[redacted]

	1958	1959	1960	1961	1962	1963	1964	1965	1966
L.C. Plant	.494	1.658	2.083	3.599	5.249	11.551	10.374	9.050	2.697
~US$	3.800	10.362	10.415	12.853	13.459	19.578	8.168	4.763	1.215
+F.X.	—	15.635	5.740	8.539	9.774	4.526	.138	—	.489
Total	3.800	25.997	16.155	21.392	23.233	24.104	8.306	4.763	1.704
L.C. Trans	.029	.022	.291	.155	.399	1.473	1.884	10.683 ?	
~US$	.223	.137	1.455	.554	1.023	2.497	1.483	5.623	
+F.X.	—	.322	2.622	1.747	2.463	3.758	1.781	.878	.032
Total	.223	.459	4.077	2.301	3.486	6.255	3.264	6.501	

Total:	1958-66
Plant:	+0.769
L.F.	84.649
F.F.	44.841
Total	129.490
	0.769

Transmission	1958-64	1958-65
		.092
L.F.	7.372	12.995
F.F.	12.693	13.571
Total	20.065	26.566

.726
2.006
2.221
2.945
3.661
2.913
14.412

14.8
18.9

Contingencies : + Engineering + Sub-Total 2 + Cost Increases
Sub Total 1

F.X. { Plant 33.7 + 2.36 = 36.06 + 3.79 = 39.85 + 1.65 = 41.50
Trans. 13.4 + 0.94 = 14.34 + 1.51 = 15.85 + 0.65 = 16.50
47.1 50.40 55.70 58.00

L.C. { Plant 7.040 + .815 = 7.855 + 0.850 = 8.705 + 4.438 = 13.143
Trans. .576 + .058 = .634 + 0.087 = 0.721 + 0.363 = 1.084
7.616 8.489 9.426 14.227

Without Cost increase :

	L.C.	F.X.	Total
Plant	66.96	39.85	106.81
Trans.	5.55	15.85	21.40
Total	72.51	55.70	128.21

With cost increase in F.X only

	L.C.	F.X.	Total
Plant	66.96	41.50	108.46
Trans.	5.55	16.50	22.05
Total	72.51	58.00	130.51

442.8
128.8
57.6
539.2
333.6
872.8
.057.6
815.2

GENERATION: TOTAL (1)

- FURNAS Power Plant (Loan 211)

- ESTREITO Power Plant, Stage I (Loan 403)

- Other Generating Plants in operation not covered by IBRD loans
  FUNIL Power Plant X
  SANTA CRUZ Power Plant X

- Interest during construction

TRANSMISSION: TOTAL (1)

- FURNAS Transmission System (Loan 211)

- ESTREITO Transmission System (Loan 403)

- Other Transmission Systems in operation not covered by IBRD loans
  FUNIL Transmission System X
  SANTA CRUZ Transmission System X

- Interest during construction

TOTAL PROJECTS: (1)

FURNAS

ESTREITO

FUNIL

SANTA CRUZ

Interest during construction

FURNAS + Interest.

NOTE: (1) Excluding interest during construction

12.5.71

1957	
Local Cost Cr$ x 10^3	Foreign Exch. US$ x 10^3
180	
12	
12	
2	
112	
14	
126	

1958	
Local Cost NCr$ x 10^3	Foreign Exch US$ x 10^3
494	
61	
29	
4	
523	
65	
588	
+126 = 714	

7.584
1.668
.998
10.190

8.503
8.801
1.628
18.932

40.405
1.920
6.630
.067
7.584
1.668
8.503
8.801
.170
5.062

xch.	1968 Local Cost Cr$ x 10³	1968 Foreign Exch. US$ x 10³	1969 Local Cost Cr$ x 10³	1969 Foreign Exch. US$ x 10³	1970 Local Cost Cr$ x 10³	1970 Foreign Exch. US$ x 10³	
	2613		14206		17286		
BR	68903	403-BR 7584	18851	8.503	698	170	
	48572		45072		56178		
	6609		896	359	695	19	
	43574	1151	52291	1.641			
	13305		23097		32434		
		USAID 2173		965		57	
BR	2042	1668 403-BR	13404	8801	5851	5062	
	1610		727				
	679	550	353	445	873	941	
	15918	2173	37303	965	49710	57	
	70945	9252	32255	17304	6549	5232	
	48578		45072		56178		
	8219		1623	359	695	19	
	44258	1701	52644	2086	873	941	

Esheito Plant Stage I.

	1962	1963	1964	1965	1966	1967	1968	1969	1970
L.C. Plant	.027	.095	.991	5.830	41.968	57.266	68.903	18.851	0.698
~ US$	.069	.161	.7805	3.066	18.890	21.430	20.240	4.620	0.152
+ F.X.	—	—	—	.085	1.920	6.630	7.584	8.503	0.170
Total	.069	0.161	.7805	3.151	20.810	28.060	27.824	13.123	0.322
L.C. Trans	—	—	.233	.018	.043	.241	2.042	13.404	5.951
~ US$			0.184	0.01	.019	0.090	0.601	3.289	1.272
+ F.X.						.067	1.668	8.801	5.062
Total	—	—	0.184	0.01	0.019	0.157	2.269	12.090	6.334
	0.39	0.59	1.27	1.90	2.22	2.67	3.40	4.08	4.60

Total :	1962-1970
Plant: L.F.	
F.F.	24.892
Total	94.300
Trans: L.F.	
F.F.	15.598
Total	21.054

2
4.69
161
3.780
23.151
20.810
28.060
27.824
13.123
0.322
94.300
21.054
115.354

33
.185
.019
.157
2.269
12.090
6.334
21.054

1
.067
1.668
8.801
5.062
15.598

21
2.170
8.503
7.584
6.630
1.920
.085
24.892
15.598
40.490
~~15.598~~
~~6.088~~

30.24
21.06
9.18

24.84
15.60
3.8
44.29

94.30
26.85
119.15
31.4
87.75

15.60
+1.90
17.50
−7.85
9.65
24.892

40.490

24.89
1.90
26.79

26.79
4.96
21.83

ROJECTS

URNAS

Local Cost is in historic NCr$.

1964 Local Cost Cr$ x 10^3	1964 Foreign Exch. US$ x 10^3	1965 Local Cost Cr$ x 10^3	1965 Foreign Exch. US$ x 10^3	1966 Local Cost Cr$ x 10^3	1966 Foreign Exch. US$ x 10^3	1967 Local Cost Cr$ x 10^3	1967 Foreign US$ x 1
10374	138	9050		2697	IBRD 211 489	2092	
991		5830	85	41968	1920 IBRD 463	57266	[663
9782		13572		26428		29666	
1593	43	4127	(4267 439)	15094	(8767 800)	17039	35
2935	2170	5104		6474		20588	86
1884	1781	10683	878 1121 (USAID)	17769	IBRD 211 32 6280 USAID	20553	USAID 362 [6
233		18		43		241	
60		790		2690	(354)	5044	
271	743	833		2245	18 IDRD	1368	26
12258	1919	19733	1999	20466	6801	22645	362
1224		5848	85	42011	1920	57507	669
9782		13572		26428		29666	
1653	43	4917	(4267 439)	17784	(8767+354) 9121	22083	35
3206	2913	5937		8719	818	21956	133
15,464	4.832		2,084				
					(6250) USAID 69		
					2441 IBRD?		

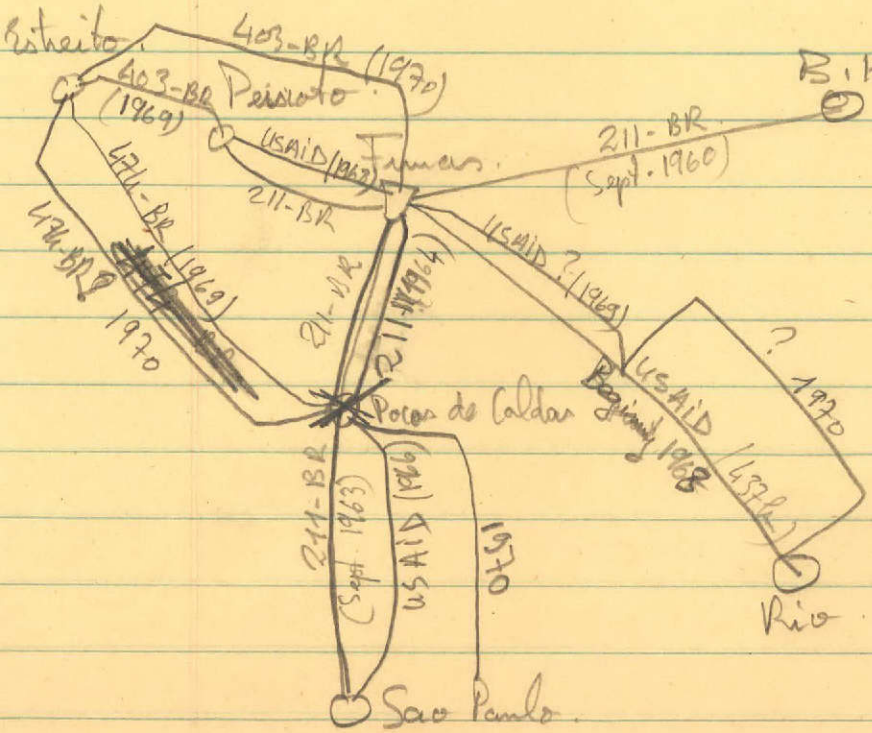
1 9 5 9 Local Cost Cr$ x 10^3	1 9 5 9 Foreign Exch. US$ x 10^3	1 9 Local Cost Cr$ x 10^3
1658 -	15.635	2.083
		16
		1
877	712	862
22 -	322	291
11	14	121
1,680 -	15.957	2374
		16
		1
888	726	983
1,568	16.683	3,357
		27.326
		27.051

ORIGINAL COST OF P

BRAZIL - F

60	1961		1962		1963	
Foreign Exch. US$ x 10^3	Local Cost Cr$ x 10^3	Foreign Exch. US$ x 10^3	Local Cost Cr$ x 10^3	Foreign Exch US$ x 10^3	Local Cost Cr$ x 10^3	Foreign Exch. US$ x 10^3
5740	3599	8539	5249	9774	11.551	4526
			27		95	
	235		1091		3402	
	8		72		260	
1377	895	1844	1707	2352	2735	2368
2622	155	1747	399	2463	1473	3758
					16	
629	37	377	123	593	286	1233
8362	3754	10286	5648	12237	13024	8284
			27		95	
	235		1091		3402	
	8		72		276	
2006	932	2221	1830	2945	3021	3601
10.368	4,686	12.507	7,478	15.182	16,045	11.885

Transmission system of Furnas.



Installed Capacity

	1	2	3	4	5	6
	Thermal		Hydro		Total	
	SCR	%	Brazil	%	SCR	%	Brazil	%	SCR	%	Brazil	%	
1960			1,158				3,642				4800		1960
1961			1,396				3,809		3,676	71	5205	29	1961
1962			1,603				4,126		4,034	70	5729	30	1962
1963			1,876				4,479		4,571	72	6355	28	1963
1964	925	48	1,946	52	4,026	82	4,894	18	4,951	72	6840	28	1964
1965	947	47	2,020	53	4,509	84	5,391	16	5,456	74	7411	26	1965
1966	993	49	2,042	51	4,627	84	5,524	16	5,620	74	7566	26	1966
1967	1,207	54	2,255	46	4,645	80	5,787	20	5,882	73	8042	27	1967
1968	1,174	49	2,372	51	4,875	79	6,183	21	6,049	71	8555	29	1968
1969	1,240	52	2,405	48	5,928	75	7,857	25	7,168	70	10262	30	1969
1970	1,240	52	2,405	48	6,319	72	8,828	28	7,559	67	11233	33	1970

	7		8		9		10		11	12	13	14
	Liquid		Production		Sales							
	SCR	%	Brazil	%	SCR	%	Brazil	%				
1	17050	75	22865		13805	75	18346					
2	18765	77	24405		15275	78	19630					
3	21019	77	27158		16705	76	21857					
4	21761	78	27869		17682	78	22618					
5	22564	78	29094		18364	78	23521					
6	23767	79	30128		19214	79	24268					
7	25939	79	32654		20682	78	26494					
8	27213	79	34238		21851	78	27988					
9	29648	78	38181		24549	78	31399					
10	30652	74	41648		26678	78	34201					
11	33837	74	45813		29036	77	37587					
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
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35												
36												
37												
38												
39												
40												

SOUTH CENTRAL BRAZIL

INSTALLED CAPACITY (MW)

CAPACIDADE INSTALADA NA REGIÃO CENTRO-SUL - 1960/70

	TÉRMICA	HIDRÁULICA	(MW) TOTAL	% Thermal	% Hydro
1960					
1961			3676		
1962			4.034		
1963			4571		
1964	925	4.026	4.951	18.7	81.3
1965	947	4.509	5.456	17.4	82.6
1966	993	4.627	5.620	17.7	82.3
1967	1.207	4.645	5.852	20.6	79.4
1968	1.174	4.875	6.049	19.4	80.6
1969	1.240	5.928	7.168	17.3	82.7
1970	1.240	6.319	7.559	16.4	83.6

Inclui Autoprodutores. Exclui a potência da Usina de Jupiá (MT)

FONTE : DNAEE/DE.

Acréscimo de Potência em (MW) 1970, foi somente em hidrelétricas.

		Unid
N. Mamiça	12,5	1
Chavantes	200,0	2
Furnil	140	2
Ibitinga	32,1	1
	390.600 kw	

BRAZIL

INSTALLED CAPACITY - (MW)

CAPACIDADE INSTALADA NO BRASIL - 1960/70

	(MW) TÉRMICA	HIDRÁUL.	TOTAL	% Thermal	% Hydro
1960	1158	3642	4800	24.1%	75.9
1961	1.396	3.809	5205	26.8	73,2
1962	1.603	4.126	5.729	28.0	72.0
1963	1.876	4.479	6.355	29.5	70.5
1964	1.946	4.894	6.840	28.5	71.5
1965	2.020	5.391	7.411	27.3	72.7
1966	2.042	5.524	7.566	27.0	73.0
1967	2.255	5.787	8.042	28.0	72.0
1968	2.372	6.183	8.555	27.7	72.3
1969	2.405	7 857	10.262	23.4	76.6
1970	2405	8828	11.233	21.4	78.6

OBS. Inclusi Autoprodutors.
Captive Plants are included
FONTE: DNAEE

GENERATION AND CONSUMPTION — BRAZIL

PRODUÇÃO E CONSUMO DE ENERGIA NO BRASIL (GWh)

ANO	PRODUÇÃO LÍQUIDA TOTAL (LIQUID PRODUCTION) Gross		CONSUMO TOTAL (CONSUMPTION)	Losses	Losses %
1960	23.166	22865	18316	4820	20.8
1961	24743	24405	19630	5113	20.7
1962	27.618	27158	21857	5761	20.9
1963	28.295	27869	22618	5677	20.1
1964	29.523	29074	23521	6002	20.3
1965	30.508	30128	24268	6240	20.5
1966	33.043	32654	26474	6549	19.8
1967	34.664	34238	27988	6676	19.3
1968	38.662	38181	31399	7263	18.8
1969	42.260	41648	34201	8059	19.1
* 1970	46,500	45813	37587 X	8913	19.2

FONTE: DNAEE/DE.

* O ano de 1970 os dados são estimados.

Liquid Production = Gross — (auxiliaries & pumping)

GROSS GENERATION – BRAZIL

GERAÇÃO BRUTA NO BRASIL – 1960/70

(GWh)

1960	23166
1961	24.743
1962	27.618
1963	28.235
1964	29.523
1965	30.508
1966	33.043.
1967	34.664.
1968	38.662.
1969	42.260
* 1970	46.500

Captive Plants are included

FONTE : DNAEE

* Dado Preliminar

SOUTH CENTRAL BRAZIL

LIQUID GENERATION (GWh)

GERAÇÃO LÍQUIDA NA REGIÃO CENTRO-SUL

(GWh)

		Sales	Losses	%
1960	17050	13 805	3245	19.0
1961	18 765	15,275	3490	18.6
1962	21 019	16,705	4314	20.5
1963	21 761	17,682	4079	18.7
1964	22 564	18,364	4200	18.6
1965	23 767	19,214	4553	19.2
1966	25.939	20,682	5257	20.3
1967	27.213	21,851	5362	19.7
1968	29.648	24,549	5099	17.2
1969	30.652	26,678	3974	13.0
* 1970	33 837	29,036	4801	14.2

FONTE: DNAEE,

* Dado Preliminar

— South Central Brazil —

TOTAL CONSUMPTION (GWh) (same as total sales)

VENDAS TOTAIS DAS EMPRÊSAS DA REGIÃO CENTRO-SUL

	(GWh)	1960/70
1960	13 805	
1961	15 275	
1962	16 705	
1963	17 682	
1964	18 364	
1965	19 214	
1966	20 682	
1967	21.851	
1968	24.549	
1969	26 678	
* 1970	29.036	

OBS: Incluí as vendas dos principais Autoprodutores.

FONTE: ELETROBRÁS

*Dado Preliminar

Captive Plants are included

SOUTH CENTRAL BRAZIL
PEAK DEMAND (MWh/h)

		NÃO SIMULTÂNEA	(x)	SIMULTÂNEA		
1969	J					
	F					
	M					
	A					
	M					
	J					
	A					
	S	4982	GRUPO LIGHT, CEMIG, CBEE, CPFL, CESP, FURNAS			
	O	4948				
	N	4961				
	D					
1970	J	4973	CELF(32), CELG(5?), COPEL (120)			
	F	5070				
	M	5191				
	A	5467				
	M	5487				
	J	5487				
	J	5667	ESCELSA (67)			
	A	5814	CEB (76)			
	S	5824				
	O	5778				
	N	5779				
	D	5831				
1971	J	5876		5581	CFLMG (136)	
	F	6017		5788		
	M	6221		5957	4ª f.	20:00 h
	A					
	M					
	J					
	A					
	S					
	O					
	N					
	D					

(x) Representa cerca de 75% da demanda global da RCS.

	Light / S.P.	Light GB this	CBEE	CEMIG	CPFL	CFLMG	CME	EEUP	Tbdc /	
✓ 1958	1080	610	67	150	214	77	19	8		
✓ 59	1200	660	71	155	255	81	20	9		
✓ 60	1325	695	81	177	280	91	21	11		
✓ 61	1405	745	81	215	305	88	23	14		
✓ 62	1530	735	83	273	330	95	25	16		
✓ 63	1570	760	92	323	355	98	26	17		
✓ 64	1590	790	98	348	364	106	26	14		
✓ 65	1800	870	98	375	375	187	28	18		
✓ 66	1900	910	108	426	405	115	27	20	49	
✓ 67	2200	1010	120	505	440	125	29	—	53	
✓ 68									62	42
69									70	54
70									80	73

1023 592 62 97 200

76 18 7

— SOUTH CENTRAL BRAZIL —

PEAK — DEMANDA (MWh/h)

— PRINCIPAIS EMPRESAS —

Forecast	Actual		LIGHT (São Paulo) ①	LIGHT (Rio + GB) ②	CBEE (E. Rio) ④	CEMIG (MG) (Geração)	CPFL (S.P.) ③	CFLMG (B. Horiz) (inc. na CEMIG)	CEZF (E. Rio)	ESCELSA (E. Santo)
		1950	534	322	35	–	96	29		
		51	560	349	35	–	101	33		
		52	576	345	38	–	102	41		
		53	575	357	38	–	100	47		
		54	664	419	42	–	127	50		
		55	727	450	47	44	144	57		
		56	860	498	53	73	166	60		
2188	1832	57	890	544	56	97	177	68		
122 2570	2103	58	57 1.023	592	62	150	200	76		
2892	2218	59	58 1.090	614	66	155	217	76		
3239	2467	1960	59 1.225	658	71	177	254	82		
3627	2704	61	60 1.341	693	81	215	282	92		
4022	2919	62	61 1.431	739	81	273	307	88		
4524	3105	63	62 1.544	734	84	323	325	95		
5056	3231	64	63 1.572	764	93	348	356	98		
5571	3335	65	64 1.603	790	98	375	364 (405)	105		
6080	3727	66	65 1.799	867	98	426	390	108	49	
6671	3983	67	66 1.903	923	107	481 (51?)	401	115	53	
7306	4604	68	67 2.186	1.121	119	509	441	124	62	42
7995	4787	69	68 2.347	1.076	125	503	475	137	70	54
8763	4691	1970	69 2.503	1.158	132	771	515	153	80	73

O.R.

	CELG (Goiás)	CEB (Brasília)	CESP (S. Paulo)
1969	145	65	914 (600)
1970	152	77	1.145 (800)

incluído ... — inclui sup. LIGHT, CPFL, outras

DEL ←

PROJECTS BRAZIL - FURNAS

Technical Characteristics				1958	
Transmission				Local Cost NCr$ Millions	Foreign Exchange US$ Millions
Km of Lines	Kv Rating	Kva Capacity of Transformers			
		Total KVA. capacity	Critical Capacity KVA.		
712					
447	345	900000	600.000		
265	345	300.000	450.000		
400	345	300.000	1.100.00		
130-160	345		600.000		
30	345		600.000		
910	345/230	270.000	450.000		
1590	500	2.200.000	1.200.000/per line		
684	345		450.000/per line		
420	230/138/		200.000		

FHL
falar CAP

François M. E Hora
16.30 dia 4ª feira

COST OF

Construction			
Begins	Ends	Commissioning Date of units	Generation Capacity MW

GENERATION: TOTAL[1/]

- Furnas Power Plant (Loan #211)
- Estreito Power Plant (Stage I) (Loan #403)
- Porto Colombia (Loan #565)
- Marimbondo Plant (Loan #677)
- Furnas ~~Turbo-Generators~~ (Loan #677)
- Other Generating Plants not covered by loans ~~(specify)~~
  - Furnil
  - Santa-Cruz
  - Furnas (1 to 4)
- (Interest during Construction)

TRANSMISSION: TOTAL[1/]

- Furnas-~~Guanabara~~ São Paulo Transmission (Loan #211)
  - Furnas - São Paulo
  - Furnas - Belo Horizonte
- Estreito Transmission (Stage II) (Loan #474)
  - Estreito - Pôços
  - Estreito - Furnas
  - Estreito - Peixoto
  - Pôrto Colombia - Brasília
- Porto Colombia Transmission (Loan #565)
- Marimbondo Transmission (Loan #677)
- Other Transmission Projects not covered by Bank loans ~~(specify)~~
  - 3 AID lines
  - 3 Furnas lines?
- (Interest during Construction)

TOTAL PROJECTS:

1/ Excluding interest during construction

1/ Excluding interest during construction

Table III

Total Expenditures US$ Millions	Same Information for each year through 1970		
	Local Cost NCr$ Millions	Foreign Exchange US$ Millions	Total Expenditure US$ Millions

1.7
2.3

2
11.5
12.1
16.9
11.6
8.0
17.1

Computation cost of non-Bank plants of FURNAS

	Furnas Santa Cruz	Generation & Transmission
	Furnas	**$ million**
210 MW	Gen	84,891 $ 404
	Trans.	?
	Santa Cruz	
160 MW	Gen	33,373 $ 208
	Trans.	4597
	Furnas AID Transmission	14,224

1= $1 = .24

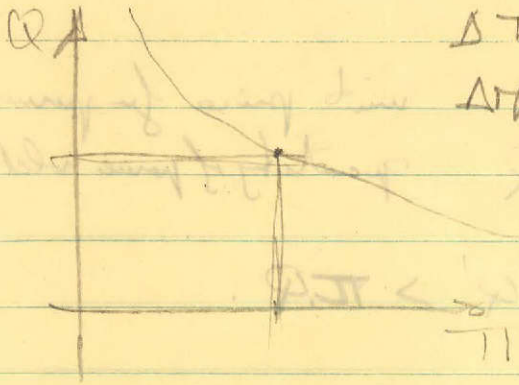
Total	L.C.	F.X	Trans.
60	80		
61	839		
62	2797		
63	5766		
64	7702		
65	7143		
66	11,905		
67	11,111		
68	14,288		
69	11,047		
70	12,213		
	84,891		

US$1 = 1.27

	S. Cruz L.C.	F.X.	Trans.
60	5	43	
61	29	4267	
62	185	8767	
63	441	355	27
64	1254	359	47
65	2172	19	416
66	6799	13,791	1212
67	6382		1889
68	1944		474
69	220		178
70	151		4243
	19,582		354
			4597

Total

33,373



$\Delta\pi > 0 \Rightarrow \Delta Q < 0$

$\Delta\pi < 0 \Rightarrow \Delta Q > 0$

$(\pi - \Delta\pi)(Q + \Delta Q) > \pi \cdot Q$

$\pi Q - \Delta\pi \cdot Q + \pi \cdot \Delta Q - \Delta\pi \cdot \Delta Q > 0$

$\left(1 - \frac{\Delta\pi}{\pi}\right)\left(1 + \frac{\Delta Q}{Q}\right) > 1$

$\frac{\Delta\pi}{\pi} > 0$

$\Delta\pi > 0$

$1 - \frac{\Delta\pi}{\pi} + \frac{\Delta Q}{Q} - \frac{\Delta\pi}{\pi} \cdot \frac{\Delta Q}{Q} > 1$

$-1 + \frac{\Delta Q/Q}{\Delta\pi/\pi} - \frac{\Delta Q}{Q} > 0$

$\frac{\Delta Q/Q}{\Delta\pi/\pi} > 1 + \frac{\Delta Q}{Q} \Rightarrow \varepsilon_Q > 1$

Conversely: $\Delta Q/Q > \frac{\Delta\pi}{\pi}$ $(\sim \varepsilon_Q > 1)$

$1 + \frac{\Delta Q}{Q} - \frac{\Delta\pi}{\pi} > 1$

π unit price for power.
Q quantity of power sold.

$\pi' < \pi$ $\quad \pi' \cdot Q' > \pi \cdot Q$.
$Q' > Q$.

$$\frac{\pi' Q'}{\pi Q} > 1$$

$$\frac{\frac{\pi - \Delta\pi}{\pi}}{\frac{Q}{Q+\Delta Q}} > 1$$

$$\frac{(1+\Delta\pi)}{1+\Delta Q} > 1$$

$$\left|\varepsilon_q\right| = \frac{\frac{\Delta Q}{Q}}{\frac{\Delta\pi}{\pi}} > 1$$

$$\left(1 - \frac{\Delta\pi}{\pi}\right)\left(1 + \frac{\Delta Q}{Q}\right) > 1$$

GENERAL PRICE INDEX (*)

(ANNUAL VALUES)

Cost of Projects:

Year	Value	Index
1958	3,73	100,0
1959	5,14	137,8
1960	6,64	178,0 ← 100
1961	9,10	243,9
1962	13,80	369,9
1963	24,20	648,7
1964	46,10	1.235,9
1965	72,30	1.938,3
1966	99,70	2.672,9
1967	128,0	3.431,6
1968	159,0	4.262,7
1969	192,0	5.147,4 ← 2891.8
1970	230,0	6,166,2 ← 3464.2

(*) Conjuntura Econômica - Column 2

11/5/71

FURNAS

NET FIXED ASSETS IN OPERATION - DECEMBER 31,
ADDED THE MONETARY CORRECTION OCCURRED IN THE NEXT YEAR
NCr$ x 10^3

1963		1966	1969	1970
	Fixed Assets In Operation	515.173	2.256.347	2.919.184
	Depreciation Reserve	(35.709)	(178.203)	(284.664)
192.049	Net Fixed Assets in Operation	479.464	2.078.144	2.634.520

AVERAGE ANNUAL EXCHANGE RATE — IFS. 1960.
NCr$/US$

Appraisal reports:

Year	Albatte. (Average)	Rate		Average free rate.
1958	0.130	0,1293	100	.1287
1959	0.	0,1565	121.0	.1574
1960	0.229	0,1896	146.6	.1901
1961	0.279	0,2723	210.6	.2766
1962	0.387	0,3877	299.9	.3912
1963	0.617	0,5770	446.3	.5838
1964	1.234	1,2711	983.1	1.3254
1965	1.893	1,8914	1462.8	1.9116
1966	2.220	2,2163	1714.1	2.2200
1967	2.663	2,6622	2058.9	2.6737
1968	3.396	3,3906	2622.3	3.4325
1969	4.060	4,0772	3153.3	4.0925
1970	4.593	4,5936	3552.7	4.6175

Appraisal reports:
.130
Average between 1.5 and 1.5/1.6
403-BR 474-BR.
1.219 or 1.610?
1.850 or 2.035
2.22
2.72
3.2725 or 3.525

11/5/71

Free market rates:
Dec 57 = 0.0905
Dec. 58 = 0.1385
Dec. 59 = 0.2038 — .204
Dec. 60 = 0.2051 —

Vol 12 - Part 1

Aug & Feb.

		1958	1959	1960	1961	1962
Jan	1	97.50	143.60	186.31	230.10	318.80
Feb.	2	99.50	139.75	186.54	214.50	318.00
Mar	3	106.75	139.50	191.89	276.46	318.00
April	4	120.75	136.50	189.21	280.97	318.00
May	5	122.00	131.25	185.75	264.17	359.10
June	6	132.80	147.75	187.23	261.52	359.48
July	7	134.00	151.90	185.69	262.59	366.91
Aug.	8	159.50	153.50	187.23	296.70	437.29
Sept.	9	156.25	166.00	190.82	297.98	475.00
Oct.	10	140.75	183.50	191.92	307.90	475.00
Nov.	11	136.25	194.50	193.99	308.23	475.00
Dec	12	138.52	201.50	205.14	318.51	475.00

		1963	1964	1965	1966	1967	1968
Jan	1	475.00	620.0	1850.0	2220.0	2220.0	3,220
Feb.	2	475,10	1168.2	1849.0	"	2,715 *	"
Mar	3	475.1	1368.5	1850,0	"	"	"
April	4	620.5	1191,8	"	"	"	"
May	5	620,0	1200,3	"	"	"	"
June	6	620.0	1200,1	"	"	"	"
July	7	620,0	1201,9	"	"	"	"
Aug	8	620.0	1262.8	"	"	"	3.650
Sept.	9	620,0	1621.5	"	"	"	3,700
Oct.	10	620.0	1609.8	"	"	"	3,700
Nov.	11	620,0	1610,0	2220.0	"	"	3770
Dec.	12	620.0	1850.0	2220,0	"	"	3,830

* On Feb. 13, 1967 Novo Cruzeiro = 1000 Old Cruzeiros

Average Cost / kwh Sold (US ¢)

	1964	1965	1966	1967	1968	1969	1970
1. Depreciation	0.10	0.21	0.24	0.22	0.12	0.14	0.17
2. Amortization	0.07	0.15	0.16	0.16	0.15	0.14	0.18
3. Sub-total	0.17	0.36	0.40	0.38	0.27	0.28	0.35
4. Fuel	—	—	—	0.01	0.07	0.06	0.03
5. Purchased Energy	—	—	—	...	0.11	0.14	0.12
6. Administration	0.02	0.01	0.01	0.02	0.02	0.01	0.02
7. Others	0.01	0.02	0.03	0.04	0.04	0.04	0.06
8. Sub-total	0.03	0.03	0.04	0.07	0.24	0.25	0.23
9. Total Unit Cost	0.20	0.39	0.44	0.45	0.51	0.53	0.58

SOURCE OF SUPPLY - POWER SECTION ON A SELECTIVE BASIS

DESCRIPTION — REFERENCE — DATE	U.S. DOLLARS OR EQUIVALENT	CURRENCIES	G/L	ACCOUNTS SUB a	b	c	d	e
BRAZIL 1967	*							
FOREIGN EXCHANGE			0					
CONSTRUCTION MATERIALS	*		0					
	22692045			106			403	
	22692045 *							
CONSTRUCTION EQUIPMENT			0					
	450343769			108			403	
	450343769 *							
MECHANICAL EQUIPMENT			0					
	408044			111			403	
	408044 *							
ELECTRICAL EQUIPMENT			0					
	20425596			119			403	
	20425596 *							
CONSULTANTS SERVICES ☐MANAG. ENG. ETC.			0					
	45937680			133			403	
	45937680 *							
FREIGHT AND INSURANCE			0					
	925103			136			403	
	925103 *							
LOAN CHARGES			0					
	41371757			139			403	
	41371757 *							
	582103994							
LOCAL EXPENDITURE			0					
CONSTRUCTION MATERIALS	*		0					
	35088985			306			403	
	35088985 *							
MECHANICAL EQUIPMENT			0					
	44930806			311			403	
	44930806 *							
ELECTRICAL EQUIPMENT			0					
	118664420			319			403	
	118664420 *							
	198684211							
*** GRAND TOTAL *** Total 403-BR	780788205 *							
	413717							
403-BR Without interest	7394165							

7.394
10.423
16.481
9.906
44.204
40.605
3.800

1.9868
1.5852
5.5158
3.7164
12.8042

44.204
12.804
31.400

SOURCE OF SUPPLY - POWER SECTION ON A SELECTIVE BASIS

DESCRIPTION — REFERENCE — DATE	U.S. DOLLARS OR EQUIVALENT	CURRENCIES	G/L	ACCOUNTS SUB a	b	c	d	e
BRAZIL 1968	*							
FOREIGN EXCHANGE			0					
CONSTRUCTION MATERIALS	*		0					
	8952276			106			403	
	8952276 *							
CONSTRUCTION EQUIPMENT			0					
	124342982			108			403	
	124342982 *							
MECHANICAL EQUIPMENT			0					
	76998922			111			403	
	76998922 *							
ELECTRICAL EQUIPMENT			0					
	579403323			119			403	
	579403323 *							
CIVIL WORKS			0					
	515287			131			403	
	515287 *							
CONSULTANTS SERVICES ▫MANAG. ENG. ETC.			0					
	93534995			133			403	
	93534995 *							
LOAN CHARGES			0					
	93753067			139			403	
	93753067 *							
	977500852							
LOCAL EXPENDITURE			0					
CONSTRUCTION MATERIALS	*		0					
	35293585			306			403	
	35293585 *							
CONSTRUCTION EQUIPMENT			0					
	8810638			308			403	
	8810638 *							
MECHANICAL EQUIPMENT			0					
	45902826			311			403	
	45902826 *							
ELECTRICAL EQUIPMENT			0					
	68518219			319			403	
	68518219 *							
	1585252 68							
*** GRAND TOTAL *** Total 403-BR	1136026120 *							
	937531							
403-BR without interest	10422730							

SOURCE OF SUPPLY – POWER SECTION ON A SELECTIVE BASIS

DESCRIPTION – REFERENCE – DATE	U.S. DOLLARS OR EQUIVALENT	CURRENCIES	G/L	ACCOUNTS SUB a	b	c	d	e
BRAZIL 1969	*							
FOREIGN EXCHANGE			0					
CONSTRUCTION MATERIALS	*		0					
	47985077			106			403	
	47985077 *							
CONSTRUCTION EQUIPMENT			0					
	227697613			108			403	
	227697613 *							
MECHANICAL EQUIPMENT			0					
	151833110			111			403	
	151833110 *							
ELECTRICAL EQUIPMENT			0					
	588903305			119			403	
	588903305 *							
CIVIL WORKS			0					
	5904090			131			403	
	5904090 *							
CONSULTANTS SERVICES ¤MANAG. ENG. ETC.			0					
	69306654			133			403	
	29243562 –			133			565	
	98550216 *							
FREIGHT AND INSURANCE			0					
	4948747			136			403	
	4948747 *							
LOAN CHARGES			0					
	162814504			139			403	
	162814504 *							
	1288636662							
LOCAL EXPENDITURE			0					
	*							
CONSTRUCTION MATERIALS			0					
	203082745			306			403	
	203082745 *							
CONSTRUCTION EQUIPMENT			0					
	5250398			308			403	
	5250398 *							
MECHANICAL EQUIPMENT			0					
	29053897			311			403	
	29053897 *							
ELECTRICAL EQUIPMENT			0					
	314196040			319			403	
	314196040 *							
	551583080							
*** GRAND TOTAL ***	1840219742 *							

Total 403-BR 292436
18.109761
1.628145
→ Total 403-BR without interest = 16.481616

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT
INTERNATIONAL FINANCE CORPORATION – INTERNATIONAL DEVELOPMENT ASSOCIATION

SOURCE OF SUPPLY - POWER SECTION ON A SELECTIVE BASIS

DESCRIPTION – REFERENCE – DATE	U.S. DOLLARS OR EQUIVALENT	CURRENCIES	G/L	ACCOUNTS SUB a	b	c	d	e
BRAZIL 1970	*							
FOREIGN EXCHANGE			0					
	*							
CONSTRUCTION MATERIALS			0					
	8928003			106			403	
	8928003 *	596.258						
CONSTRUCTION EQUIPMENT			0					
	20240159	354.921		108			403	
	20240159 *	486.863						
MECHANICAL EQUIPMENT			0					
	51617982			111			403	
	51617982 *	1.436.042						
ELECTRICAL EQUIPMENT			0					
	451744189			119			403	
	59425866 —			119			565	
	511170055 *							
CIVIL WORKS			0					
	3895165			131			403	
	3895165 *							
CONSULTANTS SERVICES ⊡MANAG. ENG. ETC.			0					
	80391458			133			403	
	35492064 —			133			565	
	115883522 *							
FREIGHT AND INSURANCE			0					
	2102381			136			403	
	2102381 *							
LOAN CHARGES			0					
	255823495			139			403	
	255823495 *							
MISCELLANEOUS			0					
	40445			199			403	
	40445 *							
	969701207							
LOCAL EXPENDITURE			0					
	*							
CONSTRUCTION MATERIALS			0					
	50571442			306			403	
	50571442 *							
MECHANICAL EQUIPMENT			0					
	42661561			311			403	
	42661561 *							
ELECTRICAL EQUIPMENT			0					
	278404501			319			403	
	48686336 —			319			565	
	327090837 *							
	420323840							
		4.203.238						
		486.863						
		3.716.375						
*** GRAND TOTAL ***	1390025047 *							
	1.436.042							
Total 403-BR	12.464.208							
	2.558.235							
403-BR without interest	9.905.973							

	Foreign	Local	Local as % total
Construction Materials	885,374	3,240,368	78.5%
	4,125,942		
~~Construction~~ Equipment	8,226,245	140,610	
Mechanical Equipment	2,808,580	1,625,491	36.7%
	4,434,071		
Electrical Equipment	16,404,764	7,797,831	32.2%
	24,202,595		
Total		12.804	
	41.130		

FURNAS

: 0.95039 | $\frac{4696}{4963}=0.9462$ | $\frac{8090}{8584}=0.9424$ | $\frac{8212}{8716}=0.9418$

~~US$/Kwh~~ US$.10^6 / Kwh.10^6 : → US$/Kwh .10^2

Operating Expenses:

	1964	1965	1966	1967	1968	1969	1970
Sales (GWh)	3215	2681	3713	4406	5733	9937	9255
Generation: Total	3416	2842	3944	4636	6045	10,528	9813
o.w. Thermal			–	119	751	1,169	600
o.w. Purchased Energy			–	–	1,082	1,944	1,097
Personnel	2505	2650	1911	2286	2491	3015	3775
Exchge Rate	1.27	1.90	2.22	2.67	3.40	4.08	4.60
US$/mWh Operating Expenses:							
→ Energy Purchases:	–	–	–	0.0073	6.3139	14.4494	11.0505
Cost of Energy Purchased US$/Mwh	–	–	–	–	0.5836	0.7433	1.0073
→ Thermal Generation Cost	–	–	–	0.6115	4.5101	6.6337	3.724
Thermal Cost US$/Mwh gen.				0.5139	0.6005	0.5675	0.6207
→ Hydro Generation non Purchased	0.875	0.933	1.6466	2.2651	2.7064	3.8629	6.4296
Cost of hydro generated US$/Mwh	0.026	0.033	0.0417	0.05015	0.06425	0.05211	0.07922
US$/Mwh sold. Fuel	—	—	—	0.0106	0.0665	0.0581	0.0303
Purchased Energy	—	—	—	0.0002	0.1101	0.1454	0.1194
Administration	0.017	0.0131	0.0144	0.0188	0.0173	0.0134	0.0217
Others	0.0102	0.0217	0.0300	0.0359	0.0421	0.0342	0.0577
Sub-total (Op. Cost)	0.0272	0.0348	0.0444	0.0655	0.2360	0.2511	0.2291

P.T.O.

Average total cost / kwh sold per origin.

	1967	1968	1969	1970	
1. Total Sent out	4609	5983	10457	9731	
2. o.w. Purchased	—	1082	1944	1097	
3. (1-2)/1 x Sales	4406	4696	8090	8212	← Sales due to Furnas' own generation.
4. (1-2)/1 x Sent out (1)	4609	4901	8513	8634	← Energy sent-out coming from Furnas only.
5. Depreciation + Amortization (US¢/kwh sold)	0.379	0.333	0.347	0.393	← changed to Sales due to Furnas own's gene.
Op. Exp/kwh sold: Hydro	0.0528	0.0679	0.0553	0.0841	
Thermal	0.5407	0.6346	0.6021	0.6588	
Average Total Cost/kwh sold:					
Hydro	0.432 18	0.401 09	0.4023	0.4771	
Thermal	0.920	0.9676	0.9491	1.052 18	
Sales due Energy Purchase	—	1037	1847	1043	
Cost of energy purchase/kwh sold	—	0.6089	0.7823	1.0595	

FURNAS - CENTRAIS ELÉTRICAS S. A.
SEDE: RIO DE JANEIRO — GUANABARA — BRASIL
RUA REAL GRANDEZA, 219
END. TEL.: RIOFURNAS - TELEX: 031/118
C. G. C. 23.274.194

ESCRITÓRIO EM BELO HORIZONTE: RUA RIO DE JANEIRO, 462 - 20.° — END. TELEGRÁFICO: BELFURNAS — BELO HORIZONTE — MG
ESCRITÓRIO EM SÃO PAULO: RUA SETE DE ABRIL, 261 - 10.° - END. TEL.: CELFURNAS - TELEX: 021/394 - CX. POSTAL 2166 - SÃO PAULO - SP
ESCRITÓRIO EM BRASÍLIA: AVENIDA W - 3 — ED. CARIOCA — G. 401 — QUADRA 17 — SETOR COMERCIAL SUL — BRASÍLIA — DF

Rio de Janeiro, December 9, 1971
DFI.F.E.0701.71

INTERNATIONAL BANK FOR
RECONSTRUCTION AND DEVELOPMENT
1818 STREET, N.W.
WASHINGTON, D.C. 20433
U.S.A.

Attention: Mr. F. M. Ettori

Subject : Request for Information

Dear Sirs,

1. Complying with your request as per telex dated November 5, 1971 enclosed herewith please find following information for the period 1964 - 1970:

a. Furnas' annual operating expences excluding depreciation, amortization and taxes, for hidroelectric and thermal plants.

b. Furnas' annual wage bill.

Yours very truly

FURNAS - CENTRAIS ELÉTRICAS S. A.

Sérgio Coutinho de Menezes
Financial Director

ATTACHMENT

FURNAS - CENTRAIS ELÉTRICAS S. A.
SEDE: RIO DE JANEIRO — GUANABARA — BRASIL
RUA REAL GRANDEZA, 219
END. TEL.: RIOFURNAS - TELEX: 031/118
C. G. C. 23.274.194

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FURNAS - CENTRAIS ELÉTRICAS S. A.

Sergio Coutinho de Menezes
Financial Director

ATTACHMENT

ATTACHMENT I

FURNAS - CENTRAIS ELÉTRICAS S.A.

OPERATING EXPENSES-1964/70

(CR$-CENTS OMITED)

	1964	1965	1966	1967	1968	1969	1970
1. Total Operating Expenses							
1.1. Operation	207.846	579.432	871.102	1.890.211	4.111.294	5.373.801	7.887.357
1.2. Maintenance	201.803	522.226	1.047.414	2.269.321	3.071.527	4.629.436	9.208.184
1.3. Fuel	-	-	-	1.245.594	12.956.522	23.543.730	12.899.752
1.4. Power purchase	-	-	-	19.427	21.467.313	58.953.555	50.832.077
1.5. Administration	694.227	669.089	1.187.346	2.211.260	3.375.534	5.429.675	9.260.269
1.6. Other	7.049	1.443	549.547	64.084	1.021.175	3.853.816	7.451.422
Total	1.110.925	1.772.190	3.655.409	7.699.897	46.003.365	101.784.013	97.539.061
2. Operating Expenses-Thermal Plant Sta. Cruz							
2.1. Operation	-	-	-	247.496	1.552.141	2.086.015	2.313.037
2.2. Maintenance	-	-	-	135.018	620.150	1.032.897	1.095.441
2.3. Fuel	-	-	-	1.245.594	12.956.522	20.831.870	12.015.750
2.4. Other	-	-	-	4.699	205.559	341.364	481.993
Total	-	-	-	1.632.807	15.334.372	24.292.146	15.906.221
3. Operating Expenses-Thermal Plant Lameirão and Marechal Hermes							
3.1. Operation	-	-	-	-	-	19.527	199.735
3.2. Maintenance	-	-	-	-	-	32.503	84.819
3.3. Fuel	-	-	-	-	-	2.711.860	884.002
3.4. Other	-	-	-	-	-	9.505	55.883
Total	-	-	-	-	-	2.773.395	1.224.439

TG/vfl

ATTACHMENT II

FURNAS - CENTRAIS ELÉTRICAS S.A.

WAGE BILL - Cr$

1964	2.792.923,12
1965	5.037.017,49
1966	5.952.247,41
1967	10.245.234,00
1968	17.607.732,00
1969	29.120.714,00
1970	48.641.832,00
	119.397.700,02

Remarks:

Includes wages relative to operation, construction and Administration.

Excludes social and fringe benefits.

TGM/ima

FURNAS:

Operating Costs: NCr mln.

	1963	1964	1965	1966	1967	1968	1969	1970
								4.24
Operating Costs	0.08	1.11	1.77	3.66	7.70	46.00	101.78	97.54
	(82%)	(67%)	(91%)	(90%)	(85%)	(54%)	(53%)	(60%)
Dept+Amort	0.36	5.51	18.62	32.64	44.58	53.18	114.50	148.38
F.X. Loss		1.63						
Total	0.44	8.25	20.39	36.30	52.38	99.18	216.28	245.92

5296 9359 9213
1082 1944 1037
6212 7415 8116

87% of 46 − 7.7 = 33.32 due to increased energy and fuel purchases.

86% of 101.8 − 46 increase = 47.97 mln due to fuel and purchased energy increases; balance water conditions in 1969

Reduction from 101.8 to 97.5 due to less fuel and energy purchases

Generation GWh.

	1966	1967	1968	1969	1970
Hydro		4,517	5294	9359	9213
Thermal	—	119	751	1,159	600
Total	3944	4636	6045	10,528	9813
o.w. Purchased Energy	—	—	1,082	1944	1097
			1833	3113	1697

	1964	1965	1966	1967	1968	1969	1970
Operating Cost/kwh sold NCr	0.034	0.066	0.098	0.175	0.802	1.024	1.054
US¢	0.027	0.035	0.044	0.065	0.236	0.251	0.229
Average Cost/kwh sold US¢	0.202	0.400	0.440	0.444	0.509	0.533	0.578
A- Δ Average Cost/kwh US¢		0.198	0.040	—	0.065	0.024	0.045
B- Δ Operating Cost/kwh US¢		0.008	0.009	0.021	0.171	0.015	−0.022
B/A in %		4%	22%	~~~	263%	63%	−49%

	1963		1964		1965		1966		1967		1968		1969		1970
Oper. Exp.	0.083	19	1.111	13	1.772	9	3.655	10	7.700	15	46.003	46	101.784	47	97.539 40%
Dep.	0.202	46	3.224	39	10.943	54	19.210	53	26.101	50	24.391	25	56.096	26	73.099 30%
Amort.	0.156	35	2.284	28 / 67	7.677	37 / 91	13.431	37 / 90	19.479	35 / 85	28.788 / 79	29 / 54	58.407	27 / 53	75.278 30%
FX. Exp	—	0	1.628	20											
Total	0.441	100	8.247	100	20.392	100	36.296	100	52.280	100	99.182	100	216.28	100	245.916

Productivity: −2% 92% −1% 19% 48% −26%

Personnel:	1963	1964	1965	1966	1967	1968	1969	1970
Q. Exp		0.443	0.669	1.913	4.868	18.468	33.759	25.848
Personal		5	54%	186%	76%	448%	83%	−24%
1000 Inflation			50%	17%	20%	27%	20%	18%

24.239.

3.05

Personnel: 1.5 = $\frac{3975}{2505}$ Wage bill: 24.26

Productivity: 2.57 $\left(\frac{3296}{1281}\right)$

1.51 × 2.57 = 3.88

Unit Cost / barrel sold (US $)

	64	65	66	67	68	69	70
Dep. + Amortiz	0.175	0.365	0.396	0.379	0.273	0.282	0.349
Operating:							
Finland Purchased Energy					0.171	0.220	0.181
Others					0.065	0.031	0.048
Subtotal:	0.027	0.035	0.044	0.065	0.236	0.251	0.229
Total	0.202	0.400	0.440	0.444	0.509	0.533	0.578

1	1.273	1.528	1.723
7.70	36.13	66.61	56.61
	28.43	30.48	-10.00

24.73

$26.17 = a \times 632 + b \times 1{,}082$

$53.26 = a \times 1050 + b \times 1{,}944$

$10.00 = a \times 561 + b \times 847$

7.7. 12.68.

$47.02 = b \times 0 + a \times$ 9.82

7.7

33.32 81.29 77.01

12.68

46.00

Operating Costs (US $ mln).

	64	65	66	67	68	69	70
Op. Costs	0.87	0.93	1.65	2.88	13.53 (9.80)	24.95 (11.71)	21.20
Dep + Amortiz	4.34	9.80	14.70	16.70	15.64	28.06	32.26
Total	6.50	10.73	16.35	19.58	29.17	53.01	53.46
Sales Personnel	3215	2681	3713	4406	5733	9937	9255
	2505	2650	1911	2286	2491	3015	3775

9.80 | 18.88 | 14.26

69.88 17.12 65.61

FURNAS

Exchge. Rate	1.27	1.90	2.22	2.67	3.40	4.08	4.60
	1964 ?	1965	1966 o.k.	1967 o.k.	1968 o.k.	1969 o.k. modif.	1970 o.k.
n.i.c.g.	6072 ?	8.37	43.89	67.27	65.13	102.42	238.72
Financial income	6.83	25.31	40.98	59.09	89.57	152.73	273.80
+ Depreciation	5.51	18.62	32.64	44.58	53.18	114.50	148.38
	11.74	43.93	73.62	103.67	142.75	267.23	422.18
− Dividends + Bonus	1.87	4.74	16.90	31.94	47.00	75.53	98.08
~~Gross i.c.g.~~	~~9.87~~	~~39.19~~	~~56.72~~	~~71.73~~	~~95.75~~	~~191.70~~	~~324.10~~
	7.35	13.20	23.91	25.87	64.17	98.57	118.98
Interest: Total	11.56	19.12	18.75	20.09	66.38	36.59	115.49
non capitalized	3.81	19.12	18.75	13.71	49.54	33.23	106.53
	6.15	11.10	21.13	20.17	23.09	78.93	84.78
= I.c.g.	0.18	24.81	54.87	83.58	76.37	168.66	306.69
+ Amortization	—	16.44	10.98	16.31	11.24	66.24	67.97
Amortization from	1.95	6.45	11.63	12.23	18.18	27.51	45.03
Price rep. adjts		−0.76	+0.81	−0.15	+0.23		

Aggregate net investments (and equity)

Forecasts

	1970			X	1969			X	1968			X	1967			X
	Cruz	US$	Total													
Santa Cruz	47.757	14.220	24.602		8.548	1.885	3.980		10.192	3.621	6.736		19.446	.526	7.809	
Fumil	50.745	12	11.044		30.957	—	22.293		62.156	—	18.281		42.964	—	16.091	
Esteito and Trans-	72.388	9.679	25.415		88.367	19.374	41.033		98.059	11.292	40.133		62.480	7.322	30.723	
Porto Colombia and trans	78.709	1.537	18.648		20.301	.293	5.269		1.622		.477		—	—	—	
Maringuendo and trans-	45.372	28	9.891		4.414		1.082		.565		.166		—	—	—	
			(12.677)				(6.915)				(3.029)				(1.370)	
Others, Furnas trans.	87.059	1.720	20.646		39.160	1.664	11.262		9.283	2.203	4.933		5.509	.169	2.232	
									9.636	2.448	5.282		30.506	3.832	15.257	
Total	382.030	27.196	110.246		251.747	23.216	84.919		191.913	19.564	76.008		160.905	11.949	72.113	
					64.60		44.08		3.4				2.67			

	1966			1965			1964			Total 1964-1970
			X			X			X	
Santa Cruz	—	—	—							43.127
Tunil	—	—	—							67.709
Estreito	34.794	2.357	18.030	12.009	.083	6.404	.990		.780	162.518
Rio Colombia	—	—	—							24.394
Manimbondo	—	—	—							11.139
Others	6.842	.158	3.240 (1.989)	2.269	—	1.194	1.164		.916	44.423 (⇒27.2 Working cap.
Furnas	21.771	6.824	16.631	17.782	1.917	11.276	17.706	4.829	18.771	67.217
Total	63.407	9.339	37.901	32.060	2.000	18.874	19.860	4.829	20.467	420.528
							Purchase of Cheap.			⇒ 81.140
	2.22			1.90			1.27			501.667
							.614		(0.59)	

26278

Central Eléctrica de Furnas SA

Source and Application Funds

USAID loan made previously to Chevap

includes purchase of Chevap properties, incluc during that

	1967 N$ 10³	1967 US$ 10³	1968 N$ 10³	1968 US$ 10³	1969 N$ 10³	1969 US$ 10³	1970 N$ 10³	1970 US$ 10³	1961	1962	1963	1964	1965	1966	1967 Includes purchase of Chevap for $ 81.14 mln	1968	1969	1970
Application of Funds																		
Total Investments	280914	+33 000 26278	193885	19049	252195	23113	384649	26665	28.652	40.165	43.860	20.467	18.874	37.901	153.253	76.074	84.925	110.284
Addition to Working Capital	–	–	–	–	–	–	–	–	(3.450)	(.274)	(2.513)							
Others	–	–	–	–	–	–	–	–	1.668	.400	.610			1.934	1.370	3.029	6.915	(12.677)
TOTAL	280914	26278	193885	19049	252195	23113	384649	26665	26.870	40.291	41.957	20.467	18.874	37.901	153.253	76.074	84.925	110.284
Sources of Funds																		
(x) I - Net Internal Cash Generation	67270	–	65134	–	102417	–	138718	–	–	–	1.300	4.781	4.405	19.769	25.195	19.157	25.102	51.895
Share Capital II - Domestic contribution -	21472	–	50338	–	–	–	–	–										
- from private sector (Luz)	133	–	403	–	–	–	–	–	.071	.249	.370	–	–	–	.050	.119		
- from public sector (Eletrobras etc.)	21339	–	39935	–	–	–	–	–	.929	2.674	3.970	.321	3.077	–	7.992	11.745		
Loans Loans (Eletrobrás)	162172	33000	86441	–	149330	–	(x) 145411	–	12.086	21.980	23.986	10.536	9.392	8.733	60.738+33.0	25.424	36.600	31.611
Others									1.278	.205	.447							
III - foreign borrowing: Subs																		
- Suppliers credit	–	18891	–	7747	–	3447	–	13995			–	–	1.121	6.349	18.8914	7.757	3.447	13.995
- Bilateral ODA (USAID)	–	–	1972	–	4) 448	–	2) 520	–			–	–	–	–	–	.580	.110	.113
- Regional Development Bank	–	–	–	11292	–	19666	–	12670	12.506	15.183	11.884	4.829	.879	2.990	7.387	11.292	19.666	12.670
- IBRD : total	–	7387	–		–		–											
IV - Total	280914	26278	193885	19049	252195	23113	384649	26665	26.870	40.291	41.957	20.467	18.874	37.901	153.253	76.074	84.925	110.284

	1958	1959	1960
Investments	13.054	34.572	26.854
Δ Working Capital	.677	2.237	6.575
Others	(1.500)	(.294)	.305
Total Applications	12.231	36.515	33.734
Net Int. Cash	–	–	–
Share Capital Private	.177	.156	.290
Share Capital Public	2.308	2.100	3.885
Loans Eletrobras	9.231	17.181	18.170
other loans	.515	.506	.635
IBRD	–	16.572	10.754
Total	12.231	36.515	33.734

2.87
7.81
11.36
18.40
13.72
54.34

2.99
7.33
11.29
18.67
12.67
54.01

776
11,885
.59
106965
59425
7.01215

7.012
18.866
25.878

Central Eletrica Furnas SA

Source and Application of Funds

12.5.71.

	1958 NCr$ 10^3	1959 NCr$ 10^3	1959 US$ 10^3	1960 NCr$ 10^3	1960 US$ 10^3	1961 NCr$ 10^3	1961 US$ 10^3	1962 NCr$ 10^3	1962 US$ 10^3	1963 NCr$ 10^3	1963 US$ 10^3	1964 NCr$ 10^3	1964 US$ 10^3	1965 NCr$ 10^3	1965 US$ 10^3	1966 NCr$ 10^3	1966 US$ 10^3
Application of Funds																	
Total Investments	1697	2880	16,572	3220	10,754	4521	12,506	9743	15,183	18866	11,884	19860	4,829	32060	2,000	63407	9,339
Addition to Working Capital	88	358	–	1315	–	(1966)	–	(107)	–	(1.483)	–	–	–	–	–	–	–
Others (Miscellaneous)	(195)	(47)	–	61	–	467	–	156	–	360	–	–	–	–	–	–	–
TOTAL	1590	3191	16,572	4596	10,754	4022	12,506	9792	15,183	17743	11,884	19860	4829	32060	2,000	63407	9339
Sources of Funds																	
I - Net Internal Cash Generation	–	–	–	–	–	–	–	–	–	767	–	6072	–	8369	–	43886	–
II - Domestic contribution:	323	361	–	835	–	280	–	1140	–	2560	–	407	–	5847	–	–	–
Share Capital: 1 - from private sector (Light)	23	25	–	58	–	20	–	97	–	218	–	–	–	–	–	–	–
Share Capital: 2 - from public sector (Eletrobras etc...)	300	336	–	777	–	260	–	1043	–	2342	–	407	–	5847	–	–	–
Loans: Loans - (ELETROBRÁS)	1200	2749	–	3634	–	3384	–	8572	–	14152	–	13381	–	17844	–	19521	–
Loans: Others	67	81	–	127	–	358	–	80	–	264	–	–	–	–	–	–	–
III - Foreign Borrowings:	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
- suppliers credit	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
- Bilateral ODA (USAID)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
- Regional Development Bank	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1,121	–	6,349
- IBRD: total	–	–	16,572	–	10,754	–	12,506	–	15,183	–	11,884	–	4,829	–	879	–	2,990
IV - total	1590	3191	16,572	4596	10,754	4022	12,506	9792	15,183	17.743	11,884	19860	4,829	32060	2,000	63407	9,339
	0.13	0.16		0.20		0.28		0.39		0.59		1.27		1.90		2.22	

(!) ≠ disbursements from 474-BR in IBRD sources of funds above!

11.884
4.829
16.713

10.93
5.78
16.71

CENTRAL ELÉTRICA DE FURNAS S. A.
SEDE: PASSOS - MINAS GERAIS
CADASTRO GERAL DOS CONTRIBUINTES
INSCRIÇÃO N.º 23.274.194

ESCR. CENTRAL:
RUA SÃO JOSÉ, 90 - 3.º PAV.
TELEGRAMAS: RIOFURNAS
TELEX: 031/118
RIO DE JANEIRO - GB

ESCR. SÃO PAULO:
RUA SETE DE ABRIL, 261 - 10.º PAV.
TELEGRAMAS: CELFURNAS
TELEX: 021/394
SÃO PAULO - SP

ESCR. B. HORIZONTE:
RUA RIO DE JANEIRO, 462 - 20.º PAV.
TELEGRAMAS: BELFURNAS
MINAS GERAIS

Rio de Janeiro, June 22, 1971
DCB.F.E.0509.71

Mr. FRANÇOIS ETTORI
PROGRAMMING & BUDGETING DEPARTMENT
INTERNATIONAL BANK FOR
RECONSTRUCTION AND DEVELOPMENT
1818 H STREET, N.W.
WASHINGTON, D.C. 20433
U.S.A.

Dear Mr. Ettori,

1. In your recent visit to Brazil, you requested a breakdown by foreign or national origin of goods utilized in Furnas' completed projects covered by IBRD loans.

2. Equipment and materials were purchased in Brazil in local currency with IBRD financing as follows:

2.1 Furnas Project - Loan Nº 211 BR

No such procurement.

2.2 Estreito Project - Loan Nº 403-474 BR

Us dollars equivalent of cruzeiros at the rate of conversion for each withdrawal, in multiples of US$ 1,000.00:

Year	Category A	Category B	Category D	Total
1967	1,987	-	-	1,987
1968	1,232	353	-	1,585
1969	696	4,705	116	5,517
1970	926	2,790	-	3,716
	4,841	7,848	116	12,805

Category A:

Turbines, generators and accessory equipment, penstocks, gates, cranes, related materials and equipment.

Category B:

Transmission and Substation equipment and materials.

Category D:

Construction and Operation Equipment and Spare Parts.

./.

3. As to the equipment and materials of foreign origin purchased for both projects directly with our own funds, their value is irrelevant if compared with the total amount of the projects.

4. I would be obliged for your comments and your asking for any additional data or details you may require.

Yours very truly,

FURNAS - CENTRAIS ELÉTRICAS S.A.

UM/ecf

José Carlos S. Barata
Executive Assistant to the
Financial Director

Average Cost / Barrel sold (US¢)

	1964	1965	1966	1967	1968	1969	1970
Depreciation	0.10	0.21	0.24	0.22	0.12	0.14	0.17
Amortization	0.07	0.15	0.16	0.16	0.15	0.14	0.18
Sub Total.	0.17	0.36	0.40	0.38	0.27	0.28	0.35
Operating Cost.	0.03	0.04	0.04	0.06	0.24	0.25	0.23
Total	0.20	0.40	0.44	0.44	0.51	0.53	0.58

Furnas - Entretien with Mr. Bloor.

1.02 - "The installed capacity of the Company"

2.04 not upper Rio Grande, but Rio Grande.

2.04 - One des raisons du split entre 403 et 474-BR fut que la Banque ne voulait pas faire un gros prêt d'un seul coup en une année car l'argent manquait à la Banque.

2.06 - completion

3.01 - The Federal Government sector - and makes loans to other state utilities.

8.01 - Cost/Work = Furnas has a lot of extra-curricular activities, in place of Electrobras in the planning of the whole sector.

Also Furnil and Santa-Cruz.

Also = the high demand charges of Furnas.

A real study should be made of the internal rate structure of Furnas.

The pb between Furnas and Cemig will increase in future with St Simon (1500 MW). The coming gap in Cemig's supply is thought to be filled by a Cemig's thermal plant instead of purchasing power from Furnas. (in 1974/75)

Bank never asked for this study. It should be done: Cemig does not intend to buy power from Furnas and tariff rates of Furnas introduce a distortion in the investment planning in the area.

NATIONAL 45-614 EYE-EASE Made in U.S.A.

	7	8	9	10	11	12	13	14
		Installed	Available	Difference	Maintenance	Water Level	Peak	Peak - Installed
1963								
	Sept.	150	122	28	20	8	160	10
	Oct.	150	134	16	8	8	160	10
	Dec.	300	257	43	27	16	320	20
1964								
	Feb.	300	286 (306)	14	14	0	320	20
	Mar.	300	285 (305)	15	15	0	320	20
	Apr.	450	439 (469)	11	11	0	480	30
	May.	450	440 (470)	10	10	0	480	30
	June.	450	409 (439)	41	41	0	480	30
	July	450	442 (472)	8	8	0	480	30
	Aug.	450	436 (466)	14	8	6		
1965								
	Feb.							
1966								
	Nov.							
1967								
	Oct.	980	781 (841)	199	199	0	1040	60
1968								
	Jan.	980	892 (952)	88	88	0	1040	60
	Jul.	1260	1234 (1294)	26	26	0	1320	60
	Nov.	1260	1196	64	28	36	1320	60
	Dec.	1260	1231	29	17	12	1320	60
1969								
	Feb.	1335	1246 (1306)	89	89	0	1395	60
	Jul.	1865	1615	250	209	41	1952	87

PURCHASES OF ENERGY BY FURNAS COMPANY (GWh)

	1963	1964	1965	1966	1967	1968	1969	1970
JAN	–	1.55	1.08	0.20	0.03	0.18	240.00	73.00
FEB	–	1.54	1.13	0.31	0.01	0.08	232.00	54.00
MAR	–	1.51	0.52	0.11	0.08	0.01	208.00	94.00
APR	–	1.49	0.52	0.15	0.01	13.00	144.00	122.00
MAY	–	1.67	0.52	0.11	〃	87.00	165.00	131.00
JUN	–	2.32	0.48	0.10	〃	98.00	135.00	82.00
JUL	–	2.78	0.24	0.13	〃	99.00	152.00	91.00
AUG	–	2.70	0.72	0.11	〃	116.00	141.00	86.00
SEPT	1.70	2.63	0.13	0.10	0.22	109.00	136.00	85.00
OCT	1.78	2.51	0.14	0.42	0.11	138.00	146,00	88.00
NOV	1.59	2.25	0.13	0.09	0.13	166.00	129.00	09.00
DEC	1.49	1.26	0.13	0.10	0.05	187.00	93.00	85.00
	6,56	24.21	5.74	1,84	.68	1013.27	1921	1040
% of Gross Gen.	1,6%	0,7%	0.2%	0,04%	,01%	16.8%	18.2%	10.6%

NOTE: Since september 1963 to march 1968 the purchased energy by FURNAS was only used to feed the auxiliary service

PURCHASES OF ENERGY BY FURNAS COMPANY (GWh)

	1963	1964	1965	1966	1967	1968	1969	1.970
JAN	–	1.55	1.08	0.20	0.03	0.18	240.00	73.00
FEB	–	1.54	1.13	0.31	0.01	0.08	232.00	54.00
MAR	–	1.51	0.52	0.11	0.08	0.01	208.00	94.00
APR	–	1.49	0.52	0.15	0.01	13.00	144.00	122.00
MAY	–	1.67	0.53	0.11	〃	87.00	165.00	131.00
JUN	–	2.32	0.48	0.10	〃	98.00	135.00	82.00
JUL	–	2.78	0.24	0.13	〃	99.00	152.00	91.00
AUG	–	2.70	0.72	0.11	〃	116.00	141.00	86.00
SEPT	1.70	2.63	0.13	0.10	0.22	109.00	136.00	85.00
OCT	1.78	2.51	0.14	0.42	0.11	138.00	146,00	88.00
NOV	1.59	2.25	0.13	0.09	0.13	166.00	129.00	89.00
DEC	1.49	1.26	0.13	0.10	0.05	187.00	93.00	85.00

Note: Since september 1963 to march 1968 the purchased energy by FURNAS was only used to feed the auxiliary service

CAPACITY OF TRANSMISSION NETWORK OF FURNAS (MVA)

	1963	1964	1965	1966	1967	1968	1969	1970
JAN	–	600	860	865	1.015	1240	1465	1690
FEB	–	600	860	865	1.015	1240	1.465	1720
MAR	–	600	860	865	1.015	1.465	1465	1720
APR	–	600	860	1.015	1.015	1465	1465	1945
MAY	–	605	860	1.015	1.015	1465	1.465	1945
JUN	–	635	865	1.015	1.015	1.465	1690	2170
JUL	–	635	865	1015	1.015	1.465	1690	2320
AUG	–	635	865	1.015	1.015	1.465	1690	2470
SEPT	375	860	865	1.015	1.015	1.465	1690	2470
OCT	375	860	865	1.015	1.015	1465	1690	2470
NOV	375	860	865	1.015	1.015	1465	1690	2695
DEC	600	860	865	1.015	1.340	1465	1690	2920

CAPACITY OF TRANSMISSION NETWORK OF FURNAS (MVA)

	1963	1964	1965	1966	1967	1968	1969	1970
JAN	-	600	860	865	1.015	1240	1465	1690
FEB	-	600	860	865	1.015	1240	1.465	1720
MAR	-	600	860	865	1.015	1.465	1465	1720
APR	-	600	860	1.015	1.015	1465	1465	1945
MAY	-	605	860	1.015	1.015	1465	1.465	1945
JUN	-	635	865	1.015	1015	1.465	1690	2.170
JUL	-	635	865	1015	1.015	1.465	1690	2320
AUG	-	635	865	1.015	1.015	1.465	1690	2470
SEPT	375	860	865	1.015	1.015	1.465	1690	2470
OCT	375	860	865	1.015	1.015	1465	1690	2470
NOV	375	860	865	1.015	1.015	1465	1690	2695
DEC	600	860	865	1.015	1.340	1465	1690	2920

TOTAL SALES OF FURNAS (GWh)

TOTAL BILLED ENERGY OF FURNAS (GWh)

	1963	1964	1965	1966	1967	1968	1969	1970
JAN	-	192	349	184	257	388	742	652
FEB	-	182	304	298	301	425	702	552
MAR	-	197	276	339	348	360	792	622
APR	-	248	311	228	398	450	776	778
MAY	-	274	162	336	421	512	899	842
JUN	-	270	182	365	420	443	857	835
JUL	-	305	204	390	366	482	921	875
AUG	-	300	153	395	360	495	940	850
SEPT	49	300	201	356	358	476	933	790
OCT	92	300	159	297	407	499	936	814
NOV	92	301	167	256	383	591	757	783
DEC	164	346	213	269	387	612	682	862
	397	3215	2681	3713	4406	5733	9937	9255

NOTE: FOR FURNAS, TOTAL SALES IS EQUAL TOTAL BILLED ENERGY

TOTAL SALES OF FURNAS (GWh)

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	1963	1964	1965	1966	1967	1968	1969	1970
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FEB	-	182	304	298	301	425	702	552
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APR	-	248	311	228	398	450	776	778
MAY	-	274	162	336	421	512	899	842
JUN	-	270	182	365	420	443	857	835
JUL	-	305	204	390	366	482	921	875
AUG	-	300	153	395	360	495	940	850
SEPT	49	300	201	356	358	476	933	790
OCT	92	300	159	297	407	499	936	814
NOV	92	301	167	256	383	591	757	783
DEC	164	346	213	269	387	612	682	862

NOTE: FOR FURNAS, TOTAL SALES IS EQUAL TOTAL BILLED ENERGY

TOTAL ENERGY SENT OUT BY FURNAS (GWh)

	1963	1964	1965	1966	1967	1968	1969	1970
JAN	–	202	374	195	269	406	785	686
FEB	–	192	330	314	314	445	743	582
MAR	–	209	291	359	364	376	838	649
APR	–	263	330	241	419	472	814	814
MAY	–	292	171	355	446	533	938	883
JUN	–	288	192	389	442	463	897	878
JUL	–	325	212	416	380	505	973	919
AUG	–	320	161	423	373	517	995	896
SEPT	50	319	211	379	371	497	989	837
OCT	95	317	168	316	424	526	989	860
NOV	96	319	173	268	401	617	783	829
DEC	171	370	224	281	406	626	713	908
	412	3416	2837	3936	4609	5983	10457	9731

TOTAL ENERGY SENT OUT BY FURNAS (GWh)

	1963	1964	1965	1966	1967	1968	1969	1970
JAN	–	202	374	195	269	406	785	686
FEB	–	192	330	314	314	445	743	582
MAR	–	209	291	359	364	376	838	649
APR	–	263	330	241	419	472	814	814
MAY	–	292	171	355	446	533	938	883
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JUL	–	325	212	416	380	505	973	919
AUG	–	320	161	423	373	517	995	896
SEPT	50	319	211	379	371	497	989	837
OCT	95	317	168	316	424	526	989	860
NOV	96	319	173	268	401	617	783	829
DEC	171	370	224	281	406	626	713	908

TOTAL GROSS GENERATION OF FURNAS (GWh)

	1963	1964	1965	1966	1967	1968	1969	1970
JAN	–	202	375	195	270	410	790	691
FEB	–	192	330	315	315	450	747	588
MAR	–	209	291	359	366	381	842	656
APR	–	263	330	241	421	477	820	820
MAY	–	292	171	356	447	539	945	889
JUN	–	288	192	390	443	468	903	894
JUL	–	325	213	417	382	508	980	926
AUG	–	320	161	424	376	523	1001	902
SEPT	50	319	211	379	374	503	995	842
OCT	95	317	169	317	428	531	996	865
NOV	96	319	174	369	404	622	790	834
DEC	172	370	225	282	411	632	719	917
	413	3416	2842	3944	4637	6044	10528	9814

TOTAL GROSS GENERATION OF FURNAS (GWh)

	1963	1964	1965	1966	1967	1968	1969	1970
JAN	–	202	375	195	270	410	790	691
FEB	–	192	330	315	315	450	747	588
MAR	–	209	291	359	366	381	842	656
APR	–	263	330	241	421	477	820	820
MAY	–	292	171	356	447	539	945	889
JUN	–	288	192	390	443	468	903	884
JUL	–	325	213	417	382	508	980	926
AUG	–	320	161	424	376	523	1001	902
SEPT	50	319	211	379	374	503	995	842
OCT	95	317	169	317	428	531	996	865
NOV	96	319	174	269	404	622	790	834
DEC	172	370	225	282	411	632	719	917

MONTHLY PEAK DEMAND OF FURNAS (MW)

	1963	1964	1965	1966	1967	1968	1969	1970
JAN	-	284	561	544	611	901	1.278	1633
FEB	-	302	557	563	635	819	1362	1645
MAR	-	307	540	555	634	865	1404	1.593
APR	-	444	563	556	634	1.026	1456	1976
MAY	-	449	536	584	675	1184	1541	1996
JUN	-	469	537	606	689	1148	1622	2069
JUL	-	468	563	619	668	1285	1659	2049
AUG	-	464	570	614	682	1.186	1710	2037
SEPT	137	528	554	612	779	1193	1703	2043
OCT	141	452	543	620	791	1179	1.671	1979
NOV	230	535	558	598	773	1233	1655	1998
DEC	289	555	544	608	828	1257	1663	2021

MONTHLY PEAK DEMAND OF FURNAS (MW)

	1963	1964	1965	1966	1967	1968	1969	1970
JAN	-	284	561	544	611	901	1.278	1633
FEB	-	302	557	563	635	819	1262	1645
MAR	-	307	540	555	634	865	1404	1.593
APR	-	444	563	556	634	1.026	1456	1976
MAY	-	449	536	584	675	1184	1541	1996
JUN	-	469	537	606	689	1148	1622	2069
JUL	-	468	563	619	668	1285	1659	2049
AUG	-	464	570	614	682	1.186	1710	2037
SEPT	137	528	554	612	779	1193	1703	2043
OCT	141	452	543	620	791	1179	1.671	1979
NOV	230	535	558	598	773	1233	1655	1998
DEC	289	555	544	608	828	1257	1663	2021

TOTAL PEAK CAPACITY OF FURNAS (MW)
(NOMINAL + OVERLOAD PEAK CAPACITY POTENTIAL)

	1963	1964	1965	1966	1967	1968	1969	1970
JAN	—	320	640	960	960	1.040	1395	2250
FEB	—	〃	800	〃	〃	〃	〃	〃
MAR	—	〃	〃	〃	〃	1.120	1579	2320
APR	—	480	〃	〃	〃	1220	1.584	2390
MAY	—	〃	〃	〃	〃	1320	1768	〃
JUN	—	〃	〃	〃	〃	〃	〃	〃
JUL	—	〃	960	〃	〃	〃	1952	〃
AUG	—	〃	〃	〃	〃	〃	1996	〃
SEPT	160	640	〃	〃	1040	〃	〃	〃
OCT	〃	〃	〃	〃	〃	〃	〃	〃
NOV	320	〃	〃	〃	〃	〃	2.180	〃
DEC	〃	〃	〃	〃	〃	〃	2.250	〃

TOTAL PEAK CAPACITY OF FURNAS (MW)

	1963	1964	1965	1966	1967	1968	1969	1970
JAN	–	320	640	960	960	1.040	1395	2250
FEB	–	〃	800	〃	〃	〃	〃	〃
MAR	–	〃	〃	〃	〃	1.120	1579	2320
APR	–	480	〃	〃	〃	1220	1.584	2390
MAY	–	〃	〃	〃	〃	1320	1768	〃
JUN	–	〃	〃	〃	〃	〃	〃	〃
JUL	–	〃	960	〃	〃	〃	1952	〃
AUG	–	〃	〃	〃	〃	〃	1996	〃
SEPT	160	640	〃	〃	1040	〃	〃	〃
OCT	〃	〃	〃	〃	〃	〃	〃	〃
NOV	320	〃	〃	〃	〃	〃	2180	〃
DEC	〃	〃	〃	〃	〃	〃	2.250	〃

INSTALLED CAPACITY OF FURNAS - MW

	1963	1964	1965	1966	1967	1968	1969	1970
JAN	-	300	600	900	900	980	1335 (310	2154
FEB	-	300	750	900	900	980	1335 1310	2154
MAR	-	300	750	900	900	1060	1510 1485	2224
APR	-	450	750	900	900	1160	1515	2294
MAY	-	450	750	900	900	1260	1690 1660	2294
JUN	-	450	750	900	900	1260	1690	2294
JUL	-	450	900	900	900	1260	1865	2294
AUG	-	450	900	900	900	1260	1909	2294
SEPT	150	600	900	900	980	1260	1909	2294
OCT	150	600	900	900	980	1260	1909	2294
NOV	300	600	900	900	980	1260	2084	2294
DEC	300	600	900	900	980	1260	2154	2294

O.K.

14260 20905 27178

25 MM CELG
5 MW "

INSTALLED CAPACITY OF FURNAS - MW

	1963	1964	1965	1966	1967	1968	1969	1970
JAN	-	300	600	900	900	980	1335	2154
FEB	-	300	750	900	900	980	1335	2154
MAR	-	300	750	900	900	1060	1510	2224
APR	-	450	750	900	900	1160	1515	2294
MAY	-	450	750	900	900	1260	1690	2294
JUN	-	450	750	900	900	1260	1690	2294
JUL	-	450	900	900	900	1260	1865	2294
AUG	-	450	900	900	900	1260	1909	2294
SEPT	150	600	900	900	980	1260	1909	2294
OCT	150	600	900	900	980	1260	1909	2294
NOV	300	600	900	900	980	1260	2084	2294
DEC	300	600	900	900	980	1260	2154	2294

AVAILABLE CAPACITY OF FURNAS - MW

(NOMINAL — OUT OF SERVICE — WATER HEIGHT LOSS)

YEAR / MONTH	1963	1964	1965	1966	1967	1968	1969	1970
JAN	-	292 284	35 596 561	147 691 544	145 756 611	51 ~~892~~ 952	1 1279 1278	209 1842 1633
FEB	-	4 ~~286~~ 306	27 584 557	155 718 563	762 635	14 833 819	44 ~~1246~~ 1306	155 1800 1645
MAR	-	-2 ~~285~~ 305	60 600 540	175 730 555	99 733 634	1002 865	1409 1404	1940 1593
APR	-	~~439~~ 469	86 649 563	730 556	843 634	1086 1826	1491 1456	2169 1976
MAY	-	~~440~~ 470	214 750 536	742 584	785 675	1215 1184	1593 1541	143 2139 1996
JUN	-	-30 ~~409~~ 439	632 537	143 749 606	81 770 689	1248 1148	1625 1622	142 2211 2069
JUL	-	~~442~~ 472	724 563	122 741 619	78 746 668	9 ~~1234~~ 1294	43 ~~1615~~ 1702	2197 2049
AUG	-	~~436~~ 466	750 570	746 614	67 749 682	1246 1186	1773 1710	134 2171 2037
SEPT	-5 ~~122~~ 132	557	671 551	740 612	42 821 779	1208 1193	1719 1703	48 2091 2043
OCT	~~134~~ 144	570	750 543	94 714 620	50 ~~781~~ 841	1197 1179	1719 1671	2144 1979
NOV	279	580	684 558	81 679 598	858 773	23 ~~1196~~ 1256	1803 1655	2125 1998
DEC	-12 ~~289~~ 277	581	734 544	754 608	929 828	34 ~~1231~~ 1291	1890 1663	2173 2021

AVAILABLE CAPACITY OF FURNAS - MW

YEAR / MONTH	1963	1964	1965	1966	1967	1968	1969	1970
JAN	-	8 292 284	35 596 561	147 691 544	145 756 611	-9 892 901	1 1279 1278	209 1842 1633
FEB	-	-16 286 302	27 * 584 557	155 718 563	127 762 635	14 833 819	-16 1246 1262	155 1800 1645
MAR	-	-22 285 307	60 600 540	145 730 585	99 733 634	137 1002 865	5 1409 1404	347 1940 1593
APR	-	-5 439 444	86 649 563	174 730 556	209 843 634	60 1086 1026	35 1491 1456	193 2169 1976
MAY	-	-9 440 449	214 750 536	158 742 584	110 785 675	31 1215 1184	52 1593 1541	143 2139 1996
JUN	-	* -60 409 469	95 632 537	143 749 606	81 770 689	100 1248 1148	3 1625 1622	142 2211 2069
JUL	-	-26 442 468	161 724 563	122 741 619	78 746 668	-51 * 1234 1285	-44 1615 1659	148 2197 2049
AUG	-	-28 436 464	188 750 570	131 746 614	67 749 682	60 1246 1186	63 1773 1710	134 2171 2037
SEPT	122 -15	29 557 528	117 671 554	128 740 612	42 821 779	15 1208 1193	16 1719 1703	48 2091 2043
OCT	134 -7	118 570 452	207 750 543	94 714 620	-10 781 791	18 1197 1179	48 1719 1671	165 2144 1979
NOV	279 49	45 580 535	126 684 558	81 679 598	85 858 773	-37 1196 1233	148 1803 1655	127 2125 1998
DEC	* 257 -32	26 581 555	190 734 544	146 754 608	101 929 828	-26 1231 1257	227 1890 1663	152 2173 2021

TOTAL MONTHLY AVERAGE CAPACITY OUT OF SERVICE
PROGRAMMED MAINTENANCE + BREAKDOWN

MAJOR BREAKDOWN

1) 150 MW FROM JUL 65 TO SEPT. 66

2) 150 MW IN NOV 66

	1963	1964	1965	1966	1967	1968	1969	1970
JAN	-	2	4	209	144	88	56	304
FEB	-	14	166	182	138	147	89	349
MAR	-	15	150	170	167	58	101	277
APR	-	11	101	170	57	74	24	132
MAY	-	10	0	158	115	45	79	152
JUN	-	41	118	151	130	12	35	80
JUL	-	8	176	159	154	26	209	94
AUG	-	8	150	154	151	8	47	123
SEPT	20	31	229	160	159	34	65	203
OCT	8	18	150	186	199	33	59	150
NOV	7	8	216	221	122	28	216	169
DEC	27	15	166	146	51	17	208	121

Americanization
Lack of power
Brazilian industry participation.

Entrevue avec Mr. Lyra : Vendredi 12 Mai - 5.00 pm

- Initial steps in establishment of Furnas:
Now Bank is interfering more and more in the bidding: it wants to control the prequalification stage but not responsibility. (Conclusion)
European Eastern Countries: prices are always lower as a rule (but not always) - Contract ∃ with Centrais Electricas de Goias.

- Establishment of Furnas: Development Council decision → BNDE → Electrobras. Bank approach: it accepted after an interim period of no loans in Brazil. No objection on semi public status of Furnas. (~~Institutional Building Origin~~)

- Critics: Bank should just establish the guidelines and not control every detail of bidding documents as it does now.
~~Bank financed 11 doubling lines to existing ones for electrical storms reasons.~~ (Conclusion)

- Furnas had very very good relations and help from the Bank, in particular from the technical Department, mainly at the beginning.

- In the 1st loan, Bank asked for guarantee on return on revaluation of assets.
- Present consumers pay for future ones with amortization.
- Concession is not a pb because Furnas ∈ Government.
- Initially, the sales of Furnas went only to shareholders mainly to Light.
- Constitution of Furnas was changed many times (30 times) for minor points. 1957, 1960 1966 , 1970.
- Originally, shareholders could not raise more capital. BNDE neither. (~~Institutional Building Financing~~)
- The joint planning board was established only in 1969, so late because the Cies do not want to have control and be dictated orders for operations which are now decided on optimal computer program for the whole region (SCR) (in operation 2 or 3 years ago). (~~Institutional Building Coordinating~~)

Institutional framing / Coordinating

- ~~A~~ no load dispatch center but several ones will established. An intercompany dispatch center will be established first in Furnas in 1972.

- Transmission lines: the first one turned out to be 345 kv although the optimal voltage were 380 kv. But choosed to 345 kv because "American specification and ~~a~~ cold Berlin war in Europ at this time.

Records

- In 1970, very dry year and the minimal generation will be slightly above 4000 Gwh.

Construction

- Furnas plant: turbines from Sweden NOHAB - Generators Siemens. Gates and insulators from Japan - Towers from Italy. Participation of Brazil industry: very minor - But civil works from Brazil.

Construction

- The 2nd stage of Furnas (from 500 to 900 MW) was financed from savings on the loan 211-BR. The 7 and 8th units of Furnas were not needed until recently (677-BR).

Financing

- The financial projections of 211-BR were changed completely for the reasons above and because of Estreito construction which was not planned for in 211 BR.

- No silt in Furnas reservoir for time being and Furnas protects the other down stream dams.

Institutional building / Training

- Training: people sent to companies abroad, to manufacturers (Bonneville Power Cie, Bureau of Reclamations) for operations, design, stability and reliability of systems. Training was about 3 months. In overall, for all loans, over 100 people including ~ 65 for first loan.

Consultants

- Consultants: cost has been very low for the services received. Pbs: not as general. Education fulfilled correctly.

2nd entretien avec M. Lyra.

Project Development

- The feasibility study of the Furnas plant was made by Furnas Cie on the basis of data prepared by International Engineering for Cemig and completed by Furnas.

Consultants

- The UNDP study was just an inventory study. The feasibility studies were prepared by International Engineering and Furnas qui utilise ce Consultant pour agrandir son personnel.

Project Construction

- Porto Colombia est effectivement un barrage au fil de l'eau. Furnas has a 16 km³ reservoir et Estreito a 1 km³. Furnas would not have chosen this site of Porto Colombia because other sites have higher priorities and returns (though P. C. still has a good return). The plant was supposed to be done for Paulista Cie who could not do it, and the plant was passed over to Furnas.
- Coordination of operations took place gradually only because of reluctance of other companies.

Project Consultants

- In 1964, plant superintendant of Furnas was lacking. Arthur Andersen made a study for financial operations and control. Now training takes place for financial, technical and administrative people to improve at the best level above their present good level

Construction of Project

- Low cost of Estreito: good foundations, and very good prices for equipment. Savings on loan will be used to add 2 more units in Estreito (175 MW each) and more transmission than in 477-BR.
- Transmission for Estreito was due in time except of a few delays of about 6 months. The line was completed in 1970 and extension of lines due to savings in loan is still under construction.

This was needed in 1966 See Mr. Baratta. I.B. Training

- Training for 677-BR: Beginning of a training program and implementation of a new set of methods for accounting and computerizing procedures. Bank buys

But according to Mr. Lyra, il vaut mieux payer plus pour le consommateur (plutôt qu'en taxes redistribuées à Furnas par le Gouvernement) et investir légèrement plus que strictement nécessaire dans un secteur fondamental comme l'électricity.

The training program as proposed by Furnas (in the loans)

Tariffs Conclusions

- Tariffs levels and inflation: impression is yes.
- Electrobras has accepted for a small amount to convert their loans into shares in order to keep the debt/equity ratio at a constant reasonable level.

G[th] ... GWh

- Bank asked Electrobras to review the load forecasts (in 1969) because it had doubts about the load growth after 1965. After the study showed that load was growing faster than Bank thought initially in 1965, the Bank accepted to finance Marimbondo.

I.B. Consultants

- Furnas uses Commonwealth Consultants for the 500 kV lines. Personnel was trained and competed with Consultants.

I.B. Tariffs

- CESP has rather expensive plants. But CEMIG has higher capital costs but lower depreciation so that its tariffs are lower (slightly) than Furnas's.
- Depreciation rates of Furnas: ask Mr. Menezes.
- Tariff legislation and other covenants: ask Mr. Cotrim.

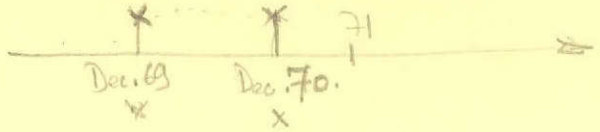
Discussion with Mr. Menezes:

Financing 1[st] loan

- Most of shareholders because of the inflation did not increase their participation as forecast in 211-BR (they did not have even enough for themselves). BNDE took then a larger part than forecasted. The last local currency payments from BNDE (and then Electrobras) were difficult to get by Furnas, but Furnas got it from the Government through an equity contribution from Electrobras. The Government did it because of the existing power shortage at that time.

Financing 2[nd] loan

- The projections of the 2[nd] loan were made by Furnas on the basis of the plants already conceded by Government and of these plants alone (not considering other plants planned ahead in addition to those in project). Then the projections included a big cash surplus (for plants not



included in program) which was lower in reality because of the increased investments made. But the schedule of the financing was different, because of the new investments.

I.B. Tariffs

- In negotiations for 2nd loan, Bank first introduced in the loan agreement a change against the legislation which wanted to compute the 10% rate return adjustment for tariffs on the basis of the net fixed assets in operation corrected by the monetary coefficient good for the end of the 1 year same as the concerned n.f.a.i.o. Then Govt realized this and ∃ a 2nd negotiation for remission of this.

I.B. Management and Consultants

- In 1966, the accounting Dept was reorganized because Temas turned from consulting to operations company. Then ∃ the Consultant of Arthur Andersen for computerization of the budgeting and accounting operations. The conclusions of the Consultants were fully implemented from 1966 to beginning of 1967. Installation of the computer software was difficult (Univac)

- A full integrated management information system will not be in operations before 4 years from now. The expertise is being limited

Financing (5.5%)

- US AID loans: (5.75%)
  1st : $ 16.7 million + int. (Trans Commerciales Temas)
  2nd : $ 15.5 million + int. (Same as 1st stage)
  3rd : $ 41.2 ——— + — (——— 2nd stage).
  Financial cost : similar to Bank's loans.

I.B. Financing 1968-69

- Amortization and depreciation were not reduced as expected by SES-BK. But the Govt reduced the depreciation rate maximum of 3%.

Conclusion Future financing

- Future financial needs : the heaviest need is for 1971. (for Electrolineas). The net inflow is 120 million Cr$/year 1971 from Electrolineas - Other sources expected in

1970-1978 : - from Banks for Itumbiara.
- from Supplier for Atomic Plant.

Conclusion Future Financing

- Furnas cannot go on the internal market now because the market is not mature enough. But it would be easier for Furnas to issue bonds or float on the external markets. But the Government says not. So no attempt.
- The financial projections computer model will be ready by end of 1971.

Conclusion Opinion of Banks

- The Managers think the requests of the Banks on Furnas are a minimum and reasonable. Electrobras has at least the same amount of requests.

The hydro system needs a backing from thermal plants. (recommended by the Cadambra study)

Conclusion Future projections

- The atomic plant : ✓ no fossil fuel in Brazil → why atomic and no steam with classical fuels. The Govt transfered the nuclear plant responsability to Electrobras → to Furnas. The plant will be ready by the end of the 1970's (started in 1972). The plant would achieve about 6-15% of
- Conversion of frequency : was completed in February 1971. Except for 2 steel mills with their own captive plants at 50 Hz, there is no place left with 50 Hz now in the whole SCR.

E.B. Section

participation of Brazil industry in equipment. Training has already started (Nuclear Utility Service in U.S. gives special courses in atomic training for foreigners).
- Cadambra studies include the losses in fuel costs to operations costs of thermal plants when making choices of alternatives.
- Future Itumbiara project (to start in 1974) is being

followed up by Bank. It will have 2000 MW and yearly reservoir.

- Bank in general lungs the projections of load made by Furnas and Electrobras for SCR.

With Mr. Cotrim:

- The prices of equipment purchased by USAID loans are much higher than equipment purchased from Bank loans. The (+40%) financial cost are ~.
- Operational standpoint: procedures for utilizing the loans are simpler with USAID than with Bank. Their control is less burdening and paper exchange less important. The biggest procedure difficulty now with the Bank is: - writing out the specifications - getting appraisal of bids approved (delays of weeks or months). The Bank now gives the impression that it works in the interest of the manufacturers rather than of the borrowers.
- Joint financing is a nightmare. All the paper work necessary for getting some $ million from joint financiers is tremendous compared to that necessary for Bank.
- Advantages of Bank loans are diminishing. More and more Brazilian industries and contractors get involved as suppliers and the list of items unfinanciable by Bank grows up. The scope of Bank loans and the facility of using the loans have diminished.
- Furnas had in 2 instances (India and Canada) to change its specifications and the list of invited Cies for the biddings! [Manufacturers' countries look to Furnas to have gained influence within the Bank for the list of invited manufacturers.]
- CFE has complained a lot to Cotrim about the joint financing very heavy procedures. Furnas could simplify the procedures. The financial cost of the joint financiers will probably be higher than the Bank's cost.

PTO

Conclusion

- The joint financing effort will be useless for Furnas. The "introduction" of this operation with the other lenders is not necessary for Furnas who is very broadly and well known.
- Bank will still be the best source of financing provided the Brazilian industry can still participate in the loans and biddings. Also Brazilian prices are kept down in the bids.

BRAZIL – FURNAS — Questions and Facts.

I) Loan 211-BR. (Sept. 1958)

Amount: $ 73 million (25 years; 5 years grace; 5.75%). (including $ 14 million for interest).

(460 MW) — for 1st stage of 1100 MW Furnas plant → Total Cost: $ 210 million; F.X. Cost: $ 73 million.

Summary: 1st stage to be completed by June 1963. 2nd stage by mid 1965.

— Furnas Co was established in 1957. Initial assets would be
1 Capital contributions (BNDE, State, other utilities): Cr$ 6 billion.
2 Long-term loans (BNDE, Fed. Elect. Fund): Cr$ 11 billion.

Debt/equity: 65/35 initial

— ∃ bill in process at that time to allow for assets revaluation (the Govt assurance was a condition of effectiveness of the loan).

— Consultants in 1957 were Int. Engineering Inc. of San Francisco.

Report: — Furnas was granted a 30 year concession in 1957. [Q: exclusion?]

M-Q → — Capital contributions: 50% common – 50% preferred stock.
BNDE would have 51% of common which have voting right (Govt control)

M-Q → — ~~Electricity from Furnas will be sold only to shareholders~~ [Q: True?]

F-Q → : Why need for Bank finance? Were shareholders capital limited?

M-Q → — A joint planning board should be established. [Q: Was it?]

— Transmission lines would total 680 km, at 330 KV, the most

T-Q → economical feasible voltage at that time. [Q: Voltage true?]

T-Q → — Average annual output in full stage would be 5,700 GWh, with minimum annual of 4,000 GWh. [Q: True?]

M-Q → — Does Furnas still think that return on the thermal alternative has been 17% for the whole project?

— Forecasts for 1958–1965 sources of funds were:

F-Q → 1) Foreign borrowing: $ 127.4 million. 2) Auto-financing: Cr$ 2.6 billion
3) Share capital: Cr$ 6.8 billion, and 4) Govt loans: Cr$ 13.5 billion.
Are these forecasts in line with reality?

— Shares of the Fed. Elect. Fund will be transferred to Electrobras when the latter is established.

F-Q → — Above 50% of the Stage II would be self-financed by Furnas. Q: True?

VIP: F, M-Q → Justification and meaning of the "amortization" provision?

M-Q → — Was the concession period extended from 30 y to 40 y and if yes, when? No.

M-Q — The bill for asset revaluation was expected to allow

X an increase of return rate from 10% to 12% **Q: Result?**

1 M-Q → What was the Bank's contribution in establishment of legal the company and of its regulations?

F-Q → ? Were the initial capital and long-term loans made as scheduled?

T-Q → Has there been any silt problem in Furnas reservoir?

T, M-Q → : What was financed and covered by the loan savings on the original project?

M-Q → : What has been the training provided under this loan and under the other loans?

Q = Consultants experience : cost of contract, education function, quality of advice, ---

(including $9 million interest)

II – Loan 403-474 BR : Amount: $57 million + $39 million.

February 1965 – 1st stage (533 MW) of Estreito hydro plant: Total Cost: $82 million; F.X.: $48 million.

December 1966 – 2nd stage of Estreito (transmission): Total Cost $49.5 million, and F.X. cost: $39 million. (excluding interest)

Summary – Total Cost of both Stages would be: $131 million (o.w. $87 million of F.X.), and $9 million of interest.

Report: M-Q→ : Furnas opinion on UNDP study (Bank was executing agency).

M-Q→ – Furnas was granted 30 y. concession also for Estreito – Q: extension?

M, F – Q→ – Why and how Eletrobras hold 85% of Furnas stock by end 1964?

M – Q→ – Why, in 1965, the operations coordination was planned only for 1970?

M – Q→ – What kind of qualified employees was lacking in 1964?

– Financial forecasts are made in constant 1964 Cr$ at the average exchange rate of US$ 1 = Cr$ 1,500.

Conversion of Govt loans into shares?

– 3 important supply (power) rationing in 1963 and 1964.

Eletrobras Q→ – What were arrangements to be made for distribution expansion in Rio and Sao Paulo areas in 1965 (effectiveness condition of loan)?

Eletrobras Q→ – How was financed the 1965-1970 investment program of the south-central region, forecasted to be $1.3 billion?

– Transmission in 1st stage would be 175 km of 345 kv lines.

T – Q→ – Due to what was due the reduction in F.X. of Estreito Stage 1 between 403 and 474 BR forecasts?

M – Q→ – Has been Estreito stage II been completed in same time as Stage I by early 1971 (Loan Agreement covenant)?

1. M – Q→ – What was training provided in loans necessary for?

Last loan also? Bank's appraisal?

– The permission to revaluate assets for tariff purposes was given only in Beginning 1965, starting January 1965.

1. F, M – Q→ – Effect of automatic tariff adjustment on internal prices level?

Obtain F – Q→ – Terms and conditions of USAID loan ($17.6 million) for Furnas?

VIP – M – Q→ – Why, in 403-BR, Bank asked Furnas not to undertake during 1965-1970 any major investment in addition to Furnas and Estreito plants, and then afterwards it agreeds to finance Marimbondo (contradictory attitudes and reasons for both?)?

No

X T-Q → — Did the expected water shortage materialize in 1965-1966?

F, M-Q → — In 1966, Gov't asked the Bank to improve and adjust the (Eletrobras) tariff legislation through new loans covenants Q: True?

VIP Mr. Cothim — Is that possible that Bank intervened in Government's changes in legislation of "compulsory loan" on charge of consumers (para 21, page 8 of 474-BR)?

X M-Q → — Why Furnas did not sell more energy to Minas Gerais (Cemig) State (its 2nd potential customer) while Sao Paulo light demand fell off in 1965? Exact reasons for this fall off?

X F, M-Q → — Does the Furnas' tariff structure (demand charge) incline its customers to rely more on their own more expensive plants (it does) and then does it hamper sectorial coordination? This is also the reason for Cemig not buying power in 1965. Has been the Bank helpful in this matter against Eletrobras?

X F, M-Q → — Is coordination of Bank's actions in Furnas and Cemig financial covenants on returns withdictory because the covenant for Furnas → full use of tariff legislation → high Furnas's tariffs compared to Cemig's tariffs and thus lack of power purchase from Cemig to Furnas?

X M. Q → — Why was it necessary to reorganize the accounting Dept and train the accounting personnel in 1966?

X Barretta

— Financial projections of 474-BR were made in constant Crs at the December 1965 value (US$ 1 = Cr$ 2,200).

F Fact — Furnas used to have high depreciation and amortization charges (5% and 3% respectively). Bank covenants for computing rate of return use only a 2.5% depreciation charge.

X F-Q → — Were the sources of funds for 1966-1970 correct: 32% from net int. cash - 58% borrowing - 11% share capital?

X Barretta.

— Debt service was expected by Bank to be difficult in 1968, 1969 (para 45, p. 17 of 474-BR).

X T-Q → — Was the choice of 345 kV voltage for transmission correct?

VIP X T-Q → — From where come the demand forecasts and how were they made?

∃ consol balance sheets for December 1964, 1965, 1967, 1968

III Loan 565-BR – Amount: $ 22.3 million (25y; 6.5y grace; %)
Septembre 1968 – Porto-Colombia plant (360 MW) and associated transmission (270 km)
Total cost: $ 69.8 million – F.X.: $ 22.3 million (excluded interest)
– This project closely linked with Volta Grande project of Cemig –
Report: XQ→ : What kind of training has been provided for in this loan?
– Coordination of operations and investments in electric section in south-central region was achieved gradually in 1964-1968, due to merging of international lending agencies. What was
TENDR
X M-Q→ the Bank's share actually compared to others? (accounting agency)
– The benefits of this coordination are given in para 3.03, p. 4.
M,T-Q→ – Has the situation of distribution in the south-central region improved enough to make use of all available power? Bank's real contribution to this improvement? (paras 3.05, 3.06).
M,Q→ – Do the Bank's covenants about future allowed project have any usefulness and meaning? (ds 403-474 fut violé!).
Baratta.
XF,M,Q→ – Why ∃ so heavy construction interest in total projects costs?
M-Q→ – What has been the type of physical, organizational (and financial difficulties which often delayed construction of hydro projects? To whom this happened? To Furnas?
E,M-Q→ – Ds les études économiques de comparaisons thermo-hydro, does Canambra include import duties in the final cost? If yes, did the Bank accept and agree with the results?
1 – Actual results on Bank tests: rate of return was 11.8%, 14.9% and 14.3% for 1965, 1966 and 1967 (according to Bank's definition). Interest coverage was 1.3, 2.1 and 2.9 respectively in these years.
– Reorganization, training and computerization of Accounting Dept of Furnas by Andersen Consultants was completed in 1968. How was the experience of Furnas with these consult?
XF,M-Q→
M,Q→ – Why did the Govt rescind the Chevap concessions and transferred its concessions and assets to Eletrobras and then Furnas?
M,Q→ – What is the Section 5.11 of Loan Agreement 403-474 BR (para 10.07)?

Cotrim X Q → — ∃ conflicts, contradictions or difficulties between Covenants of Bank loans and of USAID loans ?

Cotrim. F J Q → — List of USAID loans, projects and covenants ?

Cotrim F - Q → — Same thing as above for IDB - compare with Bank.

X F - Q → — Was amortization discontinued in 1968 and depreciation rate reduced to 4% in 1969-70, as forecasted in 565-BR ?

Baratta

X F - Q → — Did ever the Furnas' average rate/kwh decrease after new plants were added to assets in operation ?

— Interest coverage expected to be only 1.2 in 1968.

X F - Q → — What is the % of social security expenditures in total operating cost ?

— Reasons and uses of the social security tax in the tariff (10%) ?

— Tariff legislation is : 1 cover operating costs (incl. income tax)

2 - depreciation (max. 5% for hydro) of gross fixed assets in service.

3 - Reversion (3%) or amortization (5%) provision on gross fixed assets in service

4 - 10% return on remunerable investments defined as :

a. gross plant in service valued at end of current year.

b. less depreciation and reversion or amortization reserves net of funds

c - plus working capital allowance = 2 months billing + cash.

LOAN 677-BR : Amount $80 million. (30y; 7½ grace years;)

May 1970 Project: Marimbondo plant (1,400 MW) and associated transmission plus 300 MW ultimate stage of Furnas plant.
Total cost = $ 287 million – Ext. Financing = $ 106 million, of which $ 26 million by joint financing of supplier countries.

Report – Transmission on Marimbondo would be 1,400 km of 500 kV lines.

M,Q→ – History of the Committee for Coordination of Integration Operation. Role – Does ∃ a load Dispatch Center between the Companies?

Q→ – Training provided under the loan? Describe the Engineering, Training and managerial services provided by loans.

T,M:Q→ – What has been the reserve capacity of Furnas in peak periods? Sufficient? Plr in future?

M→Q→ – The Nuclear Plant: Why Furnas and not a steam generating Company – Does expertise exist? Why Nuclear?

M–Q→ – What means "The Bank has reserved the right to assure itself that a satisfactory plan of financing is adopted for any project to start before completion of Marimbondo? Has Bank any leverage or possible action?

– Transmission in this project is: 1,400 km of 500 kv lines.

T–Q – Plr for handling, constructing and operating a 500 kv line? Does the expertise exist in Furnas, or will it provided?

Lamarão and M. Hermes plants?
– These 2 plants are gas turbine plants transferred to Furnas from State of Guanabara – Used as cranking and peaking units in Santa-Cruz plants.

– Conversion of 50 Hz to 60 Hz was completed in January 1971. Except the two steel mills, in the SCR, there is now no region with 50 Hz.

–

INTERNATIONAL BANK FOR
RECONSTRUCTION AND DEVELOPMENT

INTERNATIONAL DEVELOPMENT ASSOCIATION

INTERNATIONAL FINANCE CORPORATION

Mr. Bloom (Furnas):

- Furnas plant (211-BR) was built at about the same cost (in $) as the forecast (± 10%) including the contingencies.
- The cost estimate for Estreito was certainly too high - Thus ∃ proposals from Furnas to use the money left from the loan to finance other things.
- Engineering was in general incomplete and when engineering was finished, capacity was changed.
- In Furnas and Estreito, ∃ extra money which was used for 2 other units for Furnas and for extra transmission for Estreito.
- Porto-Colombia was underestimated and there will be no extra. In the 1st stage of construction, overruns will be about 40 to 50% on total costs.
- Furnas plant has been completed. (403 and 474-BR)
- In June 68, ∃ an Estreito project $ 20 million which was used for 2 additional units in generating plant and additional transmission.

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INTERNATIONAL FINANCE CORPORATION

- All the 4 original units of Estreito plant have been in operation for at least a year (in Fall 1970). The last 2 units permitted in 1968 financed from extra money savings.
- In 403-BR, the 7.5% increase for contingencies was for cost increase and the 15% for contingencies. (Cost estimates were made on a $ basis).
- In general, civil works contingencies and equipment contingencies are for price increases (estimates are made on a $ basis).
- UNDP was cancelled and projects went in line with the study of UNDP.
- The II stage of Furnas was eventually financed by Bank from the extra money savings of 211-BR.
- Frequency plan in Rio Grande do Sul, conversion will be finished in 1973-1974. In Rio, conversion is practically completed.
- Load Shedding: in early 60's, 3 to 4 outages per day in Rio: lack of generation but mainly lack of distribution facilities. Now, in February 71, 3 only one outage in Rio. Voltage plan 3 also.

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— on Furnas system, the real market is Rio. At first, 3 transmission (in 1967) plus, but now it's O.K, except for storms and lightning (few protections against that).

— The loans financed also quite a lot of technical training. Also Bank pushed for ordered sales contracts, for load dispatching and network integrations. Bank then put a lot in institutional building.

— Training for key people of Furnas was provided in loans after 211. Also it hired good consultants, engineers and management.

— See Mr. Catrim, Pdt
Mr. Lyra - chief Engineer.
Delphim, for Costs of Projects.
Luis Carlos Barretta, for operations.
Sergio Menezes, for finances.

Electrobras: Federal Holding Co (Rio)
Mario Bhering, Pdt ← discuss with

Pb: rate structure: Furnas has a problem with (very high demand charges.
The rate of return is 10% allowed by law on revaluable investments which are > net fixed assets in service/ return on these latter is 11.5% about.

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Mr. [redacted] Cornford : Furnas :

- Voir si possible l'annual report 1969.
- Furnas is in Rio.
- les projets terminés ? ∄ pas en dérapage → se référer aux dates de terminaison des rapports.
- For actual costs of projects, ask Bloor.
- For contingencies : ask Bloor.
- Salto Santo green cover report : → tariff regulation.
- Amortization : + Depreciation - are revaluated.
- Income taxes : ∃ Furnas ∈ Electrobras, Federal Government.
- Indirect taxes : not in operating revenues
- Revaluation of assets : it should be correct to revaluate the assets shown in annexes of appraisal reports (because revaluations are one year late / to actual inflation).

See Sergio de Menezes (Finances)

Central Elétrica de FURNAS S/A

1967 { ADD NC$ 33 MILLIONS TO TOTAL INVESTMENT } SOURCE OF APPLICATION OF FUNDS
ADD NC$ 33 " TO LOAN (ELETROBRÁS)

Contratos	% a a				Nº de Anos		Data da Assinatura
	JUROS (INTEREST)		Tx Fiscalização				
	Carência	Amortização	Carência	Amortização	Carência	Amortização	
Ex FFE-3	8	8	1	0,5	4 1/2	20	15.01.59
Ex FFE-9	8	8	1	0,5	4	20	27.10.61
Ex BNDE-134	9,5	9,5	1	0,5	4 1/2	15	15.01.59
Ex BNDE-251	9,5	9,5	1	0,5	1/2	15	30.12.64
ECF 60/67	12	12	1	0,5	2	15	22.12.67
ECF 61/67	12	12	1	0,5	2	15	22.12.67
ECF 61 A/68	12	12	2	1	1	15	20.12.68
ECF 68/68	12	12	1	0,5	-	10	30.08.68
ECF 84/69	12	12	2	1	2	10	30.05.69
ECF 106/69	12	12	2	1	4	10	31.12.69
ECF 114/70	12	12	2	1	1 1/2	10	24.04.70
ECF 119/70	12	12	2	1	5 1/2	15	22.05.70
ECF 134/70	12	12	2	1	3 1/2	10	06.08.70
ECF 142/70	12	12	2	1	1	-	23.12.70
ECF 145/70	12	12	2	1	3	10	23.12.70
ECV 38/68	6	8	-	-	3	20	06.11.68
Verba Federal S. Cruz	6	8	-	-	3	20	14.01.66
em 14.05.71 — Ansaldo S. Giorgio	7	7	.	-	2 1/2	5 1/2	03.10.63
Sprecher & Schuh	6.5	6.5	-	-	3	6	27.11.63
ECV 21/67	6	6	-	-	6 1/2	15 1/2	28.02.67
AID 512-L-011	5.75	5.75		-	3	17 1/2	23.09.63
AID 512-L-023	5,5	5,5	x -	-	3	22 1/2	02.10.64
AID 512-L-066	6	6	-	-	5 1/2	15 1/2	13.10.67
BID - Eletrobrás	6	6	-	-	3	11 1/2	16.12.66
AID - Repasse (...) Banco Brasil	2,5	2,5	-	-	3	15 1/2	27.10.70
	-	-	-	-	-		

CENTRAL ELÉTRICA DE FURNAS S.A.
SEDE: PASSOS - MINAS GERAIS

ESCR. CENTRAL:
RUA SÃO JOSÉ, 90 - 9.º PAV.
TELEGRAMAS: RIOFURNAS
TELEX: 031/118
RIO DE JANEIRO - GB

ESCR. SÃO PAULO:
RUA SETE DE ABRIL, 261 - 10.º PAV.
TELEGRAMAS: CELFURNAS.
TELEX: 021/394
SÃO PAULO - SP

ESCR. B. HORIZONTE:
RUA RIO DE JANEIRO, 452 - 20.º PAV.
TELEGRAMAS: BELFURNAS
MINAS GERAIS

Rio de Janeiro March 4, 1966
DPC.E.288.66

To
International Bank for
Reconstruction and Development
1818 H Street, N.W.
Washington 25, D.C. 20433
U. S. A.

REGISTERED
MAIL NUMBER 16969

Attention: -Western Hemisphere Department

Subjec: - Loan Nº 211 BR
Revised List of Goods

Dear Sirs,

1. As requested in your letter dated 25th February ult., we have pleasure to enclose herewith the Final Resivion to the List of Goods, based on the actual expenditure relating the above mentioned Loan.

2. Kindly sign one copy and return same to us at your earliest convenience.

Yours very truly,
CENTRAL ELETRICA DE FURNAS S.A.

C. M. Feveret
Director

MCF/ars
-cop.-

Encls. original

CONFIRMED:

International Bank for Reconstruction
and Development

BY: _____
Authorized Representative

DATE: March 29, 1966

CENTRAL ELETRICA DE FURNAS S.A.

LIST OF GOODS

Amount shown in equivalent US$ thousands

Revision: 11
Date: February 1966

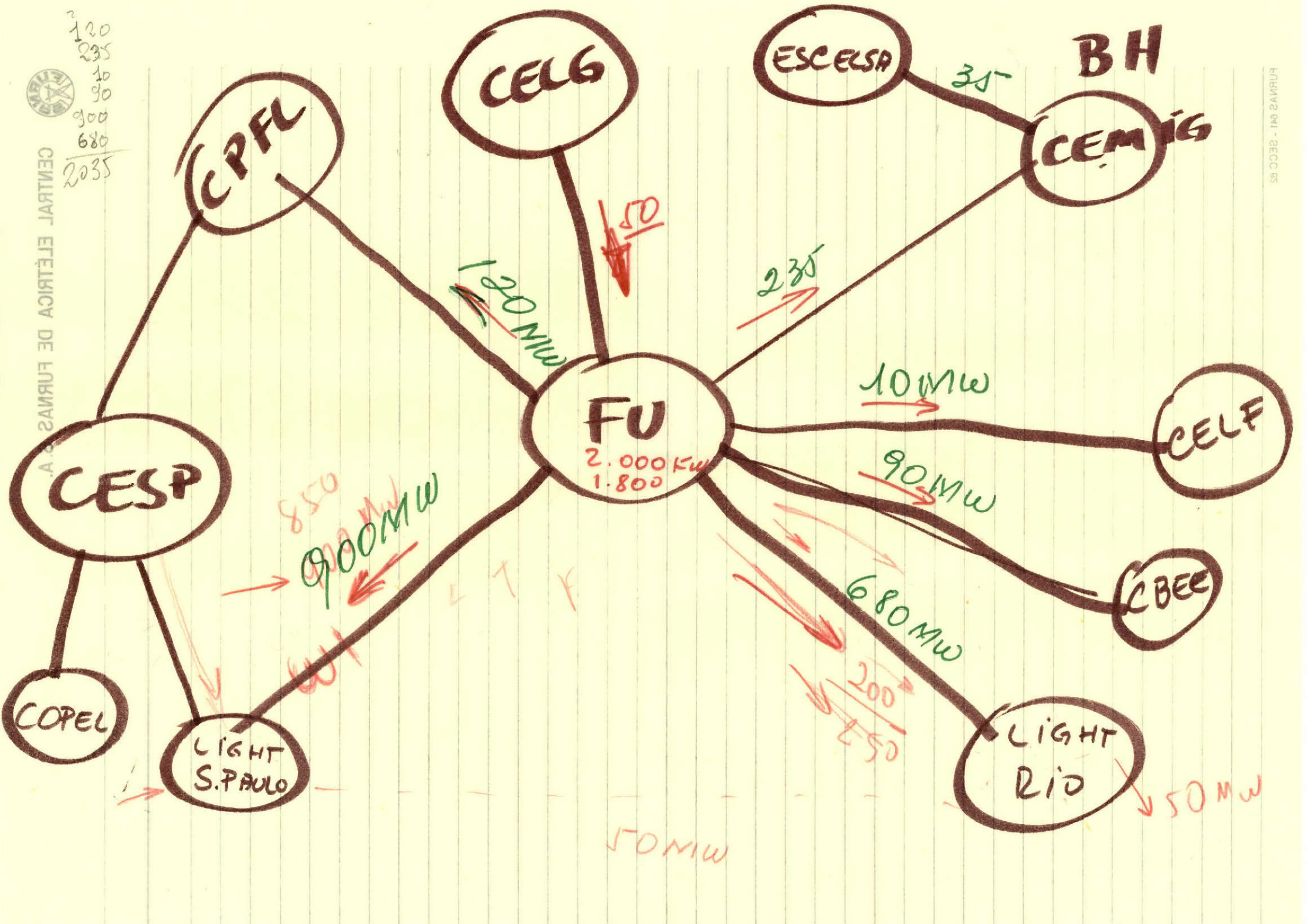
		Original Estimate	Revision 10 of January 1966	Final Revision February 1966
I	- Equipment and Materials for Civil Works	14,800	21.585	21,577,774.61
II	- Generating Plant and Associated Equipment	18,900	12,826	12,707,461.07
III	- Transmission Lines, Substations and Associated Equipment	13,400	15,347	15,295,693.64
IV	- Engineering Inspection, Contractor's Fee and Services	5,300	8,911	9,096,913.06
V	- Interest During Construction and Other Charges	14,400	14,322	14,322,150.00
VI	- Unallocated	6,200	9	-
		73,000	73,000	72,999,992.38
	- Balance Cancelled			7.62
				73,000,000.00

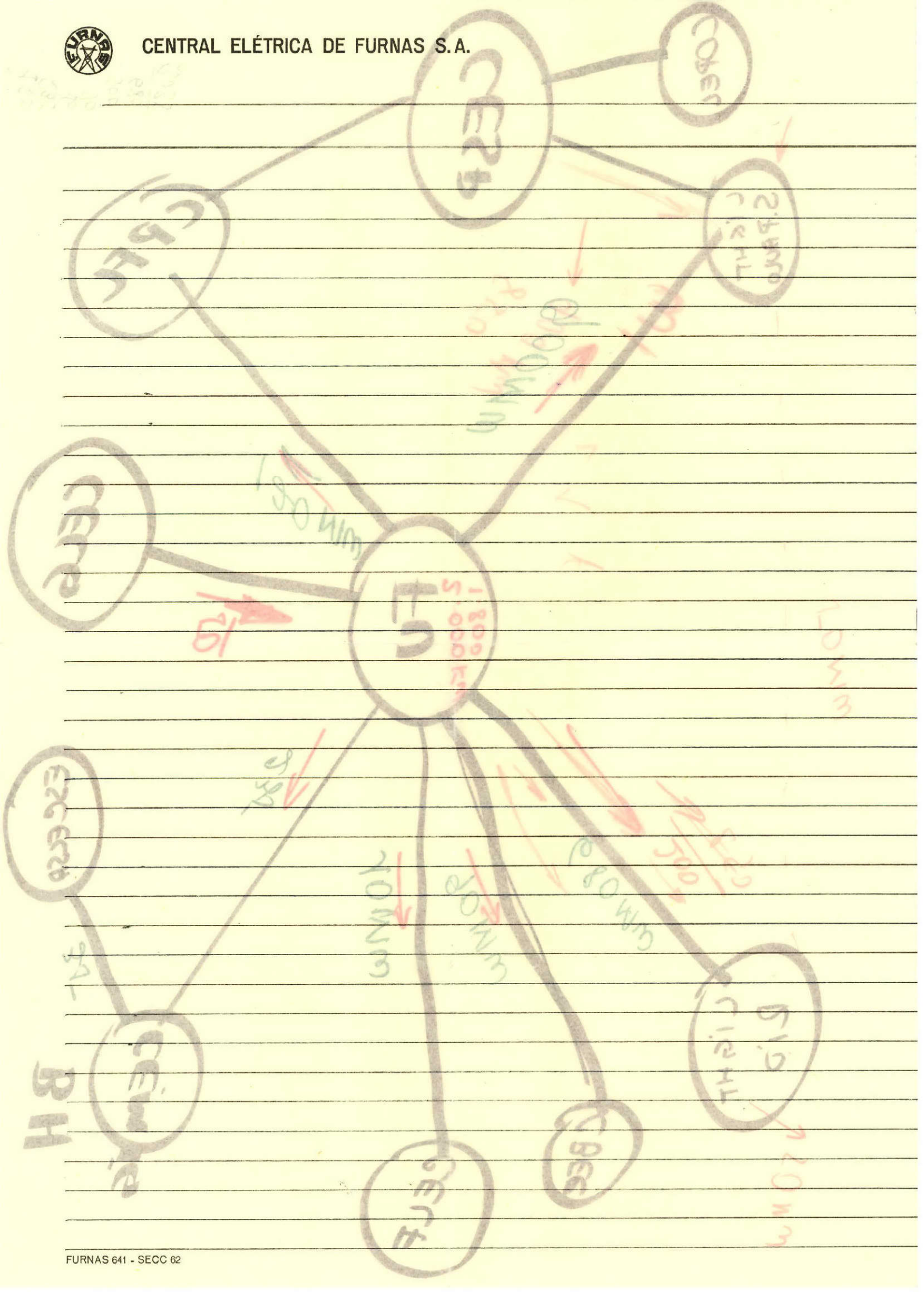
CENTRAL ELETRICA DE FURNAS S.A.

By _____ Director

_____ Director

MCF/ars


CPFL
CELG
ESCELSA
BH
35
CEMIG
50
120 MW
235
10 MW
CELF
FU
2.000 KW
1.800
90 MW
CESP
850
900 MW
CBEE
680 MW
200
250
COPEL
LIGHT
S.PAULO
LIGHT
RIO
50 MW
50 MW



BRAZIL : FURNAS

1st loan $73 million : Finance 1st stage of 1,100 MW project. Total cost: $ 304 million
1st stage capacity: 460 MW. Cost: $ 210 million (FX: $ 73 mil)

- Furnas Company was formed for project purpose.
Project: Earth dam, spillway and powerhouse.
- Considering in 1958 to revaluate the assets on cruzeiro depreciation. Check afterwards

I.P. Generated Output from Furnas will be bought by other utilities in bulk which will distribute it. These utilities are shareholders of Furnas. The National Dev.t Bank (controlled by State) has a controlling power on common stock.

∃ a description of situation existing in 1957 in the region to be served by FURNAS:

Annex I
- Demand: 2,200 MW - Supplies (including losses): 11,700 million kwh.
Plant capacity: 2,424 MW.

Annex II
- Distribution of sales to consumers in 1957: Commercial: 15%; Industrial: 44%; Residential: 18%; others: ; Total: 8,670 million kwh

In 1958, 78% of Brazil industrial production and 69% of agricultural products came from Furnas' area.

Annex III
- Peak demand forecasts in area: 2,570 MW in 1958 to 8,763 MW in 1970
- Allowance made for risk of plant outage: para 19

Comparison!
- Other projects: Peixoto of Paulista, and Tres Marias of CEMIG.

Annexes IV and V.
- Power surplus and deficits:

		1963	1964	1965	1966	1967	1968	1969
Forecasts in M.W. →	Deficit	540	1012	1467	1956	2387	2962	3651
	Furnas	460	736	1104	1104	1104	1104	1104
	Net Deficit	80	276	363	752	1283	1858	2547

Mang.t: I.P.
- The Rio light System works on 50 hertz. Single such enclave. ↑

I.P.
- Furnas capacity will have to be increased by further 3000 MW by 1970.

See Area Dep.t:
- "Program of Targets" from the National Development Council: para. 23

Mang.t. V.I.P. para. 25, 26.
- Big task ahead, but lack of coordinated long-term plan. Competition between utilities needed to optimize use of funds and capital. Recommand to establish a joint planning board. Role of "Electrobras"?
- Work started in June 1958. Contracts made on a target price basis. The cost includes provisions for 110 km of railroad to be flooded.

- Hydrology : Minimum energy production (dry period) : 4.10^9 kwh
  Average annual output : $5.7\ 10^9$ kwh.
  Floods : maximum flow was 6,600 m^3/s. Spillway designed for 13,000 m^3/s and provisions made for reaching 15,000 m^3/s.
- Costs Estimates : Critical points are : a) Interest during construction and other charges - b) Increase in cost of labor and equipt
- Economic Justification : No rate of return analysis with alternative. Importance of industrial development in Furnas' area.
- Management of Furnas is judged to be good.

BRAZIL : FURNAS

2nd Loan: Finance 1st stage of capacity 533 MW of Estreito project. Cost: $ 90.5 million, loan $ 57 million (= F.X.) - Project consists in: dam, power house and transmission facilities.

Furnas project: construction of 900 MW project under completion in 1965.

Share holding in the capital:

	1958 (Forecast)			1965 (Actual, January 1st)		
	Common % Stock	Preferred % Stock	Total Capital %	Common % Stock	Preferred % Stock	Total Capital
BNDE	51	—		—	—	
GEMIG (State)	25	25		4.6	4.6	
D.A.E.E.S.P. (State)	24	15		5.6	7.0	
S.P.L.C	—	50.6		—	5.0	
C.P.F.L. (Electrobras)	—	9.4		—	0.6	
C.H.R.P. State S.P.	—	—			1.6	
Electrobras	—	—		89.8	81.2	
	100 %	100 %	Cr$ 6 billion	100 %	100 %	Cr$ 25 billion

- Electricity will go 10-50 to Sao Paulo and Minas Gerais States and only to the shareholders.
- Employees: 80 engineers and 2,500 others.
- **Furnas 1st project:** In 1965, Furnas had 4 (150 MW) units and two others to be in service by June 1965. It was put in service late in 1963.

Transmission lines: 571 km on 345 kvs. Other 314 km in construction.

- Exchange rate used for forecasts of operating results: Cr$ 1,500 = US$ 1.
- Demand for energy at generation level: para 10 and 11.

Para 12.

- Capacity existing in 1964: 4,400 MW, of which 3,750 hydro.

II Institutional building

- Institutional: expansion of saturated distribution facilities in Rio and Sao Paulo are condition of effectiveness.
- Total program of power investment through 1970: US$ 1.3 billion
- Effective coordination of the operations in the system was insecure in 1965 and Government will encourage such coordination by 1970.

Project: Dam, Powerhouse, 4 units of 133 MW each (2 will be installed later). Transmission lines: 140 km and 35 km.

- Rainfall and flow studies → spillway requirement of 13,000 m³/s.
- Work expected to start July 1965 and project completed early 1971.
- Cost: para. 23.

Cost per kw : US$ 130.

A second stage of Estreito project will start in 1967 and include transmission lines and substations costing US$ 53 million.

- Revaluation of assets was not allowed before January 65.
- 7 a list of official annual correction factors published by the National Economic Council.
- Forecast of income statement : Annex 2.

CHAPTER VI
REPRESSED DEMAND

6.1 Definition of Repressed Demand

For the purposes of the present report, repressed demand is considered to be any restriction to the ample and free use of electricity due to some kind of hindrance to the power supply.

Repressed demand has existed to a lesser or greater extent in all power systems of South Central Brazil. It can appear in a number of forms both in cause and effect. Some of them are quite apparent whereas others can only be identified by the technical experts in the power business.

In Chapter IV it was shown that most of the power systems of South Central Brazil have had a somewhat irregular and erratic pattern of evolution over the period 1950-1967. In that Chapter the question of repressed demand was dealt with in very broad terms. In the present Chapter the matter will be explored in deeper detail.

It is believed that the analysis of the historical evolution of the power systems and of the problems of repressed demand is of fundamental importance to the understanding of the characteristics of the power companies in South Central Brazil, their past evolution, their present problems and plans, and their prospects for future development.

6.2 Deficiencies in Power Supply

As pointed out in Chapter IV, the market growth of most, if not all concessionaires in South Central Brazil was subjected to severe limitations. Most were due to inadequacies in the supply and to power consumption curtailment. Through the period 1950-1964 such conditions were fostered by the inadequate regulatory legislation which discouraged the electric utilities from making the necessary investments required for system expansion.

For the purposes of the present report power curtailments will be classified under two categories: declared and disguised curtailment.

6.2.1 Declared Curtailments

In general, declared curtailments are due to system's inadequacies of generating capacity, but they can also result from limitation in the transmission and/or distribution systems.

They quite inevitably result in a reduction of the rate of growth of the power market and they introduce serious limitations in the consumption of electric power by certain if not all the categories of consumers. Declared power curtailment is so evident that technical expertise is not necessary for its identification.

Experience has shown that once this kind of curtailment is eliminated the market will tend to grow at its long term average rate of growth. This means that unless very special care in marketing is exercised by the concessionaire there will be a permanent net loss in the consumption of electricity through the future years. This is particularly true when declared curtailment becomes frequent.

On the other hand, this type of curtailment, which reflects poor service, has a very unfavorable psychological influence on the customer's attitude towards the concessionaires and very particularly towards the use of new appliances. It can even influence industrial customers not to expand their facilities or even not to build their plants in the area supplied by that utility. The image of the concessionaire is severely affected by declared curtailment which can only be applied by permission of the Government. Therefore, the concessionaires do not recur to this kind of curtailment as long as they can get by with other means of load reduction.

Table VI-1 presents a summary of declared power curtailments in the main power companies of South Central Brazil in the period 1950-1967. The reasons for these curtailments were identified in Chapter IV, either explicitly of implicitly in the graphs of historical evolution of each individual concessionaire. It is important to notice the frequency and widespread occurrence of declared curtailments in the systems of South Central Brazil which, to a great extent, hindered the pattern and the rate of growth of electric power consumption in the area.

Most of the declared curtailment that took place in the period 1950--1967 were primarily due to inadequate generating facilities. South Central Brazil is now engaged in a program of power plant construction, based on CANAMBRA's suggestions, which should provide adequate supply from the generation standpoint. Therefore the past trend of electricity consumption growth in the Region cannot be used as the main basis for extrapolation. Yet, the analysis of this historical trend is important because it provides better judgment on the expectancies within each system if an adequate power supply were provided.

TABLE VI - 1
SOUTH CENTRAL REGION
DECLARED POWER CURTAILMENT IN
THE MAIN POWER SYSTEMS

LIGHT-São Paulo	CPFL
1950	1951
1951	1952
1952	1953
1953	
1954	CFLMG
1959	1950
1963	1954
1964	1958
	1959
LIGHT - Rio Ⓐ	1960
1950	
1951	CBEE
1952	1950
1953	1951
1954	1952
1955	1953
1963	1954
1964	1955
1967	1962
	1963
Ⓐ Guanabara plus	1964
Rio de Janeiro	1967

6.2.2 Disguised Curtailment

6.2.2.1 General

Even though the general conditions that result in disguised curtailment are basically the same as those that entail the declared one, they are different in intensity and cause. They are subtler and can only be identified by a careful analysis of the systems' growth and operating conditions.

Disguised curtailment results in a reduction of power consumption that is not noticed by the average customer.

Disguised curtailment means inadequacy of electric services. It retards the growth of consumption and gives the customers an erroneous concept of the adequate standards of electric service to be expected.

There is a very close relationship between declared and disguised power curtailment. The practice in South Central Brazil has indicated

that systems frequently subjected to declared curtailments are permanently under disguised power shortage.

Disguised curtailment can occur in different forms: voltage reduction; frequency reduction; simultaneous reduction of both voltage and frequency; interruption of power supply to selected distribution circuits; customers fuses or quick-lag circuit breakers of inadequate capacity; difficulties or refusal to connect new customers.

6.2.2.2 Voltage and Frequency Reduction

"The operation of an electric system today requires the highest possible reliability of service to the customer consistent with economic justification of the costs of such service. Under certain load conditions and capacity limitations there may be a deficiency of generation. Reduction of voltage will reduce load and this has been applied for emergency load relief on many electric systems. It has been proposed and some systems have utilized a reduction in frequency as a means of reducing load". (The Effect of Frequency Reduction on Plant Capacity and on System Operation, AIEE, February 1955, page 1632).

The most common instance of voltage reduction due to lack of generation occurs when a section of the system loses a substantial import under fault conditions. The remaining generating plants in the system tend to become overloaded and to tripp. Load shedding through voltage and/or frequency reduction might then be an adequate procedure to avoid a complete collapse of the system.

In general voltage reduction gives better results because all appliances that use electric energy are sensitive to voltage variation while many are not so sensitive to frequency variation (ranges, water heaters, incandescent lamps, etc.). Furthermore, voltage reduction can be restricted to the area where the generating capacity deficiency occurs while frequency change affects the whole interconnected system.

"The type of connected load will materially affect the results obtained by frequency reduction. On systems with a high percentage of motor load, such as pumping, a combination of frequency and voltage reduction may secure maximum load relief in an emergency". (The Effect of Frequency Reduction ..... page 1637).

In systems with a large proportion of resistive loads, such as incandescent lamps, ranges, heaters, etc., voltage reduction is very efficient in the short run, for the ensuing load decrease is proportional to the square of the voltage reduction. In the long run it may happen that poor voltage levels induce customers to increase the connected load, by installing more lamps and using heaters

nominally more powerful, in order to obtain the same result with, sometimes, an even greater consumption. This, however, hardly applies to low income populations so that voltage reduction has been, by and large, a very effective and widespread means of power curtailment.

There is a great difference between the above-mentioned practices and the practices in South Central Brazil. The basic difference is that whereas frequency and/or voltages drops were used solely for emergency purposes in the operation of power systems in Great Britain and elsewhere, this has been current operative practice in South Central Brazil, in order to compensate for inadequacies in power supply. It is important to realize that emergency measures do not substantially affect the power market growth. However, when measures that are justifiable only on an emergency basis become routine in the operation of the power system, they turn out to be a serious hindrance to the market development.

The increasing degree of interconnection among the main systems in the Region has been very helpful to the improvement of the average frequency level and stability.

Voltage reductions though less common and intense, are still frequent in most systems within the South Central Region, as verified by means of a field survey (see Table VI-2) and through spot-checking carried out by ELETROBRÁS, in connection with the present Market Study. This problem has been of great concern to the concessionaires and the Government, and important and effective measures are underway in order to eliminate such defficiency.

TABLE VI-2
SOUTH CENTRAL REGION
RESIDENTIAL CUSTOMERS
VOLTAGE REGULATOR SATURATION

City	Saturation %
São Paulo	36.7
Rio de Janeiro	14.7
Belo Horizonte	22.8
Juiz de Fora	16.0
Campinas	54.4
Indaiatuba	50.0
Araraquara	23.6
Bragança	58.0

6.2.2.3 Interruption of Power Supply

It has been the practice, in the operation of the power systems of South Central Brazil, to interrupt the supply of power in selected distribution circuits during emergencies. Power interruptions also occur because of poor distribution facilities and lack of adequate system protection. This is one of the most well known deficiencies in Brazilian electric systems. Even foreign visitors are familiar with it.

This kind of disguised curtailment has been so widely used in most South Central Region power systems that it has become a serious hindrance to the development of sound habits of electric power use. It has also had a major influence on the level of service quality expected by the customers.

A company might decide to interrupt service in the following circumstances:

Lack of generating peaking capability

Lack of adequate transmission facilities

Lack of proper distribution system capacity

Maintenance or repairs in the system network

Even though the last reason is justifiable, in power systems of poor quality it becomes so frequent that it ultimately leads to a form of disguised curtailment.

Most administrations of the Region's concessionaires are now concerned with this problem. Important measures are underway with the scope of improving the operating conditions of the generation, transmission, and distribution systems, so as to eventually provide customers with a more reliable and adequate power supply. Yet, for some companies, there is still a very long way to go before this target is reached.

Table VI-3 gives some typical examples of power curtailment derived from extended and repeated disconnections, in three counties located in the State of Rio de Janeiro, very close to Guanabara.

TABLE VI-3
INTERRUPTIONS OF POWER SUPPLY
(From January 1st to March 31, 1968)

Counties	UNSCHEDULED		SCHEDULED		TOTAL	
	Nº	Duration	Nº	Duration	Nº	Duration
Nova Iguaçu	74	141h 31m	13	215h 10m	87	356h 41m
Meriti	247	297h 57m	10	163h 28m	257	461h 25m
Caxias	28	20h 46m	7	110h 05m	35	130h 51m

Source: LIGHT

On a per day basis the above figures mean lack of electric power during approximately 4 hours in Nova Iguaçu, 5 hours in Meriti, and one and a half in Caxias.

6.2.2.4 Quick-Lag Circuit Breakers

In regard to residential customers, quick-lag circuit breakers, or fuses, are used with the primary purpose of protecting the customers appliances from electric disturbances in the distribution network of the concessionaire, besides protecting the customers' wiring facilities from faults within it. When it permits the full utilization of the customer's appliances the fuse represents an adequate protection to the customer's electric installation, as well as to the concessionaires distribution network, if they are designed to bear that load. Whenever, due to an improper choice, circuit breakers do not have enough current capacity they become a restraining factor to the use of electric power and therefore represent a source of disguised curtailment.

In some systems in the South Central Region, under certain circumstances, quick-lag circuit breakers became widely used after the concessionaires refused to connect new electric ranges to the distribution network and the customers decided to connect 220 V ranges to the 110 V circuit. This practice resulted in a considerable increase in the cooking time, in a loss of stability in the distribution network, and in the burn out of meters. The large scale use of customer circuit breakers to avoid loss of meters was then decided by these utilities.

The widespread use of this kind of circuit breaker gives the concessionaire an opportunity to limit the power used by the customers (if the concessionaire so desires) simply by delaying or even refusing

to replace a circuit breaker of inadequate capacity, when this becomes necessary or convenient to the customer by another one of higher capacity.

6.2.2.5 Connection of New Customers

It has also been frequent, in many power systems in South Central Brazil to purposely delay or even to refuse service to new customers. This is an apparent form of disguised curtailment. Evidence of this practice was found in the Autoprodutores survey (Chapter VII), in the historical analysis of system evolution (Chapter IV), and in the Field Survey (Chapter X). This problem is also known from practical experience in system operation in the Region.

A concessionaire might delay or refuse the connection of a new customer if it does not want to supply power to that type of load. In some instances this has been the case for electric ranges, certain industries, and any other relatively large loads.

When either the electric power system distribution or transmission networks are already overloaded, and generating facilities are inadequate, the concessionaire might try to postpone connecting new customers until the bottlenecks have been removed. The same attitude will occur when the concessionaire is not willing or does not have proper conditions to make new investments in the expansion of system facilities. This attitude often leads an industrial concern to build its plant not in the concessionaire's area of influence but rather elsewhere or to resort to self-supply.

In South Central Brazil this problem has been one of the main causes for the development of the Autoprodutores (see Chapter VII) particularly in the areas of heaviest industrial concentration, in and around the cities of Rio de Janeiro and São Paulo.

6.2.2.6 Other Forms of Disguised Curtailment

There are many other forms of technical disguised curtailment which are not as important, from the point of view of market growth and system service quality, as the ones previously discussed.

As an example it could be mentioned that in the larger cities the building elevators often are not operated simultaneously. This practice was promoted by the concessionaires at times of major shortage of peaking capacity; by increasing the diversity factor in the use of elevators a considerable saving in peaking capacity was obtained and

this practice has remained as a habit among many customers.

Another form of disguised curtailment would be the use of automatic light switches, with very short time-setting, in apartment buildings halls.

6.3 Electrification of "Favelas"

6.3.1 The General Picture

The analysis of power supply to "Favelas" (slums) showed that there is a very serious condition of repressed demand in that group of customers.

Since about one quarter of Guanabara State population lives in slums, the detailed analysis of power supply to the Favelas becomes a major factor in the evaluation of LIGHT's power market prospective in this State.

Favelas have also become a serious problem in the city of Belo Horizonte, and a growing problem in Niterói. In the city of São Paulo they are of minor importance.

The average population growth in Brazil between 1950 and 1960 was 3.0% per year, whereas the rate of urbanization of the South Central Region was considerably higher, as indicated in Table VI-4.

TABLE VI-4
SOUTH CENTRAL BRAZIL
MAIN URBAN CENTERS
POPULATION

	1950	1960	Average Growth Rate %
Belo Horizonte	346.2	642.9	6.3
Great São Paulo	2,236.2	3,662.7	5.1
São Paulo	2,041.7	3,164.8	4.5
São Bernardo do Campo	20.0	61.6	11.9
Santo André	97.4	230.2	9.0
São Caetano do Sul	55.4	114.0	7.5
Guarulhos	16.3	78.0	16.9
Mauá	5.4	14.1	10.1
Rio de Janeiro (Guanabara)	2,335.9	3,223.4	3.2
Nova Iguaçu	58.5	257.5	16.0
Niterói	174.5	228.8	2.7
Campinas	101.7	179.8	5.9
Ribeirão Prêto	65.1	116.2	5.9
Juíz de Fora	86.8	125.0	3.7
BRAZIL:			
Urban	18,803.9	32,465.1	5.6
Total	51,944.4	70,119.1	3.0

Source: IBGE

Housing and urbanization programs, however, have not attained such a pace as to cope with the extent and growing needs of the population.

Table VI-5 shows the distribution of income among the "Favelados" (people that live in the "FAVELAS"), according to three independent surveys carried out between 1965 and 1968 by municipal agencies in Belo Horizonte, Rio de Janeiro, and Niterói.

TABLE VI-5
SOUTH CENTRAL REGION
FAMILY INCOME DISTRIBUTION IN THE FAVELAS

Income in terms of minimum wage (1)	Belo Horizonte Nº of Families (2)	%	Rio de Janeiro Nº of Families (3)	%	Niterói Nº of Families (3)	%
Less than 1	9,818	39.1	670	29.6	179	26.8
From 1 to 1.5	9,568	38.2	854	37.8	242	36.2
From 1.5 to 2	2,248	9.0	380	16.8	70	10.5
From 2 to 3	1,830	7.3	261	11.5	37	5.5
More than 3	883	3.5	67	3.0	21	3.2
Not specified	729	2.9	29	1.3	119	17.8
	25,076	100.0	2,261	100.0	668	100.0

Notes:

(1) NCr$ 120,00 (US$ 35.00) per month, as of July 1968.
(2) Total for Favelas in Belo Horizonte in 1965.
(3) Number of families included in the field-sample survey.

According to the "Housing Program" of the "Ten Year Plan", and on the basis of an assumed 5.09 persons per household, it was estimated that in 1967 the total number of poor households that should be substituted for new houses amounted to 730,700 units, distributed as follows:

TABLE VI-6
SOUTH CENTRAL REGION
ESTIMATE OF INADEQUATE HOUSING FACILITIES
IN URBAN AREAS
1967

Rio de Janeiro	241,000
São Paulo	165,000
Belo Horizonte	68,600
Sub-Total	474,600
Other urban areas	256,100
Total	730,700

Source: "Ten Year Plan".

In the research done by ELETROBRÁS in connection with the present Power Market Study, the above figures were confirmed, with the exception of Belo Horizonte, where the "Favela" population was estimated to be 174,700 inhabitants. This implies about 36,400 households as compared with the "Ten Year Plan" estimate of 68,600 units.

A complete census of the "Favelas" population was carried out in Belo Horizonte both in 1955 and 1964. A comparison of their results with the growth of total population of the city shows that the population of the slums is increasing at a much faster rate of growth.

TABLE VI-7
BELO HORIZONTE
POPULATION GROWTH

	Total Population		Population in the Favelas	
Year	Inhabitants	Rate of Growth	Inhabitants	Rate of Growth
1950	346,200		-	-
		6.3%		
1960	642,900		-	-
1955	497,100 +		36,432	
		6.3%		13.5%
1964	765,000 +		119,799	

+ Estimated.

Source: Favela Census, Belo Horizonte Municipality.

There is a similar situation in the Rio de Janeiro area. Two "Favelas" censuses were made in 1950 and 1960, indicating a total population of 169,305 and 337,412 inhabitants, respectively, with an implied average rate of growth of 7.2% per year. This is also considerably higher than the 3.2% average rate of growth for the total population of the city. It should be pointed out that in the Rio Favela census the definition of "Favela" is substantially different from the one adopted in this Report. Nevertheless, the criteria for the 1950 and 1960 censuses were the same and therefore the results are adequate for determining the population growth rate.

The progress of the "Government Favelado Housing Program" has not kept pace with the growth of the Favela population. It is excepted that this tendency will change considerably over the next few years, due to the new Housing Program of "Banco Nacional de Habitação", already well underway. Actually, there has been a growing concern

within the Government in regard to the "Favela" problem.

The electric power companies in Belo Horizonte, Rio de Janeiro and Niterói have not given special attention to the question of power supply to the "Favelados". One obvious reason is that they are still going through the process of improving power supply to their regular customers. Another reason is that "Favelas" are usually located in public owned areas, still not recognized by the municipalities as urban areas, and without legal jurisdiction as far as power supply is concerned.

The concessionaire in Belo Horizonte is presently studying the problem of power supply to the "Favelas". According to an official of this utility, there is a tendency to design distribution facilities of a rather modest standard but adequate for reliable power supply to the customer.

6.3.2 The Especial Case of Guanabara

In the State of Guanabara only about 10% of the 'Favela" area is supplied directly by the local concessionaire. Table VI-8 presents a summary of the power suppliers, according to actual surveys in two "Favelas".

TABLE VI-8
FAVELAS POWER SUPPLY
GUANABARA
Percentage of Occupied Area

	Brás de Pina	Morro União
Resale	64.0	60.8
Comissões de Luz (Power Committees)	-	10.5
Concessionaire - LIGHT	8.0	10.5
Without Power Supply	14.0	1.7
Unoccupied Area	14.0	17.0

Source: Centro Nacional de Pesquisas Habitacionais.

Studies available indicate that Table VI-8 is representative for the "Favelas" as a whole.

The concessionaire does not feel it has a responsability towards

consumers that live in urban areas that are not legally recognized by the State Government. It supplies power directly to about 10% of the "Favela" area. Besides, it sells bulk power to a few "Favelados" that resell it to customers within the "Favela". In the latter case the "Favela" distribution network does not have an adequate or even a reasonable standard of construction, operation and safety.

The "Power Committees"are sponsored by the State's "Comissão Estadual de Energia". They buy bulk power at high voltage from the concessionaire and resell it to the customers at a slightly higher price to cover the administrative and operating expenses. They also supervise the construction and operation of the distribution network.

Since the Guanabara area concessionaire classifies all the supply to "Favelas" as "residential," the actual number of residential customers in the Guanabara area is quite different from the statistical figures, a factor that must be taken into account when analysing the growth of residential consumption and/or projecting it (see also Chapter X).

As far as power rates are concerned, and due to the extreme complexity and relative abandonment of the power supply to "Favelas", an opportunity appeared for the exploitation of the "Favelados" by the resalers.

Reselling on a system of "flat rate per appliance" has been adopted by retailers in most "Favelas" of Guanabara. Table VI-9 is representative of such rate system.

TABLE VI-9
FAVELAS POWER SUPPLY
GUANABARA
RESALE PRICE OF ELECTRICITY
NCR$

Favela	Lamp	Electric Iron	Refrigerator
Praia do Pinto	5,00	5,00	8,00
Escondidinho	5,00	....	....
Acari	5,00	....	10,00
Brás de Pina	3,00	....	10,00

Source: Sample Field Survey, ELETROBRÁS

The end result of such a rate basis is a cost of electricity approximately four times greater than that charged to regular residential customers in the State of Guanabara. At present rate levels

this means about NCr$0.45/kWh for "Favelados" and NCr$0.12/kWh for regular customers, or approximately US$0.12/kWh and US$0.035/kWh, respectively.

Since there are now about 120,000 customers paying such prices for electricity this fact must be taken into account when projecting the residential consumption in the Guanabara area (see Chapter X).

On the other hand, as the "Power Committee" buys power at high voltage and resells at a price just enough to cover its expenses, the cost to their customers is actually slightly below the nne charged by the concessionaire to its regular residential customers.

Therefore, as the work of the "Power Committees' expand, there will be an opportunity for more "Favelados" to buy power at cheaper rates.

Table VI-10 presents a summary of "Favela's" electric appliances saturation, as indicated by field surveys carried out between 1964 and 1968.

TABLE VI-10
SATURATION OF ELECTRIC APPLIANCES IN "FAVELAS"
Percentage of Families Included in Census

	RIO DE JANEIRO				
	Brás de Pina	Mata Machado	Morro União	Niterói	Belo Horizonte
Radio	64.9	73.4	64.1	60.6	42.6
Electric	.....	.....	....	42.2	....
Battery	.....	.....	....	18.4	.....
Range	73.0	82.8	78.0	.....	95.5
Gas	....	.....	....	67.0	41.7
Wood	....	.....	.....	9.9	53.4
Electric	....	.....	.....	.....	0.4
Ironer	....	.....	.....	68.8	.....
Electric	....	.....	.....	54.5	.....
Coal	....	.....	.....	14.3	.....
Refrigerator	20.4	27.0	22.8	20.8	4.6
Floor Polisher	3.2	8.1	3.8	.....	2.2
Electric Mixer	20.7	22.9	18.0	16.2	7.7
Record-Player	6.9	11.2	7.9	7.6	6.4
Electric Shower	.....	.....	.....	.....	1.9
Water Heater	.....	.....	.....	.....	0.5
Ventilating Fan	.....	.....	.....	11.0	.....
T.V.	10.2	12.6	11.2	14.9	3.4

Source: Rio de Janeiro - Centro Nacional de Pesquisas Habitacionais.
Belo Horizonte and Niterói - Municipality.

The results of the survey in the Guanabara "Favelas" are summarized in the following table:

TABLE VI-11
STATE OF GUANABARA
SATURATION OF ELECTRIC APPLIANCES
Percentage of Families Included in Survey

	Brás de Pina %	Mata Machado %	Morro União %
Radio	64.9	73.4	64.1
Refrigerator	20.4	27.0	22.8
Floor Polisher	3.2	8.1	3.8
Electric Mixer	20.7	22.9	18.0
Record-Player	6.9	11.2	7.9
T. V.	10.2	12.6	11.2
Sewing-Machine	45.1	48.6	49.9
Electric Range or Gas Stove (1)	73.0	82.8	78.0

(1) About 100% gas stoves.
Source: Centro Nacional de Pesquisas Habitacionais.

The average consumption by the "Favelado" customer varies according to the type of household and the location of the "Favela".

It has been observed that when the "Favelados" are transfered to a new residential area, planned and built according to the Housing Program of the Banco Nacional de Habitação, the consumption per customer doubles, as shown by Table VI-12.

TABLE VI-12
FAVELAS
ESTIMATED AVERAGE CONSUMPTION
OF ELECTRICITY
kWh per Month

	"Favela" Customer	New BNH Housing Facilities
Rio de Janeiro	50 +	100
Belo Horizonte	25	54 - 77

\+ Resale Customer

The main causes of such striking increases of consumption are: the "Favelado" feels that he enjoys a more permanent living condition in his new dwelling and is more willing to purchase new electric appliances; only the "Favelados" that earn at least the minimum salary are eligible to be transfered; the new housing units are larger and better provided with power supply facilities than the shacks.

Thus, two main conclusions can be drawn from Table VI-12: first, the consumption doubles or even triples when the "Favelado" moves from the old shack to new and better housing facilities, regardless of an increase in his level of income; second, the average consumption in the Rio de Janeiro "Favelas" compares favorably with that of regular residential customers in many power systems, as shown by Table VI-13.

TABLE VI-13
SOUTH CENTRAL REGION
RESIDENTIAL CONSUMPTION
kWh per Customer per Year
1967

Concessionaire	kWh
Companhia Fôrça e Luz de Minas Gerais	1,700
LIGHT - São Paulo	1,541
LIGHT - Guanabara only	1,520
LIGHT - Rio de Janeiro only	1,320
Companhia Brasileira de Energia Elétrica	1,250
Companhia Mineira de Eletricidade	1,200
Companhia Paulista de Fôrça e Luz	1,100
Centrais Elétricas de São Paulo	910
Companhia Elétrica Caiuá	870
Companhia Prada de Eletricidade (São Paulo)	840
Espírito Santo Centrais Elétricas	815
Companhia de Eletricidade de Nova Friburgo	810
Emprêsa de Eletricidade Vale do Paranapanema	790
Centrais Elétricas Fluminenses	790
Companhia Luz e Fôrça Hulha Branca	785
Centrais Elétricas de Minas Gerais	750
Companhia Sul Mineira de Eletricidade	680
Emprêsa Hidro-Elétrica Lutzow	640
Companhia Geral de Eletricidade (Minas Gerais)	610
Companhia Fôrça e Luz Alegre Veado	610
Emprêsa Luz e Fôrça Itabapoana	605
Companhia Fôrça e Luz de Jacutinga	420
FAVELAS	
Guanabara	600
Belo Horizonte	300

It is relevant to point out that in 1967 there were about 304 "Favelas" in the State of Guanabara, which covers an area of 1,356 square kilometers; the level of consumption of electric power by the "Favelado" customers was only 20% below the average residential consumption in CEMIG's system, which included, in 1967, a transmission and distribution network that supplied power to 341 cities, towns and villages, spread in an area of 153,000 square kilometers. It is also important to consider that according to official information from CEMIG, 43% of its residential customers has an annual consumption of less than 360 kWh.

The population and load concentration of the "Favelas" in the State of Guanabara, besides the average per capita income and living standard, make the "Favela" power market an attractive one to be developed at low cost.

6.4 Other Kinds of Repressed Demand

Besides the two forms of repressed demand already considered, (see items 6.2 and 6.3), and which are by far the most significant, a few others should be mentioned.

6.4.1 Rural consumption

There are several rural areas, relatively well developed, and often close to urban centers, which are poorly or not electrified at all. In the vicinity of the main cities, medium size rural properties and weekend vacation resorts are frequently found in South Central Brazil; they are usually at an economic level that admits a reasonable level of electricity consumption, in refrigerators, ranges, waterheaters, food blenders, ventilators, electric lights (in and outdoors) water pumps, dairy equipments (centrifuges, mixers, etc), as well as in more intensive electric power driven equipment like saws, grinders, poultry incubators, etc.

Often times these properties resort to self-supply of electric power, either by installing diesel groups or by developing local water power. In either case, electric power is generally substantially more costly and less reliable than if it were provided by the local concessionaire.

Even though cooperative effort among prospectives rural consumers is either helpful or necessary, it appears that several concessionaires should have displayed a greater interest in approaching them. A typical underserviced area is the Paraíba Valley; along its bottom runs the busiest highway in the country, connecting Rio de Janeiro and São Paulo, and parallel to it there is an important railway. In spite of this favorable situation, Figure 0-1 shows that a considerable strech across this valley is still served by small concessionaires of Group B. Also, in Guanabara State, its rural or rather, suburban areas, as well as the "Favelas", have not attracted the local concessionaires' service.

6.4.2 Electric traction

Since the elimination of street-cars from the main cities and their partial substitution by trolley-buses, urban electric traction has diminished considerably; on the other hand, suburban, intermunicipal and interstate electric traction is increasing fast, due to the population expansion and the Region's economy growth. Thus, railroad traffic density is also increasing, and many stretches have reached the point where their electrification might be recommended on an economic basis.

The survey on this subject, ordered by ELETROBRÁS, and on which Chapter XIII is partly based, provides some evidence that - probably due to insufficient power availability - concessionaires have been reluctant to supply power to electric railroads. It should be expected, however, that the larger utilities should be able to find room in their load diagrams for such an important service load which, incidentally, is not necessarily unfavorable to the system's load factor and related economics.

6.4.3 Autoprodutores

Autoprodutores, as further expanded in Chapter VII, are consumers which supply their own electric power requirements.

Generation of electric power for self-supply has usually been contingent upon unavailability of reliable supply from the local concessionaire's system, and not a matter of economics. This has been particularly true in regard to industrial autoprodutores.

Self-supply quite often hinders electric power consumption economics twice-fold: firstly, the concessionaires do not get full benefit from a potentially higher load density; secondly, the autoprodutor has to undergo higher energy costs than he would have under regular service from the concessionaire.

In spite of all disadvantages, the total autoprodutores generation in South Central Brazil presented a 10.4% per year average growth rate in the 1952-1968 period, while the concessionaires' growth rate was 9.1%.

In the past, autoprodutores did not get a high priority when they applied for concessionaires' service; since the latter were usually short of generating capacity, they tended to assume that autoprodutores could somehow still get along by themselves. Often times autoprodutores themselves had a considerable inertia in making an effective application to the concessionaire since they considered its service to be unreliable, and frequently more expensive than their own.

6.4.4 Large Commercial or Residential Loads

The inadequacies of the concessionaire's distribution system and of the customers wiring facilities frequently become a serious hindrance to the increase of power consumption; this was proved by the field survey made for ELETROBRÁS in connection with residential and commercial customer's supply and wiring problems.

This type of bottleneck is typical of relatively large customers, located in urban areas supplied by an old distribution system, already overloaded, and still presenting a high number of customers and/or connected load growth rate.

It should be mentioned that the inadequacies on the supply side have caused a number of large commercial concerns, such as supermarkets, department stores, theaters, restaurants, and even some small stores, to become autoprodutores; even though their study was not considered in ELETROBRÁS' autoprodutores analysis, it appears that they do not generate a large amount of power, but keep their plants - mostly diesel units - as a reserve for concessionaire's supply failures.

It should be observed that the supply to new or increased loads oblige the concessionaire to reinforce its feeders and make other modifications in its distribution network where that customer is located. These works may involve expenses that the concessionaire is not always willing to incur and the customer cannot afford to bear.

6.4.5 Street Lighting

Most cities in the South Central Region are either poorly or very poorly illuminated. Significant sections of important cities are literally in the dark; even the downtown area quite often presents a very poor street lighting service.

There is a lot of controversy as to whom is responsible for the investment in street lighting as well as for the payment of its related consumption expenses. The controversy usually involves the local concessionaire, the municipality and the State's Government. When the local concessionaire belongs to the municipality or to the State, difficulties tend to be somewhat reduced.

On the other hand, it should be reminded that in the past some concessionaires were reimbursed with considerable delay - and frequently only partially - for the energy provided to the street-lighting system. Even though there are many ways of avoiding such a controversy, it has, in the past, served as an excuse for neglecting the service.

The extremely high growth rates attained in some systems — which have recently started major programs of street-lighting facilities expansion, such as CBEE —, indicates the potentialities of consumption in this service category.

Finally it should be noticed that, in some cases, such as when the system service capacity can hardly follow the market fast expansion, the public lighting service tends to receive a lower priority for improvement and/or expansion. Street lighting has also always been seriously affected by declared power curtailments.

6.4.6 Backlog of Customers' Applications

Since there have been serious shortcomings in concessionaire's power supply system — from generation through distribution —, new prospective customers have often had to wait a long time before they were connected to the distribution network (see also 6.2.2.5).

This problem has always been more or less acute. When CANAMBRA concluded its Report, many concessionaires were just beginning major programs of remodelling and expanding their distribution facilities (see also Table X-6); at that time, the impressiveness of the backlog of customers' applications led to the almost general consensus that it

was the very backbone of the repressed demand issue. The present Study, however, ranks the backlog of customers' applications as only one of the aspects of repressed demand, and certainly not the most important.

It should be noticed that, according to information presented in Chapter IV, there has been considerable improvement lately regarding this aspect of repressed demand; this was also confirmed by the field survey done for ELETROBRÁS in connection with residential and commercial supply (Chapter X, item 10.3).

6.5 Final Remarks

There are almost countless sources of repressed demand. However, they are very similar in their essence, since most of them derive from the concessionaire's supplying capacity shortage and from the inadequacy of consumers' own facilities. In short, the situation in South Central Brazil has been such that demand has been almost always ahead of supply.