difficulties encountered in the project CEMIG did an excellent job in putting the plant on line (see Annex 11). The forecast and actual dates for putting the four units on line are as follows:

	FORECAST	ACTUAL
Unit 1	end of September 1973	July 1974
Unit 2	end of December 1973	February 1975
Unit 3	end of April 1974	May 1975
Unit 4	end of August 1974	August 1975

1/ The ex-post analysis in the PCR dated 12/28/76 shows a return of 23% based on actual costs.

19.02 Of the three transmission lines subsequently covered by Loan 442-BR the Volta Grande-Jaguara and Jaguara-Pimenta lines had been completed by August 1975, the actual commissioning date of Volta Grande Unit #4. The last section (i.e. Pimenta-Barbacena-Taquaril) is now complete (as of January 1977), although some delay was experienced in the delivery of equipment. In spite of this equipment delay the Volta Grande output was transmitted using CEMIG and Furnas existing transmission lines thereby avoiding problems in the system.

20. Project Costs

20.01 The appraisal cost estimate for the Volta Grande project was US$78.5 million plus interest during construction of US$16.8 million for a total of US$95.3 million. Total actual costs incurred on the final Volta Grande project were US$218.9 million (including the cost of transmission lines financed by the Jaguara project funds). The 130% cost overrun can be attributed to the fact that the original cost estimate did not include provision for price increases, and to the problems encountered with civil works (para. 19.01).

20.02 The largest cost increase in absolute terms took place in the civil works for the hydroelectric plant (US$62.6 million or 174%). Construction materials increased in cost more rapidly than other products during the project's construction period. The foundation problems experienced (para. 19.01) also contributed to the increase.

20.03 The largest cost increase in relative terms was in engineering and administration (US$21.6 million or 474% over the appraisal forecast). The original estimate was 5.8% of direct project costs, which would be in line with experience with projects of this size in other countries. The actual engineering and administration expense for the project was 18.9% of direct project cost. While this figure is rather high, it is not unusual for Brazil, where professional staff commands high salaries.

20.04 The foreign component of the project cost was 19.6% higher than the appraisal estimate due to an under estimation of foreign interest during construction of US$3.5 million, an increase in the foreign component of civil works of US$3.7 million and an increase in foreign engineering costs of US$3.5 million. These increases were partly offset by a US$5.8 million decrease in transmission costs (Annex 5).

21. Allocation of the Proceeds of the Loan (in US$ equivalent)

21.01

		Original	Final
I.	Turbines & Generators	11,124,500	10,784,791
II.	Electrical Equipment	4,020,000	3,950,278
III.	Mechanical Equipment	5,888,000	5,886,469
IV.	Transmission	3,535,000	3,568,915
V.	Engineering & Other Services	2,032,500	1,994,093
	Subtotal	26,600,000	26,184,546
	Amount Cancelled	-	415,454
	Total	26,600,000	26,600,000

21.02 The proposed loan of US$26.6 million was based on the estimated cost of equipment and services to be purchased after international competitive bidding (excluding physical contingencies of US$9.1 million). Interest during construction was not financed by the loan.

22. Procurement

22.01 The main contracts were awarded to the following companies:

(a) Civil works - Construtora Jose Mendes, Jr. (Brazil)

(b) Turbines - Dominion Engineering Co. (Canada)

(c) Generator - Siemens (Germany)

(d) Transformers - G.E. (Brazil)

(e) Gates (intake) - Sorefame (Portugal)

(f) Gates (spillway) - ATB (Italy)

22.02 The procurement of goods financed by the Bank was done by international competitive bidding and local firms were given a 15% margin of preference for equipment and materials.

22.03 Bidding for civil works was restricted to Brazilian contractors. The Bank's loan did not finance these works.

23. Operating Results

23.01 CEMIG's performance in the period 1968-75 (see income statements in Annex 2) shows that the operating income presented a decrease of 22.9% compared to the appraisal forecast for the same period (in constant prices

of December 1967). This difference is due principally to an overestimation of 1067 GWh in energy sales during the period as compared to the actual sales and to a forecast average tariff overestimated by 4.4% compared to the actual tariffs for this period. CEMIG's sales exceeded the appraisal forecast through 1971, but were below forecast in 1972-75. However, because of strong growth in 1974-75, sales in 1975 were only 2% lower than the appraisal forecast and the actual average annual growth in sales over the period 1968-75 was 14.4%, compared to the forecast of 14.7%;sales in 1976 grew by 17.1%.

23.02 Expenses for employees, materials and services (in constant prices of December 1967) surpassed by approximately 19.5% the appraisal estimates. This was offset, in part, by an overestimation of the cost of energy purchased from Furnas (2.1%). Meanwhile the rate of return on remunerable assets as defined by Brazilian law, for the period was on average better than the level forecasted of 10% (Annex 2, page 2). These rates of return ranged from a high of 11.6% in 1970 to a low of 9.8% in 1973. The average financial rate of return on net fixed assets in operation during the period was 13.9%, which coincided with the forecast (Annex 7).

24. Financing Plan

24.01 CEMIG's total financial requirements for construction and working capital in the period 1968-75 were 66% higher (in terms of 1967 Cr$) than had been forecast at the time of appraisal. The following table shows the actual and forecast sources of CEMIG's financing in the period 1968-75.

	ACTUAL		APPRAISAL ESTIMATE	
	Constant 1967 Cr$ 10^6	%	Constant 1967 Cr$ 10^6	%
BORROWINGS	1332.5	65.3	456.6	35.9
IBRD 566-BR	57.7[1]	2.8	85.7	6.7
IBRD 422-BR (Partial)	15.1	0.7	-	-
ELETROBRAS (Volta Grande)	127.5	6.2	55.0	4.3
OTHERS	1132.2	55.6	315.9	24.9
NET INTERNAL CASH GENERATION[2]	108.3	5.3	501.3	39.5
STATE GOVERNMENT FUNDS	544.3	26.7	266.6	21.0
OTHER EQUITY FUNDS	56.1	2.7	45.6	3.6
TOTAL	2041.2	100.0	1270.1	100.0

1/ A further 1967 Cr$0.9 million was disbursed in 1976.

2/ Net Internal Cash Generation

	ACTUAL	APPRAISAL
Gross Internal Cash Generation	873.1	1113.4
Less: Interest	261.1	225.6
Amortization	221.1	266.5
Cash Dividends	282.6	120.0
	764.8	612.1
Net Internal Cash Generation	108.3	501.3

24.02 The total construction costs of CEMIG for the period 1968-1975 were higher than the investment forecast by Cr$766.9 million, equivalent to 66% in constant 1967 prices (see Annex 3). These variations which occurred mainly from 1973 onward are due to cost overruns, and the addition to the construction program of the Igarape thermal plant (125 MW) (para. 27.3), alteration of the Sao Simao project from 1,000 MW to 1,620 MW.

24.03 The significant increase in the cost of the construction program in constant 1967 prices has not been paralleled by a corresponding increase in the gross internal cash generation in constant 1967 prices. On the contrary the internal cash generation was about 27.5% below forecast for the period 1968-1975. This shortfall was mainly due to 13.6% below forecasted revenues, 44.4% below forecasted depreciation; offset by 6% below forecasted total operating expenses.

24.04 The construction program increase was compensated in part by a higher net influx of state capital provided from the sole tax and capital infusions of funds from the state through its budget. The large increase in the total construction program as related to internal cash generation motivated an indebtedness level in 1975 higher by 217% over that estimated, characterized mainly by the Sao Simao hydro and Igarape thermal plant borrowings from 1973 forward.

24.05 In consequence, the participation of borrowings in the total financing of the investment program during the period 1968-1975 which was forecast at 35.9% was increased to 65.3%. This increase in borrowings came mainly from ELETROBRAS and foreign private banks. While debt service was close to the forecast, the lower than forecast internal cash generation resulted in a reduction in CEMIG's debt service coverage ratio through the period 1968-1976 (Annex 7).

25. Forecast Financial Performance

25.01 Because of the strong growth of industry in the state of Minas Gerais, CEMIG has excellent growth possibilities. The population growth of the state is estimated at 27% for 1977-1987. However, this growth will require a large investment program to be carried out by CEMIG; this will strain the utility's finances if measures are not taken to increase its internal cash generation and to finance a greater proportion of its investments with equity, rather than borrowed funds. CEMIG has had to request the Bank's concurrence in its borrowings since 1975 (see discussion of the debt limitation covenant below) and this situation can be expected to continue for some time.

26. Covenants

26.01 The Government and the State of Minas Gerais have complied with all their undertakings under the Guarantee Agreement and the Project Agreement respectively (Annex 6). In particular the interconnected operation of power utilities in the South-Central region is now efficient; the creation of a Coordinating Group for Interconnected Operations (GCOI) in 1973 has led to substantial progress in the coordinated allocation of reserve capacity.

26.02 CEMIG has complied with all of its obligations under the Loan Agreement (as amended). Since 1975, CEMIG has been unable to meet the debt service coverage test defined in the loan covenant, whereby the company cannot incur any new debt without the Bank's agreement when net revenues for the last 12 months do not cover 1.5 times the debt service requirements on all outstanding debts (including the debt to be incurrred) in any succeeding year (Annex 6); it complied, however with the covenant, by asking for the Bank's agreement before incurring any new debt. As mentioned earlier, there is a good possibility that this situation will continue in the coming years and CEMIG has indicated that it would like the debt limitation covenant amended to eliminate the debt service coverage test. This would not resolve the basic problem (the insufficiency of net internal cash generation). The Bank should act to help prevent CEMIG's potential financial structure problems by encouraging the Federal and/or State Authorities to increase substantially their contribution to CEMIG's capital and soften the terms of their loans, in the context of the preparation of any new project which might be considered by the Bank.

26.03 It can be noted that under the debt limitation covenant in its original form (before amendment), which only limited the Borrower's debt to 66-2/3% of its total fixed assets, the Bank would not have been able to review CEMIG's borrowings, since its indebtedness never reached that level. This tends to prove the limited usefulness of this type of debt limitation covenant in this case.

27. Organization and Management

27.01 CEMIG was incorporated in 1952 with the majority shareholders being the State of Minas Gerais and the most important minority shareholder being ELETROBRAS (a Federal holding company). At the end of 1975 CEMIG had an installed capacity of 1,522 MW. Its share capital went up from Cr$70 million in July 1965 to Cr$2,820 million at December 31, 1975. The ownership percentage was as follows at December 31, 1975:

State of Minas Gerais	65.8%
ELETROBRAS	17.4%
Others	16.8%

27.02 ELETROBRAS therefore complied with the obligation it had undertaken, to keep its ownership level over 16%.

27.03 CEMIG is and has been competently managed and staffed and its operating personnel has been adequately trained to operate the project. However, the very cautious attitude of the management has led CEMIG to stray somewhat from the concept of a Region-oriented (rather than State-oriented) development of the power sector, embodied in the CANAMBRA study. In particular, its investment in the Igarape thermal plant appeared to be based more on self-sufficiency considerations than on economic analyses; CEMIG was responsive, however, to Bank advice and limited its investment therein (125 MW instead of 400 MW originally planned). Thereafter the Bank went on to amend the major expansion loan covenant which now requires CEMIG to ask for the Bank's agreement on any major generation

expansion project which would depart from a specifically agreed-upon program (Annex 6).

28. Consultants

28.01 CEMIG retained for the Volta Grande project consulting engineers TAMS ENGENHARIA, LTDA. Engineering services were furnished under a single comprehensive contract between CEMIG and the Consortium formed by TAMS, Engevix S/A and Tippetts - Abbett - McCarthy - Stratton of New York. This covered preliminary studies, necessary engineering and supervision of construction. CEMIG also used the assistance of certain individual consultants for specific assignments.

28.02 The Bank and the Borrower were satisfied with the performance of the consortium and the individual consultants. The foundation problems experienced during construction were extremely localized and could not reasonably have been anticipated on the basis of surface investigations.

29. Lessons to be Learned

29.01 The lessons which can be learned from the experience of this project, are similar to those derived from the PCR on Loan 442-BR (Jaguara project):

(i) the insufficiency of the original major expansion covenant (based merely on the financial capacity of the firm to implement new projects) might have led the Borrower to undertake investment aiming at self-sufficiency rather than at a Region -oriented (instead of State-oriented) development of the power sector; this was prevented by a modification of the covenant (by way of an amendment to the loan), which now requires the Borrower to ask for the Bank's agreement on any major departure from a specifically agreed-upon program;

(ii) the original formulation of the debt limitation covenant (limiting the Borrower's debt to 66-2/3% of its total fixed assets) similarly proved a posteriori inadequate since it would not have enabled the Bank to review CEMIG's borrowings, which the amended covenant (debt service coverage test) now permits.

29.02 Also, it appears that the difficulty in estimating the effects of future local and worldwide inflation in CEMIG's financial forecasts, has led to a significant divergence between its forecast and actual financial situation. It is clear that preparation of a realistic financing plan for situations such as that experienced during the project implementation period (with lags between local construction cost increases and foreign exchange parity readjustments), and changes in the revaluation index, requires provision of sufficiently high price contingencies on local costs to offset such lags.

Latin America and the Caribbean Regional Office
March 29, 1977

BRASIL

CENTRAIS ELÉTRICAS DE MINAS GERAIS S. A. (CEMIG)

LOAN 566-BR

BALANCE SHEET - APPRAISAL ESTIMATE COMPARED WITH ACTUAL

(IN CONSTANT DECEMBER, 1967 CRUZEIROS)

(IN MILLIONS OF CRUZEIROS)

	1968		1969		1970		1971		1972		1973		1974		1975		1976 (*)
ASSETS	ACTUAL	APPRAISAL ESTIMATE	ACTUAL	APPRAISAL ESTIMATE	ACTUAL	APPRAISAL ESTIMATE	ACTUAL	APPRAISAL ESTIMATE	ACTUAL	APPRAISAL ESTIMATE	ACTUAL	APPRAISAL ESTIMATE	ACTUAL	APPRAISAL ESTIMATE	ACTUAL	APPRAISAL ESTIMATE	ESTIMATE
FIXED ASSETS																	
. Fixed Assets in Operation	429,4	575,2	492,4	668,9	577,3	750,0	689,6	992,6	917,9	1.233,7	1.162,9	1.507,1	1.187,4	1.696,9	1.399,0	1.831,8	1.363,7
. Less: . Depreciation Reserve	48,5	57,7	63,1	77,4	71,4	99,5	93,8	128,7	120,6	165,0	155,3	209,3	155,7	259,2	193,0	313,1	213,0
. Net Fixed Assets in Operation	380,9	517,5	436,3	591,5	505,9	650,5	595,8	863,9	797,3	1.068,7	1.007,6	1.297,8	1.031,7	1.437,7	1.205,0	1.518,7	1.153,7
. Work in Progress	106,5	150,3	188,9	237,4	301,5	350,0	292,3	298,2	283,5	233,6	448,1	109,4	450,7	41,5	660,0	15,2	963,9
TOTAL FIXED ASSETS	487,4	667,8	625,2	828,9	807,4	1.000,5	889,1	1.162,1	1.080,8	1.302,3	1.455,7	1.407,2	1.482,4	1.479,2	1.866,0	1.534,9	2.117,6
INVESTMENTS	20,5	19,1	12,4	19,1	10,6	19,1	10,6	19,1	13,5	19,1	15,8	19,1	15,4	19,1	17,1	19,1	13,3
CURRENT ASSETS																	
. Cash and Banks	8,4	18,7	10,8	15,2	10,1	25,7	12,1	29,4	10,6	21,3	10,5	33,0	23,0	60,3	22,3	61,2	10,5
. Inventories	22,1	34,4	27,8	36,1	31,5	37,9	24,0	33,8	23,5	41,8	28,7	43,9	44,0	46,1	45,8	48,4	41,0
. Accounts Receivable	24,2	19,5	20,0	24,3	22,0	28,8	23,0	36,0	27,5	42,0	34,9	50,0	34,7	57,0	65,5	63,0	48,3
. Other Current Assets	4,0	16,9	8,4	16,9	11,9	16,9	49,0	16,9	26,2	16,9	9,1	16,9	1,8	16,9	38,3	15,9	33,1
TOTAL CURRENT ASSETS	58,7	89,5	67,0	92,5	75,5	109,3	108,1	122,1	87,8	122,0	83,2	143,8	103,5	180,3	171,9	189,5	131,0
OTHER ASSETS	35,8	9,6	26,9	9,6	28,5	9,6	15,6	9,6	14,6	9,6	26,8	9,6	38,7	9,6	54,2	9,6	44,0
TOTAL ASSETS	602,4	786,0	731,5	950,1	921,9	1.138,5	1.023,4	1.312,9	1.196,7	1.453,0	1.581,5	1.579,7	1.637,0	1.688,2	2.109,2	1.753,1	2.305,9

(*) - Based on Cash-Flow - DECEMBER, 1976.

. To take into account actual figures have been adjusted to the variations of the Brasil general price index (Getúlio Vargas Fund) at the end of each year, from the time of appraisal (DECEMBER, 1967).

(Dec.1967:100, 1968:125,1969:151,1970:180,1971:215,1972:249,1973:288,1974:387,1975:500,1976:732)

ANNEX 1/B
Page 1 of 2 pages

BRASIL

CENTRAIS ELÉTRICAS DE MINAS GERAIS S.A. (CEMIG)

LOAN 566-BR

BALANCE SHEET - APPRAISAL ESTIMATE COMPARED WITH ACTUAL

(IN CONSTANT DECEMBER, 1967 CRUZEIROS)

(IN MILLIONS OF CRUZEIROS)

	1968		1969		1970		1971		1972		1973		1974		1975		1976(*)
LIABILITIES	ACTUAL	APPRAISAL ESTIMATE	ACTUAL	APPRAISAL ESTIMATE	ACTUAL	APPRAISAL ESTIMATE	ACTUAL	APPRAISAL ESTIMATE	ACTUAL	APPRAISAL ESTIMATE	ACTUAL	APPRAISAL ESTIMATE	ACTUAL	APPRAISAL ESTIMATE	ACTUAL	APPRAISAL ESTIMATE	ESTIMATE
EQUITY																	
. Share Capital	200,0	430,0	306,9	559,1	297,4	630,7	375,7	725,4	377,6	843,0	442,6	909,4	440,4	1.100,9	604,6	1.247,0	595,9
. Contribution in Aid of Construction	13,9	22,4	14,0	22,9	16,7	23,4	15,1	23,9	14,1	24,4	19,2	24,9	20,2	25,4	10,0	25,9	13,7
. Legal Reserve	4,7	6,1	6,1	9,1	7,4	12,5	8,8	17,0	11,0	22,0	13,6	27,7	14,6	33,8	15,6	40,6	15,7
. Surplus	2,4	1,1	8,6	1,3	18,5	1,3	27,1	1,3	43,2	1,3	58,5	1,3	71,9	1,2	90,1	1,2	99,0
. Revaluation Reserve	40,8	53,0	106,5	-	159,8	-	164,4	-	170,8	-	179,2	-	181,1	-	210,6	-	255,2
. Amortization Reserve	8,0	10,0	8,4	10,0	8,5	10,0	10,3	10,0	10,4	10,0	21,3	10,0	18,2	10,0	18,6	10,0	17,2
. Other Reserves	31,9	-	1,2	-	5,6	-	95,2	-	54,9	-	69,7	-	46,5	-	13,3	-	0,8
. Government Grants	1,2	15,2	0,4	19,2	0,5	23,2	0,2	27,2	1,5	31,2	4,2	35,2	6,1	39,2	4,2	43,2	7,8
TOTAL EQUITY	320,9	538,6	451,2	618,6	514,4	709,1	568,8	814,8	683,5	931,9	808,3	1.068,5	794,0	1.210,5	934,4	1.367,9	975,3
LONG-TERM DEBT	125,9	203,7	184,3	284,4	301,3	379,7	340,8	441,5	408,9	460,5	636,0	446,0	703,8	409,2	989,6	311,9	1.112,3
. Less: Current Maturity of Long-Term Debt	8,0	11,4	10,1	13,4	13,5	16,4	34,0	22,4	39,7	22,8	61,5	22,4	46,4	25,7	46,0	19,1	67,8
NET LONG-TERM DEBT	117,9	192,3	174,2	271,0	287,8	363,3	306,8	419,1	369,2	437,7	574,5	423,6	657,4	383,5	943,6	292,8	1.044,5
CURRENT LIABILITIES																	
. Current Maturity of Long-term Debt	8,0	11,4	10,1	13,4	13,5	16,4	34,0	22,4	39,7	22,8	61,5	22,4	46,4	25,7	46,0	19,1	67,8
. Account Payable, Accruals and Deferred Credits	61,2	14,6	67,1	15,2	71,7	15,9	66,7	16,6	65,0	17,3	90,3	18,0	88,5	18,7	120,0	48,8	145,9
. Other Current Liabilities	22,6	24,0	21,6	26,7	23,1	28,6	22,3	34,8	32,6	38,1	39,6	42,0	44,4	44,6	61,9	19,3	69,3
TOTAL CURRENT LIABILITIES	91,8	49,9	98,8	55,3	108,3	60,9	123,2	73,8	137,3	78,2	191,4	82,4	179,3	89,0	227,9	87,2	284,0
OTHER LIABILITIES	1,8	5,2	7,3	5,2	11,4	5,2	4,6	5,2	6,7	5,2	7,3	5,2	6,3	5,2	3,3	5,2	2,1
TOTAL LIABILITIES	602,4	786,0	731,5	950,1	921,9	1.136,5	1.023,4	1.312,9	1.196,7	1.453,0	1.581,5	1.579,7	1.637,0	1.688,2	2.109,2	1.783,1	2.305,9

. To take into account actual figures have been adjusted to the variations of the Brasil general price index (Getúlio Vargas Fund) at the end of each year, from the time of appraisal (DECEMBER, 1967).

(Dec.1967:100,1968:125,1969:151,1970:180,1971:215,1972:249,1973:288,1974:387,1975:500,1976:732)

BRAZIL

CENTRAIS ELETRICAS DE MINAS GERAIS, S.A. (CEMIG)

LOAN 566-BR

INCOME STATEMENTS - APPRAISAL ESTIMATE COMPARED WITH ACTUAL
(In Constant 1967 Cruzeiros*)
(In millions of Cruzeiros)

Year Ending December 31	1968		1969		1970		1971		1972		1973		1974		1975		1976
	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Estimated
Sales (millions of kWh)	3150	3010	3542	3880	4153	4100	4904	4888	5353	5650	5902	6375	6788	7201	7895	7998	9294
Average Price Per MWH (Cruzeiros)	34.3	38.9	35.5	41.8	37.6	40.5	36.5	41.5	41.3	42.6	45.9	44.8	45.8	44.0	48.4	45.9	40.6
Operating Revenues	108.1	117.2	125.7	145.4	156.2	166.1	179.0	202.7	221.1	240.7	270.9	285.6	310.9	316.6	379.6	367.3	377.3
Less: Reversion & Guarantee Quotas	-	-	-	-	-	-	-	-	12.7	-	32.5	-	32.3	-	47.9	-	47.9
Fuel Usage Quotas	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.7	-	6.6
Operating Expenses																	
Operating, Maintenance, Adm.	27.0	26.9	33.1	30.2	35.1	33.7	48.2	37.8	42.8	42.3	54.2	47.4	65.3	53.1	89.7	59.4	88.2
Purchased Power	13.1	14.4	28.1	27.2	40.5	35.3	42.8	35.7	40.3	39.7	51.4	47.4	52.2	50.4	53.1	78.1	51.9
Exchange Difference	2.6	-	1.4	-	1.2	-	1.9	-	3.0	-	-	-	3.2	-	5.4	-	1.9
Depreciation	14.8	16.9	13.0	19.7	12.1	22.1	17.7	29.2	27.1	36.3	29.2	44.3	30.0	49.9	44.7	53.9	40.6
Others	4.4	5.0	2.1	5.6	3.7	6.3	3.1	8.3	-	9.3	-	10.6	-	11.4	-	12.7	-
Total Operating Expenses	61.9	63.2	77.7	82.7	92.6	97.4	113.7	111.0	113.2	127.6	134.8	149.7	150.7	164.8	192.3	204.1	182.6
Operating Income	46.2	54.0	48.0	62.7	63.6	68.7	65.3	91.7	95.2	113.1	103.6	135.9	127.9	151.8	134.7	163.2	140.2
Other Income	0.9	1.0	-	1.1	-	1.1	0.5	1.2	(3.4)	1.2	0.4	1.3	(7.4)	1.3	5.7	1.4	-
Interest																	
Interest Paid	11.3	9.8	15.2	16.6	30.2	26.2	32.0	33.2	36.5	37.3	35.6	37.9	41.8	35.1	58.5	29.5	97.1
Less: Interest Charged to Const.	7.8	8.9	11.6	13.8	20.0	23.5	29.0	29.3	24.6	23.2	21.0	14.4	24.0	4.2	24.2	1.5	86.1
Interest Charges	3.5	0.9	3.6	2.8	10.2	2.6	3.0	3.9	11.9	14.1	14.6	23.5	17.8	20.9	34.3	28.0	11.0
Income Tax	-	-	-	-	-	-	-	-	1.7	-	1.8	-	1.7	-	7.6	-	7.8
Other Deductions	-	-	0.7	-	4.9	-	6.8	-	5.9	-	4.6	-	2.4	-	0.5	-	-
Net Income	43.6	54.1	43.7	61.0	48.5	67.2	56.0	89.0	72.3	100.2	83.0	113.7	98.6	122.2	98.0	136.6	121.4
Surplus Beginning of Year	0.9	1.1	2.2	1.1	7.9	1.3	16.3	1.3	25.0	1.3	40.4	1.3	48.2	1.3	76.6	1.2	68.7
Allocated to																	
Legal Reserves (5%)	1.7	2.7	2.2	3.0	2.4	3.4	3.0	4.5	3.8	5.0	4.1	5.7	4.9	6.1	4.7	6.8	6.6
Private Cash Dividends	7.9	9.8	6.3	11.0	6.8	12.1	9.7	16.1	11.7	18.1	12.5	20.5	12.1	22.1	12.4	24.7	10.8
Stock Dividends to ELETROBRAS	7.0	8.7	5.7	9.8	5.4	10.9	5.5	14.4	6.8	16.2	10.2	18.4	10.7	19.7	11.6	22.0	11.3
Stock Dividends to State Gov't	25.3	32.9	22.4	37.0	21.8	40.8	25.1	54.0	29.2	60.9	34.0	69.1	39.3	74.4	44.1	83.1	46.0
Surplus Retained	2.6	1.1	9.3	1.3	20.0	1.3	29.0	1.3	45.8	1.3	62.6	1.3	79.8	1.2	101.8	1.2	115.4

* To take inflation into account, actual figures have been adjusted according to the variations of the Brazil general price index (Getulio Vargas Foundation) yearly average from December 1967. (Dec. 1967:100, 1968: 115, 1969:139, 1970: 167, 1971:201, 1972:235, 1973:270, 1974:348, 1975:444, 1976:628).

CENTRAIS ELETRICAS DE MINAS GERAIS S.A. (CEMIG)

LOAN 566-BR

OPERATING RESULTS

(in constant December 1967 Cruzeiros*)
(in millions of Cruzeiros)

	1968	1969	1970	1971	1972	1973	1974	1975	1976
1. OPERATING REVENUES	81.9	97.6	129.3	147.2	181.6	243.8	298.0	358.6	361.3
Sales of electric energy	25.9	25.8	24.6	30.4	36.1	23.2	8.3	9.6	10.6
Other electric utilities	0.3	2.3	2.3	1.4	3.4	3.9	4.6	11.4	5.4
Other income									
Less: Reversion and guarantee quota	-	-	-	-	12.7	32.5	32.3	47.9	47.9
Fuel usage quota	-	-	-	-	-	-	-	4.7	6.6
TOTAL OPERATING REVENUES	108.1	125.7	156.2	179.0	208.4	238.4	278.6	327.0	322.8
2. OPERATING EXPENSES	3.2	4.5	5.8	7.1	7.7	9.4	9.4	12.3	11.1
Operating expenses hydro	0.4	1.0	1.6	1.8	1.3	1.2	1.8	2.9	3.0
Thermal station - other expenses	13.1	28.1	40.5	42.8	40.3	51.4	52.2	53.1	51.9
Purchased power	3.9	4.8	4.2	5.2	5.7	7.6	8.5	11.8	12.2
Transmission expenses	8.9	11.0	14.8	16.8	18.1	23.8	31.5	44.3	44.6
Distribution expenses	10.6	11.8	8.7	17.2	10.0	12.2	14.1	18.4	17.2
Administration expenses	14.8	13.0	12.1	17.7	27.1	29.2	30.0	44.7	40.6
Depreciation	4.4	2.3	3.7	-	-	-	-	-	-
Taxes	2.6	1.2	1.2	5.0	3.0	-	3.2	5.4	2.0
Other									
TOTAL OPERATING EXPENSES	61.9	77.7	92.6	113.7	113.2	134.8	150.7	192.3	182.6
3. OPERATING INCOME	46.2	48.0	63.6	65.3	95.2	103.6	127.9	134.7	140.2
4. NONOPERATING REVENUES	7.8	11.6	20.0	29.0	24.6	21.0	24.0	24.2	86.1
Interest charged to construction	3.2	4.1	3.8	5.1	5.6	13.3	5.6	10.5	-
Others									
5. INCOME DEDUCTIONS	11.3	15.2	30.2	32.0	36.5	35.6	41.8	58.5	97.1
Interest on long-term debt	2.3	4.8	8.7	11.4	14.9	17.5	15.4	5.3	-
Others									
6. NET INCOME BEFORE INCOME TAX	43.6	43.7	48.5	56.0	74.0	84.8	100.3	105.6	129.2
7. INVESTMENT TO BE RETURNED	415.7	455.5	546.5	636.1	836.9	1058.7	1128.7	1250.9	1096.6
8. REMUNERATION % - (3÷7) 100	11.1%	10.5%	11.6%	10.3%	11.4%	9.8%	11.3%	10.7%	12.8%
9. SALES (millions of kWh)	3150	3542	4153	4904	5353	5902	6788	7845	9294

* To take inflation into account, actual figures have been adjusted according to the variations of the Brazil general price index (Getulio Vargas Foundation) yearly average from December 1967. (December 1967:100, 1968:115, 1969:139, 1970:167, 1971:201, 1972:235, 1973:270, 1974:348, 1975:444, 1976:628).

BRAZIL

CENTRAIS ELETRICAS DE MINAS GERAIS S.A. (CEMIG)

LOAN 566-BR

FUND STATEMENTS - APPRAISAL ESTIMATE COMPARED WITH ACTUAL
(In constant December 1967 cruzeiros*)
(In millions of Cruzeiros)

Source of Funds	1968		1969		1970		1971		1972		1973		1974		1975		1976
	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Estimated
Net Internal Cash Generation																	
Operating Income	46.2	54.0	48.0	62.7	64.6	68.7	65.4	91.7	95.2	114.1	103.6	135.9	127.9	151.8	136.7	164.2	140.2
Depreciation	14.8	16.9	13.0	19.7	11.1	22.1	17.7	29.2	27.1	36.3	29.2	44.3	30.0	49.9	44.7	53.9	40.6
Total Gross Internal Cash Generation	61.0	70.9	61.0	82.4	75.7	90.8	84.0	120.9	122.3	150.4	132.8	180.3	157.9	201.7	179.4	217.1	180.8
Borrowings																	
Volta Grande																	
IBRD - 441-BR (Partially)	-	-	-	-	-	-	-	-	2.5	-	11.7	-	0.9	-	-	-	-
IBRD - 566-BR	-	-	0.8	3.2	3.0	8.1	8.3	12.4	14.0	23.1	23.3	23.3	7.8	15.0	2.5	-	0.9
EXTEL-ELETROBRAS (Partially)	-	-	-	-	-	-	-	-	-	-	0.7	-	0.6	-	0.2	-	-
LIBRA Bank - 2nd (Partially)	-	-	-	-	-	-	-	-	-	-	-	-	7.2	-	-	-	0.5
ELETROBRAS	-	-	2.2	5.0	20.5	15.0	25.6	15.0	22.5	15.0	36.0	5.0	16.2	-	4.5	-	-
C.E.E. (PIS)	-	-	-	-	-	-	-	-	-	-	-	-	14.4	-	-	-	-
Subtotal	-	-	3.0	8.2	23.5	23.1	33.9	27.4	39.0	38.1	69.7	28.3	47.1	15.0	7.2	-	1.4
Others																	
Foreign Loans	9.6	52.6	23.3	75.1	89.9	55.6	36.5	28.4	11.4	3.3	37.7	-	120.3	-	177.2	-	96.5
Local Loans	30.5	39.7	40.2	58.8	34.5	40.0	17.3	22.4	48.8	-	124.3	-	93.6	-	235.0	-	275.1
Total Borrowings	40.1	92.3	65.5	92.1	143.9	108.7	87.7	78.2	99.2	41.4	230.7	28.3	261.0	15.0	419.4	-	371.0
Federal Grants	3.5	4.0	0.8	4.0	-	4.0	-	4.0	1.3	4.0	4.2	4.0	1.1	4.0	0.5	4.0	-
Capital Resources	37.5	34.1	46.8	25.5	33.9	40.9	96.0	28.3	65.7	40.5	79.7	38.9	83.7	37.4	101.0	41.0	96.8
Contributions in Aid of Construction	-	0.5	2.8	0.5	9.1	0.5	1.0	0.5	3.0	0.5	10.5	0.5	7.8	0.5	12.0	0.5	16.5
Net Other Income	0.9	1.0	-	1.1	-	1.1	0.4	1.2	(3.4)	1.2	0.3	1.3	(7.4)	1.3	5.7	1.4	-
Total Sources of Funds	143.0	202.8	176.9	205.6	262.6	246.0	269.1	233.1	288.1	227.0	448.2	253.2	504.1	260.5	718.0	264.0	669.1

* To take inflation into account, actual figures have been adjusted according to the variation of the Brazil general price index (Getulio Vargas Foundation) yearly average from December 1967 (Dec. 1967=100, 1968: 115, 1969:140, 1970:167, 1971:201, 1972:235, 1973:270, 1974:348, 1975:444, 1976:628).

BRAZIL

CENTRAIS ELETRICAS DE MINAS GERAIS S.A. (CEMIG)

LOAN 566-BR

FUND STATEMENTS - APPRAISAL ESTIMATE COMPARED WITH ACTUAL
(in constant December 1967 Cruzeiros*)
(in millions of Cruzeiros)

	1968		1969		1970		1971		1972		1973		1974		1975		1976
Application of Funds	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Estimated
Construction Program (excluding IDC)																	
Jaguara Plant	41.0	68.0	59.0	73.3	93.7	58.6	49.8	23.2	11.0	9.5	1.9	-	3.4	-	0.2	-	-
Volta Grande Plant	0.9	1.8	5.8	10.8	46.0	29.2	55.1	47.3	83.5	42.9	138.2	38.2	64.0	26.1	33.7	-	11.5
Thermal Plant	-	-	-	-	-	-	-	-	0.4	-	9.0	-	17.8	-	42.9	-	33.1
Sao Simao Plant (Units 1-6)	-	-	-	-	-	-	8.3	-	34.8	-	64.4	-	141.4	-	279.8	-	218.2
System Expansion	48.0	79.1	63.3	82.9	66.5	82.3	38.4	91.0	64.0	100.9	124.7	96.6	93.4	91.6	144.0	108.1	236.5
Total Construction Program	89.9	148.9	128.1	167.0	206.2	170.1	151.6	161.5	193.7	153.3	338.2	134.8	320.0	117.7	500.6	108.1	499.3
Debt Service																	
Interest: IBRD Loan-V.Grande (566-BR)	-	-	0.7	0.2	0.5	1.0	1.0	1.6	1.3	2.7	2.2	4.0	2.9	5.4	3.4	5.6	0.1
ELETROBRAS Loan-V.Grande	-	-	1.4	0.6	1.8	2.4	4.0	4.2	6.8	6.0	-	6.6	9.5	6.6	9.3	6.2	0.2
C.E.F. (PIS)	-	-	-	-	-	-	-	-	-	-	-	-	0.9	-	0.7	-	-
Other Loans	11.3	9.8	13.1	15.8	27.9	22.8	27.0	27.4	28.4	28.6	33.4	27.3	28.5	23.1	45.1	17.7	96.8
Less Interest Capitalized	1.7	-	2.8	-	6.7	-	10.4	-	20.8	-	11.2	-	4.0	-	4.1	-	30.2
Subtotal Interest	9.6	9.8	12.4	16.6	23.5	26.2	21.6	33.2	15.7	37.3	24.4	37.9	37.8	35.1	54.4	29.5	66.9
Amortization: IBRD Loan-V.Grande	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.4	2.3	1.3
ELETROBRAS-V.Grande	-	-	-	-	-	-	-	-	-	-	2.2	-	8.1	3.2	10.2	3.5	5.0
C.E.F. (PIS)	-	-	-	-	-	-	-	-	-	-	-	-	3.1	-	2.5	-	0.9
Local Loans - Other	0.9	1.2	7.9	2.4	2.4	3.4	4.4	4.4	11.4	5.2	23.2	26.9	18.2	36.2	24.6	78.3	25.5
Foreign Loans - Other	6.1	9.2	6.4	9.0	7.9	10.0	8.9	12.0	24.6	17.2	19.0	15.9	15.5	13.0	12.2	13.2	9.6
Subtotal Amortization	7.0	10.4	14.3	11.4	10.3	13.4	13.3	16.4	36.0	22.4	44.4	42.8	44.9	52.4	50.9	97.3	42.3
Total Debt Service	16.6	20.2	26.7	28.0	33.8	39.6	34.9	49.6	51.7	59.7	68.8	80.7	82.7	87.5	105.3	126.8	109.2
Increase or Decrease in Net Working Cap.	0.5	7.3	(8.6)	4.3	(17.0)	4.8	(1.0)	6.2	(14.8)	6.0	(16.2)	7.9	22.2	7.5	18.5	6.1	(6.9)
Dividends	17.4	10.3	28.8	9.8	25.7	11.0	24.1	12.1	51.3	16.1	43.9	18.1	46.5	20.5	44.7	22.1	55.8
Other - Net	15.2	3.5	(2.5)	-	12.7	-	51.6	-	5.8	-	12.4	-	15.5	-	43.9	-	12.1
Total Application of Funds	139.6	190.2	172.5	209.1	261.4	225.5	261.2	229.4	287.7	235.1	447.1	241.5	486.9	233.2	713.0	263.1	669.5
Net Cash Accrual	3.4	12.6	4.4	(3.5)	1.2	10.5	3.9	3.7	0.4	(8.1)	1.1	11.7	17.2	27.3	5.0	0.9	(4.4)
Cash Balance Beginning of Year	5.3	6.1	7.2	18.7	9.7	15.2	8.9	25.7	11.0	29.4	10.1	21.3	8.6	33.0	20.1	60.3	16.8
Cash Balance End of Year	8.7	18.7	11.6	15.2	10.9	25.7	12.8	29.4	11.4	21.3	11.2	33.0	25.8	60.3	25.1	61.2	12.4
Debt Service Coverage by Internal Cash Generation (Times)	3.7	3.5	2.3	2.9	2.2	2.3	2.4	2.4	2.4	2.5	1.9	2.2	1.9	2.3	1.7	1.7	1.7

* To take inflation into account, actual figures have been adjusted according to the variation of the Brazil general price index (Getulio Vargas Foundation) - yearly average from December 1967. (Dec. 1967:100, 1968: 115, 1969:139, 1970:167, 1971:201, 1972:235, 1973:270, 1974:348, 1975:444, 1976:628).

B R A S I L

CENTRAIS ELÉTRICAS DE MINAS GERAIS S.A.

12. COMPARISON BETWEEN LOAD FORECAST AND ACTUAL CONSUMPTION

GWh

	INDUSTRIAL CONSUMPTION			SUPPLY TO OTHER UTILITIES			DISTRIBUTION			TOTAL		
YEAR	FORECAST	ACTUAL	ACTUAL GROWTH RATE%PER ANNUM	FORECAST	ACTUAL	ACTUAL GROWTH RATE%PER ANNUM	FORECAST	ACTUAL	ACTUAL GROWTH RATE%PER ANNUM	FORECAST	ACTUAL	ACTUAL GROWTH RATE%PER ANNUM
1968	1,971	2,072	-	586	673		453	405	29.8	3,010	3,150	21.3
1969	2,301	2,330	12.4	647	747	10.9	532	465	14.8	3,480	3,542	12.4
1970	2,741	2,770	18.9	741	744	(2)(0.4)	618	639	(2)37.4	4,100	4,153	17.3
1971	3,355	3,327	20.1	803	866	16.4	722	711	11.3	4,880	4,904	18.1
1972	3,905	3,699	11.2	886	869	0.3	859	784	10.3	5,650	5,352	9.1
1973	4,431	4,150	12.2	957	549	(1)(36.8)	989	1,203	(1)53.4	6,377	5,902	10.3
1974	5,030	4,868	17.3	1,033	184	(1)(66.5)	1,138	1,736	(1)44.3	7,201	6,788	15.0
1975	5,570	5,686	16.8	1,119	210	14.1	1,309	1,943	11.9	7,998	7,839	15.5
1976(3)										8,770	9,180	17.1

(1) Adquisition of CFLMG (B. Horizonte Electric Utility) (AMFORP) and Prada Company - October/1973.

(2) Adquisition of CSME (Southern State Electric Utility.

(3) Detailed information not available.

BRAZIL

CENTRAIS ELETRICAS DE MINAS GERAIS S. A. (CEMIG)

MARKET GROWTH PER CLASS

1968/76
kWh

CLASSES	1968	1969	1970	1971	1972	1973	1974	1975	1976
TOTAL	3.149.755.983	3.542.274.123	4.153.215.323	4.904.122.916	5.352.543.248	5.901.925.046	6.787.515.562	7.839.024.864	9.179.651.551
Industrial	2.072.322.724	2.329.843.360	2.770.516.009	3.327.516.704	3.699.498.843	4.149.848.449	4.867.957.562	5.686.292.645	6.752.914.627
Electric Power Utilities	673.309.632	747.239.224	744.045.186	865.773.679	869.334.927	543.324.504	184.228.032	210.225.645	236.292.158
Residential	181.922.909	206.049.613	277.710.345	300.184.044	328.002.623	552.680.584	818.529.136	902.817.544	1.038.482.164
Commercial	76.865.200	79.109.566	104.468.494	112.186.292	131.473.475	254.699.595	412.832.811	461.059.349	521.569.459
Public Lighting	54.125.105	64.993.752	92.176.892	105.478.953	116.465.414	151.810.425	199.767.445	219.989.218	239.525.579
Companies Of Public Utilities (*)	-	39.972.397	77.141.020	91.597.876	103 900.380	115.443.601	129.348.763	151.935.847	170.531.384
Rural	9.684.562	18.652.675	26.957.486	31.381.302	37.921.455	43.243.489	51.670.065	57.407.572	54.294.553
Public Utilities	53.832.519	21.101.578	25.282.045	29.848.173	34,032.038	58.799.850	87,303.125	87.805.756	95.422.632
Interdepartmental	14.091.661	16.622.181	16.660.077	22.446.511	16.989.418	13.955.498	24.565.111	52.522.526	51.754.207
Electric Traction	13.605.671	18.489.757	17.237.768	17.018.382	14,924.675	12.119.051	11.293.211	8,968.761	8.764.687

(*) - Refers to Water and Sewerage System including in the sector of Public Utilities up to the year of 1968.

BRAZIL

CENTRAIS ELETRICAS DE MINAS GERAIS S. A. (CEMIG)

LOAN 566-BR

Project Costs, Actual and Appraised
(US$ Equivalent)

ITEMS	APPRAISED			ACTUAL			DIFFERENCE	
	LOCAL	FOREIGN*	TOTAL	LOCAL	FOREIGN*	TOTAL	AMOUNT	%
01 - Civil Works (incl. const. equip. & land rights)	35.943	-	35.943	94.822	3.745	98.567	62.624	+174
02 - Overhead Cost	2.612	-	2.612	14.593	-	14.593	11.981	+459
03 - Turbines and Generators	2.585	10.200	12.785	4.533	10.931	15.464	2.679	+ 21
04 - Electrical Equipments - various	231	3.100	3.331	2.435	3.286	5.721	2.390	+ 72
05 - Mechanical Equipments - various	2.337	2.000	4.337	8.806	2.238	11.044	6.707	+155
06 - Engineering	1.053	900	1.953	7.146	4.447	11.593	9.640	+494
07 - Transmission	7.183	10.400	17.583	31.220	4.575	35.795	18.212	+104
08 - Total (before interest)	51.944	26.600	78.544	163.555	29.222	192.777	114.233	+145
09 - Interest Capitalized	12.300	4.500	16.800	18.144	8.000	26.144	26.144	+ 56
10 - Total Cost (interest included)	64.244	31.100	95.344	181.699	37.222	218.921	140.377	+130

* Includes indirect foreign exchange costs.

ANNEX 5/B

BRAZIL

CENTRAIS ELETRICAS DE MINAS GERAIS S.A. (CEMIG)

LOAN 566-BR

Principal Undertakings in Loan Documents

1. Loan Agreement

(a) Section 5.02(a) and (b) - Competent consultants and contractors acceptable to the Bank, shall be employed.

(b) Section 5.05 - Certified and audited financial statements of the CEMIG group are to be forwarded to the Bank within four months after the close of each calendar year.

(c) Major expansion covenant - Under Section 5.13 of the original loan agreement, neither CEMIG nor its subsidiaries were to undertake any major expansion project (costing over US$ 3 million) unless evidence was furnished to the Bank that the plan is in accordance with the plan of the Guarantor for the South-Central region of Brazil and that the Borrower will have adequate financial resources for the expansion.

(d) Tariff adjustments and assets revaluation covenants - Under Section 5.15 of the loan agreement as restated in the amending agreement of October 31, 1973, CEMIG shall (i) take any necessary action to cause its tariffs to be set and maintained so as to produce revenues, as provided by existing federal tariff regulations, sufficient to ensure its continued operation in accordance with sound financial and public utilities practices (i.e. providing for a return on remunerable investment between 10% and 12%), and (ii) revalue its assets at least once every calendar year and apply for the corresponding rate adjustments.

(e) Debt limitation covenant - Section 5.14 of the original loan agreement provided that the maximum amount of consolidated debt of CEMIG and its subsidiaries would be limited to 66-2/3% of its total fixed assets (debt including also short-term debt other than incurred in the ordinary course of business). The amending agreement of October 31, 1973 stipulates instead that CEMIG or any of its subsidiaries shall not incur any debt without the Bank's agreement unless the net revenues of the CEMIG group for the last 12 months shall cover 1.5 times the debt service requirements on all outstanding debts (including the debt to be incurred in any succeeding

year). Under this amendment, (i) "debt" means all debt except debt of less than 1 year term incurred in the ordinary course of business, and (ii) "revenues" means gross revenues adjusted for tariff rates at time of the debt incurrence, less all operating expenses but before depreciation and interest charges.

(f) Section 5.16 - Neither CEMIG nor its subsidiaries shall acquire the ownership or control of any company or business unless such acquisition is made in accordance with a financing plan satisfactory to the Bank.

(g) Section 6.02 (d) - If there is any change in legislation of the Guarantor which, in the judgment of the Bank, shall materially and adversely affect the CEMIG Group's operations or adjustments in rates, the Bank may suspend withdrawals from the Loan accounts.

2. Guarantee Agreement

(a) Section 3.05 (b) - The Government shall cause the appropriate agency to take action on tariff applications of the CEMIG Group within a 30-day period.

(b) Section 3.06 - The Government shall take action to encourage effective coordination of an integrated system and to expand the transmission and distribution facilities in order to ensure that power generated will efficiently reach retailers and consumers.

3. Project Agreement

(a) Section 2 - The State of Minas Gerais warrants that the Project shall have the highest priority in the allocation of the development funds of the State as provided in State laws.

(b) Section 4 - The State shall, as required by its laws, reinvest in capital stock of CEMIG not less than 80% of all dividends paid to it by CEMIG and invest the remainder in other entities of CEMIG.

(c) Section 5 - The State shall transfer to CEMIG all funds received from the Federal Government or Eletrobras for use in carrying out the Project.

BRAZIL

CENTRAIS ELETRICAS DE MINAS GERAIS S. A. (CEMIG)

LOAN 566-BR

FINANCIAL INDICATORS

	1968		1969		1970		1971		1972		1973		1974		1975	1976
	ACTUAL	APPRAISAL ESTIMATE	ACTUAL	APPRAISAL ESTIMATE	ACTUAL	APPRAISAL ESTIMATE	ACTUAL	APPRAISAL ESTIMATE	ACTUAL	APPRAISAL ESTIMATE	ACTUAL	APPRAISAL ESTIMATE	ACTUAL	APPRAISAL ESTIMATE	ACTUAL	ESTIMATE 4/
1. Total Debt/Total Fixed Assets (%)	25.8	30.5	29.5	34.3	37.3	38.0	38.4	38.0	37.8	35.4	43.7	31.7	47.5	27.7	52.9	52.5
2. Depreciation Charges/Average Gross Fixed Assets (%)	3.5	3.1	2.7	3.2	2.2	3.2	2.9	3.2	3.4	3.2	2.6	3.1	2.1	3.1	3.3	3.0
3. Rate of Return 1/	11.1	13.1	11.7	14.9	13.5	15.7	11.9	14.7	15.5	13.2	15.1	12.7	15.7	12.0	16.7	16.4
4. Gross Debt Service Coverage by Gross Internal Cash Generation (Times) 2/	3.3	3.5	2.1	2.9	1.9	2.3	1.8	2.4	1.7	2.5	1.7	2.2	1.8	2.3	1.6	1.3
5. Net Debt Service Coverage by Gross Internal Cash Generation (Times) 3/	3.7	6.3	2.3	5.8	2.2	5.7	2.4	6.0	2.4	4.1	1.9	2.7	1.9	2.4	1.7	1.7
6. Average Outstanding Billings at Year End, (days)	104	28	61	26	55	28	50	30	58	27	61	27	45	27	45	45

1/ Net operating income plus reversion as % of average net revalued fixed assets in operation
2/ Capitalized interest included in debt service.
3/ Capitalized interest deducted from debt service.
4/ Based on Cash-flow - December, 1976.

ANNEX 7/B

BRAZIL

CENTRAIS ELETRICAS DE MINAS GERAIS, S.A. (CEMIG)

LOAN 566-BR

ECONOMIC RATE OF RETURN
(in millions of constant December, 1967 Cruzeiros)

I.

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
I. Based on Appraisal Data 6/										
Construction Costs 1/	1.8	10.8	33.2	61.9	66.6	52.3	26.1	-	-	-
Contribution to Cost of System Expansion 2/	-	-	-	-	-	88.4	91.6	-	-	-
Operating Costs	-	-	-	-	-	-	11.9	11.9	11.9	11.9
Revenues 4/	-	-	-	-	-	-	32.3	64.5	64.5	64.5
II. Based on Actual Data										
Construction Costs 1/	0.9	5.8	46.0	55.1	83.5	138.2	64.0	33.7	11.5	-
Contribution to Cost of System Expansion 3/	-	-	-	-	-	-	93.4	144.0	-	-
Operating Costs	-	-	-	-	-	-	-	13.0	13.0	13.0
Revenues 5/	-	-	-	-	-	-	-	67.4	78.0	89.3

1/ Includes associated transmission expenditures. Excludes interest during construction.
2/ Based on contributions to cost of expansion for 1973 and 1974 for total of Cr$180 million per Appraisal Report.
3/ Based on actual contributions to cost of expansion for 1974 and 1975 in constant 1967 cruzeiros.
4/ Based on average annual generation of 1.5 billion kWh.
5/ Based on average annual generation of 1.7 billion kWh.
6/ The appraisal report gives a figure of 10.2% for the internal rate of return, but does not show the annual cash flows. The figures given result in a 10.6% rate of return.

ANNEX 8/B

BRAZIL

CENTRAIS ELETRICAS DE MINAS GERAIS S.A. (CEMIG)

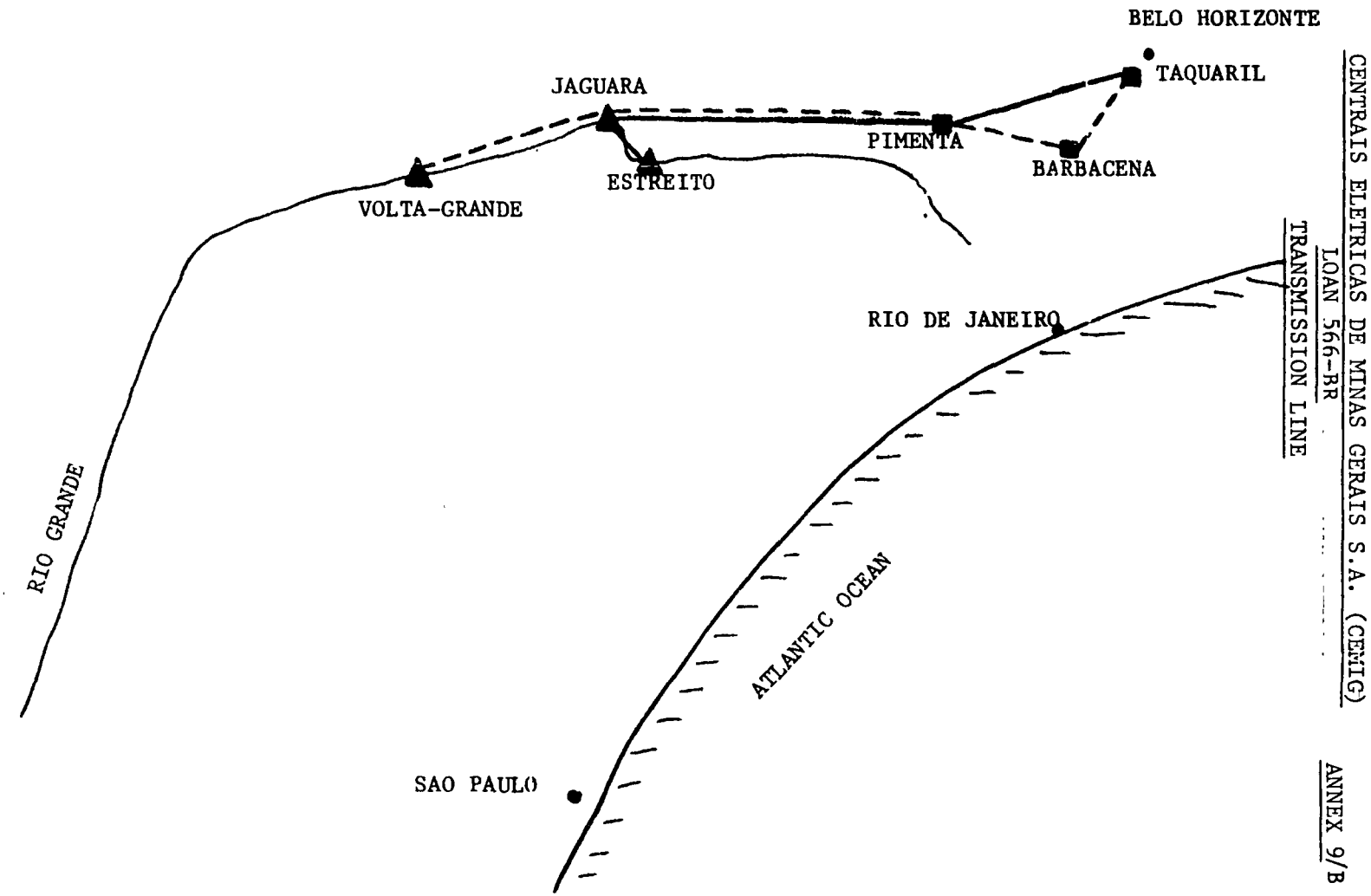
LOAN 566-BR

TRANSMISSION LINE

ANNEX 9/B

---- Lines originally included in Loan 442-BR

---- Additional lines (originally included in Loan 566-BR) (except Pimenta - Barbacena - Iaquaril which were financed by CEMIG)



VOLTA GRANDE HYDRO PLANT

PROJECT DESCRIPTION

1. GENERATING PLANT
   - 1.1 Earth fill dam
   - 1.2 Right bank
     - Length 1,212 meters
     - Maximum height 40 meters
   - 1.3 Left bank
     - Length 297 meters
     - Maximum height 36 meters
   - 1.4 Power house
     - indoor power house
     - 4 generators with rated capacity of 100,000 kVA for 60°C temperature rise and 115,000 kVA for 80°C temperature rise (above 40°C)
     - No provision for future expansion at the site.
   - 1.5 Concrete spillway with 10 trainter gates.

2. TRANSMISSION
   - 2.1 Transmission lines:
     - 2.1.1 Volta Grande - Jaguara
       - Voltage: 345 KV
       - Length: 89 km
     - 2.1.2 Jaguara - Pimenta
       - Voltage: 345 KV
       - Length: 180 km
     - 2.1.3 Pimenta - Barbacena
       - Voltage: 345 KV
       - Length: 260 km
     - 2.1.4 Taquaril - Barbacena
       - Voltage: 345 KV
       - Length: 145 km

2.2 Substations

2.2.1 Volta Grande

4 transformers 13,8/345 KV
115 MVA

8 circuit - breakers - 345 KV

2.2.2 Jaguara

2 circuit - breakers - 345 KV

2.2.3 Pimenta

2 circuit - breakers - 345 KV

2.2.4 Barbacena

1 auto-transformer 345/138 - 13,8 KV
150 MVA

3 circuit - breakers 345 KV

2.2.5 Taquaril

1 auto-transformer bank 345/138 - 13,8 KV
3 x 75 MVA

1 circuit - breaker 345 KV

Volta Grande

Geology

The site is in the area of the basaltic flows common to the southern half of the Paraná Basin.

The concrete structures and the left embankment are founded on rock. The right embankment foundation is partly rock and partly saprolite. During the design stage, investigations were carried out to decide if the saprolite was a suitable foundation for the earth dam; the tests showed it had low strength and high compressibility and part of the saprolite was removed. Measurements of settlements have shown that the actual compressibility of the saprolite foundation is less than anticipated.

Some time after the excavation of the foundations for the concrete structures some problems occurred in the spillway and powerhouse areas. The foundation of the spillway was right above a contact between flows; this contact had been proven to be closed and watertight, but 4 months after excavation the contact was found to be somewhat open. Evidences showed that the opening only appeared at this time, and that it was caused by high residual stress in the basalt and possibly triggered by nearby detonations. In the excavation of the powerhouse some 12 m high promontories of rock were left between penstocks in order to save concrete. There was a "fault-joint" about 1 m above the base of the promontories; right after cleaning the excavation debris it was found that the rock of the promontories above the joint had moved outwards up to 15 cm. It was concluded that the movement was caused mainly by the blasting procedure.

The spillway foundation had to be somewhat re-excavated and the promontories removed. Those operations implied some delay and extra cost.

BRAZIL

CENTRAIS ELETRICAS DE MINAS GERAIS S.A. (CEMIG)

LOAN 566-BR

Construction Schedule

Original Construction Schedule

(a) In the preliminary report the on-line date for the first unit was shown as March 1, 1973 same as indicated in the contract between CEMIG and the contractors. No comprehensive studies for the schedule were made at that time.

(b) Construction Schedule at the Beginning of Construction:

During the preparation of bidding documents and immediately after the signing of the contract for the major civil works, comprehensive schedule studies were made. As a result of these studies, the contractors' official construction schedule was issued in early January 1970, and it gives the following on-line dates for commercial operation of the units:

Unit 1	End of September 1973
Unit 2	End of December 1973
Unit 3	End of April 1974
Unit 4	End of August 1974

(c) Actual Power On-Line:

When the foundation for the concrete structures were exposed, it was found that the condition of the basalt was somewhat worse than anticipated during the subsurface explorations. More excavation and a certain amount of concrete dental work and an extensive grouting operation were required. These additional operations delayed the construction; and to recover as much of the lost time as possible, the construction schedule was reprogrammed. Although the lost construction time was largely recovered, certain delays occurred in the equipment supply, which again delayed the on-line dates. The actual dates on which the units were in commercial operation are as follows:

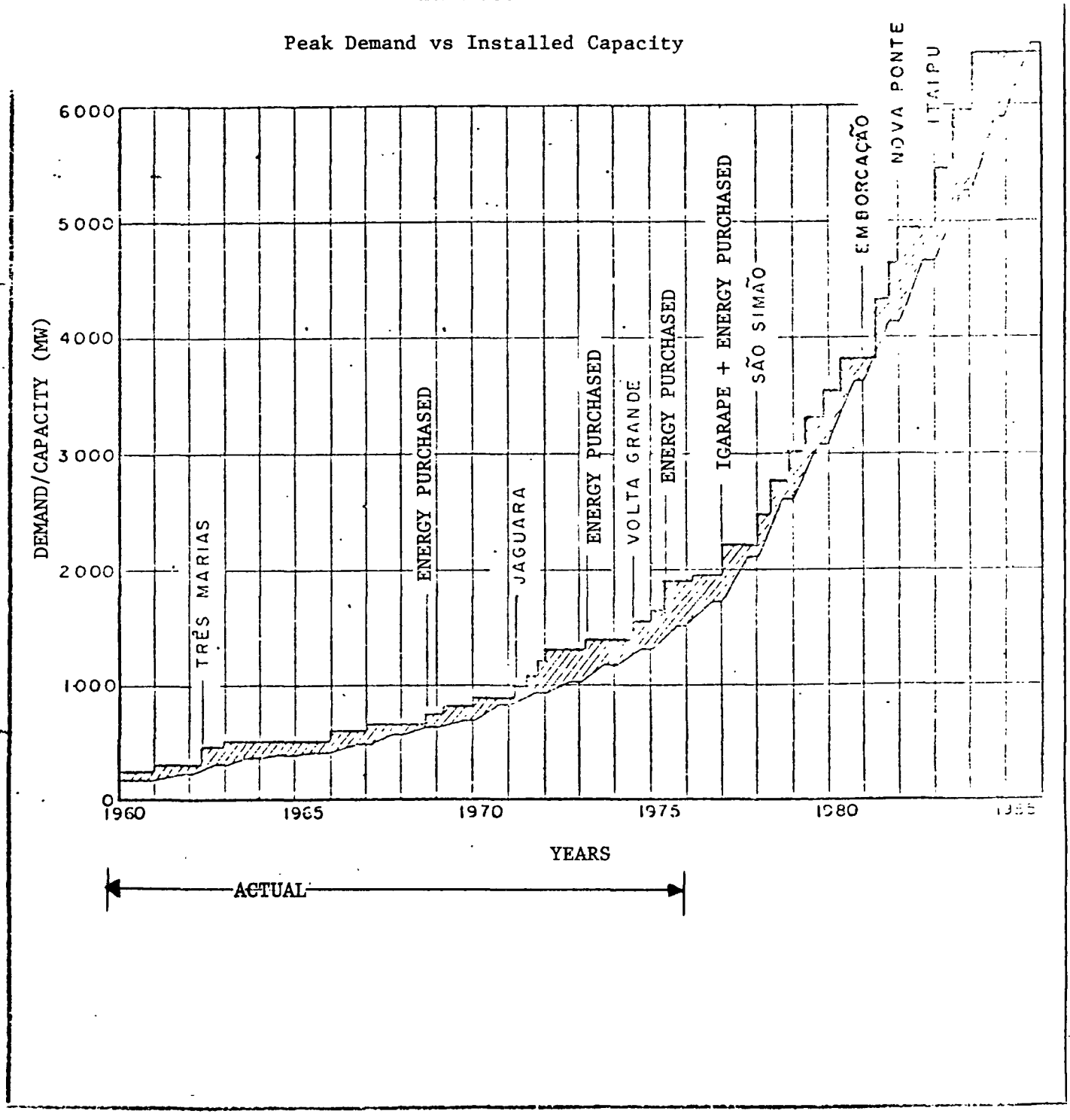
Unit 1	July 1974
Unit 2	February 1975
Unit 3	May 1975
Unit 4	August 1975

BRAZIL

CENTRAIL ELETRICAS DE MINAS GERAIS S. A. (CEMIG)

LOAN 566-BR

Peak Demand vs Installed Capacity



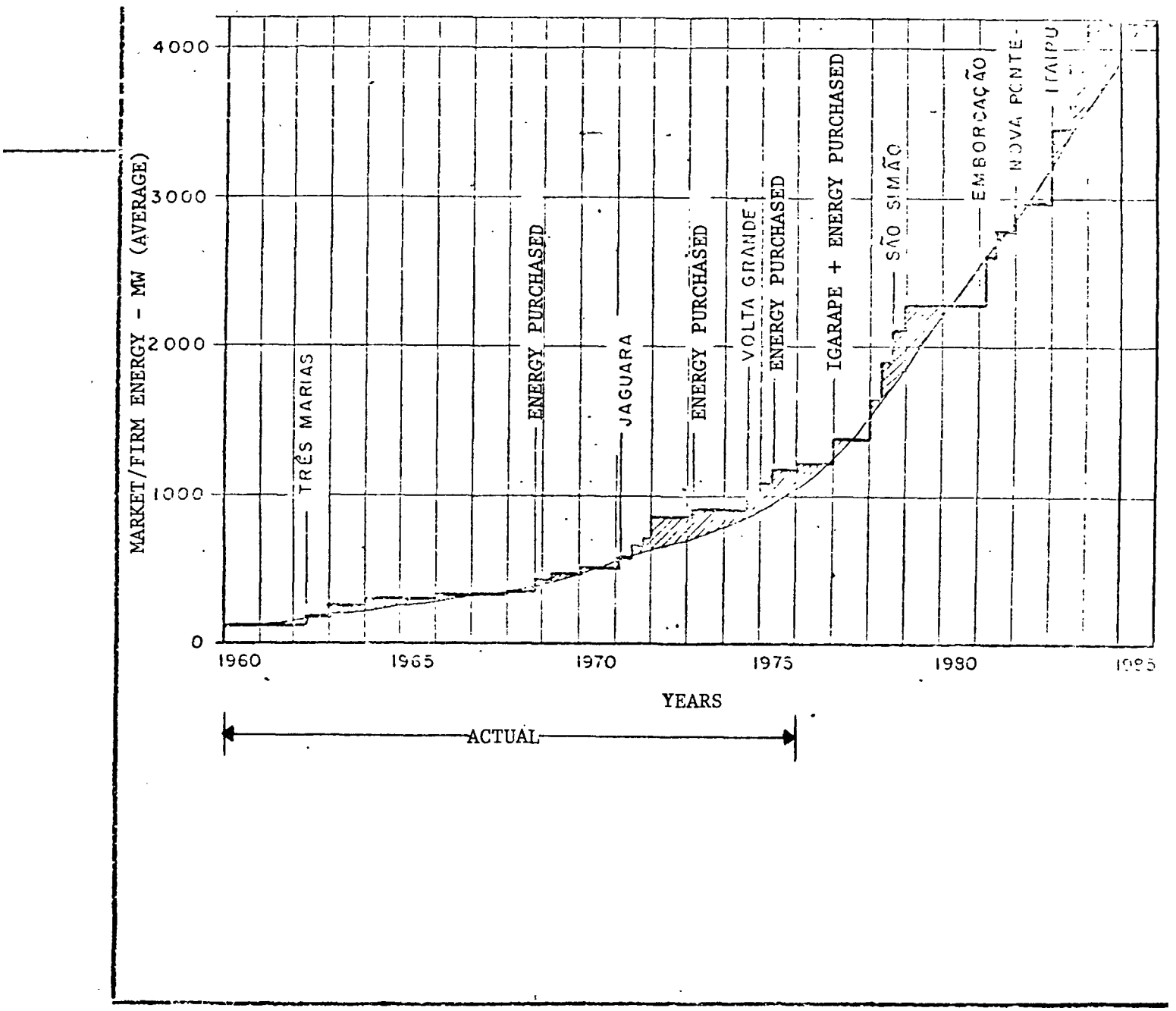
BRAZIL

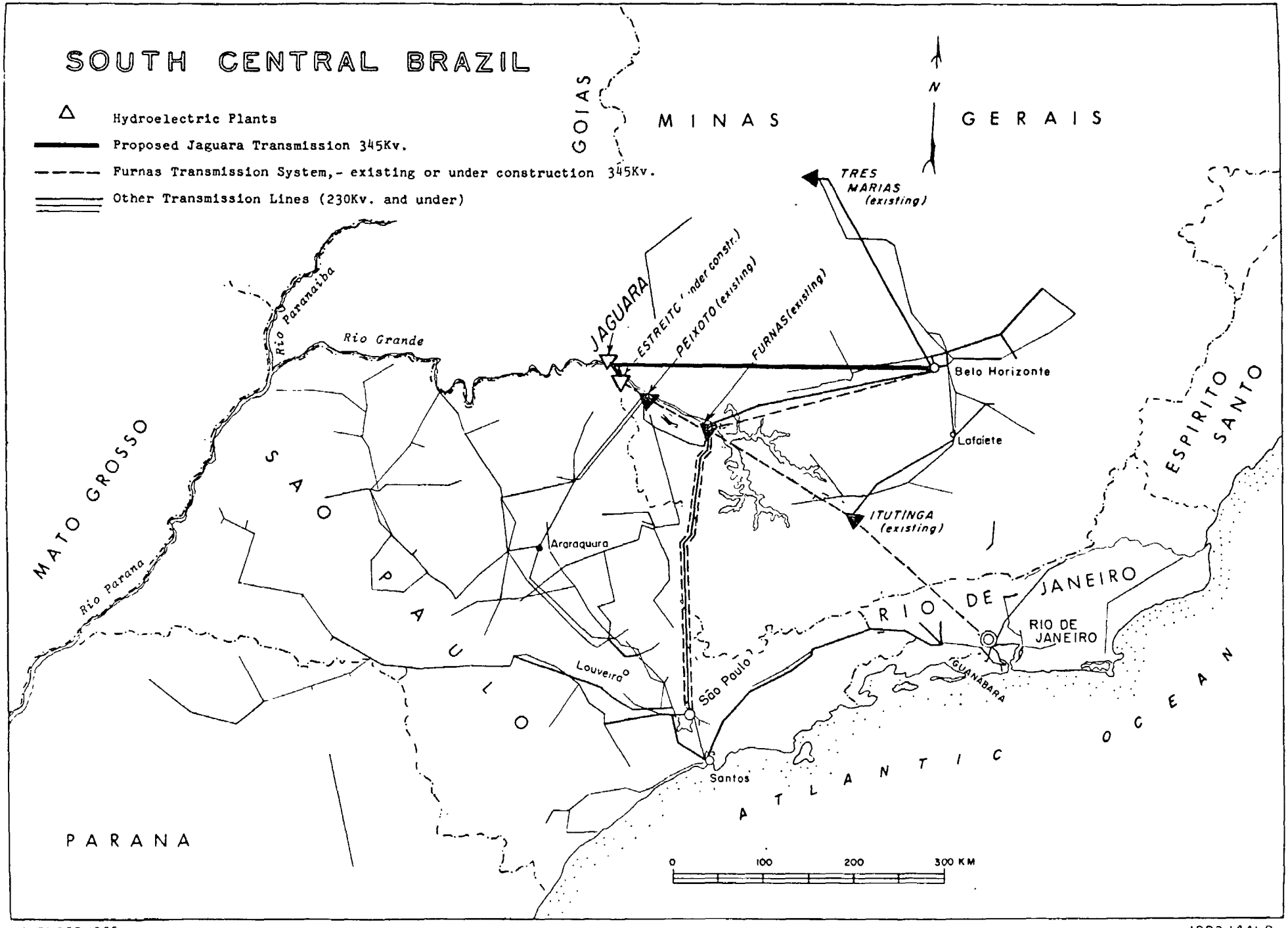
CENTRAIL ELETRICAS DE MINAS GERAIS S. A. (CEMIG)

LOAN 566-BR

Available Firm Energy vs Market Requirements

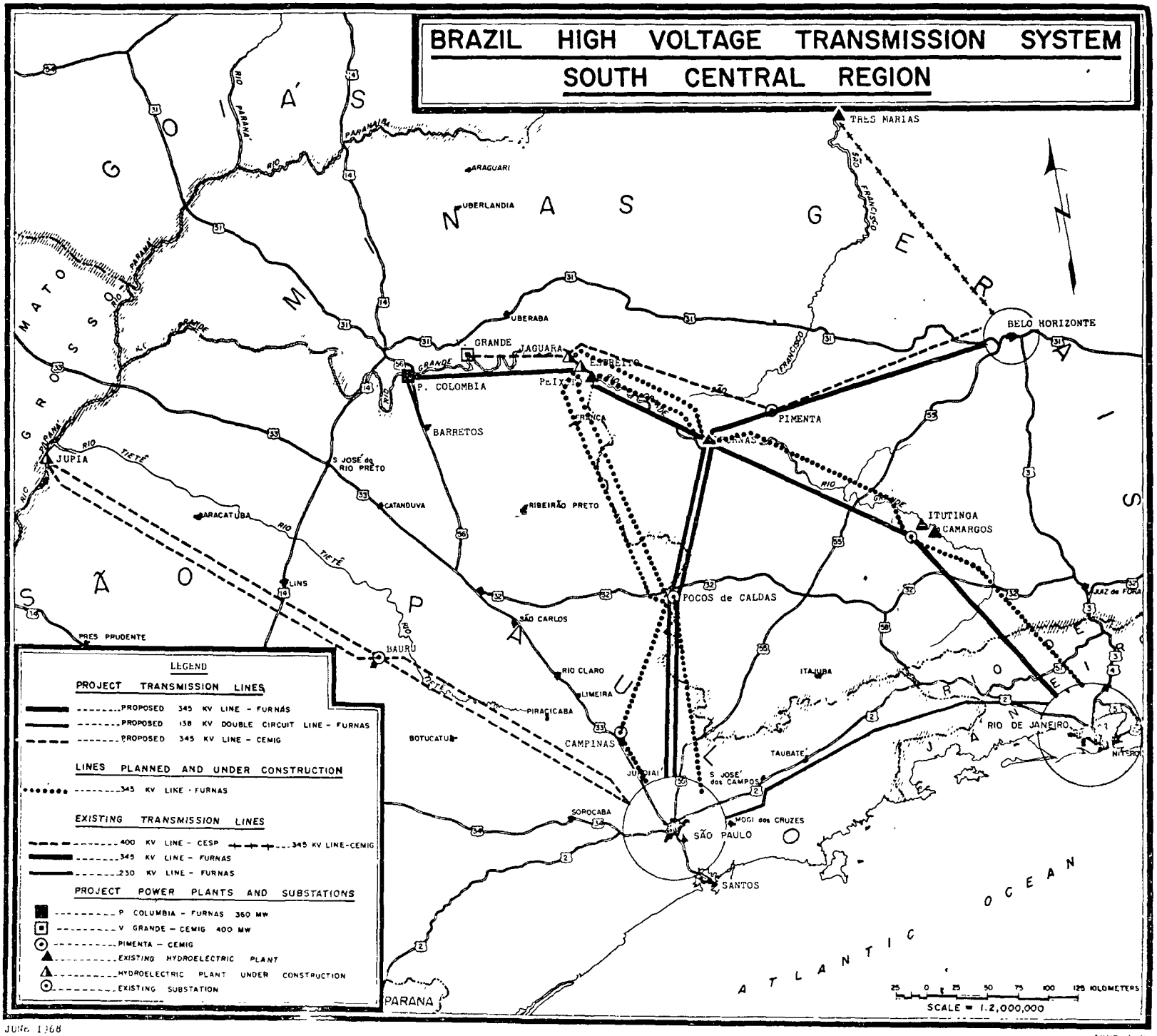
1960 to 1985





NOVEMBER 1965

IBRD 1441 R1



JUNE 1968

IBRD 2559