OED Special Studies
85035-003

Power - Operations Evaluation Report : Electric Power [Preliminary Draft

1972 (Feb)

Meeting Thursday March 2nd, 1972 :

— PUB, Blaxall, Willoughby, ~~HE~~.

ii, 2nd line : at lowest long-run cash i.e. capital and current cash ?

2, 6th line : replace $ 450/kw by ? 500/kw.

9, para 1.13 :

16, para 2.05 : further deterioration in 1971.

17, para 2.06 : "modern capital" ?

23, para 2.16 : "Industrial development" ?

29, para 2.24 : Frequency unification.

30, para 2.25 : Fuel cost is subsidized by ~~PEMEX to CFE~~
CFE pays 25 cts / million BTU over country price < production + transport cost.

32, para 2.28, line 4 : "turned down" ...

35, para 3.03 : "severe regional discrepancies" ...

36, para 3.04 : ——— " good markets" ...

38, — 3.06 : " Ex Im Bank" ... dubious.

39, para 307 :
Ple of distribution investments lending by Bank:
Ble thought that it has been difficult to supervise distribution works.

49, para 3.20 : Control of CVC over Chidral.

58, para 4.02 : Better to use $\frac{\text{Forecast absolute level}}{\text{Actual absolute level}}$,

61, para 4.05 :

64, para 4.11 and 4.12 : "savings"

65, para 4.13 : 4% increase in Kwh / consumer.
Cut out the sentence.
Labor productivity = meaningless.

69, para 4.20 : cut out the "spirit" (last line).

70, ~~para~~ Table 4.3 : footnote on last for increase of long-term debt.

95, para 6.05 : last sentence in page. not true in Mexico.

98 para 6.08 = "social" marginal cost prices.

101, para 6.10 :

99, para 6.10 : "illustrative evidence" - - -.

104, para 6.13 : electricity is a better service in most capital cities in developping countries.
Say : It is unreasonable that in the capital....
The issue is more complex than it appears : "electricity is too much capital and import intensive to be supplied so much".

107, para 7.04 = Without Bank loan, utilities can either raise tariffs or cut the load.

114, para 7.11 : subsidize electricity consumers ?

115, para 7.13 : choice between urban and rural areas.
Rural electrification is also limited by its capability to carry investment, not only by cash flow.
major extensions were unattractive.

116, para. 7.14 :

118, para. 7.16 : premature to suggest the tables on marginal cost structure.

125, para 7.26 : ECG encouraged by Bank to serve dividends to the State.

VIP { Add in Preface that emphasis is put on latin American cases which are quite different from other parts of the world.

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(A)

In view of the "lumpy" nature of ~~~~ hydro electric capacity, it is normal for there to exist a sizable amount of excess capacity in the first few years after a new station is commissioned. However, because demand has grown more slowly than forecast, reserves are ~~higher~~ ample than forecast. The ~~timing~~ next project should therefore be carefully timed so as to come on line after the present excess capacity is utilized (probably about 1979-80).

Master

STRICTLY CONFIDENTIAL

PRELIMINARY DRAFT 2/23/72

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

OPERATIONS EVALUATION REPORT: ELECTRIC POWER

Programming & Budgeting Department
Operations Evaluation Division

PREFACE

The Operations Evaluation Division of the Programming and Budgeting Department was established late in 1970 with responsibility for evaluating "the contribution of the Bank's operations to the development of member countries". Since little formal evaluation work had previously been done in the Bank it was decided to start with an experimental phase testing two approaches -- a comprehensive review of all the Bank's operations since 1948 in one country, Colombia, and another smaller-scale study covering selected power borrowers in various parts of the world and focusing on the question whether the objectives for which loans were made to them had been achieved on schedule and if not why not. The study of power loans was supplemented by analysis of the broad pattern of Bank lending for power, by use of research undertaken for the Colombia study and by comparative review of the performance of the various power companies covered. This made it possible to put together the attempt at evaluation of past Bank work in power which is presented in this document.

The purpose of the present report, then, is to review the Bank's lending to the developing countries for electric power, in order to see whether it has been effective and to learn whatever lessons may be drawn from experience. Effectiveness may be understood in many different ways, and in few it is easy to judge. The Bank Group's loans for electric power have tended to contain a variety of objectives, but in broad terms their purpose has been to enable the expansion, in line with demand, of a service considered vital for economic growth. In this framework the immediate

objective has been the timely and efficient construction of the necessary plant, procured at the lowest possible costs. Related to this were many arrangements designed to ensure competitive costs, sufficient cash flow to avoid delays in construction, and adequate engineering supervision of construction. Improvements in the institutional structures relating to power have also frequently been sought in connection with power loans -- often, even usually, at the level of the individual utility concerned, but also sometimes on a broader level, affecting the organization and regulation of the power supply industry for an entire region or a whole country. Such improvements have many dimensions and facets, and various approaches have been used to secure them, ranging from agreements to discuss progress in their achievement, through the appointment of consultants to assist, to firm refusal of further financing pending implementation of the improvements.

On occasion, it should be noted, the Bank's objectives in direct connection with the granting or refusal of power loans have extended far beyond the power field itself. Such loans have been conditional on adoption by a country's Government of macroeconomic policy measures which the Bank deemed conducive to development. The power sector, with its large requirements for capital goods, of which a high proportion is often imported, is sometimes seen as particularly suitable for receipt of loans which are principally designed to achieve objectives of this much broader type.

Effectiveness may be judged, then, in relation to the various specific objectives defined by the Bank in the negotiations surrounding

its lending for power. But the underlying objective of the Bank has been to promote the development of its member countries, and the corresponding criterion of effectiveness is the contribution of the Bank's power lending to a country's overall development. In the most general terms there is no question electric power is essential to modern development, particularly of industry. But the question is how much, where, to what degree of reliability, and supplied by whom? According to an old view an ample public supply of cheap electricity could induce rapid industrial development. In reality, except in a few very special situations, such as the aluminum industries of Iceland and Ghana, it is unlikely that the availability of electric power has ever made a critical difference in the decision to establish or not to establish an industry in a country: electricity generally represents too insignificant a part of total costs, and the alternative of installing a power plant within the industrial enterprise is too easy. Electricity may play a more important role, in actually inducing development, in connection with small industry or agriculture, although here too it is only a substitute for other forms of energy (such as diesel fuel for a pump), with some superiority in flexibility and convenience.

The Bank's contribution to development through its power lending is not to be sought, then, in any resultant massive industrial expansion, but rather in the answer to more modest and intricate questions such as whether what opportunities there were for inducing broader development through improved power supply were taken advantage of, and whether electricity supply was expanded reasonably in line with all the other

services and facilities that are essential to development. Were the most important demands met first, and was the path followed in expansions of the power supply system itself well balanced, for instance regionally, between different components of the system (generation, transmission and distribution) and in terms of the different types of generating equipment used? Was the electricity supply system efficiently and economically run and operated? At these levels the specific objectives adopted by the Bank in connection with a power loan -- such as the construction of certain facilities in a given region, attainment of certain targets of financial performance, introduction of organizational or institutional reforms -- themselves come into question. Were these specific objectives correct, and, closely related to this, was any effect that the Bank has on project composition and design, or on the source from which the facilities were obtained, desirable?

And there is still another broader set of questions that may be asked, about the effect of the Bank's loans for power (as for other purposes) on such macroeconomic parameters as the levels of investment and savings in the country and the return to expenditures at the margin in the economy as a whole. For instance, did the Bank loan substitute for, or complement, domestic savings efforts?

This reports leaves aside these important questions of macroeconomic performance and macroeconomic lending conditions, in order to concentrate fully on the effectiveness of the Bank Group's activities in the power field as such. But within the power field it is concerned both with the question of whether the specific objectives adopted by the Bank

in connection with its loans were effectively achieved, and also the question of whether they were the right objectives.

It is essential to a proper understanding of the report to appreciate that it is oriented to learning for the future. It is not part of the task of the Operations Evaluation Division to identify past mistakes in order to attribute blame for them, either within the Bank or outside, but rather to see what factors may need to be taken into account in order to avoid repetition of them. The Bank is considered as an integral institution. Practical suggestions for the future, not theoretical lucubrations about the past, are the aim. Consequently, for instance, the question whether or not some turn of events which affected a project was foreseeable at the time the decision was made to support it is a matter of relatively little interest compared with what the case teaches regarding factors to look out for in comparable circumstances in the future; whether a particular objective was consistent with views generally held at the time a loan was made is relatively unimportant compared with whether the loan seems in retrospect to have contributed effectively to development. On the other hand, it is also important to recognize that the report is not designed to produce major methodological developments for coping with problems encountered; in covering a wide swath of history it has to content itself with making simple suggestions, some of which may need to be taken up for subsequent development of appropriate methods of analysis.

Since the Bank Group has made more than 200 loans and credits to developing countries wholly or partly for electric power a review of

the Bank's work in this field has to be based on a sample, and it must of course be borne in mind that a sample different from that chosen might well lead to somewhat different results. The sample actually chosen is far from random, although it is fairly large. It includes some 40 loans , made to 10 companies which were selected from among the Bank's borrowers in such a way as to cover companies with which the Bank has been most closely involved in a variety of different settings, in terms of geography, level of national development, and power problems. The companies were studied in different degrees of depth. Seven of them -- three in Latin America, two in Africa and two in Asia -- were covered in a brief comparative performance review which was designed to concentrate entirely on the question of whether the Bank's specific objectives, as presented in the official documents of the Bank concerning each loan, had been achieved; in fact it was possible to go a little beyond this to touch on the more basic question of the validity of these objectives. On the other hand, as part of the larger study of all the Bank's past operations in Colombia, a more thorough review was undertaken of lending to the three principal power utilities in that country. In that study an explicit attempt was made to go beyond mere assessment of performance under the loans, to raise and try to answer some of the more fundamental questions about the Bank's role. Most aspects of utility performance were treated more fully in the Colombia study. Certain matters which had largely to be neglected in the rapid cross-country review -- such as the economic validity of projects in light of alternatives for system expansion, and of tariff structures in light of system costs -- could be analyzed in some

depth. Bank advice on policy and institutions in the power sector could be studied more thoroughly, and generally a better feel could be obtained for what might have occurred in the absence of Bank participation. Underlying these differences is a difference between the contexts in which the power loans were reviewed and hence also the perspectives of the two approaches: mainly confined to the utility itself in the brief cross-country performance review but extending to the country as a whole in the Colombia study.

The main contacts with the borrowers reviewed took place in the first half of 1971. For the non-Colombian cases these contacts were strictly limited to the companies themselves, each of which was visited for about a week between March and May. Contacts in Colombia were more extensive; some three months of field work were done directly on power.

The excellent cooperation afforded by all the companies involved -- principally SEGBA in Argentina, Furnas in Brazil, CVC/Chidral, EEEB, EPM and ISA in Colombia, EELPA in Ethiopia, VRA in Ghana, NEB in Malaysia, CFE in Mexico, and PUB in Singapore -- is greatly appreciated. The Bogota Power Company (EEEB) undertook several small studies which particularly helped. Also in Colombia, officers of the National Planning Department (Planeacion) -- particularly Messrs. Eduardo Barrera and Raul Serna -- made major and valuable contributions, especially in bringing to an operational status, and then applying, the computer models used to analyze the main Colombian power systems and the retrospective economic validity of some of the investments there.

LIST OF ABBREVIATIONS AND ACRONYMS

CADE	(Argentina)	- Compania Argentina de Electricidad: foreign-owned predecessor to SEGBA.
CANAMBRA	(Brazil)	- Consortium of three foreign consulting engineering firms which prepared in 1963-66 a long-range expansion program for electric facilities in the South-Central region, under a UNDP grant for which the Bank acted as Executing Agency.
CEMIG	(Brazil)	- Centrais Eletricas de Minas Gerais: a state-owned utility supplying the state of Minas Gerais.
CENTRO	(Mexico)	- Compania de Luz y Fuerza del Centro: formerly a subsidiary of MEXLIGHT, now a government-owned utility supplying Mexico City.
CFE	(Mexico)	- Comision Federal de Electricidad: a government-owned authority responsible for all phases of public electricity supply in Mexico.
CHEC	(Colombia)	- Central Hidroelectrica de Caldas: a subsidiary of ICEL, supplying power to Manizales and environs.
CHEVAP	(Brazil)	- Companhia Hidroelectrica do Vale do Paraiba: a company granted concessions in 1961 and 1963 for the construction of the Funil hydroelectric and Santa Cruz thermal plants with U.S. AID financial assistance. Concessions were rescinded in 1965, and properties were taken over by Eletrobras which transferred them to Furnas in 1967.
CHIDRAL	(Colombia)	- Central Hidroelectrica del Rio Anchicaya Ltda: a wholesale energy supplier to CVC and EMCALI and owned by those entities.
CIAE	(Argentina)	- Compania Italo-Argentina de Electricidad: a Swiss-controlled utility supplying Buenos Aires in conjunction with SEGBA.

CORELCA	(Colombia)	- Corporacion Electrica de la Costa Atlantica: a nationally chartered regional entity responsible for interconnecting major markets of the north (including Barranquilla, Cartagena, and Santa Marta).
CVC	(Colombia)	- Corporacion Autonoma Regional del Valle del Cauca: an autonomous multi-purpose agency set up to supervise the overall development of the Cauca Valley (including the city of Cali).
DAC		- Development Assistance Committee: an advisory committee under the OECD, grouping representatives of non-Communist countries which supply capital to developing countries.
ECG	(Ghana)	- Electricity Corporation of Ghana: a government-owned entity responsible for distribution in southern Ghana of energy generated by VRA, and for diesel generation and distribution of energy elsewhere in Ghana.
EEEB	(Colombia)	- Empresa de Energia Electrica de Bogota: a municipally owned utility supplying Bogota.
EELPA	(Ethiopia)	- Ethiopian Electric Light and Power Authority: a government-owned utility responsible for the electricity supply in all of Ethiopia except Asmara.
ELECTRAGUAS	(Colombia)	- Instituto Nacional de Aprovachimiento de Agua y Fomento Electrica: predecessor to ICEL.
ELETROBRAS	(Brazil)	- Centrais Eletricas Brasileiras: the national holding company in the power field, owned by the Federal Government and responsible for channeling Finance to regional power companies.
EMCALI	(Colombia)	- Empresas Municipales de Cali: a semi-autonomous municipal agency responsible for providing public services to the city of Cali, including water, sewerage, and telephone service, and distribution of electric energy purchased from CHIDRAL.
EPM	(Colombia)	- Empresas Publicas de Medellin: an autonomous municipally-owned entity which provides the city of Medellin with electricity, water, sewerage, and telephone service.

FURNAS	(Brazil)	-	Centrais Electricas de Furnas: an autonomous government-owned bulk energy supplier, and largest subsidiary of ELETROBRAS.
ICEL	(Colombia)	-	Instituto Colombiano de Energia Electrica: a government-owned holding company which, through its various subsidiaries, is responsible for virtually the entire public power supply in Colombia, outside the service areas of EEEB, EPM, and CVC/CHIDRAL.
ISA	(Colombia)	-	Interconexion Electrica S.A.: a corporation jointly owned by EEEB, EPM, CVC/CHIDRAL, and ICEL/CHEC responsible for interconnecting these four main power systems and future bulk supply to them.
KESC	(Pakistan)	-	Karachi Electricity Supply Corporation Ltd: a public utility corporation solely supplying power in the Karachi area; a majority of shares is owned by the Government.
KfW	(Germany)	-	Kreditanstalt für Wiederaufbau: the bi-lateral government lending agency of the Federal Republic of Germany.
LEBRIJA	(Colombia)	-	Central Hidroelectrica del Rio Lebrija: a subsidiary of ICEL serving Bucaramanga.
MEXLIGHT	(Mexico)	-	Mexican Light and Power Co.: a foreign-owned company, formerly the owner of CENTRO and power supplier to Mexico City, now a holding company only with no power operations.
NEB	(Malaysia)	-	National Electricity Board: an autonomous government operating and regulatory agency responsible for coordinating the supply of power throughout the Federation and directly for supplying power throughout most of the Malayan peninsula.
OECD		-	Organization for Economic Cooperation and Development.
PUB	(Singapore)	-	Public Utilities Board: an autonomous public corporation which is the sole supplier of public electricity, water, and gas to Singapore.

SEGBA	(Argentina)	- Servicios Electricos del Gran Buenos Aires: an autonomous public corporation wholly owned by the Government; the larger of two principal power utilities serving Buenos Aires.
UNDP		- United Nations Development Program.
VALCO	(Ghana)	- Volta Aluminum Company: a private company, principally owned by the Kaiser Corporation, for eventually developing the aluminum resources of Ghana; the main customer of VRA.
VRA	(Ghana)	- Volta River Authority: an independent government authority established ~~with multi-purpose and regional development responsibilities, including the~~ to construction and operation of the Volta River project. and with multi-purpose and regional development responsibilities resulting from relating to the project to fulfil

SEGBA	(Argentina)	- Servicios Electricos del Gran Buenos Aires: an autonomous public corporation wholly owned by the Government; the larger of two principal power utilities serving Buenos Aires.
UNDP		- United Nations Development Program.
VALCO	(Ghana)	- Volta Aluminum Company: a private company, principally owned by the Kaiser Corporation, for eventually developing the aluminum resources of Ghana; the main customer of VRA.
VRA	(Ghana)	- Volta River Authority: an independent government authority established with multi-purpose and regional development responsibilities, including the construction and operation of the Volta River project.

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CHAPTER I - INTRODUCTION

1.01 Production of electricity has increased at an average annual rate of about 8% in the world as a whole in the 1950s and 1960s, but about 11% in the developing countries; in some even faster and in none less than about 5%. Increasing electricity production has been intimately connected with urbanization, and most of the electricity produced has gone to serve household demand and industrial requirements in the cities. In most developing countries electricity supply outside the towns and cities remains quite limited, except in a few areas -- such as parts of the Punjab in Pakistan and Tamil Nadu in India -- where electricity service has generally come in connection with the production requirements of agriculture (principally irrigation) and industry.

1.02 Electricity is often produced on a relatively small scale by industrialists for their own use, either because of unreliability in the public supply or because the technical characteristics of the industrial production processes used make it cheaper to meet all or part of their own electricity requirements. But the large majority of electricity production is by public utility organizations serving all classes of consumer. In the developing countries these public utilities are now principally owned by Government of one level or another -- Central or Federal, State or Departmental, County or Municipal.

1.03 Analysis of the 87 developing countries which had populations of more than one million in 1968 and which are members of the Bank Group shows that utility generation has been increasing over the last two

decades at average annual rates of about 13.5% in Asia (excluding Japan), 13.0% in Africa, 12.0% in Europe (developing countries only) and 9% in Latin America. Utility generating capacity in those 87 countries, which was less than 14,000 MW in 1950, reached over 80,000 MW in 1968 and probably exceeded 100,000 MW, more than seven times the 1950 level, by the end of 1970. A reasonable figure for the combined capital costs of generation, transmission and distribution is about US$ 450 per kw installed.[1/] This would mean that the total investment in power utilities in the developing countries over the past twenty years has approximated US$ 40 billion.

1.04 The Bank Group has been a major factor in the expansion of electricity production in the developing world. It has directly disbursed some US$ 3 billion out of the US$ 40 billion mentioned, or about 15% of the total foreign exchange portion[2/] of this amount. It has contributed to financing nearly 20,000 MW of generating capacity already completed, or nearly 25% of the total increase between 1950 and 1970. The Bank's impact has been widespread. The Bank has been involved in the power sector of 36, or two-thirds, of the developing countries where utility generating capacity has increased by 100 MW or more over the past two decades. Its impact has also been heavily concentrated. In Latin America, it has helped finance more than 50% of the total increase in utility generating capacity between 1950 and 1970, in Africa and Asia about 15% and

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1/ This is naturally quite a rough figure, but it indicates the correct order of magnitude. Available evidence suggests that, despite general inflation, the figure has remained fairly constant over the past two decades because of technological advances in production of power supply equipment, including rapidly increasing scale economies for generating plant.

2/ About 50% of the total.

in the European developing countries less than 5%. Only in eight out of the 21 developing countries on the American continent has the Bank financed less than one-third of the net increase in generating capacity between 1950 and 1968; and only in eight out of the 66 major developing countries on other continents has the Bank financed more than one-third of the net increase in generating capacity over this period. Country detail is shown in Table 1.1.

1.05 To accomplish this large role, Bank Group operations have historically been fairly heavily concentrated in electric power. Disbursements on power loans account for exactly one-third of total disbursements, through the end of 1970, to the 87 developing countries mentioned. For Latin America, the ratio is 57%; for Africa about 25%; and for Asia and Europe about 20%. Comparable ratios are not available for other agencies but figures on a commitment basis indicate that the Bank has been more heavily concentrated in power than others. Power accounted for some 26% of total IBRD/IDA commitments in the 1960s, but for only about 14% of total commitments over the same period both by the Inter-American Development Bank and by KfW out of German capital aid funds; this is also the share of total bilateral official commitments in 1967 and 1968 which is accounted for by power, according to DAC figures.

1.06 The one-third share of power in Bank Group disbursements is also high compared with power's typical share in investment in the developing countries. Because growth of electricity supply and overall rates of investment have varied considerably among countries, the share of total investment devoted to electricity has differed among countries, but in

Table 1.1

Growth of Public Power Supply in Developing Countries 1950-70 and IBRD Contribution

	(1) Ave. annual growth of generation 1950-68 (%)	(2) Installed Generating Capacity 1968 (MW)	(3) Absolute Increase in Installed Capacity 1950-68 (MW)	(4) IBRD/IDA Financed Capacity (MW)	(5) IBRD/IDA-Financed Capacity as % of: Total Installed 1968 (4)/(2)	(6) IBRD/IDA-Financed Capacity as % of: Total Increment 1950-68 (4)/(3)	(7) Power as % [a] of Total IBRD/IDA Disbursements through 12/31/70 (%)
Africa							
Nigeria	13.5	480	457	-	-	-	60.3
Egypt	14.2	2,486	2,266	-	-	-	-
Ethiopia	17.7	136	123	32	23.5	26.0	30.6
Congo (Zayre)	15.7 [b]	185	167	-	-	-	-
Sudan	16.9	97	88	-	-	-	9.9
Morocco	7.4	461	310	-	-	-	-
Algeria	4.6	639	310	135	21.1	21.1	12.4
Tanzania	11.7	102	79	-	-	-	5.8
Kenya	8.8 [b]	153	126	-	-	-	-
Ghana	28.9	~~599~~ 675	591 ~~512~~ 588	-	85.4	86.6	97.7
Uganda	23.7 [b]	157	150	-	-	-	18.3
Malagasy	9.4	62	50	-	-	-	-
Cameroon	9.5	20	15	-	-	-	-
Upper Volta	19.0	11	10	-	-	-	-
Mali	14.6	10	9	-	-	-	-
Tunisia	7.8	219	153	-	-	-	-
Malawi	24.4	39	38	-	-	-	1.7
Ivory Coast	27.2	85	83	-	-	-	-
Zambia	39.0 [b/c]	431	426	352	81.6	82.6	48.2
Niger	20.5	11	10	-	-	-	-
Guinea	15.5	12	10	-	-	-	-
Senegal	12.5	95	73	-	-	-	-
Chad	21.0	15	14	-	-	-	-
Burundi	inf. [b]	5	5	-	-	-	-
Rwanda	26.5	35	34	-	-	-	-
Somalia	9.7	6	3	-	-	-	-
Dahomey	15.3	12	10	-	-	-	-
Sierra Leone	15.4	31	27	13	41.9	48.1	100.0
Libya	16.2	169	160	-	-	-	-
Togo	17.8	8	7	-	-	-	-
Cent. Afr. Rep.	22.0	14	13	-	-	-	-
Liberia	22.0	47	45	-	-	-	1.3
Mauritania	23.3	25	24	-	-	-	-
Subtotal	13.0	6,857	5,896	1,044	15.2	17.7	24.3
Europe							
Turkey	16.4	1,617	1,442	54	3.3	3.7	21.8
Spain	11.2 [a]	13,146	10,946	-	-	-	-
Yugoslavia	13.6	4,357	3,857	384	8.8	9.9	21.4
Portugal	11.3	1,868	1,596	385	20.6	24.1	100.0
Greece	13.9	1,798	1,575	-	-	-	-
Ireland	9.7	1,290	1,024	-	-	-	100.0
Subtotal	12.0	24,076	20,440	823	3.4	4.0	22.8
America							
Brazil	8.8	7,446	5,649	2,181	29.2	38.6	86.0
Mexico	9.9	4,864	3,853	3,739	76.8	97.0	62.1
Argentina	6.4	4,118	2,728	720	17.4	26.3	84.6
Colombia	11.1	1,689	1,449	916	54.2	63.2	44.5
Peru	10.3	869	769	240	27.6	31.2	28.8
Venezuela	13.4	1,928	1,768	350	18.1	19.7	47.0
Chile	6.0	1,090	740	544	49.9	73.5	49.0
Ecuador	24.5	197	192	26	13.1	13.5	16.0
Guatemala	12.0	129	111	-	-	-	42.8
Bolivia	5.7	140	95	38	27.1	40.0	88.2
Haiti	8.9	20	15	-	-	-	-
Dominican Rep.	12.8	203	183	-	-	-	-
El Salvador	14.3	148	129	108	72.9	83.7	41.4
Uruguay	6.8	469	269	226	48.1	84.0	57.0
Honduras	16.5	73	67	30	41.0	44.7	35.1
Paraguay	8.2	86	65	-	-	-	-
Jamaica	12.9	157	136	99	63.0	72.7	67.4
Nicaragua	16.8	117	112	83	70.9	74.1	67.5
Costa Rica	9.6	213	174	94	44.1	54.0	43.6
Panama	11.5	124	103	4	3.2	3.8	22.5
Trinidad & Tobago	16.7	203	186	100	49.2	53.7	78.7
Subtotal	8.9	24,283	18,793	9,498	39.1	50.5	57.1
Asia							
India	13.2	12,974	11,261	1,513	11.6	13.4	10.9
Pakistan	22.0	1,741	1,669	455	26.1	27.2	22.6
Indonesia	6.2	652	495	-	-	-	-
Philippines	13.9	1,243	1,059	356	28.6	33.6	44.1
Thailand	23.2	860	830	280	32.5	33.7	32.3
Korea (South)	15.9	1,274	1,079	-	-	-	-
Iran	15.7	1,089	1,009	130	11.9	12.8	13.9
Burma	12.4	193	168	-	-	-	-
Vietnam (South)	12.5	453	403	-	-	-	-
Afghanistan	17.9	221	216	-	-	-	-
China (Taiwan)	13.3	1,940	1,664	-	-	-	4.8
Ceylon	12.0	187	154	125	66.8	81.1	91.9
Nepal	13.6	32	29	-	-	-	-
Malaysia	9.5	610	482	380	62.2	78.8	69.3
Iraq	14.8	370	330	-	-	-	-
Saudi Arabia	24.7	188	183	-	-	-	-
Cambodia	10.5	63	53	-	-	-	-
Syria	9.6	138	113	-	-	-	-
Yemen A. R.	-	-	-	-	-	-	-
Hong Kong	15.5	1,054	944	-	-	-	-
Laos	19.8	8	7	-	-	-	-
Israel	14.5	1,012	903	-	-	-	-
Lebanon	13.0	422	382	73	17.2	19.1	100.0
Papua & New Guinea	21.1	33	31	-	-	-	-
Jordan	19.1	40	38	-	-	-	-
Singapore	12.8	464	427	240	51.7	56.2	66.6
Southern Yemen	14.0	56	52	-	-	-	-
Subtotal	13.7	27,317	23,981	3,552	13.0	14.8	19.8
GRAND TOTAL	—	—	—	—	—	—	—

a/ Disbursements for power may be shown, even though there are no figures referring to Bank-financed generating capacity because i) the disbursements taken are cumulative through December 31, 1970 whereas the MW capacity figures are as of December 31, 1968; ii) some loans have been entirely for transmission and distribution; and iii) where the loans are for generating capacity, that capacity may still be uncompleted.

b/ For these countries growth of consumption is significantly different from the growth of generation shown due to sharp increases in exports or imports.

c/ The Kariba station is located on Rhodesian territory but for purposes of this table half of its capacity has been attributed to Zambia since it has been jointly owned by the two countries.

Sources: U.N. Statistical Yearbook, UN Statistical Papers Series J, IBRD/IDA Records. For details see Appendix Tables 1.1, 1.2, 1.3 and 1.4.

most countries in most years it has been in the range of 3%-10%; in relation to public sector investment the figure is normally in the range of 5%-20%. Adequate statistics are not available to permit being more specific with any certainty, but it is probable that modal figures are about 6% for power as a proportion of total investments and 15% for power as a proportion of total public investment.

1.07 There is no simple explanation to the considerable variation among countries and continents in the extent of the Bank's participation. As indicated, for instance, the Bank's role has been largest in the Latin American continent where growth of generation has also been slowest. Some of the principal factors accounting for the differences among countries are as follows: lack of need to borrow abroad (e.g. Libya and Saudi Arabia), ineligibility for borrowing from the Bank Group due to lack of creditworthiness and/or poor economic policies (e.g. Indonesia and Egypt), availability of other sources of financing (e.g. Korea and China), ability to meet principal equipment needs domestically (e.g. India and Spain). On the other hand, where expansion of the power system has been large in scale and especially where it has involved major hydroelectric projects with their large initial capital requirements, there has been a strong tendency for the Bank to be requested to provide financial support.

1.08 The Bank made its first power loan in 1948, to Chile, and power projects have always been seen as suitable for Bank lending. Traditionally the Bank stressed the productive nature of such projects, related to the fact that a relatively large proportion of public utility electricity supply in developing regions generally goes to meet the needs of industry. Power

companies are often quite efficient compared to other organizations in a country, and, with their large capital requirements, they seemed a relatively good channel for funds designed to result in projects that would contribute to development. From the point of view of the recipient companies and countries, Bank loans for electric power had the advantage that they were available on fairly long terms commensurate with the long lives of generating stations, in large amounts usually adjustable to total foreign exchange costs, and in freely transferable currency such that bids could be obtained on a competitive international basis with consequent cost savings.

1.09 Loans for electric power development have generally originated with a request from a power company or a country for assistance with a particular project. The Bank has relatively seldom taken initiative in trying to identify or generate projects in this field, though it has helped sometimes in the 1960s in sponsoring large-scale planning studies, and it has not infrequently turned down projects proposed, for instance on grounds they were uneconomic. The actual nature of the project covered by a loan has depended significantly on the institutional set-up of the power sector -- whether the company had regional or national responsibilities, for example -- but the Bank has normally been concerned to obtain confirmation from the national planning authorities of the priority of the project proposed, relative to other needs in the power sector and in other fields.

1.10 The typical power loan to a developing country has been to cover the direct foreign exchange costs of an individual project, for instance, a hydroelectric scheme, or of a utility's overall expansion program (including generation, transmission and distribution) over a two-three year period.

Loans have sometimes been made for multipurpose dams which were parts of larger schemes covering several sectors, and often they have been made for individual projects forming parts of national power development schemes; but loans have not generally been made for the larger schemes themselves, and the attention of the Bank has been mainly concentrated on the individual projects. In this sense the loans to the Mexican national power authority (CFE), which are discussed in this volume, are rather exceptional since they have always included contributions for many component projects and in the last decade have been largely sector program loans, with funds designated for the authority's expansion program as a whole rather than for individual projects, and with performance being checked at the national level rather than in connection with individual construction projects.

1.11 Once initiated, the relationship with a utility has often been maintained by further loans in support of further expansion. There are a number of companies with which the Bank has been associated more or less continuously since the early 1950s or even earlier, such as CFE in Mexico, KESC in Pakistan, Chidral in Colombia, ENDESA in Chile and CEMIG in Brazil, and there are numerous companies with which similarly continuous relationships have been maintained since the late 1950s or early 1960s. Interruptions in the Bank's series of loans to such companies, where they have occurred, have generally resulted from delays by the company or, more often, the Government authorities in taking certain steps -- for instance, to increase electricity tariffs -- upon which the Bank insisted. Other interruptions have resulted from deteriorations in the country's economic

situation or economic policies, which caused the temporary cessation of all Bank lending to that country, or from the availability of funds from other sources to finance an expansion program (e.g. U.S. AID for KESC and IDB for Chidral).

1.12 Justification of power projects for Bank financing has always been principally by means of establishing some rough relationship between the expected growth of peak demand for power in the market area served by the borrowing company, and the amount of system generating, transmitting and distribution capacity required to meet that demand. The Bank and its borrowers have tended to plan on the premise that no kilowatt-hour is more expensive than the one that is not available, and hence, that all demand in the existing service area must be met. The borrowers or their consultants have prepared load growth forecasts, normally on the basis of past trends or of experience in other countries, sometimes with special adjustments for any backlog of unmet demand or for major new industrial loads expected to arise in the near future. In a few instances, as in Turkey in 1957 and Pakistan in 1966, the Bank has made a detailed study of load growth, but normally its staff has made some overall judgments as to the adequacy of the load forecast and accepted the borrower's projection, possibly with minor amendments; on the few occasions when sophisticated techniques of analysis have been applied the results have often turned out no better than those based on balanced judgments, and sometimes worse. Capacity installation has generally been planned in such a way as to meet the projected demand plus some simple but fairly conservative reserve criterion as insurance against shortage -- e.g. 10%-15% of system capacity, 'largest

unit out,' or for hydroelectric systems, use of lowest recorded flow year for capacity planning.

1.13 To the extent that economic considerations have entered explicitly into the analysis of electric power projects, they have been concentrated on the matter of comparisons between alternative means of meeting the projected load growth -- particularly comparisons between hydroelectric and thermal plants. Increasingly, since the late 1950s the Bank has required that hydroelectric projects be justified by showing that the operating (mainly fuel) cost savings that result from meeting the projected load with the proposed hydroelectric plant rather than a thermal plant, yield a reasonable rate of return to the extra initial investment required to build the hydroelectric plant rather than the thermal alternative. In some cases, especially in Latin America, available hydroelectric sites are so favorable that the unit cost of capacity is no greater, or even less, than that of thermal capacity; then, provided transmission distances are not too great and river flows are sufficient to provide reasonable capacity factors, there is not much question about the economic superiority of the hydroelectric scheme for meeting system load growth. But in other cases the choice is not so clear, and a number of crucial decisions have in fact hung on a comparison of the type described. The Bank has generally not been prepared to finance hydroelectric projects where the yield to the incremental investment was expected to be less than 6% or 7%, and somewhat more in recent years. Shadow prices have sometimes been used in the analyses, for instance where foreign exchange was felt to be undervalued at its official price. Sensitivity analyses

have also sometimes been carried out to allow for alternative possible rates of load growth or thermal fuel costs.

1.14 In project appraisal and project supervision alike, financial aspects of power projects have normally received more attention than economic ones and have often been the prime focus -- mainly with a view to ensuring that the utility company would have sufficient funds to execute without delays the generation/transmission project for which the Bank loan was made, to carry out the expansion of the distribution system required in order to ensure sales of the power to be produced, and to meet debt service obligations. Covenants relating to injections of additional equity into the utility or Government budgetary contributions, maximum permissible debt-equity ratios, limitations on incurrence of further debt, and minimum tariff levels have been regular features of Bank loans for power. Tariff covenants have probably been in practice the most important; they have generally been phrased in such a way as to require that the borrowing utility earn a surplus sufficient to finance a part of its own further investment requirements, sometimes a specified part, or to yield a certain rate of return on total net fixed assets in operation, sometimes revalued to allow for inflation.

1.15 A standard condition of Bank loans for power since the late 1950s has been to require an annual external audit of the borrowing utility's books, and submission of audited financial statements to the Bank. But the Bank has also frequently gone much beyond this to require introduction of improvements in utility billing and inventory control and in accounting systems, including satisfactory records and classification of

fixed assets and use of depreciation allowances related to plant life. Borrowers have also sometimes been required to undertake special studies and/or hire consultants to help simplify tariff structures that were excessively complex or to bring them more into line with costs to supply the different classes of consumer.

1.16 Attention has always been given to the capability of the borrowing utility to execute and maintain the planned expansion project and to market its services. Efficiency, defined largely in company financial terms, has been the guiding objective. The Bank has often been concerned with trying to ensure insulation of the utility from political considerations and insulation of operations from day-to-day interference by the utility's Board, particularly in regard to matters such as staffing and contracting. Covenants requiring Bank approval of appointments to senior positions in the utility have been quite frequent features of Bank loans. In many cases the Bank has urged its borrowers to establish or strengthen certain departments (especially financial) or to hire consultant engineers and management consultants to assist on project design, construction supervision, or with operational reorganization. In recent years increased attention has been given to staff training requirements and, in some instances, provisions have been included in the loan to cover part of the cost of this.

1.17 In some cases, principally in Latin America -- where the Bank has been so heavily involved in power and where the institutional structure of the power sector is typically rather complex and fragmented -- the Bank has played an important role by taking a rather broader view of

power development than the individual borrowing company. Through studies, advice, loan conditions and lending itself, it has sought to bring about changes in the sector's institutional structure or in Government policies toward the industry, which would enable the power sector to expand more quickly and at lower unit cost than would otherwise be the case.

1.18 To see how effective Bank Group activity has been in the electric power field and what lessons might be learned for the future, companies and countries were selected, as pointed out, not in a random manner but from among those with which the Bank has been more closely involved. In the case of Colombia some attention was given to companies which the Bank had decided not to assist as well as to the Interconnection Company which the Bank helped create, but the main emphasis was on the three principal power companies with which the Bank has been associated. Table 1.2 summarizes Bank Group lending to these three companies and the seven covered in the cross-country review. Table 1.1 showed that in all of these countries, through its lending to these and other companies, the Bank had contributed toward financing at least 25% of the additions to power generating capacity made between 1950 and 1968, and in many cases much more. Equally, electric power has accounted for some 25% or more of total Bank Group disbursements to each of these countries.

1.19 The selected ten companies account for about 20% of the total number of Bank Group loans to all developing countries for electric power, but for nearly 40% of total cumulative disbursements (and commitments) for power to the developing countries. The average size of the loans

under review is considerably larger than the average size for all Bank Group loans to developing countries for power.

Table 1.2

Bank Lending to the Ten Companies Reviewed in this Report

Company	All Loans Committed			Loans Fully Disbursed or Nearly Fully Disbursed	
	Number of Loans	Amount Net of Cancel. (US$ mln)	Amount Disbursed as of 12/31/70 (US$ mln)	Number of Loans	Amount Disbursed as of 12/31/70 (US$ mln)
CFE (Mexico)	7	542.80	448.13	6	410.99
SEGBA (Argentina)	3	204.35	151.64	2	144.35
FURNAS (Brazil)	5	271.30	126.96	2	125.23
NEB (Malaysia)	5	142.74	108.62	3	125.23
PUB (Singapore)	4	59.44	49.03	3	37.57
VRA (Ghana)	2	53.00	47.05	1	47.00
EELPA (Ethiopia)	2	46.60	27.34	1	23.46
Colombia					
EEEB	3	85.60	78.06	2	67.60
EPM	3	73.00	67.94	3	67.94
CVC/Chidral	5	44.63	44.63	5	44.63
	39	1,523.46	1,149.40	28	1,074.17

CHAPTER II: SEVEN MAJOR BORROWERS

2.01 This Chapter deals very briefly, and in turn, with each of the seven major borrowers covered in the cross-country review and listed in Table 1.2. For each borrower, its responsibilities and main characteristics are first defined and the history of the Bank's involvement with the company is briefly recounted. Then the principal objectives of the Bank in its association with the company are described. Next the extent of achievement of these objectives is discussed. Finally, in cases where it is appropriate, a comment is added in overall assessment of the company's performance and the Bank's role.

SEGBA - Argentina

2.02 SEGBA, a corporation wholly owned by the Government, is responsible for generation, transmission and distribution of electricity and accounts for about 85% of electricity sales in the Buenos Aires area, where one-third of Argentina's population and two-thirds of its industry are located. The corporation was formed in 1958 to take over part of the assets of CADE, a Belgian-owned company. In 1959, the Bank acted as executing agent for a study of the Argentine power situation financed by the UN Special Fund and in 1960 the Government requested Bank assistance in implementing the major effort to expand and improve public power supply in Buenos Aires that was recommended by the study. SEGBA was reconstituted in 1961, with a view to eventual sale of its shares to the Argentine public, and it was given responsibility for parts of CADE's

distribution network previously transferred to a federal government power agency and for construction of the 600 MW Costanera thermal plant started by this agency but stalled by lack of local funds. The Bank strongly supported the institutional solution chosen by the Government and in 1962 made a "balancing" loan, the larger part of it for local currency expenditures, to contribute to completion of the expensive Costanera plant and substantial distribution expansion. Following 3-4 years of negotiations, a second Bank loan was made early in 1968 to cover part of the cost of a further large expansion of generating capacity and of distribution. A third loan, almost entirely for transmission and distribution, was made in 1969. The total amount committed to SEGBA is $210.0 million, including large provisions for local procurement in all loans.

2.03 Through its loans to SEGBA, the Bank has sought a major improvement in the quantity and quality of electric power supply in Buenos Aires, and in order to achieve this, it has placed primary emphasis on the following: expansion of capacity, autonomy of SEGBA, Bank approval for top management appointments, stronger financial situation, better coordination between SEGBA and the other company operating in Buenos Aires (CIAE) and, since 1965, improved SEGBA efficiency, particularly in the use of labor. Great emphasis was placed initially on gradual sale of stock to the Argentine public, to ensure operation along private enterprise lines, but this objective was later downgraded though not abandoned.

2.04 The power supply situation in Buenos Aires, which was completely unsatisfactory in the early 1960s with one fourth of demand unmet, has improved considerably, but still suffers from substantial deficiencies.

SEGBA's generating capacity (all thermal) has increased since 1962 by about 150% or 1,100 MW (nearly 1,000 MW partly financed by the Bank) to 1840 MW but it is barely adequate to meet demand, even when supplemented by purchases from other producers. Distribution deficiencies are more serious. Customers have increased by 600,000 to 2.3 million, but there are 200,000 potential residential customers awaiting connection. The proportion of capacity out of service and the share of energy lost in distribution (including stolen energy) have declined but remain quite high; distribution losses account for some 15% of energy generated. Load shedding, negligible during 1964-68, has increased significantly, with about 5% of the peak demand periodically unmet in the last two years, mainly due to shortages in the distribution network. Coordination with CIAE, for which the Bank had long pressed, has improved particularly with the opening of a central dispatch center under SEGBA in 1968, but distribution networks are still overlapping in some areas.

2.05 The company's autonomy has been infringed on several occasions, most recently in mid-1971 when the Government again removed top management and formally 'intervened'. No shares have been sold to the public. Government refusal of tariff increases has prevented the company in 1964, 1965, 1967, and 1970, and 1971 from earning the 8% return on revalued assets that it is allowed under its concession, which the Government is in turn obliged, under the Bank's Loan Agreements, to apply. Financial performance improved between 1964 and 1969 -- as indicated by improvements in the rate of return earned, self-financing, current ratio, working capital position and accounts outstanding -- but there was some deterioration in 1970, with a future decline in 1971 and resumption of these trends remains uncertain. favorable

permit? (is 8% max. or min.?)

2.06 SEGBA's continued political prominence and vulnerability result in part from its high costs and consequent high prices, and from the quality of its service, which must be considered unsatisfactory for a modern capital. Average costs of production, at US¢ 2.3 per Kwh, are the highest among those of the utilities studied here (more than twice those of the Singapore thermal system which has much smaller scale-economies) and are not much less now than they were in 1962, although they have declined from the very high levels of the middle 1960s. The Bank has been a strong proponent of the company's interests in negotiations with the Government -- for instance, securing lower taxes on equipment purchased by SEGBA, special Government contribution in 1966 to its working capital, Government support for renegotiation of the labor contract in 1968. But not until 1965 did the Bank begin to give much attention to SEGBA's very high costs, its related labor problems and the possibilities of improving internal efficiency. Staff has been reduced by some 2,000 or 8% since 1966, but considerable overstaffing remains. SEGBA itself hired management consultants in 1963 and substantial progress has been made in billing, inventory control, accounting and financial planning but it has been slow. The institutional autonomy sought by the Bank has proven, in the Argentine context, unpalatable in principle and unattainable in practice.

Furnas - Brazil

2.07 Furnas is a bulk supplier of electricity in the populous and prosperous South-Central Region of Brazil (including both Rio de Janeiro

and Sao Paulo); it is 95% owned by Eletrobras, the Federal Government holding company for the power sector, other shareholders being the distributing companies that purchase its power. Formed in 1957, the company produced its first electricity in 1963, on completion of the first units of the Furnas hydroelectric plant, and it has since expanded to service nearly one-third of utility power demand in the South-Central region, which contains 45% of Brazil's population and accounts for 75% of the country's electricity consumption. The company has received strong support throughout from the Bank which made a loan in 1958 for the first stage of the Furnas plant and further loans in 1965 and 1966 for the Estreito hydroelectric plant. These two plants, built on schedule and with large savings on unit costs/kw, account for 1,600 MW out of the total 2,300 MW installed capacity of the company at the end of 1970; part of the remainder, including 200 MW thermal, was acquired from Chevap on its dissolution and the other part is rented. Additional Bank loans were made in 1968 and 1970 for the Porto Colombia (360 MW) and Marimbondo (1,400 MW) hydroelectric plants respectively, both of which are under construction. All loans included provisions for high voltage transmission related to the various plants and for personnel training. Total commitments amount to $271.3 million.

2.08 In connection with its loans to Furnas and other important Brazilian power companies, the Bank has placed major emphasis on better coordination in the planning and operation of the power sector and on introduction of systematic revaluation of assets as a means of securing adequate tariffs. Coordination in planning has improved, partly due to

the major power study done by CANAMBRA in 1963-66 with UNDP financing and Bank supervision. Furnas has taken a lead in improving coordination, chairing a system interconnection committee finally formed in 1968 and bringing together all the main power utilities in the South-Central region. Revaluation of assets was expected to be permitted shortly after the Bank's first loan in 1958 but was finally introduced in 1964. Clarification and improvement of the regulations was made a prerequisite for finalizing the Bank's second loan to Furnas, in 1965. Difficulties in the application of the new regulations, and the very heavy weight of the peak demand charge, with ratchet provisions, in Furnas' tariffs prevented it from selling all its power in 1965-67, but since then sales have generally been close to capacity. Generating capacity reserves on the South-Central system as a whole appear to have been reasonable.

2.09 Furnas' development and management have been impressive; since 1966 it has earned a financial rate of return (on net assets) in excess of 9% and financed internally about 30% of its rather large investments, and it has been given increasing responsibilities for sectoral coordination and new developments in the power sector, as well as taking over the Chevap properties. Its average unit costs (in real terms) have shown a strong upward trend, reaching US¢ 0.6 in 1970, but this was principally due to legal changes regarding amortization and depreciation provisions as well as operation of thermal plant since 1967; labor costs, although relatively very small, have also shown a strong upward trend per Kwh sold.

EELPA - Ethiopia

2.10 EELPA is the national electricity authority of Ethiopia, responsible for supply in all parts of the country other than Asmara, and currently having some 1.7 million people in its service area, out of Ethiopia's total population of 23 million; power supply has been confined mainly to population centers to date. By the end of 1970, it had an installed generating capacity of about 120 MW, of which 94 MW, primarily hydroelectric, are in the interconnected system serving Addis Ababa and several other principal cities. The Bank has made two loans to EELPA, one in 1964 and the other in 1969, amounting to a total of $46.6 million. Both loans were principally for hydroelectric plants: Awash II and III schemes (32 MW each), the second of which was completed in February 1971, and the 100 MW Finchaa project now under construction.

2.11 The Awash II scheme was completed with a slight cost saving and only a few months behind schedule, in December 1966. But serious technical problems were encountered in the Awash III scheme, mainly due to faulty design, which resulted in a slight cost overrun and a delay of three years in project completion. Load shedding, which became necessary in late 1965 due to poor hydrological conditions and a thermal plant breakdown were prolonged through 1966 by the delay in completion of Awash II. But the much longer delay on Awash III has not affected EELPA's ability to meet demand in subsequent years because it has grown much more slowly than expected -- about 11% p.a. on average compared with an expected 16%. As a result, reserves on the interconnected system in 1971 were important, with a peak load of 57 MW compared with

As a result reserves on the Interconnected System were still adequate by the end of 1970 with a peak load of 50 MW compared with 94 MW installed capacity and some 72 MW (including some 10 MW of thermal plant) of firm capacity. The slow down in Ethiopia's economy after 1967 and the consequent slow down in load growth resulted in an uneconomically high level of reserve capacity after Awash III was commissioned in March 1971. This position will be further ~~upgraded~~ aggravated with the completion of Finchaa, (the financing of which was taken over by the Bank from USAID after construction had started), which is expected for late 1972.

126 MW installed capacity and some 100 MW firm capacity (allowing for low river flows). Despite the difficulties arising in operation of some of the plants, the high cost of thermal fuel for EELPA and plant indivisibilities, it seems doubtful whether such high reserves and the implied level of system realiability are appropriate to a country of Ethiopia's poverty and needs; these reserves will increase substantially with the completion of Finchaa, expected for late 1972.

2.12 EELPA has doubled its number of customers (to over 110,000) since the Bank's first loan of 1964 and increased its employees by about two-thirds. Average unit costs of production have declined over the long term, but rose slightly in the late 1960s, approximating US¢ 2.2 per Kwh in 1970. The authority has generally adhered to all loan covenants with the Bank, except in the 1964-68 period when it failed to achieve 40% self-financing.

VRA - Ghana

2.13 VRA is an independent Government authority established in 1961 as an integrated regional development agency, to build and operate the Volta River project, consisting principally of a dam and hydroelectric power plant at Akosombo and the resultant Volta Lake. The project was built between 1962 and 1966; four generating units, totalling 588 MW, were installed at that time, and the final two units, of 294 MW together, are now being installed. VRA also owns and operates a 500 miles 165 kv transmission ring covering most of the southern and more densely populated part of Ghana. More than 70% of power generated is sold to the

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Alternatively charge other consumers agreed rate of 15 units instead of 10 units now charged as arranged on appraisal

VALCO aluminum smelter (90% owned by Kaiser Corporation), which was established in conjunction with the project and has since been processing imported alumina into ingots. The remainder is sold to the Government authority responsible for distribution of power in Ghana (ECG) and to mines. The Bank was intimately involved in the original negotiations regarding the project and made in 1962 a loan covering about half the foreign financing originally required, the rest coming ~~mainly~~ from U.S. Government agencies, the UK Government and the Government of Ghana. A small further loan was made in 1969, supplementing a credit from the Canadian International Development Agency ~~contributing to the foreign exchange costs of~~ for the last two units. The Bank's two loans together amount to $53.0 million. An IDA credit of $10.0 million for distribution works was also made in 1968 to ECG, merger of which with VRA the Bank has continuously been recommending.

2.14 Bank missions in 1957 and 1960 were not enthusiastic about the Volta project, but Kaiser Corporation and the Ghana Government pursued the idea. During contract negotiations in 1961, the Bank urged Ghana to seek a higher power price and a shorter contract than VALCO was offering. The eventual contract was for thirty years with a price of only 2.625 U.S. mills/Kwh, ~~which would need to be raised now, in the opinion of VRA, if it were to earn an 8% return on average net fixed assets in operation in the immediate future.~~ The project at appraisal was evaluated to yield an internal rate of return on Ghana's investment of 8.2%, assuming a 50-year life. It was envisaged that net earnings on Ghana's total equity in the project would not reach 8% before 1974.

There are a number of industrial
white elephants from Nkrumah's days

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2.15 The main project works were completed slightly ahead of schedule, with a saving of some $18 million equivalent (or 10%) over expected costs. Energy sales to all classes of consumer have been greater than forecast. VRA's rate of return on assets has risen about as expected, reaching 4% in 1970, although non-aluminum consumers have been charged much less than originally envisaged. VRA has provided an efficient and reliable power supply.

2.16 Net foreign exchange earnings of Ghana from the combined hydroelectric/aluminum project (including savings made by meeting non-smelter demand from Akosombo rather than a thermal alternative) appear to be positive currently and should increase when the country's own bauxite deposits begin to be exploited. Small-scale industrial development using VRA power has been better than expected; but it is still small and might have been greater had it been properly promoted. There have been important adverse environmental effects of the Volta project, mainly of a health nature, and resettlement of the 80,000 population affected has been slow and, in the opinion of many observers, unsatisfactory. A more thorough study than has been possible here would be needed to see what the net contribution of the project has been to Ghana's development and what measures might have been taken to increase benefits and avoid negative side effects.

NEB - Malaysia

2.17 NEB is both a regulatory and an operating agency, directly responsible for public electricity supply throughout the Malay peninsula except for Penang Island, supplied by a municipal plant, and part of the state of Perak, supplied by a foreign-owned private company. NEB's principal facilities are on the western side of the peninsula, where most of the population and commercial life of Malaysia is located. Since 1958, when the Bank first lent to the company, the main power markets have gradually been linked, and NEB's interconnected system now runs from the north of Prai (opposite the island of Penang) all the way to Johore Bahru opposite Singapore. This system contains nearly 95% of NEB's total generating capacity or some 565 MW, 265 MW hydroelectric and 300 MW thermal (excluding the 60 MW Johore Bahru thermal plant weakly connected to the rest of the network). Almost all the hydroelectric capacity is in the Cameron Highlands scheme, supplying mainly peak power and built between 1959 and 1968 with the aid of the first three Bank loans, in 1958, 1963 and 1966. The latter two Bank loans also provided for the transmission interconnection and for 240 MW of thermal generating capacity (at Prai, Johore Bahru and Port Dickson south of Kula Lumpur), constituting the bulk of NEB's present base-load capacity. Further loans were made in 1969 and 1970 which, together with supplier credit financing, were to provide an additional 510 MW of thermal capacity, most of it at Port Dickson, which is now under construction. Total commitments to the entity amount to $156.0 million, but of this, $13.3

million has been cancelled due to cost savings mainly on the plants of the Cameron Highlands scheme and at Port Dickson.

2.18 Load growth and plant installation have proceeded fairly close to schedule, sometimes slightly ahead of it, with the result that no shortages of capacity have been suffered; with a peak load of 363 MW on the interconnected system in 1970 and a firm capacity of about 465 MW (allowing for low water conditions), demand is presently covered amply. The Cameron Highlands scheme was undertaken to develop local water resources as much as to attain economies, which were actually expected to yield a return of only about 6% on the extra investments required to build it rather than a thermal alternative.

2.19 Over the twelve years since the Bank has been associated with NEB, its customers have tripled to some 470,000 while its staff has doubled. Conversion from expatriate to Malaysian management has been fully and smoothly accomplished. Bank loan covenants have been fully adhered to, and a rate of return in excess of the required 8% of assets has generally been earned. Cost of power production has shown a small but steady downward trend, reaching US¢ 1.7 per Kwh in 1970, as have distribution losses, being less than 10% in 1970 despite the wide spread of the system.

CFE - Mexico

2.20 CFE is a national authority, wholly owned by the Government, now responsible for all phases of public supply of electricity throughout Mexico except in Mexico City itself where operation is partly in

the hands of the Government-owned Compania de Luz y Fuerza del Centro (Centro), formerly foreign-owned and known as Mexlight. Of the 6,100 MW public generating capacity installed in Mexico CFE owns 5,400 MW, and Centro about 700 MW. CFE now serves directly more than 3.8 million customers and has 18,500 employees.

2.21 CFE is now the largest power entity in the developing countries with which the Bank has been directly involved, and it has received very much the largest amount of financing from the Bank, now totalling $499.8 million in seven loans spanning the period 1949-70. Over this period, CFE has evolved from a relatively small-scale utility, with less than 200 MW capacity, serving some 40,000 customers, mainly in small towns, into a national authority responsible for power supply throughout Mexico. The Bank's approach has adjusted also to CFE's changing nature and needs and has differed somewhat from that to other power agencies. In the 1950s, CFE expanded its own distribution networks and bought out some existing companies; but it became mainly a large-scale supplier of bulk hydroelectric energy. The Bank made loans in 1949, 1952 and 1958, amounting to $87.8 million in total, to cover mainly the foreign exchange cost component of selected projects of all types, including 1,060 MW generating capacity contributing 80% to the expansion of CFE's capacity, which reached 1,450 MW in 1962. After the nationalization of the power sector in 1960 and the purchase by CFE and/or its affiliates of the foreign-owned companies other than Centro, CFE was given responsibility for construction of all new generating plants and for coordination of sectoral investment planning. The Bank's

so-called program loan of $130.0 million in 1962 complemented the financing of CFE's own 1962-65 expansion program. The 1960s have seen a gradual amalgamation into CFE of its affiliates so that by 1970, the only utility remaining separate was Centro and CFE's Director General was appointed its President. The Bank's last three loans to CFE, in 1965, 1968 and 1970, and attached conditions, were made for the power sector as a whole; they have contained $282.0 million for CFE itself and $43.0 million for on-lending by CFE to Centro, which, as Mexlight, had received 2 loans in the 1950s. During the 1960s, when CFE's generating capacity has quintupled to 5,400 MW, partly by acquisition but mainly by new plant construction, the Bank has been associated with virtually all major new works.

2.22 In aggregate over the last twenty years the Bank has contributed to financing some 4,500 MW of completed generating capacity in 44 major and many minor plants and 14,000 km of completed transmission lines (one-third of it at high voltage). There have been substantial cost overruns and major delays in completion of most of the plants. Despite these delays, there have not been major power shortages in the 1960s on any of the principal systems (six large, including Centro, and four smaller); indeed, excess capacity developed in the middle 1960s due to very optimistic load forecasts, underestimation of load factors and ample planned allowances for reserves, but this overcapacity was worked off during the very late 1960s.

2.23 CFE's financial performance, as reflected by financial statements that are of uncertain precision, remained poor until the middle

of the 1960s but improved thereafter. Peso shortages, which delayed project execution in 1949, have not recurred since, due to adequate Government appropriations. However, CFE earned a rate of return on its assets of only about 3% or less until 1957 when a sharp tariff increase approximately doubled the return. In connection with its 1958 loan, the Bank pressed for the first time for improvements in earnings, in particular for a 9% rate of return on the major systems and for prompt tariff adjustments for cost increases. A uniform nationwide tariff structure introduced in January 1962, prior to signature of the fourth loan, was expected to meet the Bank's requirement for an average 33% self-financing rate over four years; this target was not met, however, due mainly to lower than expected sales and higher depreciation costs. A tariff increase sufficient to yield an 8% rate of return for the power sector as a whole was a condition for full disbursement of the 1965 loan. Since 1966, this 8% return has been earned. But self-financing has remained low and in fact declined, partly because of the very rapid expansion accomplished but mainly because of the recurrent heavy debt-service requirements, which originated with large-scale short and medium term debts incurred in the early 1960s partly as a means to sustain expansion after the Bank had refused further lending in 1959 due to poor financial performance. The Power Sector has on several occasions, particularly in 1965, faced problems in meeting its debt-service obligations, and major refinancings of debt were required; they were successfully accomplished with major assistance from the Government.

2.24 A major concern of the Bank since 1958 and more especially in the 1960s with regard to the efficiency of the Sector and of CFE has been the coordination of system planning and operations, which had been deficient during the 1950s. Measures taken in connection with the nationalization of the sector brought major improvements in this respect. In the early 1960s, studies recommended by the Bank indicated the advantage of interconnection among CFE's southern systems, and therefore of converting the largest system (Central) from its 50-cycle frequency to the 60 cycles of the other systems. The program forming the basis of the 1965 loan included the initiation of frequency unification and interconnection of the large Occidental and Oriental systems. Oriental and Occidental systems were provisionally interconnected in 1967 and fully in 1969; but despite the Bank's continuous insistence and establishment of legislation on frequency sensitive equipment, no frequency conversion has yet been accomplished, due partly to social oppostion. Studies suggest that even further interconnections between the systems, mainly from north to south, would already be economically worthwhile.

2.25 Various measures taken over the years, partly at the Bank's insistence, have improve the internal efficiency of CFE and its operations. Successful decentralization of CFE's operations has been achieved since the mid-1950s, strengthened by the training programs recommended by the Bank. Equipment acceptance tests were introduced in the early 1960s, and load dispatch centers established in some systems. Consulting arrangements for review of investment plans and of major plants have been satisfactory. But further improvements are needed in control of

construction costs, and more generally in data collection, particularly financial. Several reviews of the financial departments and their procedures have brought some improvements, in particular regarding depreciation of assets, but major efforts are still required at the central echelon to put on a sound basis accounting, management reporting, inter-department coordination and financial planning for the whole power sector (which has been CFE's responsibility since 1969); the annual external audits made since 1962 have been of limited effectiveness. Despite these continuing problems and the absorption in 1967 of 19 affiliates which increased CFE's average costs, these and the average price per Kwh sold -- US¢ 1.8 in 1970 -- have been relatively low, partly thanks to the continued low prices at which increased fuel supplies by PEMEX

2.26 All Bank loans have included provisions for local procurement (equipment and civil works) which accounted for a rather constant share of disbursements, approximating 15-20%; out of $175 million disbursed over 1967-70, some $33 million were for local procurement, of which $20 million for electrical equipment.

2.27 Despite the serious cost and time overruns on plants, altered expansion plans and the long time required to secure progress in financial performance and system coordination, the Bank's approach of lending part of the cost of a general expansion program, probably the only course feasible under the circumstances, appears to have operated satisfactorily -- mainly due to the dynamism and relative strength of CFE. Moreover this approach has recognized and likely contributed to the establishment of CFE as the leading operator and authority in the sector, a position which now has to be consolidated by effective integration of the subsidiaries recently absorbed and strengthened efficiency

in execution of the further large expansions required. Prima facie, it appears as though CFE has maintained a fair regional balance between expansion of its systems, including substantial village electrification; the share of households electrified over the country as a whole has nearly doubled to 53% ~~over 1960-70~~ between 1960 and 1970, which is a major accomplishment, in view of Mexico's very rapid population growth. Whether a good balance has been maintained between expansion of electricity in Mexico and expansion of other services and facilities is an important question, particularly in view of the large investments financed from budget resources by the Government, which has constantly sought to keep power price at minimum levels; this question cannot be answered without much further investigation than has been possible here.

PUB - Singapore

2.28 PUB was established in 1963 as an autonomous public corporation to run electricity, gas and water services on the island of Singapore; the Bank gave advice on the Ordinance establishing the entity. The Electricity Department, which has maintained separate accounts, had an installed generating capacity of 640 MW by the end of 1970, entirely thermal. The Bank has made three loans to PUB for power alone, one for power and water services together (and one for water alone); total lending for power amounts to $60.5 million. The first two loans for power, in 1963 and 1966, were entirely for the 240 MW Pasir Panjang B station, started early 1963 and completed on schedule late 1966 with slight savings on foreign exchange costs. Since 1966, PUB has financed its

generation expansion (Jurong station) with supplier credits, and the Bank's lending, in 1967 and 1969, went to distribution system expansion. A loan for a second stage at Jurong was seriously considered in 1970 but finally turned down because of PUB's failure to recruit a General Manager.

2.29 In its dealings with PUB the Bank has placed considerable emphasis on the need to strengthen top management, and on numerous contracts with consultants for advice and assistance on engineering and planning, management and organization, accounting, simplification of tariff structure and distribution planning. Although the situation regarding top management has seldom fully satisfied the Bank and the recommendations of the consultants have generally been implemented only with substantial delays, the utility shows a good record of steady expansion and improvement in efficiency. The proportion of households connected in Singapore has more than doubled to 70% over 1960-70 and the number of customers nearly tripled. Average prices and costs have been steadily reduced, the latter reaching about US¢ 1.0 per Kwh in 1970 (compared with US¢ 1.7 in 1960), distribution losses have been held at about 7-8%, and a rate of return in excess of the 8% minimum agreed with the Bank has been achieved in every year except 1965 and 1966 when the shortfall was due to a Government tax on fuel and property. Commercial accounting and external auditing have been established, good management reporting and budget control introduced, and the tariff structure is being simplified.

2.30 Electricity sales have grown rapidly, averaging 15% p.a. since 1963, and not very different from forecasts. But the load factor has

been much higher than forecast, such that 1970 peak load was 60 MW less than expected. For this reason and because very conservative planning principles have been followed by PUB and its principal consultants, there appears to have been some overinvestment in generating capacity, particularly since the installation of the Jurong station (not directly financed by the Bank); even after allowing for substantial maintenance outage (partly due to initial difficulties with the Pasir Panjang units) and for 60 MW spinning reserve, there has still been excess available capacity of some 50-100 MW at time of system peak in each of the last five years. With the current expansion of the Jurong plant, this situation seems likely to continue for several years.

together with the desire to provide an exceptionally reliable power supply to attract foreign mfg I (Govt policy)

CHAPTER III - POWER IN COLOMBIA

3.01 Colombia stands about mid-way among Latin American countries in terms of population (some 23 million), per capita income (about $250) and real growth of GNP accomplished over the last twenty years (a little under 5% p.a. on average). But in terms of the rate of increase of electricity production since 1950 (an average rate of some 10 - 11% p.a.) it leads most other Latin American countries, although, at just over 100 watts per capita, it remains below the median as regards per capita generating capacity installed. The Bank has given substantial support to the growth of the power sector, especially since 1958 when the Government assigned top priority in the development effort to power expansion. The Bank has directly financed as much as 30% of the total investment in the sector over the last decade, and provided nearly 75% of the foreign loan financing for the sector since 1950.

3.02 The western part of Colombia which contains some 90 - 95% of the country's total population is traversed by three major Andean mountain ranges which provide numerous favorable hydroelectric sites but also divide the people into separate communities with strong regional loyalties and cultural traditions of their own and a certain mistrust for one another and for central institutions.. Each of the major regions of the country is dominated by a leading city, particularly Bogota, Medellin, Cali, Barranquilla, Bucaramanga, Cartagena and Manizales, to name the top seven in order of population size. These cities, and particularly the three largest, have been growing very rapidly over the last twenty years as people have fled the insecurity and the poverty of the countryside.

3.03 Growth of public power supply has been characterized by severe regional discrepancies, heavily affected by the institutional complexity and weakness of the sector. There are two large and relatively strong municipal companies, enjoying the best markets and excellent local hydroelectric sites -- EEEB in Bogota and EPM in Medellin. Three entitites (CVC, Chidral and EMCali), with overlapping and conflicting responsibilities, are responsible for power supply in Cali and nearby towns. The remaining cities mentioned above, as well as all the other main populated areas of the country, are generally served by subsidiaries of the national holding company in the power field, ICEL (formerly Electraguas); much the strongest of these subsidiaries is CHEC serving Manizales and various surrounding towns in the main coffee-growing region of the country. An important mission sponsored by the Bank in 1949 to advise on overall Colombian development emphasized the need to make Electraguas a strong national agency with responsibility for collecting statistics, planning on a national basis and implementing plans but, despite some efforts, it has remained poorly organized and subject to political interference. Statistics on all aspects of the power sector remain deficient, little long-range planning has been done for the sector, duplication of investment has occurred, there is little coordination among the various entities and most of the subsidiaries of ICEL remain weak in terms of personnel and finances. The situation has been improved as regards the four largest and strongest companies -- EEEB, EPM, CVC/Chidral and CHEC -- by the formation in 1967, under strong urging from the Bank, of ISA, a company owned in equal shares by each of these

four entities and endowed with responsibility for interconnecting them and later generating bulk power supply to meet their requirements. CORELCA, another regional interconnection company, also formed in 1967, to serve the areas on the north coast (including Barranquilla and Cartagena) is expected to have similarly positive effect there.

3.04 The four strong companies mentioned, serving areas now containing about 25% of the national population, have greatly outpaced the others in terms of growth. Between 1950 and 1970 their combined generating capacity has grown at an average rate of some 13.6% p.a., rising from 46% of the public sector total of 241 MW in 1950 to over 70% of the 2078 MW total in 1970. Capacity of the remaining companies has increased only at 8% average rate. Industrial self-generation rose rapidly in the 1950s to nearly 250 MW but has remained roughly constant since then. Distribution networks have lagged in all areas but especially among the weaker companies and losses of energy in distribution typically range between 15% and 25%, sometimes reaching higher. Only EEEB and EPM, with their very good markets, accounting for some 50% of the national total, more than have been able to earn rates of return on revalued assets above 5% in the most recent years and to finance their expansion largely without recourse to national Government resources. Most of the ICEL subsidiaries have been making financial losses even on a non-revalued asset base. Late in 1968, after strong representations by the Bank, the Government finally established a National Public Utility Tariff Board, first recommended twenty years before, to try to introduce improvements in tariffs which would remove the strong financial constraint that has inhibited expansion of the smaller systems in the past.

3.05 The Bank has made 17 power loans to Colombia, totalling $294.1 million, or nearly 40% of total commitments to the country, substantially more than for any other sector. Disbursements on power loans amounted to $220.5 million by the end of 1970, accounting for just over 40% of all Bank disbursements to Colombia. Bank financing has been concentrated exclusively on the seven largest cities listed earlier, with the exception of Barranquilla. Lending to Colombia for power started with three small loans in 1950-51 to three Electraguas subsidiaries, those responsible for Cali (Chidral), Manizales (CHEC) and Bucaramanga (Lebrija). Further loans were made in the middle 1950s to Chidral and a second loan in 1959 to Manizales. But the Bank's principal lending for power started in 1959 from which date it has been almost entirely concentrated on the three largest urban centers -- Bogota, Medellin and Cali -- and on the interconnection between them. A small loan was made in the early 1960s to the Electraguas subsidiary responsible for Cartagena. Some 90% of aggregate disbursements to date have been for the four major systems now joined in ISA. The Bank has played a fundamental role in the development of EEEB, EPM and CVC/Chidral, helping to finance some 80% of their present installed capacity.

3.06 The Bank's loans have generally originated with requests from the individual borrowing companies. The three projects for which loans were made in 1950-51 were first presented to the Bank in 1948 and their priority was verified in an economic mission of that year and by the important 1949 mission. Several further small loans were made to Chidral to try to cope with the recurrent power shortages which resulted from rapid growth of the

city, absence of effective long-term planning and the company's financial weakness. From 1953, the Bank did insist that all projects submitted for its consideration should have prior approval of the national economic planning authority, which it had helped to establish. Serious conversations with EEEB and EPM started in 1954 but they were truncated by the Bank's requirement of changes in the constitutions of these companies, deterioration of Colombia's overall financial situation in 1955-56 and suspension of lending in 1956-58. When lending resumed in 1958-59, these most important centers of the country urgently needed additional power facilities to catch up with the delay, to facilitate industrial expansion and to cope with the large influx of population from the smaller towns that was occurring; the revived national planning department assigned top priority to power expansion. If advantage was to be taken of the attractive hydroelectric sites available, financial requirements were large, and, given Colombia's financial situation at the time, there were probably no other sources except possibly for the ExIm Bank that could have met the requirements on reasonable financing terms.

3.07 Further loans to the major companies rapidly ensued in the early 1960s, effectively to raise the quality of their systems to a higher level than had prevailed, although serious attention was not given to what an appropriate level of system reliability would be. A minor effort was, however, initiated by the Bank to develop relations, either through Electraguas or directly, with some of the smaller power companies. This eventually led to the loan for Cartagena previously mentioned. But the

effort was soon abandoned on the ground that it would require more intensive work on institutional and financial improvement than the Bank was in a position to provide, and further requests from the Colombian authorities for assistance in this direction were turned down. Despite the large amounts of financing being devoted to the power sector, the Bank's economic reports never dealt with the fundamental questions involved -- regional balance, validity of load forecasts, tariff structures, power distribution problems and policies, potential development impact of power, urbanization trends and policies. However, they did press for improvement of tariff levels, initially only in connection with the companies that the Bank was directly financing, but after the middle 1960s in a broader context. By the middle 1960s, an explicit decision seems to have been made, in light of limited personnel resources, to concentrate effort on the difficult and crucial problem of interconnection between the major companies, leaving aside Electraguas, broader national planning considerations and the weak companies serving the smaller towns. The Inter-American Development Bank has on the other hand devoted some effort to Electraguas and ICEL and has become increasingly important in financing some of the large companies which previously relied entirely on the IBRD.

3.08 The following paragraphs treat in turn the three major power companies with which the Bank has been concerned in Colombia and the creation of the interconnection company ISA.

EEEB - Bogota

3.09 EEEB is an autonomous entity responsible for all phases of public electricity supply in the city of Bogota, the capital of Colombia, and also a major manufacturing center, which accounted in 1968 for 23% of total industrial value added in the country. The autonomy of the entity and its independence from other city services were assured by decrees issued in 1959 as a pre-condition for Bank lending. Although owned by the Special District (municipality) of Bogota, appointments to the Board are made in such a way as to prevent the city council from obtaining a majority of the seats; this arrangement, agreed with the Bank, has been designed to insulate the entity from intrusion of politics and it may possibly have prevented political staffing and diversion of funds to other purposes, neither of which seem to have occurred.

3.10 Besides supplying electricity to the Bogota area, EEEB sells small amounts of bulk energy to entities responsible for neighboring towns and villages; in 1969 and 1970 it also sold quite large quantities to Cali to make up for temporary deficiencies there. EEEB generating capacity, which nearly trebled between 1950 and 1960, increased more than four and a half times over the last decade, to reach 590 MW by the end of 1970. Of this capacity, some 85 MW is thermal, principally at the Zipaquira station to the north of the city, but all the remainder is located 20 kms west of the city on a 1,800 meter drop in the Bogota River over a distance of only 24 kms, which will be fully outfitted with hydroelectric capacity upon completion of the Canoas plant now under construction. The Bank has been

closely associated with the rapid expansion of EEEB since 1960, meeting almost all foreign exchange requirements (as well as some local engineering costs) out of the proceeds of three loans, made in 1960, 1962 and 1968, and amounting to $85.6 million.

3.11 The Bank's loans have included provisions for generation, transmission and distribution, but the major part of the financing has gone to three new hydroelectric stations (including Canoas), totalling 416 MW capacity, and to the 70 MW Zipaquira thermal station with two units. The most important station is the 300 MW El Colegio, started in 1962 and completed in 1967, with the last three generating units installed in 1968-70. It was always clear that development of the very favorable hydroelectric sites on the Bogota River should be the principal means of meeting the expanding electricity needs of the city, but the Bank did have an important role in causing the Zipaquira thermal station to be built. The station was first established in 1963 with one 33 MW unit which had originally been purchased by the Colombian Government for installation at Paipa in the Department of Boyaca but which the Bank suggested should be installed in Bogota; the Bank's suggestion was undoubtedly the more economic solution. The second, 37.5 MW unit at Zipaquira was provided under the Bank's second loan of 1962, instead of the 50 MW Canoas station which EEEB had originally suggested for inclusion in its expansion program at that stage. The Bank had recommended this substitution mainly because Canoas would have had substantially larger local currency costs than Zipaquira 2, which the Bank would have found difficult to finance and for which

it would have been hard to raise local funds to cover due to weakness of the Colombian capital market, and partly because the load was expected to grow fast and a thermal unit to be quicker to build than Canoas; it was generally recognized that Canoas would probably have been more economic. EEEB accepted the Bank's recommendation. In the event the load grew less rapidly than expected, and simple economic calculations suggest that loads as they have actually developed could have been met some $5.4 million more cheaply (in terms of 1968 present worth) by keeping to EEEB's original proposal of installing Canoas at that time. What appears in restrospect to have been an unnecessary extra expenditure resulted from placing too much emphasis on alleged deferred demand in the load forecast, from the deficiencies of the local capital market and the Bank's reluctance to finance local currency costs, and from insufficient attention to the scarcity value of foreign exchange in Colombia.

3.12 Serious shortages of generating capacity occurred in 1962 and early 1963 as a result of the delays in arranging the first Bank loan and in installation of the plants covered by it, but no shortages of major proportion in meeting connected demand have occurred since then. There were delays of between one and two years in commissioning most of the units financed under the Bank loans -- variously due to complex import procedures, geological difficulties, poor contractor performance and shortages of local currency -- but these were compensated by lags behind forecast in the growth of demand, so that generating capacity reserves have not generally been excessive compared with actual demand. Demand growth was

limited partly because of delays in expansion of the distribution system; the latter were mainly due in turn to shortages of local currency and diversion of some Bank loan funds from distribution to covering cost overruns on generating units. Although it appears that EEEB is not making connections in the marginal areas of the city to the extent that would be economically warranted, the distribution problem has largely been overcome in the later 1960s, with estimates indicating that as much as 98% of the city population may now have residential connections. A small amount of electrification has been carried out outside the city, with a little assistance from Bank loan proceeds.

3.13 The area which caused the Bank most concern and to which it devoted most attention was EEEB's financial situation, which is now substantially stronger. Mainly with a view to ensuring adequate cash flow to enable expeditious progress on project construction, the Bank insisted on a number of tariff increases, to keep up with the pace of inflation in Colombia, and included covenants in the first two loans requiring EEEB to finance 40% of its investment from internal cash generation. These covenants were never met because of difficulty in obtaining Government approval of tariff increases, cost overruns and inflation. In the 1968 loan the tariff covenant was changed to requiring a rate of return of at least 9% on revalued assets. This covenant has been met, and the self-financing rate has also risen above 40%. Quite apart from these financial performance targets, the Bank also gave attention to the units in the company responsible for financial aspects and to their staff strength. It

required improvements in billing, in connection with the first loan, and it gave considerable attention to financial planning capabilities especially in connection with the second loan, when cash shortages were holding up construction. A financial department was created in 1963, at the instance of the Bank, and a commercial department, to improve marketing and load forecasts, in 1964. Accounts receivable have shown a sharp increase in recent years. It is also striking that despite the very large increase in scale of operations (system sales in 1970 more than six times the 1955 level) unit costs of production, at some US¢ 0.6 per Kwh delivered, remain about the same in real terms. This does not appear to result from having harnessed more expensive hydroelectric sites; if anything, capital costs per kw installed have declined.

EPM - Medellin

3.14 EPM is an autonomous, municipally-owned entity which provides public services of electricity, water, sewerage and telephones to the Medellin metropolitan area, Colombia's oldest industrial center now accounting for some 22% of national value added in manufacturing. EPM was established in its present form in 1955 when the companies responsible for these different services were amalgamated under a single management while retaining separate accounting and financial systems, as the Bank required, to avoid diversions of funds. The company has been run by a Board chaired by the Mayor and with a majority appointed by the Mayor from various business associations. The Bank has opposed changes in the system of making Board appointments, but in 1970 the Municipal Council of Medellin, with a majority from a new political party opposed to the two traditional parties, passed decrees affecting Board composition, powers and procedures. The

Council selected a new Board, while the old Board still remains in existence, and the issue is being contested in the courts. In the meantime, company management, with the aid of the Mayor, who is chairman of both Boards, is operating effectively.

3.15 The Electricity Department of EPM, which is much the largest in terms of assets and revenues, supplies electricity directly to Medellin and 13 smaller muncipalities in the metropolitan region and sells a small amount of bulk energy to distributors in neighboring areas. Its generating capacity, which is entirely hydroelectric, has more than quadrupled since 1960, to reach 575 MW in mid-1971 in seven plants located within 50 miles from the city to the north and east.

3.16 The Bank has financed virtually the entire foreign exchange costs of EPM's power expansion since 1959, contributing to distribution as well as generation and transmission. Two loans were made in quick succession in 1959 and 1961 to cover mainly the first and second stages, respectively, of two plants, the 36 MW Troneras plant and the 270 MW Guadalupe plant. A third and larger loan (on exceptionally easy terms of 35 years amortization, justified on grounds of the country's foreign exchange situation) was made in 1964 to cover principally the foreign exchange costs of the 264 MW Nare (Guatape) plant, of which the first two units (132 MW together) were recently completed. The three loans together amount to $79.0 million.

3.17 The Bank has been generally well-satisfied with the company's technical performance. A separate technical department was created at its suggestion in 1959 and staffed with well qualified engineers, with consult-

ant assistance. The Bank has not intervened in the company's investment decisions. Completion of the first stage of all three major plants has run between 1.5 and 3 years behind schedule but this was due mainly to poor contractor performance and even more to geological difficulties, especially with the most complex underground Guatape plant. Cost overruns have been ccnsiderable, particular for Troneras (nearly 150%),[1/] but they were successfully covered out of loan contingencies and supplementary financing, and final unit costs have still been quite low. Delays in completion of the first program caused extension of the power shortage and resultant rationing (which had started in 1959) into 1963, but serious problems have not recurred since then. This was mainly because all load forecasts proved somewhat over-optimistic, though less so in the case of the last loan. In fact, partly for this reason and partly because an additional unit obtained at low marginal cost was added to the Guadalupe III plant, there has been considerable excess capacity on the system ever since 1966. Computer simulation shows, however, that the system's energy margin has been quite low in some years, especially 1969 (about 5%) and that the Guatape units, which will provide base load capacity, were needed by the end of 1971 to provide reasonable reliability. The last two units at Guadalupe III, which mainly fulfill a peaking role, have not yet played a very essential part in meeting loads but they were probably worth installation in 1966 due to low marginal cost.

1/ Troneras was a relatively minor element in the total costs of the program, so that it was possible to cover these high overruns without upsetting the whole financing plan.

3.18 Bank financial covenants, which mainly refer to the Electricity Department of EPM only, have generally been adhered to. A 30% self-financing rate was required under the first loan and 40% under the last two loans. There was a small shortfall in the early 1960s due to delays in securing tariff increases, but the problems were much less severe than in Bogota. On a revalued assets base the rate of return fell below 6% in 1966 ~~by~~ but has recovered to above 8% for each of the last three years.

3.19 EPM has expanded its distribution network in such a way as to keep up with economic growth within the official limits of the municipalities it supplies but totally inadequately to meet the needs of the marginal areas. As a result energy thefts rose from 1% of generation in 1960 to a peak of over 16% in 1968. Inadequate expansion of the distribution network is also reflected in the fact that increase of recorded consumers -- some 75% since 1960 -- has been lower than for any other utility studied in this review. This problem has resulted less from lack of funds or plans on EPM's part than from refusal of the municipal authorities to accept incorporation of marginal areas in the official city limits and the consequent burden of service provision. The large amount of energy stolen accounts for most of the shortfall between projected and actual energy sales and equally for much of the steady upward trend that has occurred in cost per unit sold. Nevertheless, even after allowing for this fact, unit costs of delivered energy have still shown a slow but steady upward trend, reaching about US¢ 0.5 in 1969.

CVC/Chidral - Cali

3.20 CVC and Chidral are two of the three principal institutions involved in the complex organizational structure that has evolved for supplying electricity to Cali, the third largest city in the country (accounting for some 15% of national value added in manufacturing industry), and the surrounding Valle Department, the richest agricultural region in Colombia. Chidral was established in 1944, as a subsidiary of Electraguas, with full rights for the hydroelectric development of Anchicaya River, in order to overcome the shortage of power in Cali. It was the first utility in Colombia to borrow from the Bank, in 1950, and, as a condition for the loan, Chidral took over existing diesel plants in Cali and became the sole bulk supplier of electricity to the city. Distribution remained in the hands of EMCali, a municipal enterprise. In 1954-55, the Bank played a significant role in convincing the national Government to agree to the establishment of CVC[1/] as a national institution, somewhat along the lines of the U.S. Tennessee Valley Authority with responsibility for comprehensive development of the natural resources of the Cauca Valley. In 1958, majority ownership of Chidral was transferred from Electraguas to CVC. The Bank's most important loan for power development in the area was made in 1960, and under this loan CVC and Chidral were made joint borrowers, with CVC being responsible for planning and construction of the works financed and Chidral for their subsequent operation. Despite earlier hopes for merger the two organizations remain separate, and CVC, although having a large

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1/ Corporacion Autonoma Regional del Cauca. The initials CVC reflect the original intention that the entity should be active in the three departments Caldas (old), Valle and Cauca; in fact its operations have been mainly confined to Valle.

majority of Chidral shares, does not have full control of the company since Board composition is frozen, with 3 members appointed by CVC, 1 by EMCali and 1 by the city of Cali, and all important decisions require affirmative vote of four Board members, thus giving Cali veto power. While EMCali remains responsible for distribution in the city, CVC has developed a transmission network in the Valle and sells power in bulk to smaller muncipal distributors or directly in those areas where it has taken over the distributing companies.

3.21 CVC/Chidral generating capacity has increased from some 12.5 MW in 1950 to 250 MW in 1970, of which about 185 MW is hydroelectric (65 MW in the Anchicaya project and 120 MW at Calima) and some 65 MW thermal, most of it at the coal-fired thermal station in Yumbo, an industrial suburb of Cali. The Bank has provided most of the foreign exchange required for all the units at Yumbo and for the two hydroelectric stations, as well as for some transmission and distribution developments, of which the most important has been a 115 kv line from Yumbo to Cartago linking the Cali power system with CHEC (Manizales). The three small Bank loans of the 1950s (1950, 1955 and 1958) made directly to Chidral were principally for completion of the Anchicaya project (which had been started in 1945 but had to be redesigned in 1948-50 due mainly to the geological conditions encountered) and for two small 10 MW units installed on an emergency basis at Yumbo within a few years of one another; loads grew substantially more rapidly than first expected and there appears to have been a virtual absence of long-term planning. Capacity shortages frequently recurred. The relatively large $ 25 million

loan of 1960 to CVC and Chidral again provided for an emergency unit (of 33 MW) at Yumbo as well as for the first stage of Calima and for the Yumbo-Cartago transmission line. The last loan, in 1963, was principally to cover part of the cost overruns on Calima first stage and installation of an additional two units there. The five loans amount to a total of $44.6 million.

3.22 The Yumbo units were completed on schedule and fairly close to forecast costs but there were delays of two years from the Bank's forecast in completion of Anchicaya and Calima. And on the latter project, there was a very serious cost overrun, of 46% on the plant itself and 60% for the plant plus related transmission. Calima has also suffered from hydrological difficulties; it was always envisaged mainly as a peaking plant since mean flows were expected to be sufficient to generate only some 235 million Kwh per year from the 120 MW installed capacity (equivalent to a capacity factor of some 22%) but generation has not yet approached this level due to poor hydrological years experienced and delays in filling the reservoir. The feasibility study for the project, on which the Bank based its decision to support it, indicated a rate of return of at least 15% on the extra investment required to build it, as opposed to a coal-fired thermal plant. A new comparison, allowing for the hydrological difficulties experienced to date but assuming average production of 235 million Kwh in coming years, and assuming capital cost of the thermal alternative to be $ 200 per KW installed and fuel cost of US¢ 60 per million BTU (as Yumbo now), also indicates a 15% internal rate of return had construction costs been as originally expected. With the cost overruns that have occurred, however, the return to the actual incremental investments (of some $ 20 million) appears to be in the range of 6 - 10%, without making any allowance for the fact that a coal-fired plant would have been

built more quickly, hence avoiding at least part of the load shedding in 1964 and 1965 which resulted from the two-year delay on Calima. This suggests that Calima has been a rather marginal investment since the opportunity cost of capital in Colombia is probably in the range of 10 - 12%. Whether the problems -- unexpected geological difficulties with the bedrock and shortages of borrow material, disappointing hydrological conditions as well as import and labor problems for the chief contractor -- which have made the scheme barely economic might have been avoided or better foreseen is hard to say at this stage, but it does seem that insufficient attention may have been given to hydrological and geological investigations and to checking of cost estimates. The Bank did not provide direct assistance for engineering investigations until inclusion of a special provision in the last loan (of 1963), and this was partly as a means of staving off other projects which the Bank thought to be uneconomic but which had strong political support.

3.23 Nevertheless, one of the more valuable contributions of the Bank in the 1960s may in fact have been in discouraging other major new projects favored by CVC/Chidral. Hydroelectric projects in the Cauca Valley have been considerably more expensive than in the central part of the country: average costs per KW installed (including transmission) were $387 and $378 for Anchicaya and Calima, respectively, compared with the range of $160 - 250 for EEEB's and EPM's hydroplants. On various occasions, the Bank turned down the proposed Calima II, Timba and Salvajina schemes. In 1965-66 CVC pressed for assistance on a fourth unit at Yumbo, but the Bank

supported the cheaper alternative of a 115 kv link-up between CVC's Yumbo-Cartago line and a new line under construction from Bogota to Armenia. This solution was adopted and it has enabled useful imports of energy from Bogota in 1969 and 1970. It was feasible because of CVC's own foresight in including in its 1960 development program the 115 kv line down the Cauca Valley which provided a link with the CHEC system, as mentioned, and also enabled some village electrification and reduction in cost of electricity supply in the small towns of the valley.

3.24 Some of the delays and cost overruns on projects in this area, as well as lags that have occurred in extension of the distribution system and the frequent recourse to emergency solutions, have been due to the persistent financial problems of the entities involved and their recurrent cash shortages. In the 1950s, the Bank was frequently concerned with trying to ensure both additional equity contributions from Chidral's shareholders and tariff increases to keep pace with inflation. Despite periodic successes, the problems always returned. In one case, the Bank actually made loan effectiveness conditional upon appropriate action and this did induce a tariff increase, even though it delayed loan effectiveness more than a year. Generally, however, the Bank seems to have taken a rather weaker position with regard to adequacy of tariffs and financial organization than in the case of EEEB and EPM. The tariff covenant of the 1960 loan was vague; that of the 1963 loan was more specific, providing for designated levels of internal self-financing over certain periods, but the financial organization of the various entities

involved has been so weak and confused that it has not been possible, in the course of the evaluation, to establish whether these covenants have been adhered to or not. The rate of return earned on revalued assets has been very low, ranging between negative levels and 6.5% over the last 15 years; it rose in recent years but still reached only about 4% in 1969, the latest year for which data are available.

The Colombian Interconnection

3.25 Interconnection between EEEB, EPM, CVC/Chidral and CHEC, the largest individual power companies in the country and the main borrowers from the Bank, has been the central objective of the Bank in its work with the Colombian power sector over the past decade. The interconnection system, in the form of a 230 kv double-circuit Tee, with lines totalling 500 km in length extending from Manizales (CHEC) to Bogota, Medellin and Cali, is just now being completed at a total cost of some $ 23 million equivalent, 15% below the expected level. Principal foreign exchange costs have been covered out of a Bank loan of $ 18 million made in 1968 to ISA, the interconnection company set up in the previous year, after long delays, and owned in equal shares by EEEB, EPM, CVC/Chidral and ICEL/CHEC. Initially the system will be used to trade power among the companies, but in 1976 the 500 MW Chivor hydroplant, for which the Bank made a second loan to ISA of $ 52.3 million in 1970, and which is now under construction, should start to generate power for supply via the interconnection network to ISA's four owners and probably other power companies also.

3.26 The Bank has played a key role in securing creation of ISA and implementation of the interconnection and Chivor projects, and it is unlikely that the interconnection system would now be nearing completion were it not for its efforts. The Bank first raised the issue in 1962 when it decided to insist that studies be made and that any further major generating projects be considered in the context of a possible interconnection. The Bank's initiative started a long period of studies and negotiations frequently delayed by the reluctance of the regional companies to cooperate with one another and as often set moving again by Bank suggestions, questioning and pressure. Early in 1963 EEEB, EPM and CVC jointly commissioned a preliminary review of the potential advantages of interconnection by the principal Colombian engineering consultant firms and, when that had yielded favorable conclusions, arrangements were made late in the same year for the necessary deeper technical and organizational studies. Opposition to the interconnection scheme came particularly from CVC and EPM. CVC faced a prospective power shortage and, given the relatively high-cost hydroelectric potential of the Cauca Valley, stood particularly to benefit from interconnection; this also meant, on the other hand, that it might loose major new construction projects (hydroelectric plants) for its own area and that it would be heavily dependent on power supplied by other companies, thus running the risk of becoming the first victim in case of emergency. EPM, due to the favorable hydrosites in its area, was likely to be an exporter of power but it was equally reluctant to participate in a scheme which would involve sharing its good resources with

others (and possibly promoting their industrial development), raising the price of power in Medellin (since prices would tend to equality throughout an interconnected system) and becoming dependent on an entity in which the Central Government would likely play an important part. In face of this and other opposition and delays, the Bank's approach, always careful to avoid imposition of any particular solution of its own making, moved through three phases, from calling for studies of the interconnection concept, through refusing loans for projects which would be superfluous with interconnection, to denial of any further lending to the companies involved until they had implemented steps on which they had agreed in principle. It is possible that the Bank could have hastened progress by being firmer at an earlier stage and refusing to lend for EPM's Guatape project in 1964 but, due to the long delays on this project, it is actually being completed less than a year before it would be essential to the interconnected system, even with the lower than expected load growth and exceptionally favorable hydrological conditions of the last two years.

3.27 In the early years of the discussions interconnection was expected to be completed by 1967 but it was not until November 1966 that agreement in principle was finally reached among the participating companies, under strong pressure from the President of Colombia; it took nearly another year to form ISA and an additional few months to select a management team acceptable to all parties; and the Bank's loan for the interconnection network was not signed until December 1968.

3.28 Four principal classes of economic benefits should result directly from interconnection. First, it will enable earlier and faster exploitation of large hydroelectric sites such as the Chivor scheme, which is ultimately expected to have an installed capacity of 1000 MW, at an average cost of only $ 150 per KW installed. Second, amalgamation of the systems and resulting pooling of reserves will enable a given level of system reliability to be attained with less generating capacity -- probably some 50 MW less in the Colombian interconnected system during the 1970s. Third, peak load of the combined system is expected to be about 3% less than the sum of the peak loads of the separate systems due to diversity in time of individual system peaks. Fourth, integrated operation should enable more efficient use of available generating capacity, especially hydroelectric capacity, due to the possibilities of using storage capacity better and the regional diversity of hydrological regimes; this should reduce system operating costs, especially fuel costs. Various estimates of the aggregate costs of meeting expected power loads through 1980 in the regions involved show significant savings in the 'with interconnection' case. Calculations show that the savings would have been significantly greater had interconnection been accomplished by 1967.

3.29 Beyond these benefits are several others, less tangible but possibly more important in the long run. First, creation of ISA has helped to stimulate much needed cooperation among other power companies presently not involved in the scheme but preparing to join. Second, ISA provides the first link between the major power companies and may be the

nucleus of the strong central organization badly needed in the Colombian power sector to attain more efficient data collection, planning and plan implementation. Third, the fact that ISA will have responsibility for major new generating and transmission developments (a legal attribution of responsibility valuably upheld by the Bank in Chivor discussions) should tend to cause the local companies to give more adequate attention to distribution, which has tended to lag in the past. Fourth, integration of the systems, and the existence of the transmission links between them, should enable power to be made availabe more cheaply than in the past in those areas where it hasbeen most expensive, possibly contributing to righting the existing imbalance between the major cities and other areas and opening opportunities for use of power to stimulate development in the latter. The interconnection links now completed should be the core of a national system which, within the next 10 - 15 years, will join all principal inhabited regions of Colombia.

CHAPTER IV - COMPARATIVE PERFORMANCE UNDER THE LOANS

4.01 Excluding ISA, this study covers ten companies to which the Bank has made 39 loans, of which 28 are fully or nearly fully disbursed. Highlights of the evolution of the individual companies and of the Bank's work with each of them have been covered descriptively in the last two chapters. The purpose of the present chapter is to cover more systematically, and in a comparative manner, performance in connection with several specific dimensions of the loans -- the accuracy of the underlying load forecasts, the balance that eventuated between generating capacity and loads, plant construction periods and costs, trends in company growth and efficiency, and observance of agreements with the Bank. Investment financing patterns are covered in the next chapter. The main focus is on the loans fully or nearly fully disbursed.

4.02 Load forecast accuracy can be measured in different ways and for some purposes it is most useful to compare actual peak loads or total energy requirements with forecast levels. Here however emphasis is placed on changes in peak demand and energy consumption from the base year preceding signature of the loan, since it is this change which principally determines the size of investments in capacity expansion. The accuracy of forecasts has therefore been measured by the ratio

$$R = \frac{\text{Forecast Change in Demand from Base Year}}{\text{Actual Change in Demand from Base Year}} \times 100, \%$$

The error in the forecast is given by the expression (R - 100, %). For a completely accurate forecast R would assume the value 100, while for an

overestimate it would be greater than 100. This measure of accuracy obviously results in figures that are higher in absolute terms than would result from comparison of absolute levels of demand.

4.03 Leaving aside extreme observations, the following table shows the results of the analysis for both energy sales and peak demands. As the table indicates, more data were available regarding peak load than energy sales, so that the underlying samples are different and no significance can be attributed to the relationship between the figures for loads and sales for individual years.

Table 4.1

Mean and Standard Deviation of R by Forecast Intervals For Energy Sales and Peak Loads[a/]

	1	2	3	4	5	6	7	8	9	10	Total
Sales											
Observations	28	29	29	28	20	18	12	9	4	3	180
$\bar{R}$ %	86	116	116	117	120	112	115	103	97	99	108
S %	53	39	29	34	33	38	32	34	25	30	38
Peak Load											
Observations	33	34	35	34	31	25	17	14	10	4	240
$\bar{R}$ %	87	109	115	116	112	108	110	122	85	128	123
S %	54	53	46	43	46	51	36	42	29	56	50

$\bar{R}$ % = Mean of R
S % = Standard deviation of R

a/ Excluding extreme observations in which forecasts were 200% or more of actuals.

The table indicates that, over all forecast intervals, increases in energy sales and peak loads have been overestimated by an average of 8% for the former and 23% for the latter. However, for the most important forecast intervals (3 to 7 years ahead), roughly corresponding to the construction periods for the generating plants, energy sales have generally been more seriously overestimated (by some 15 - 20%) but peak demands have been overestimated by a lower amount (some 10 - 15%).

4.04 These results indicate a higher level of overestimating than was found in a larger survey of 75 Bank loans to 37 countries.[1/] There the error on forecasts of energy sales was found to average only 2%, identical to that found for a sample of (mainly European) industrialized countries. In some ways more significant than the average overestimate is the dispersion of the forecasts from actual. Table 4.1 shows that the standard deviation for the energy sales forecasts was 38%, which is identical to that found in the larger survey mentioned, and twice the level for the industrialized countries studied there. It is of course to be expected that forecasts would be somewhat less accurate for the developing countries in view of many factors such as low base levels of electricity consumption, dependence of ~~foreign exchange earnings~~ economic activity on variable harvests and international commodity prices, etc.

4.05 More important than the sheer accuracy of load forecasts is the question whether the wide dispersion of actuals from forecasts has led to significant imbalances between demand for electricity and available supply capacity. One general measure of this is the relation between forecast and

1/ See Economics Department Working Paper No. 79, 'Ex-post Evaluation of Electricity Demand Forecasts,' IBRD, June 1970.

This is not a case of two errors cancelling out - as he implies. The causes of delays in project implementation equally apply equally to the consumers own installations & are therefore the cause of the failure to achieve the demand forecast.

See also page 106.

, possibly perhaps because local factors causing delays in project implementation may similarly affect consumers project implementation, and therefore the peak demand

small systems
large consumers } ind.

perhaps partly
" similar local
factors work to slow
down completion of power projects
& industrial projects & alike.

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actual levels of gross reserve generating capacity (defined as the difference between installed capacity and peak load). Comparison shows that, despite the general tendency to overestimation of peak loads, gross reserves have in fact tended to fall short of expected levels -- by an average of about 15%. The effect of load overestimates has been more than offset, overall, by delays in plant completion. Nevertheless, delays in system additions have not generally been serious enough to require serious load shedding except in a few instances, mainly Ethiopia in 1966, EEEB and EPM in the early 1960s and CVC/Chidral in 1964-65.

4.06 Company-by-company analysis is necessary to show whether the systems presently have excess generating capacity for meeting the demand that they face. Such analysis, using a rather strict criterion -- the extent of spare capacity at effective peak[1/] -- indicates no clear excess of generating capacity for meeting loads which occurred in 1970 on most of the 14 systems analyzed (including 5 systems of CFE). Appendix Table 4.1 gives details. The large apparent capacity reserves of VRA are to be explained by the large size of its units and the requirements of its special power contract. Those of EPM and NEB result mainly from the fact that water conditions happened to be good in both cases in 1970; they would have been lower had flows been closer to recorded minimum levels. However, there are clear signs of excessive capacity in the EELPA and PUB systems and, as

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1/ Effective peak is defined as the peak at the critical time in the year when the margin between demand and capacity actually available (after water losses and maintenance outages, scheduled and unscheduled) is least or load shedding greatest (excluding short-term outages).

indicated in Chapter II, it is likely that this will continue to be the case for several years. The 1970 peak load on both systems fell substantially short of expectations -- by 30% and 15% of forecast levels for EELPA and PUB respectively. Gross reserves were 90% and 70% of peak demand and spare capacity at effective peak was 50% and 30% respectively.

4.07 The 28 loans covered in this report helped to finance completed projects having a total cost of about $2.9 billion equivalent, of which nearly 60% was for generation and most of the remainder equally divided between transmission and distribution. Appendix Table 4.2 gives details. Generating plants built or extended with the help of the loans total 71, of which 39 are hydroelectric and 32 thermal; CFE accounts for a major share, with 24 plants of each type, and this has a significant effect on the conclusions presented below.

4.08 Delays in completion of generating plants have averaged one year, but have been much longer in Mexico (16 months on average) than elsewhere (7 months). Causes for these delays were presented in the last two chapters, but most typically they were technical; in addition a significant portion of the overall delay was due to late start of construction. As regards construction periods thermal plants averaged about three years, both forecast and actual. Construction periods were naturally much longer for most hydroelectric plants and delays often larger, due to greater dependence on natural phenomena; actual construction periods averaged five years, and delays on forecasts six months, except in Colombia and Mexico where they averaged about one year.

4.09 The 39 hydroelectric plants totalled 6050 MW as against 5250 MW forecast, the capacity increase originating mainly from design changes. Overall, hydroelectric plants averaged about $190/kw total cost (excluding related transmission), 15% above forecasts. But again experience differed sharply between Colombia and Mexico, on the one hand, and the other countries covered, on the other. Plants built in Colombia had unit cost overruns averaging 25%, and those in Mexico 76%, primarily due to very large overruns on local costs. Plants in other countries averaged $180/kw, 20% under the forecast figure. The average ratio of foreign to domestic cost was 20/80 in Mexico and 47/53 elsewhere, making an overall average of 40/60.

4.10 The 32 thermal plants aggregated about 3250 MW, 350 MW more than originally forecast. Thermal plants averaged $174/kw total cost, 7% above the forecast level, with the non-Mexican plants again showing a contrary pattern with a slight saving of 3% resulting in $178/kw on average; cost overruns on Mexican plants averaged 37% above estimates but actual costs were in line with those of other plants, averaging $168/kw in Mexico. The proportion of foreign to domestic cost averaged 68/32 for thermal plants built outside Argentina and Mexico and about 55/45 in these countries, averaging 58/42 on all plants. Analysis of the actual unit costs for thermal units reveals a normal pattern of decreasing returns to scale.

4.11 The quality and extent of the technical information available from both Bank reports and the utilities on the transmission and distribution projects do not permit systematic analysis; this is partly due to the large

amount and great diversity of technical specifications and small-size equipments involved in these projects which would require, for comprehensive review, a larger amount of research than could be accomplished in this study. On transmission, about 17,500 km of circuit lines were erected under the Bank projects; time overruns were minor except in Colombia and small cost savings seem generally to have been made, averaging about 6% of original cost estimates. The proportion of foreign to domestic costs in transmission projects has varied considerably, depending mainly on the extent of local production capability, and ranging from 19/81 in Argentina to 76/24 in Africa, averaging 55/45 for all cases.

4.12 Available data on distribution expansions in four countries that were financed out of Bank loans suggest that substantial savings were made relative to cost estimates. Detailed data were not available on the large distribution expansion and rural electrification programs undertaken during the 1960s in Mexico with Bank support.

4.13 Comparison between the ten companies and electrical utilities in the developing countries as a whole shows that, except for EPM, the companies reviewed have been growing exceptionally rapidly. Even leaving aside those which have grown especially fast due to recent creation or to major acquisitions (VRA, Furnas and CFE), peak loads and energy sales for the other seven companies of the group have grown between 1960 and 1970 at an average rate (unweighted) of 13.2% p.a., which compares with 11.6% p.a. overall average growth of electrical utility energy sales in the 87 developing member countries of the Bank Group with populations of more than one million. Installed capacity of the seven companies has averaged 12.9%

annual growth. Sales have grown faster than customers, indicating an average annual increase of 4% in Kwh consumption per customer. Labor productivity, defined in terms of energy sales per employee, has been growing rapidly at rates between 6 and 9% for all companies. Appendix Table 4.3 gives details.

4.14 Appendix Table 4.4 gives, for all the companies, trends over the period 1955-70 in average prices and costs per Kwh and in annual rates of return on capital invested, based for comparability on a standardized concept which relates the net revenues from electricity sales, including indirect taxes, after adequate provision for depreciation and before interest and direct taxation, to the average net fixed assets in service, revalued where necessary to allow for sizable inflation. In all companies except VRA and CVC/Chidral, standard rates of return have in recent years exceeded the 8-9% level, and in all except SEGBA and the Colombian companies they have shown an increasing trend over the long run. Even leaving aside the hydroelectric bulk suppliers, average costs vary greatly, from 0.5¢ per Kwh to 2.3¢, as do average prices, ranging from about 1.0¢ in the case of the Colombian companies to over 3.5¢ in Buenos Aires and Ethiopia.

4.15 In discussing cost trends and related factors it is helpful to distinguish between three types of company covered in this review: first, the essentially urban utilities, responsible for supply to one city or metropolitan region (PUB, EEEB, EPM and SEGBA); second, the bulk supply companies, having practically no distribution responsibilities (CVC/Chidral, Furnas and VRA); and third, the national power entities, responsible for all phases of supply in extensive national areas (EELPA, NEB and CFE).

Within each of these classes there are of course great differences of size among the various companies, and many other technical differences which must be borne in mind.

4.16 Singapore's PUB has managed to reduce its average cost per Kwh sold substantially, so that average profits have increased even though average prices have fallen. In this respect it shows a very good operational performance compared with the other urban companies. Sharp reductions appear to have been made in all the main elements of expenditure, as shown in Table 4.2. Although its generation facilities are entirely thermal, PUB has a lower labor cost per Kwh delivered than EPM, entirely hydroelectric. Labor costs per unit are only about one-fifth of those in SEGBA, which still has a very severe problem of excess labor (it has a larger labor force than for the whole of CFE). PUB's other non-fuel-and-depreciation costs are still less than half those of SEGBA, although the latter have declined somewhat in recent years as a result of special efforts to improve efficiency; they are naturally much higher than those of the predominantly hydroelectric Colombian companies. PUB's depreciation costs per unit have declined sharply, presumably mainly as a result of the larger generating units added, with lower cost per KW installed. PUB's fuel cost/Kwh has fallen over the period 1965-70 at an average rate of some 16% p.a., of which 13% due to decrease in fuel prices and 3% to increasing operational efficiency in PUB's thermal plants and to reduction in distribution losses, which are substantially lower in PUB than in the other three urban companies.

Table 4.2: Structure of Average Costs/Kwh Sold in Utilities Serving Urban Areas

(In US¢ equivalent, at average market exchange rates)

	PUB			SEGBA[a/]			EEEB			EPM		
	1960	1965	1970	1962	1965	1968	1960	1965	1970	1960	1965	1970
Depreciation	0.55	0.45	0.37	0.43	0.35	0.47	0.19	0.27	0.24	0.11	0.19	0.21
Fuel	0.59	0.66[b/]	0.32	0.55	0.59	0.44	0.04	0.04	0.02	-	-	-
Salaries/Wages	0.54	0.63	0.15	0.85	1.39[c/]	0.96	0.21	0.24	0.22	0.17	0.26	0.21
Other Oper. Costs			0.20	0.68	0.62	0.46	0.09	0.10	0.11	0.09	0.03	0.05
TOTAL	1.68	1.74	1.04	2.51	2.95	2.33	0.53	0.65	0.59	0.37	0.48	0.47

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a/ Data not available for 1960 and 1970, so 1962 and 1968 are given instead.

b/ Includes 0.15¢ for fuel tax, which was at an exceptionally high level in 1965 and 1966.

c/ Reflects the very high staffing level reached in 1965.

4.17 Among the three bulk supply companies, Furnas has shown much the best financial performance, partly due to the arrangements made to permit regular adjustment of prices to keep up with inflation in costs. Deflated, unit costs on the Furnas system have shown a sharp increase, but much of this increase is not indicative of real cost changes but of legal changes affecting treatment of depreciation; the average cost of energy produced has also risen as a result of the take-over of thermal facilities from Chevap. Labor costs have risen sharply, partly for this reason. VRA has been able to decrease somewhat its average cost/Kwh sold to 0.2¢, the lowest among all companies. Chidral costs remain comparatively high and show no downward trend. Transmission losses have been kept under 5% of generation in the three companies, and labor productivity (again in very global terms) in Furnas and VRA has been naturally growing very rapidly, reaching about 2,500 MWh/employee in 1970.

4.18 Performances have varied widely among the three national companies, of such greatly varying size -- CFE, with 5,400 MW installed capacity and nearly 4 million customers; NEB with 670 MW and about half a million customers; and EELPA with 120 MW and barely more than 100,000 customers, by far the smallest of all the utilities under review. Standard rates of return for the three have been rather similar over the last decade, averaging 7.0%, 8.5% and 7.4% respectively. Like PUB, but in smaller proportions, NEB has steadily reduced its average price and cost per Kwh sold while increasing its average profit. Due to its wider responsibilities in administration and distribution, as well as to increased depreciation charges, CFE has had slowly increasing average costs and prices per

Kwh sold, but in 1970 both were still the lowest among the three companies. EELPA's average costs and prices have fallen substantially over the long term but shown a significant upward trend in the last years.

4.19 Many of the Bank's financial and institutional objectives in connection with its loans have been expressed in the form of covenants in the Loan Agreements or side letters attached to the Loan Agreements. The conditions set were generally designed to assure sound financial management and development and sound organization and operations in the company and/or the country's power sector as a whole. Appendix Table 4.5 gives a comprehensive summary of major covenants and side letters.

4.20 Financial covenants have covered two basic aspects: the tariff level required to obtain a minimum financial rate of return on assets or to attain a certain self-financing ratio, and limits on the incurrence of long-term debt to assure a sound financial structure and satisfactory coverage of debt service obligations. Table 4.3 shows that all the companies have respected Bank financial covenants in most years but most have failed the covenant tests in at least one year. Due to the reluctance of the respective Governments to approve tariff increases, CFE in 1961-64 and EEEB in 1963-66 did not meet the self-financing ratios required. The rate of return covenants were not complied with in some instances; NEB fell slightly short of its required 8% rate in 1967, and PUB's rate of return fell below the required 8% level in 1965 and 1966 due to sizeable increases in fuel and property taxes which were subsequently partly rescinded. More importantly, in 1964/65, 1967, and 1970, and 1971, the Argentine Government turned down SEGBA's requests for rate increases, thereby failing to implement the spirit of the Concession

Table 4.3

Departures From Financial Covenants with the Bank
(Figures in brackets represent the values taken in the years shown by the indicators to which the covenants referred)

Tests for Incurrence of Long-term Debt				1960-70 Average
Debt Service Coverage	Debt/Equity Ratio	Self-financing Ratio	Financial Rate of Return	Financial Rate of Return
SEGBA:				
1964 (1.5)	1963-70 (41/59 to 53/47)	- -	1964/65 (4 & 7.4%) 1967 (7%), 1970 (5.5%)	7.7
Furnas:				
-	-	-	1969 (9.8%)	9.0 a/
EEEB:				
-	-	1963-66 (23%)	-	12.7
EPM:				
-	1967-70	1961-65 (34%)	-	9.5 b/
CVC/CHIDRAL:				
n.a.	1957-58 (54/56)	-	-	3.9 b/
EELPA:				
-	-	1965-67 (31%)	-	5.9
VRA:				
1966-70 (max.1.3)	-	-	-	2.5 c/
NEB:				
-	-	-	1964 (7.7%)	9.3
CFE:				
1953-59, (0.3 to 1.4) 1962,1965 (1.4) (0.5) 1966-69 (0.9-1.3)	-	1961-64 (21%)	1959 f/	5.5 d/ 9.0 d/
PUB:				
-	-	-	1965-66 (6.1 and 7.2%)	10.5 e/ 9.2 e/

Entries in these two columns show not actual departures from covenants but only cases where departures could have occurred if the companies previously took on long-term debt without Bank approval.

a/ Average over 1964-70.
b/ Average over 1960-69.
c/ Average over 1966-70.
d/ The first rate does not take into account the proceeds of the Power Consumption Tax; the second one does.
e/ The first rate, averaged over 1960-70, refers to PUB's Electricity Department only; the second one refers to the whole PUB and is the average over 1961-69.
f/ CFE had agreed in a side letter to the 1958 Loan Agreement to earn a 9% return on its major systems. In 1959, returns on its systems in the Central, Oriental, Occidental, and Northern systems were 7.4, 6.9, 1.9 and 0.4% respectively.

Agreement; however, the Government partially compensated the company by additional returns in subsequent years (as required under the Agreement) and by providing additional equity and loans. Though the Table seems to imply that there were many departures from the covenants on the incurrence of long-term debt, this is not in fact the case because new long-term debts may not have been incurred even though debt-service exceeded the agreed levels or they may have been incurred with prior approval from the Bank as occurred with SEGBA, VRA, EPM and CVC/Chidral; on the other hand, CFE and other entities of Mexico's power sector on several occasions incurred long and medium term debts without the approval of the Bank.

4.21 The various management and institutional covenants introduced in the Loan Agreements aimed generally at achieving: (a) improvements of the construction, technical and planning operations of the companies, mostly through consultants' assistance (SEGBA, CFE, EEEB, EPM, CVC/Chidral, PUB); (b) review, reorganization and/or improvement of management procedures and of some departments of the companies, in particular of the financial departments and procedures and of the accounting systems (EEEB, EPM, VRA, CFE, PUB, SEGBA, VRA); and (c) improvements affecting the power sector more widely (Argentina, Brazil, Colombia, Ghana and Mexico).

4.22 Covenants of the first type, relating closely to the implementation of the projects themselves, appear generally to have been respected without major difficulties and delays. The main exception would appear to be in the case of CFE which has satisfactorily observed many such undertakings, but where improvements are still needed in the control of

construction costs which have invariably overrun the estimates and where the frequency unification, in some ways more a sector issue, is still pending implementation.

4.23 Covenants dealing with internal managerial and organizational aspects of the companies have generally been fulfilled eventually, but often with delays and difficulties. CFE's financial departments have been reviewed and reorganized since 1959 as recommended, but considerable further improvements are still needed. Conversely, the reorganization of PUB's accounting department called for in 1963 was implemented with a delay of some three years, but results have been positive and satisfactory. In CVC the covenants seem to have been little observed; in particular, the power operations of CVC and Chidral have not been amalgamated, as called for in 1963.

4.24 Sector policy commitments have generally related to improved coordination of planning and operations, improvements in Government regulations affecting tariff levels, and strengthening of distribution companies' networks. In the Buenos Aires area and the South-Central region of Brazil, coordinated planning of generation and distribution expansion have been gradually accomplished by increasing cooperation among the entities involved, and inter-utility load dispatch centers were, or are about to be, completed, in the case of SEGBA and Furnas respectively. In Ghana, ECG was established, although with a two-year delay. In Mexico four of the ten system load dispatch centers called for in the 1968 Loan Agreement have so far been established, interconnection between two major systems was made in 1967 and steps are under way towards further interconnections

as well as the frequency unification required. In the case of Colombia several of the main sectoral developments have been promoted by the Bank through separate agreements with the Government on economic policy as well as refusal of new lending rather than by Loan Agreement covenants; considerable success has been had, as discussed in Chapter III, and to the extent that the covenants do reflect these measures (creation of ISA, establishment of Utilities Tariff Board, use of revalued assets for tariff calculations) they appear to have been fulfilled.

CHAPTER V: INVESTMENT PROGRAM FINANCING

5.01 The core of the Bank's work in the field of electric power has been to mobilize financing for investment programs, and it is the purpose of this Chapter to explore some of the important financial issues which arise in this connection. The Bank has been concerned with ~~arranging~~ helping borrowers to arrange complementary domestic and foreign financing for the programs it has helped finance. An important objective has been to secure adequate domestic financing to avoid delays in program execution, as pointed out in Chapter I. Another objective, especially in recent years but existing from the earliest days, has been to raise foreign financing from sources outside the Bank itself. How far have these objectives been accomplished? Key parts of the rationale for a major IBRD role in financing electric power have been the sheer size of the resources required and certain advantages in financial terms and conditions that the Bank could offer, as mentioned in Chapter I. How valid are these points?

5.02 In Chapter I it was estimated that total investment in electrical utility systems in developing countries over the period 1950-70 aggregated some $40 billion. The following table, based on various simple assumptions, shows estimates of the breakdown of this figure by five-year periods and matches them with gross Bank Group disbursements for power to give an indication of how the Bank Group's global role has evolved.

Table 5.1

Estimates of Total Investment in Public Power Supply in Developing Countries 1951-70 and of IBRD/IDA Share
(amounts in $ billions)

Five-Year Periods	Estimated Total Investment in Power[a/]	IBRD/IDA Disbursements for Power	IBRD/IDA as % of Total	IBRD/IDA as % of Foreign[b/]
1951-55	3.9	0.2	6.2	12.4
1956-60	6.4	0.4	5.6	11.2
1961-65	11.1	1.1	9.5	19.0
1966-70	18.6	1.3	6.8	13.6
	40.0	3.0	7.5	15.0

a/ Based on UN figures for growth of installed public generating capacity and an assumed $450 total investment per KW installed.
b/ Based on assumption of 50% foreign exchange component.

Assuming, as the Table does, that about 50% of the estimated $40 billion of investment in electric power in the developing countries has been in foreign exchange, then the Bank Group has covered about 15% of this, with a peak (in percentage terms) apparently reached in the first half of the 1960s. The detailed figures underlying the table suggest that in 1970 the Bank may have provided about 13% of the total foreign exchange financing. Good figures are not available on a global basis for other sources of foreign financing, but it is quite clear that the Bank Group has been the predominant institutional source, and a reasonable estimate for the last five years, on the basis of DAC[1/] and other data, would be that, in terms

1/ Development Assistance Committee of the OECD, Annual Aid Review Statistical Tables.

of commitments, it has accounted for about 40% of the total provided by all official and Governmental sources (bilateral aid, official supplier credits and loans and grants from international institutions); this in turn would mean that 66% of total foreign exchange requirements have been met from developing countries' own foreign exchange earnings and from foreign private sources (mainly private supplier credits and bond issues).

5.03 The role of the Bank Group has of course been proportionately much larger for the investment programs in which it has actually participated. The investment programs covered in this review aggregate some $4.5 billion or a little more than 10% of the world total of $40 billion cited. Available information[1/] indicates that overall the Bank Group has accounted for about 25% of the total cost of these investment programs or about 50% of the foreign exchange requirements. The remainder of the foreign financing has been provided to the extent of about 20% each by supplier credits (official and private) and loans from foreign private financial institutions, and the rest by foreign bond issues and bilateral loans. The importance of foreign private financial institutions and foreign bond issues in the total results almost entirely from the inclusion of Mexico in the review. The Bank has been proportionately more important for all the other companies, and in several cases -- particularly the Colombian companies, Malaysia and Ethiopia -- it has been the exclusive foreign source, or nearly so.

1/ No data is available for the CVC/Chidral programs or for Mexico before 1958.

5.04 As regards domestic funds, analysis of all programs reviewed for which data are available shows that, overall, three main sources have been about equally important: loans from the public and private sectors, equity contributions from the public sector, and net internal cash generation, each accounting for some 16% of total funds. Again the pattern is heavily influenced by Mexico: leaving that case aside, net internal cash generation accounts for nearly 30% of total funds and public sector contributions (debt and equity) for about 25%.

5.05 More significant than these global averages are trends over time and comparisons of actual figures with the Bank's forecasts, the latter reflecting to some extent the financial objectives pursued by the Bank. Comparisons over time are not possible for VRA and EELPA because each had only one Bank loan fully or nearly fully disbursed by the end of 1970, and data on sources of funds are not available for CVC/Chidral, as mentioned; hence these companies have had to be omitted from the analysis. The following table shows average patterns (unweighted), both forecast and actual, for the first loan to each company and for the latest loan fully or nearly fully disbursed. Mexico is shown separately from the other cases because of its very distinct pattern.

Table 5.2

Forecast and Actual Sources of Funds: Evolution over Time
(in percentages of total sources)

	Six Company[a] Average Pattern		Average Pattern in Mexico[b]	
	first loan to utility	last loan to utility[c]	first loan to utility[d]	last loan to utility[c]
ACTUAL				
1. Net Internal Cash Generation	25	40	9 (23)	- (13)
2. Other Domestic Contributions	32	18	46 (32)	32 (19)
3. Foreign Borrowing: Total	43	42	45	68
of which IBRD	38	32	12	15
Total	100	100	100	100
FORECAST				
1. Net Internal Cash Generation	33	38	20 (45)	26 (43)
2. Other Domestic Contributions	19	15	49 (24)	31 (14)
3. Foreign Borrowing: Total	48	47	31	43
of which IBRD	34	42	31	34
Total	100	100	100	100
Total Funds: Forecast / Actual	0.87	1.03	0.57	0.83

a/ i.e. SEGBA, Furnas, NEB, PUB, Bogota and Medellin.
b/ Figures in brackets allow for inclusion of Power Consumption Tax within revenues; loans incurred to refinance debt contracted earlier are excluded from all analyses.
c/ Most recent loan to each company fully or nearly fully disbursed.
d/ i.e. 1958 loan, since sources of funds not available for earlier loans.

5.06 For the six companies the table shows that net internal cash generation, as a proportion of total funds, generally fell short of Bank projections under the first loan -- partly because of underestimates of total requirements and partly because of shortfalls in the absolute amount of internal cash generation. The gap in the financing plan was made up mainly by increased Government contributions. By contrast, under the latest loan, generally made six years after the first one received by each company, net internal cash generation has been slightly greater than forecast. Foreign borrowing has generally represented a smaller share of total sources of funds than projected but has remained about steady at just over 40%. The main change over time has been a sharp increase in the share of total requirements of funds provided from net internal cash generation (up from 25% to 40%) and a corresponding reduction in the share contributed from other domestic sources, mainly Government. A minor change has been a reduction in the share of foreign borrowing accounted for by the Bank, with supplier credits mainly filling the gap; however Bank funds still account for about a third of total requirements. The greatly increased share of retained earnings, the larger share of foreign sources other than the Bank, and the increased accuracy of the forecasts of total requirements of funds all indicate a marked strengthening of the companies' financial situation and capabilities, consistent with what the Bank had sought.

5.07 The Mexican situation contrasts strongly with the other companies. Internal cash generation has fallen far short of the share attributed to it in forecasts, and increasingly so. The Bank's actual share of

total sources has been much lower than in the other companies, but has increased slightly over time. The aggregate share of foreign borrowing has increased greatly, with bond issues and loans from private financial institutions accounting for most of the increase.

5.08 Another dimension of the Bank's financial contribution to the companies reviewed is the speed with which Bank commitments have materialized in the form of actual disbursements. Two significant indicators of the disbursement pattern were found to be the 10% and 82.5% cut-off percentages of cumulative disbursements. Before the 10% level was reached, disbursements had often been delayed by initial uncertainties about procedures and procurement, and after the 82.5% level was reached disbursements often slowed down due to minor problems in bringing a project to ultimate completion, delayed final payments to contractors, etc.; between these two cut-off percentages disbursements tended to follow a more regular pattern. Data for the 28 loans under review which have been fully or nearly fully disbursed are summarized in the following table.

Table 5.3

Periods (In Months After Signing Dates) Necessary to Reach the 10% and 82.5% Cut-Off Points on Cumulative Disbursements

	Overall Average (28 loans)	Average on first loans	Average on latest loans
Forecast			
10% cut-off	6	5	6
82.5% cut-off	30	31	28
Rates (in % per month[a/])	3.0	2.8	3.2
Actual			
10% cut-off	9	10	11
82.5% cut-off	39	42	29
Rates (in % per month[a/])	2.4	2.2	4.0
Delay between signing and effectiveness	3	4	3

a/ i.e. between the two cut-off points

The table shows that disbursements have generally started later and taken longer than expected. However, here again there have been sharp improvements over time. Whereas it had typically taken 42 months to reach the 82.5% cut-off point in first loans to the companies (compared with 31 months forecast), the pattern of the latest loans showed it to have been reached in only 29 months on average, compared with 28 forecast.

5.09 Data are unfortunately not available on typical disbursement periods for power loans from other sources, but it is possible to comment, on the basis of the sample reviewed, on three important ways in which Bank Group loans are generally believed to be preferable to other types of financing for power: better financial terms, availability for procurement

from any other member country (plus Switzerland) under international competitive bidding, and Bank scrutiny of project composition and contract specifications.

5.10 Financial terms of foreign loans are important to both the company borrowing (as illustrated by the repeated difficulties which have confronted CFE in Mexico due to its over-dependence on short-term debt) and to the country in which it is located. The rapid increase of the developing countries' debt service obligations has been a matter of world-wide concern. Due to its very heavy capital requirements (often with relatively high import component) the electric power sector is not unimportant in the overall foreign debt picture. Data available for seven out of the eight countries[1/] covered in this review show that electric power accounts for foreign debt of some $2.5 billion or 26% of total foreign debt publicly guaranteed, ranging from some 18% in Ethiopia to about 38% for Singapore.

5.11 A broad picture of the relative terms of the loans that have been made for power is given in Table 5.4, which is based on IBRD Country Debt Data and shows the original terms of outstanding debt contracted for power purposes, from the IBRD and from other sources, by five of the eight countries covered in the review. Terms are given on a weighted average basis for each class of debt.

1/ Data are not available for Brazil.

Table 5.4

Outstanding Amounts and Original Terms of Various Countries' Public Foreign Debt for all Purposes and for Power
(Status as of December 31, 1970)

	Outstanding Amounts[a] ($ mln)	Interest Rate (%)	Periods (Years) Grace	Maturity
Argentina				
Total	2,428	6.7	3.4	14.2
Power	556	6.3	4.6	19.9
of which - IBRD	271	6.3	4.3	23.0
- Other	285	6.3	4.9	16.9
Colombia				
Total	1,720	4.5	6.1	26.9
Power	422	6.1	4.5	24.1
of which - IBRD	248	6.1	4.7	26.9
- Other	174	6.1	4.2	20.1
Mexico				
Total	3,765	6.7	3.5	13.4
Power	1,089	6.7	3.3	14.5
of which - IBRD	472	5.7	3.5	21.5
- Other	617	7.5	3.1	9.1
Ethiopia				
Total	256	3.8	6.5	28.2
Power	47	5.9	5.3	25.4
of which - IBRD	45	6.0	5.1	25.1
- Other	2	3.7	10.0	32.2
Ghana				
Total	501	4.4	7.2	24.6
Power	100	4.3	6.2	29.9
of which - IBRD/IDA	59	4.9	7.1	29.1
- Other	41	3.4	4.9	31.1

a/ Including undisbursed

Source: IBRD Debt Data

The table shows that the principal advantage of the IBRD loans has been their long amortization periods, although in Mexico they also show a significantly lower interest-rate (partly due to the different times at which the bulk of each class of debt was contracted). The figures for Mexico reflect the importance of supplier credits and financing from private foreign financial institutions in meeting the capital requirements of the power sector. Average amortization periods for non-IBRD power debt in Argentina and Colombia are considerably longer than in Mexico, due to participation of German capital aid on a large scale in Argentina and to IDB lending and generally favorable terms of supplier credits in the case of Colombia. The table shows that in Ethiopia and Ghana outstanding debt for power to the Bank Group is on harder terms than that owed to others. However in Ethiopia the amount of financing provided by others is quite insignificant. In the case of Ghana the power debt was mainly incurred in connection with the Volta River Project, and the terms of the bilateral loans were somewhat easier than they might otherwise have been partly due to the importance of the international aluminum company among power consumers.

5.12 As regards international competitive bidding, there seems to be little question but that this principle generally results in lower contract prices than those obtainable under bilateral aid. It is hard to make fully valid comparisons, but all the Bank borrowers interviewed in the course of of this study were emphatic about the relatively high prices of equipment financed out of tied bilateral aid. The most striking case of cost savings by international competition is that of the 100 MW Finchaa hydroelectric

scheme in Ethiopia, now under construction. Initially this plant was to be financed under a loan from U.S. AID, with restricted bidding. But, due to the size of the bids received, it was decided to request financing from the IBRD. The low bid under international competitive bidding procedures and with IBRD financing was slightly below cost estimates, whereas the earlier bids, under restricted competition, had been more than 75% above cost estimates. Some other cases collected are partially relevant also. For instance, the 80 MW units of the Santa Cruz thermal plant in Brazil completed by Furnas in 1967/68 with U.S. AID participation have a unit cost of $208/kw, substantially higher than the unit costs experienced in the Mexican Tijuana plant ($164/kw for 75 MW units and $129/kw for one 82 MW unit); the 120 MW units of the Argentine Costanera plant, supplied and financed by a British consortium in a manner not consistent with the classical procedures of the Bank, had exceedingly high unit costs ($229/kw as compared with $120/kw in Mexican plants of comparable size).

5.13 As regards contracts financed out of supplier credits the picture is less clear, and probably less stable since prices of equipment as well as terms of financing provided depend considerably on how sharp the competition is between supplying countries at any particular moment for export contracts for particular types of equipment, depending in turn on the state of business in the developed countries, the balance of payments situation in the latter and the amount of financing available for power from international institutional sources. Some borrowers interviewed emphasized the limited availability of supplier credits and the fact that a manufacturer's time and credit are inevitably involved in making such

arrangements, so that prices would tend to be higher as a result; others stressed the highly competitive offers that they had recently obtained, with supplier credit financing -- sometimes from the Eastern European countries, which are ineligible for procurement financed out of IBRD loans. It should of course be noted that most of the countries covered in this review (outside Africa) have fairly strong balance of payments situations, so that they can obtain supplier credits fairly easily and can therefore organize international competitive bidding, with financing to be provided and financial terms to be taken into account in bid comparison. It is possible nevertheless that there may be some price advantage to procurement out of Bank funds even under these circumstances. In Singapore, the unit cost of the Jurong station (four 60 MW units), built in 1967-71 without Bank participation and mainly with supplier credit financing, is about $150/kw compared with $138/kw for the very similar Pasir Panjang B station, also consisting of four 60 MW units and built between 1963 and 1966 with Bank assistance. It would seem then that there may be some saving from procurement under IBRD loans for countries which can readily raise supplier credits, but these advantages are probably generally slight -- and may be reversing with the growing capability of non-Bank member countries to produce power supply equipment. On the other hand countries with weak foreign exchange situations which have difficulty in raising supplier credit financing may obtain more price advantage from procurement under IBRD loans.

5.14 For procurement under Bank loans the staff of the Bank always reviews the bidding documents and specifications, both to ensure that they are compatible with free international competitive bidding and to protect

the interests of the borrower. Sometimes the borrowers request a similar review by Bank staff of bidding documents for contracts to be financed out of other sources of funds. This check is a useful function often leading to minor clarifications and better specification of responsibilities. Occasionally it has led to improvements of considerable significance, for instance by broadening specifications in such a way that more suppliers can participate in the bidding, ultimately resulting in significantly lower prices. Among the projects reviewed here no particular cases of this sort have come to attention.

5.15 The falling share of Bank funds in total foreign financing of many of the companies' programs referred to above, reflects in part the tendency for Bank loans to be increasingly associated with provision of supplier credits, under either Joint Financing or Parallel Financing arrangements. Though the Bank has participated extensively in Parallel Financing, under which it finances certain contracts (often mainly civil works) 100% and other sources cover other contracts fairly fully, it has not generally been very closely involved in the arrangements. But it has undertaken special efforts to promote Joint Financing in electric power -- entirely in cases that happen to be covered by this review. The purpose of these efforts was generally to reduce the amount of IBRD financing required for the power sector in the countries where the efforts were made and to encourage greater use of ~~supplier~~ export credits instead (especially in countries which had made little use of such means of financing) or to help direct ~~supplier~~ export credit financing to priority projects and promote easing of terms (especially for countries which had used such credits), without

sacrificing the advantages of international competitive bidding. Efforts were begun in 1964 and led to a pilot operation in connection with the 1965 Bank loan to CFE; similar arrangements have since been made in connection with further Bank loans to CFE as well as two 1968 power loans to Colombia and the 1970 loan to Furnas for the Marimbondo project. Under the early Mexican schemes contracts won by firms in participating supplier countries were to be financed 66% by the Bank and 33% by supplier credits provided from the supplier countries, whereas in later schemes the sharing ratio was changed to 50/50.

5.16 In most cases larger than expected amounts of supplier credit financing have been committed by supplier countries under these schemes, and, after the Mexican pilot operation of 1965 in which contract finalization and disbursements were greatly delayed, they seem to have worked fairly effectively; amortization periods have generally been 10 years or more and interest rates reasonable. However there have been considerable administrative complications. Problems have arisen as a result of restrictions on goods that could be covered by some of the credits, multiplicity of agencies involved in each lending country, differing reporting requirements of the various countries' lending agencies, differing legal practices and standard contract provisions of the countries involved, uncertainties as to who would finance sub-contracts placed in third countries by the winning prime supplier, and late increases in the amounts of financing to be provided by particular countries as a result of delayed bidding on individual items. Moreover, by use of insurance premia and other such devices, the lending countries could sometimes make the terms of the

credits quite hard, even while abiding by their commitment to offer the most favorable terms available on similar credits. Despite improvements made in the procedures, they remain inherently rather complex.

5.17 Another indirect means to share the financing burden, which the Bank has used over a much longer period is sale of participations in its loans. Since it is normally some of the early maturities which have been sold, the terms of such financing have been quite similar to those normally provided on supplier credits. However such sales of participations, having been unrelated to procurement of equipment, do not benefit from the special arrangements made by industrialized countries to promote their exports, as do Joint Financing schemes. Although participations in one or more of the loans to every one of the companies reviewed here have been sold, the amount so raised has been quite small compared to that raised through Joint Financing. Such sales have been almost nil in 1969-70 presumably due to the fact that the Bank has been lending at an interest rate below the market rate for similar securities. Nevertheless the share of lending to the companies reviewed which has been sold in the form of participations has shown a much longer and steadier decline from the original 12% in 1949-53 ($7.0 million) to only 2% in 1964-68 ($10.8 million).

5.18 In practice the Bank has tended to move away from Joint Financing, partly because of its administrative complexity and the comparatively smaller amount of resources that can be raised in this way, towards increasing promotion of Parallel Financing. It seems likely, for instance, that the next power loan to Mexico will involve Parallel Financing rather

than Joint Financing. With either technique there appears in fact to be only a rather limited amount that the Bank can do to improve the terms of the supplied credits provided. The Bank can exhort the lenders, and it may be that the maturities of the joint loans to Colombia were somewhat longer than they would otherwise have been (since the individual orders were small). Nevertheless it appears that not all lenders adhered to the agreed minimum maturity of ten years. And, in the 1969/70 discussions about Parallel Financing for the Chivor project in Colombia, the potential lenders simply rejected the Bank's proposals, refusing to go beyond terms of 10 years amortization with 90% of the foreign exchange cost covered by the credit. It may well be that the borrowers can negotiate better terms on a bilateral basis than with the intervention of the Bank. For instance, in a semi-public forum such as the Chivor discussions, the supplying countries would be inclined to take a stand on Berne Union terms, which they seem ready to infringe in bilateral negotiations where they are in competition with one another rather than in combination. Strong central institutions in the power sector are then crucial for matching available supplier credit financing with actual requirements in different parts of the country in such a way as to get the best overall terms and prices.

CHAPTER VI: SALES PATTERNS, TARIFFS AND TARIFF STRUCTURES

6.01 This Chapter is concerned with the ultimate utilization of the electricity generated by the borrowers reviewed and the prices charged for it. From the earliest days of its lending for power development the Bank, as mentioned before, has had a strong concern about the revenues and earnings of utilities to which it lent and hence about the prices at which they sold electricity; commitments affecting tariff levels have been among the most important loan covenants. The Bank has not traditionally given so much attention to tariff structures, but it has tended to favor the principle that prices to the different classes of consumer should be related to costs to serve; and where it has noted sharp divergences between these or unnecessary complexity of tariff structures it has sometimes recommended a borrower to initiate a tariff study, if necessary with consultant help. The effectiveness of these efforts is therefore an important subject for this report. But tariff structures are additionally important here in connection with some of the more basic issues raised in the Preface regarding balance in the expansion of electricity service and between this service and others. As pointed out, these issues are hard to study outside a country context, and so special emphasis is given in the later parts of this Chapter to the case of Bogota, emerging from the study undertaken of Bank activities in Colombia.

6.02 The companies covered in this review (or, in the case of the bulk supply entities, the utilities which distribute the energy produced by them) show very varying patterns of sales. Electricity is both a

consumer good -- principally in household use, but also in public lighting -- and an intermediate good, serving commerce, industry and agriculture. Growth of Kwh sales, by category, is shown in detail in Appendix Table 6.1. Consumer classifications are not of course entirely standard among companies, but they are sufficiently comparable to warrant the broad statements which follow. Residential use ranges from a minimum of 6% of sales in the special case of VRA/ECG of Ghana and 12% in Malaysia (NEB) to a maximum of about 50% in the case of Medellin. In half the companies it lies between about 30% and 40%. In most cases the residential share of total sales has remained relatively stable over the last 10-15 years, but it has fallen sharply in two cases -- from 48% to 39% for SEGBA between 1963 and 1970 and from 52% to 33% for the Singapore PUB over the same period -- as well as in the special case of Ghana. In no case have residential sales become a significantly larger proportion of total consumption than they were in earlier years. Industry is the principal category among uses of electricity as an intermediate good -- ranging from a low of about 30% of total consumption in Buenos Aires, Bogota and Medellin to a high of about 55% for Mexico, with Ghana having an exceptional 90%. Commercial uses generally account for between 10% and 15% of total consumption, with an exceptionally high figure of nearly 30% for Malaysia. Rural or agricultural use is generally small, although it accounts for as much as 6% for Mexico as a whole.

6.03 As regards average prices, preceding chapters have shown that the companies have conformed with Bank tariff covenants in most years

and that most of them have shown improving financial performance in recent years, whether defined in terms of self-financing rate or in terms of rate of return on assets.

6.04 The structure of prices varies greatly among the companies -- even more than might be expected on the basis of differences in cost. Table 6.1[1/] gives a simple analysis of one aspect of the tariff structure -- namely, for each principal class of consumer, the average price per Kwh (i.e., total revenues for each consumer class divided by the number of Kwh supplied). The most striking difference among the companies is in the relative price of electricity to industrial and residential consumers, the two main consumer categories in the various countries. In Malaysia and Singapore industry pays, on average, one third of what a residential consumer pays for a Kwh; in Bogota industry pays 50% more than a residential consumer and in Cali nearly 20% more. Treatment of commercial consumption also varies greatly, carrying the highest prices of all major categories in Buenos Aires, Bogota, Cali and Ghana, but only about 65% or less of the residential price in Malaysia and Singapore. It is interesting to note that in absolute terms (U.S. cents equivalent) average prices vary relatively little among the companies for industrial sales, but greatly for residential sales. The price range for industry is from 1.1¢ per Kwh in Singapore to $ 2.1¢ in Buenos Aires; this range is less than it was a few years ago. On the

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1/ Comparable information is unfortunately not available for Brazil, Ethiopia or Medellin which had therefore to be omitted.

Table 6.1

AVERAGE PRICES OF ELECTRICITY TO PRINCIPAL CLASSES OF CONSUMER 1965-70 FOR SEVEN COMPANIES

	Argentina - SEGBA			Mexico - CFE[a]			Bogota - EEEB			Cali - EM Cali			Singapore - PUB			Ghana - ECG[b]			Malaysia - NEB		
	1965	1968	1970	1965	1968	1970	1965	1968	1970	1965	1968	1970	1965	1968	1970[c]	1965	1968	1970	1965	1968	1970
	(in Argentine Pesos)			(in Mexican centavos)			(in 1968 Col. centavos)			(in 1968 Col. centavos)			(in Singapore cents)			(in new pesawa)			(in Malaysian cents)		
Residential	6.37	13.38	12.50	47.4	46.9	47.0	15.3	13.4	12.4	21.5	28.0	21.1	9.68	10.61	10.60	2.7	2.5	2.5	14.53	14.13	14.18
Commercial	9.91	17.96	16.71	47.5	46.9	47.6	22.6	27.8	25.0	25.0	43.8	37.0	5.04	5.79	5.75	4.7	4.8	4.7	11.75	10.97	10.67
Industrial	5.30	9.10	7.93	20.2	21.1	20.4	19.7	21.1	19.6	20.8	29.7	24.3	3.54	3.53	3.30	3.0	1.9	1.7	5.85	5.08	4.93
Other				15.4	15.7	16.0	12.2	11.7	10.7	14.8	21.9	19.2	7.50	7.50	7.50	-	6.0	5.6	10.80	10.48	10.98
Overall	6.78	12.69	11.57	28.3	28.8	28.0	17.8	18.0	15.7	20.5	30.9	25.4	7.09	7.00	6.71	3.4	3.0	2.8	9.12	7.97	7.74
incl. taxes	7.40	14.30	12.50																		
Exchange Rate	1,686	3,500	3,779	12.5	12.5	12.5	15.9	15.9	15.9	15.9	15.9	15.9	3.0	3.0	3.0	1.02	1.02	1.02	3.0	3.0	3.0
	(in US cents)			(in US cents)			(in US cents)			(in US cents)			(in US cents)			(in US cents)			(in US cents)		
Residential	3.8	3.8	3.3	3.8	3.8	3.8	1.0	0.8	0.8	1.4	1.8	1.3	3.2	3.5	3.5	2.6	2.5	2.5	4.8	4.7	4.7
Commercial	5.9	5.1	4.4	3.8	3.8	3.8	1.4	1.7	1.6	1.6	2.8	2.3	1.7	1.9	1.9	4.6	4.7	4.6	3.9	3.7	3.6
Industrial	3.1	2.6	2.1	1.6	1.7	1.6	1.2	1.3	1.2	1.3	1.9	1.5	1.2	1.2	1.1	2.9	1.9	1.7	2.0	1.7	1.6
Other				1.2	1.2	1.3	0.8	0.7	0.7	0.9	1.4	1.2	2.5	2.5	2.5	-	5.9	5.5	3.6	3.5	3.7
Overall	4.0	3.6	3.1	2.3	2.3	2.2	1.1	1.1	1.0	1.3	1.9	1.6	2.4	2.3	2.2	3.3	2.9	2.7	3.0	2.7	2.6
incl. taxes	4.4	4.1	3.3																		
	(overall ave. = 100)			(overall ave. = 100)			(overall ave. = 100)			(overall ave. = 100)			(overall ave. = 100)			(overall ave. = 100)			(overall ave. = 100)		
Residential	95	106	106	165	165	173	91	73	80	108	95	81	133	152	159	79	86	89	160	174	181
Commercial	148	142	142	165	165	173	127	155	160	123	147	144	71	83	86	139	162	168	130	137	138
Industrial	78	72	68	70	74	73	109	118	120	100	100	94	50	52	50	88	66	61	67	63	62
Other				52	52	59	73	64	70	69	74	75	104	109	114	-	203	200	120	130	142
Overall	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
incl. tax	110	114	106																		

a/ Figures include indirect tax of 10% for all main classes of consumption in 1965; and 10% for residential, small commercial and agriculture, and 15% for large commercial and industrial in 1968 and 1970.

b/ Revenues on sales to Valco are 0.26 US cents per kwh, representing 9% of the overall average price for ECG sales.

c/ Preliminary estimate.

other hand, the range in prices to residential consumers is extreme, from 0.8¢ per Kwh in Bogota to about six times that, on the Malaysian system.

6.05 Among the companies studied the Bank has been explicitly concerned about tariff structure in three cases, mainly in the most recent years. For SEGBA and for CFE it has itself carried out some rough analyses, on marginal cost pricing principles, of the costs corresponding to the prices shown in Table 6.1, i.e., the average costs to serve the different principal classes of consumer. In SEGBA the Bank has encouraged the trend visible in Table 6.1 toward lower relative prices for industrial consumers, with a view to discouraging industrialists from installing their own power plants or continuing to use existing self-owned generators. It has encouraged SEGBA's moves to larger discounts for high-voltage supply and off-peak sales and it has pointed out that present commercial tariffs appear too high, on marginal cost pricing principles, relative to residential tariffs. In the case of Mexico, the Bank's analysis found the existing structure of tariffs much more satisfactory, but here again commercial users, even though paying the same as residential consumers rather than about 40% more as in Buenos Aires, seemed to be overcharged. Also, in Mexico, the 'other' categories of consumer -- mainly agriculture and public lighting and pumping together accounting for about 15% of all sales -- were clearly being undercharged, compared to costs. No changes have yet been made, but the Bank appears to have stimulated interest in the marginal cost pricing approach. The last of the countries studied where the Bank has

been involved to any extent in discussion of tariff structure is Singapore. In this case, under agreement with the Bank, consultants were hired to develop a simplified and rationalized tariff; the main purposes were to eliminate the separate tariffs (and consequent separate meters) for power and lighting and to introduce high voltage tariffs with separate demand charges. The consultants' recommendations are being implemented. The changes will probably not greatly alter the existing relationship between the average prices to the different broad classes of consumer, which appear to be reasonably well in balance with costs to serve.

6.06 In Colombia, as pointed out earlier, the Bank has been very concerned about the average levels of power tariffs and it has exerted considerable pressure to increase them -- directly, for the companies to which it has lent, and indirectly, through the Junta de Tarifas, for other companies. And its efforts seem to have been attended with a certain degree of success, particularly with EPM and EEEB, and potentially, and more importantly, with the other companies. Tariff structures, on the other hand, have not received so much attention. A tariff consultant was hired by EEEB in 1964, apparently at the Bank's suggestion, but his recommendations were not fully implemented. In fact EEEB's tariff structure appears to have moved over the last ten years increasingly out of line with costs to serve, mainly as a result of concentrating the main burden of tariff increases on industrial consumers and reducing the differential between day-time and evening (peak hours) energy

charges for them. This seems to have been a fairly common trend in Colombia, though not universal. The resultant distortions and cross-subsidies seem to extend beyond the subsidized prices for low-income consumers on which the Colombian authorities insisted in discussions about the Utility Tariff Board and which the Bank accepted as compatible with its financial involvement. It is likely, although by the nature of things it cannot be definitively proven without experimentation, that these distortions have led to overinvestment in power, at least in Bogota. These points will be elaborated in the following paragraphs.

6.07 The structures of EEEB's production costs and tariffs have been analyzed using social marginal cost pricing principles. Since the Bogota power system is predominantly hydroelectric the main costs are fixed costs. Estimates were made of the fixed costs (including a component for administration) involved in meeting a KW of industrial and of residential demand. To allow more adequately for the scarcity value of foreign exchange in Colombia than the official exchange rate does, a scarcity price of twice the official rate was used in analyses as well as the official rate itself. Fixed costs were estimated at about US$ 300 equivalent per KW for meeting large industrial demand, or US$ 400 equivalent allowing for the scarcity value of foreign exchange, and US$ 750 equivalent per KW for meeting residential demand, or US$ 910 equivalent allowing for the scarcity value of foreign exchange. Variable costs -- mainly fuel for the small thermal plants and the costs of reservoir storage capacity -- are quite small.

6.08 Prices currently charged for electricity in Bogota do not reflect these costs, either in structure or in distribution among the different classes of consumer. Despite the high fixed costs involved in the system, there are no charges related to consumers' peak demand or contribution to system peak demand. On the other hand, energy charges are substantially greater than variable costs of production. Industrial consumers pay a slight premium for energy consumption in the peak evening hours, but residential consumers, who are mainly responsible for the peak, pay an energy charge which is less even than the daytime rate for industry. On the average, residential consumers pay for a Kwh about two-thirds of what industrial consumers do, even though supplies to them cost about twice as much as supplies to industry. At the same time review of the revenues that would have been produced had social marginal cost prices (i.e. allowing including allowance for the scarcity exchange rate) been charged showed, as is usually the case, that there was no conflict between social marginal cost pricing and financial soundness, in the sense of generating internally a large proportion of the funds required for investment; this would not have been true, however, had no allowance been made for the scarcity value of foreign exchange.

Probably

clarify re D.

6.09 Comparison between the costs calculated and the charges levied to different classes of consumer showed that large subsidies are provided to residential consumers of all classes, generally equivalent to some 1-2% of total family income, at the expense of industrial consumers. Despite the slightly lower unit price that is charged to small residential consumers than to larger ones and the lower load factor characterizing

the consumption of the former (and hence raising costs of meeting their demand), subsidies per family were found to be of much higher absolute value for larger consumers, because the effect of their larger consumption per family more than offsets the effect of a lower subsidy per Kwh of electricity consumed. This is shown in Table 6.2. According to the estimates made, about 35% of the total subsidy goes to the wealthiest 8% of the families. Since industry meets the costs of the subsidies through paying prices substantially above costs, the impact of the tariff structure on income distribution (which it is intended to improve) is quite uncertain. Low income electricity consumers are getting some apparent direct benefit from the subsidized tariffs, but they are paying certainly for some of this subsidy, probably for most of it and possibly for somewhat more than it through higher prices for industrial goods.

6.10 What effect have these subsidies and price distortions had upon the pattern of demand for electricity? Nothing is known directly about demand elasticities, but there is tentative evidence that residential demand may be larger and more peaked than would be the case with more cost-related tariffs. In the first place, as Table 6.2 shows, the subsidies are rather large relative to the charges paid (about three times as much for the large lowest income groups and one-and-one-half times as much for the other income groups), so that demand would not have to be very price-elastic for more cost-related charges to have a significant effect on the load. In the second place, a study by the National Planning Department shows that average annual residential consumption

Table 6.2

Average Residential Electricity Bills and Estimated Subsidies by Income Groups in Bogota 1968

(all amounts in 1968 Pesos and on an annual basis; US$1.00 = 1968 Ps. 15.90)

Income Group	Percent of Families	Social Marginal Cost to Supply Per Family (Ps.)	Ave. Anl. Bill (Ps.)	Subsidy per family (Ps.)	Total Subsidy (Ps. mln)	Ave. Tariff (c/Kwh)	Ave. Cost (c/Kwh)
less than 8,000	6.7	n.a.	-	120(?)	n.a.	-	n.a.
8,000 - 16,000	21.1	170	38	132	4.9	13.8	60.0
16,000 - 24,000	19.4	438	96	342	16.4	11.0	51.0
24,000 - 32,000	17.0	576	168	408	13.3	11.4	40.0
32,000 - 44,000	12.5	798	336	462	9.2	12.0	33.0
44,000 - 60,000	9.4	1026	408	618	11.4	13.0	33.0
60,000 - 88,000	5.9	1488	612	876	11.4	13.5	33.0
88,000 - 120,000	3.6	2172	912	1260	10.3	13.8	33.0
120,000 - 160,000	1.6	2580	1092	1488	8.9	14.0	33.0
160,000 - 240,000	1.3	3396	1452	1944	5.0	14.1	33.0
more than 240,000	1.5	6066	2628	3438	11.1	14.3	33.0
Total	100.0				(101.9) a/	13.4	

a/ Figure is given in parentheses because it omits the value of the subsidies provided to the lowest income groups who are not billed at all because they have self-made, illegal connections to the network; they are not very numerous in Bogota and the total value of such subsidy is probably not very large.

(about 2,400 Kwh) is higher than in most European countries, despite Bogota's temperate climate. In the third place comparison between Bogota and Medellin (where the tariff structure includes peak demand charges, while subsidies on residential consumption, although existing, are significantly less than in Bogota) suggests that the electricity supply system may be used less efficiently in Bogota. Load factors, for instance, are consistently lower in Bogota. Measurements taken at substations indicate residential load factors of 0.63 in Medellin and 0.57 in Bogota. Since residential consumption constitutes about 28% of Bogota sales in 1970 this difference in load factor alone was equivalent to a difference in system peak load in 1970 of 10 MW, equivalent to some $8-$9 million of investment cost, using the figures cited earlier.

6.11 As regards industry it does not appear that the comparatively high prices charged by the Bogota Power Company have induced significant growth of self-generation; as shown earlier, prices for industrial supply in Bogota are still quite low on international comparison. However the lack of any demand charge and the excessive level of energy charges may be causing an inefficient pattern of demand. This is suggested by comparison of several indicators for Medellin (which has demand charges for industrial consumers also) and Bogota. These findings are not conclusive since the different industrial structures of the two cities might account for part of the differences, but there is no obvious explanation to be found on this basis. The difference in load factors by itself (0.70 at substations serving industrial consumers in Bogota compared with

0.75-0.83 in Medellin) would suggest a possible saving in Bogota, through a more rational industrial tariff structure, of the same order of magnitude as cited above for residential consumption.

6.12 From another quite different perspective -- broader and therefore harder to apply, but in many ways more important -- questions again arise as to whether the electricity supply system in the city of Bogota may not have been over-expanded. Electricity appears to be significantly more widely and amply available and with better standards of reliability than any other public service or facility. Significant relative shortages exist in water, sewerage, housing, public health, hospitals, primary and secondary education facilities, telephones and transport, though they may not be drastic except in the case of housing, public health and education. Conditions in Bogota are probably considerably better than in many other cities of Colombia, Latin America or elsewhere in developing countries. The city has managed to accommodate an exceedingly rapid population growth, at a sustained annual rate of some 7%, while increasing the proportion of population covered by many services. Nevertheless the disparities between power and other services are striking. There have been no significant shortages in the power system as a whole since 1962, when the main works under the first Bank loan were completed, and the current best estimate is that some 98% of residences are connected to the system. For water about 87% of residences have house connections, but some 60% of those connected are affected periodically by problems of low pressure and, in a small proportion of cases, discontinuous supplies. The present deficit in hospital beds is officially

estimated at a little less than half the present availability. As regards nutrition a recent survey showed that at the very least 25% of the total population fell below 50% of the official standard for 'quality' (i.e., non-carbohydrate) foods. A recent study by the Planning Department of the Municipality shows only 66% of children of primary school age enrolled in school. The existing housing deficit is officially put at 180,000 compared with 300,000 existing residences. The number of persons living three or more to a room has steadily increased over the last twenty years and is now above one-third of total population according to the 1970 survey by the National Statistical Office.

6.13 A sound tariff structure is of course only one of the factors required to ensure satisfactory balance in the expansion of services. Sound planning and accurate forecasting, emphasis on strengthening institutions in the lagging sectors and improvement of financing mechanisms are other important factors. But it does seem that the heavily distorted tariffs for power and/or the strong self-financing ability of the power company (in a context of weak fiscal and capital market mechanisms) may partly account for what appears to be an unbalanced pattern of service availability. It is possible that this seemingly unbalanced pattern does conform well to the desires of the community, expressed partly through the market mechanisms but partly also through political channels. But this is quite doubtful, and it is more questionable whether the present pattern of service availability conforms well to needs. Complaints are to be heard in Colombia that subsidized electricity has distorted demand away from things socially more important -- such as better food

seems unreasonable

for the family in a situation of widespread malnutrition. It is odd that in the capital of a country suffering such shortage of capital and of foreign exchange the one service in most ample supply by a fairly wide margin would be electricity -- the most capital- and import-intensive of all the services and facilities listed above, both in its production and in its utilization. There is some evidence to the effect that the capital equipment required to support the present consumption pattern of the poorest classes in the major cities of Colombia is higher, relative to the total amount of consumption involved, than for any other classes, and that this is mainly the result of public utility consumption, principally electricity.

other bracs too.

CHAPTER VII - CONCLUSIONS AND FINDINGS

7.01 The Bank has been much the most important single institutional source of loan financing for power expansion in the developing countries, and the sheer volume of its lending for power has been so large relative to that from other sources that it is hard to see how equivalent amounts of financing might have been provided and hence equivalent expansion accomplished had the Bank not existed. On a world-wide basis, the principal elastic types of foreign credit for developing countries over the last years have been supplier credits from industrialized countries and loans from private financial institutions. These would presumably have been the main practical alternatives to loans from the Bank, but their harder terms (mainly with respect to amortization period) and limited availability (especially for other than equipment contracts) would probably have meant that the developing countries as a whole would simply not have been able to undertake such large expansion of electricity production as has actually occurred. This would seem to apply particularly to the ten companies reviewed, production of all of which (except for EPM) has grown faster than the 11% per annum world-wide average for electrical utilities in developing countries.

7.02 Bank loans fully or nearly fully disbursed to these ten companies account for somewhat over $ 1 billion of disbursements. The projects -- mainly in generation but also in transmission and distribution -- against which these funds have been disbursed have generally been effectively executed. Some of the projects, particularly of those in Colombia,

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Or use the one on page 61 whichever you prefer.

Lastly due perhaps to the fact that local factors causing delays in project implementation may similarly delay other (industrial) development plans and therefore the growth of peak demand

This is not a case of two errors cancelling out. The delays in project construction affected the consumers projects similarly & accounted for the reduced demand - probably.

Mexico and Ethiopia, have suffered substantial overruns in construction cost and/or construction period, but most of these overruns were due to construction problems, especially of a geological nature, which seem to have been hard to foresee. The ultimate costs, even for these plants, were not generally so high as to raise doubt about the economic validity of the projects selected as the best way to meet peak load, except for one case in Colombia and possibly some in Mexico. Hence it must be concluded that the physical objectives of the Bank's loans have to a very large extent been successfully met.

7.03 The load forecasts underlying the Bank's decisions to support the projects have shown a fairly wide dispersion from the actual and some systematic tendency to overestimate future peak demand, and such attempts as have been made to improve the accuracy of these forecasts have not proven very succesful. However overestimates of future peak load have tended to be offset by underestimates of the time required to complete plant additions. As a result most of the investment programs have ultimately proved reasonably well balanced, in the sense that new capacity came on line at about the time it was required to meet the growth of demand. Reserve generating capacity has in fact normally tended to fall a little short of expectations. But there have been some exceptions to this -- particularly in Mexico in the mid-1960s and in Ethiopia and Singapore currently, where capacity is being completed ahead of the time it would be required, indicating some temporary overinvestment. The overinvestment (which is not directly financed by the Bank in the case of Singapore) appears to result primarily from faulty planning.

7.04 Most of the companies have fallen short of their financial covenants with the Bank on at least one occasion. More importantly, however, virtually all the companies have shown improving trends of financial performance, especially over the last five years. All but CVC/Chidral (and VRA, a special case) have now attained what is normally considered a reasonable rate of return (8 - 9%) on assets employed, revalued where appropriate in light of inflation; and all but CFE have been financing an increasing proportion of investment out of retained earnings. The Bank has steadily pursued, since the middle 1950s, the levying of tariffs sufficient to produce such returns, and it is quite likely that its efforts are partly reflected in the common pattern of improvement. Without Bank financing, of course, tariffs would quite likely, though not necessarily, have been even higher not only because the large economical plants that were possible to build with the assistance of Bank funds might not always have been possible in the absence of this particular source of financing, but also because a larger proportion of investment would probably have had to be financed internally. (Rates of return on revalued assets were, for instance, generally higher in PUB in Singapore, EEEB and EPM in Colombia before the Bank's involvement than after.) But once the Bank's financing was available the Bank's tariff covenants and urging of tariff increases probably did contribute to attainment of the financial performance actually reached. This improved financial performance has been a factor in enabling some of the companies, sometimes with Bank assistance, to raise increasing amounts of foreign financing from sources other than the Bank. After the

initial pilot phase the Bank's Joint Financing schemes have yielded substantial amounts of supplier credit financing, although they still suffer from administrative complexity.

7.05 The improvements of financial performance must be considered principally achievements of the companies themselves, but it would seem that a useful supporting role has been played by the Bank's financial analyses and covenants, which have themselves shown marked improvement over time. Typically the Bank's earliest power loans had financial covenants relating mainly to a maximum debt/equity ratio and to debt service coverage and therefore affecting tariffs only quite indirectly; much emphasis in negotiations preceding loan commitment was placed on securing additional equity contributions or other appropriations from Government to fill out the financial plan. But in some cases projects ran into serious problems during construction because of lack of cash flow to the borrowing enterprise, and because promised equity contributions or loans from other parties were delayed for one reason or another. Distribution works sometimes suffered. Hence more attention was soon given to company tariffs, and a tariff increase or the promise of one shortly after loan commitment were exacted before commitment of the loan. But this too proved inadequate because the promises were not always fulfilled or because inflation in the interim rendered them nugatory. Tariff covenants of various sorts began to be introduced, but they were often vague. Then, in the late 1950s, the regular practice was introduced of agreeing, before loan commitment, a certain internal self-financing rate, which was then incorporated in a side

letter to the loan agreement. Gradually this was made more precise, by specifying not only the share of new investment which was to be financed out of retained earnings but also the particular multi-year period over which the targeted share was to be accomplished. This proved cumbersome, too, for it could never be seen until the end of the period -- by which time it was anyway too late -- whether the specified self-financing rate had been accomplished or not. So, in some countries early in the 1960s and in others by the middle 1960s, the change was made to an agreed minimum annual rate of return on average net fixed assets in operation as the principal criterion of financial viability in most cases. In countries subject to severe inflation this was introduced along with some provision to ensure revaluation of assets to current prices for purposes of the computation. Covenants providing for either an agreed self-financing rate or a minimum rate of return (and mainly the latter in recent years) have been applied to all companies covered in this review except for the special case of VRA, and they have been met in most years; the effectiveness of the modern covenants is to some extent illustrated by the exceptional case of CVC, which received loans only through 1963, with rather vague tariff commitments, and which has shown comparatively poor financial performance.

7.06 Closely related to financial performance have been the institution-building objectives which have been associated with Bank lending for power from the earliest days. All ten companies have executed the Bank-financed projects successfully and reasonably efficiently, and those outside Latin America have done this while at the same time converting from considerable depen-

dence on expatriate staff at the higher levels to virtually total reliance on their own nationals. Effective project execution is important and it is not irrelevant to the role of the Bank insofar as most of the companies studied were either created or considerably reorganized within the period, with the Bank contributing to a greater or lesser extent to the formulation of their basic constitutions. Nonetheless institutional development means a good deal more than capacity to implement construction projects: effective maintenance, operation, planning, especially.

7.07 In regard to institutional development more broadly defined there is clearly one basic area where many of the companies have made considerable progress and where the Bank's impact, especially in some cases, seems to have been quite significant: system integration, whether physical or organizational, both at the local level of a particular city or urban area and, more importantly, at the national or regional level. The Bank has placed major emphasis on this, especially in the cases of Brazil, Colombia and Mexico and, to some extent, Argentina; and its efforts seem to have been attended with a good deal of success, although naturally depending importantly on the receptivity of the authorities in the country. As power systems develop, integration can contribute substantially to reducing the costs of power supply and making it more widely available. In several instances an outside institution such as the Bank, taking a national economic point of view, seems to have been able to contribute significantly to overcoming local and regional rivalries and jealousies: this is particularly clear in the case of Colombia, where, in the early 1950s, the Bank made institutional

amalgamation of distribution and generation a precondition to lending for several cities, and, in the early and middle 1960s, it took a series of actions expediting physical integration of the main power markets in the center of the country.

7.08 The Bank has also played a useful role in some instances in connection with the internal organization of individual companies and their capabilities for maintenance and operation. This has mainly been a development of the last ten years, and especially the last five years. Changes in organization and procedures have been introduced, partly at the instance of the Bank or as a result of recommendations in consultant studies suggested by the Bank. This has been of some importance in the case of CFE and of particular importance for PUB. Both have strengthened and improved efficiency considerably, and this detailed work has almost certainly contributed. Here, the Bank's assistance seems to have been effective not so much because certain basic concepts were persistently pursued -- as in the case of system integration, for example, or the principle of revaluation of assets -- but more because the Bank was responsive to changing particular needs of the companies for institutional improvement and because it helped to identify the specific problems which needed attention at any one time.

7.09 There are two companies among those reviewed which are clearly much less success stories than the others -- CVC/Chidral in Colombia and SEGBA in Argentina. They have not been able to offer a very satisfactory or adequate power supply and their unit costs are comparatively high for

the type of service they provide, mainly bulk energy in the case of CVC/Chidral and retail energy in the case of SEGBA. It is striking that, among the companies reviewed (and leaving aside the large bulk suppliers, Furnas and VRA, whose situations are rather different), these are the only two which have incomplete jurisdiction over utility power supplies in their respective service areas: SEGBA sharing responsibility mainly with CIAE, and CVC/Chidral with EMCali. Both are also involved in rather difficult political situations, which have effectively limited their autonomy. The Bank, while emphasizing the latter problem, has not been able to do much about it, despite legal commitments and, in the process, it has become embroiled in essentially internal political disputes. Very little success has been had in improving the institutional structure of power supply in Cali, CVC/Chidral's main service area; indeed, in some ways, Bank action may have added to the complications. As regards SEGBA it would appear that the Bank's most positive and effective contributions have been in work, which mainly began only in the middle 1960s, on various detailed and concrete problems relating to company efficiency, labor utilization, and working capital situation, for instance. Striking contrasts with the Bank's relatively unsuccessful handling of the case and related difficulties with successive Argentine Governments SEGBA are provided by PUB where, despite the Bank's disatisfaction with the basic organization of the company's top management, considerable advances have been made by effort at the detailed level; and also by the manner in which the Bank has successfully ~~introduced~~ supported the introduction of certain basic concepts in the power sector of Colombia even though the way these concepts were implemented did not always

conform to the Bank's preconceptions, as for instance with establishment of the Utility Tariff Board within the Planning Department instead of as an independent body.

7.10 This evaluation reveals, then, a broad background of considerable accomplishment on the part of the companies supported by the Bank and of the Bank itself. But it also reveals some areas of relative weakness and some areas where the Bank seems to have contributed less than it would try to do today -- areas that stand out the more because of the success that the Bank has had in other respects. These aspects can yield useful lessons for the future, which it was part of the purpose of this study to discover. In the Preface distinction was drawn between evaluating the extent to which specific Bank objectives in connection with each loan had been accomplished and evaluating the contribution of these objectives and their accomplishment to development. The remainder of this chapter, like the preceding part, draws upon both types of evaluation. But to the extent that there is a common theme to the lessons drawn, it is that the Bank should continue to move toward setting its objectives in the electric power field in a broader context. With some important exceptions the outlook of the past has been too often confined to the power utility itself and the approach to the utility limited to defining a certain projection into the future of the established demand for power and then trying to find the financially most efficient way to meet the projected growth. Among the means of minimizing financial requirements the Bank has emphasized international competitive bidding, contracting of loans on long terms, selection of the

cheapest alternative (in present worth terms) among system expansion projects prepared, structural changes in the power sector to enable scale economies, maintenance of cash flow to prevent delays in project works, and efficient construction and construction supervision. Each of these has been important and useful, and yet this approach has bypassed basic questions of development and of the role that electric power can play in development.

7.11 How quickly should power demand be allowed or encouraged to grow? How much effort should be devoted to expanding the coverage of the power system as opposed to improving reliability standards on the existing system? What are appropriate risks of load shedding to run under different economic conditions? How much expenditure should be allocated to electrification of villages or small towns presently unserved, and how should they be selected? How much can electricity supply induce development or improvements in efficiency in other sectors (eg. small industry and agriculture)? Under what circumstances is it ~~economically~~ worthwhile to provide power at less than cost to serve? The Bank cannot and should not attempt to dictate to its borrowers the answers to questions such as these. But they are all basic dilemmas, affecting fairly substantialy expenditures. The discussions leading to preparation of this report suggest that borrowing companies and their Governments are seeking more systematic means of resolving them and would welcome advice. This, and the experience reviewed, leads to the conclusion that the Bank could contribute substantially to development by helping to develop ~~and apply~~ appropriate methods of analysis for dealing with these questions.

7.12 The following paragraphs discuss in turn the main lessons and suggestions that seem to emerge from the study undertaken. They also present the background to each suggestion from the experience studied. It should be borne in mind that these suggestions, like all the findings of the report, are based on the sample of Bank activity reviewed and that different conclusions might have been reached had a different sample been selected, as emphasized at the outset of the report.

7.13 System Extensions: The Bank might consider an effort to develop and apply techniques for analyzing the economic validity of extending public power supply to new areas, such as marginal zones of the cities, surrounding villages or small towns or larger regions presently unserved, need to be developed. Most of the entities studied in this report have accomplished at least a small amount of such extensions, which have contributed to the large increase in the proportion of population electrified, although immigration of people into the existing service area has accounted for the bulk of new connections in most cases; the most serious evident lags in distribution extension arise in the cases of EPM and SEGBA. As regards its own financing, the Bank has sometimes been reluctant to accept extension of public lighting (marginal zones) or electrification of neighboring rural areas -- probably wisely, in view of the lack of demonstration of its economic validity. But the Bank has also directly assisted some of the borrowers in extension of service areas, including specified amounts in its loans for such purposes, most importantly and continuously in the case of CFE but also, to a much smaller extent, in various other cases,

including EELPA and on certain occasions CVC/Chidral and EEEB. But the criterion of inclusion appears to have been mainly that the work proposed was within the limits of what the company could manage with its prospective cash flow. Without an approach for analyzing the economics of distribution system extension under different conditions, it is hard to say now whether the extensions which the Bank did assist were particularly worthwhile investment or not. The Bank is already starting to work on this matter, but in view of its great importance it might be worth considering accelerating it.

7.14 Reliability Standards: It might be worthwhile for the Bank to develop and to require of utilities and their consultants more systematic procedures for rational determination of reliability standards appropriate to the conditions of different countries and regions, with a view to eventual presentation in appraisal reports of explicit justifications of standards selected, allowing for the cost of capital and foreign exchange in the country, the reliability of the load forecasts, the shape and composition of aggregate system demand, hydrological and maintenance considerations, and the economic value to major consumer classes of greater or lesser certainty of supply. Distribution and transmission standards would probably need consideration as well as generating capacity reserves. As regards generating capacity, fairly conservative reserve criteria have usually been used in the past in project planning, and reserves have often been somewhat less in practice, due to delays in plant completion. But there are clear signs of overinvestment in generating capacity on several

of the systems studied -- Mexico in the middle 1960s, and Singapore(not directly financed by the Bank) and Ethiopia currently; and there are some signs of excessive distribution standards in Singapore and Bogota. A systematic study of the matter would seem to be useful also for the complex case of Malaysia. Since power supply is so capital intensive, the question of appropriate standards seems particularly important. Again this problem is difficult, and methodological development will be required to enable rational solutions, but some European utilities have made progress in the field. Plans have been made to ~~introduce a provision for work~~ initiate a research project on this subject ~~in the 1973/74 research program of the Public Utilities Projects Department~~.

7.15 Urban Context: It might be useful for appraisal reports and sector reports about electric power to give a little consideration to power, predominantly an urban service, in its urban context and to treat explicitly the question of balance between power and other services and facilities, in terms of the quantity and quality of their supply. In the single case that it was possible to study from this point of view -- Bogota -- there did seem to be some imbalance between the quality and quantity of electric service available and of other services and facilities, and it was doubtful whether this imbalance corresponded to desires or needs. Other questions also arose in an urban context. For instance, it was found in Bogota that a fairly significant amount of investment, not all financed by the Power Company, was going into development of distribution networks in residential areas well ahead of the time that such areas might be heavily

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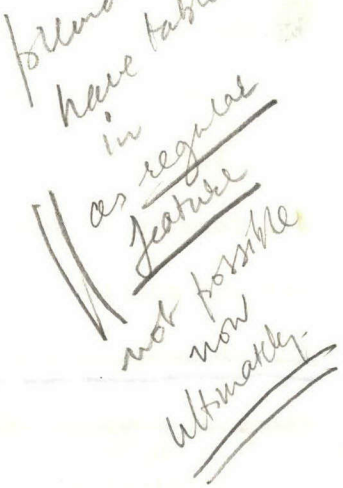
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7.16 Tariff Structures: In the last few years more attention has begun to be given to electricity tariff structures and it would seem useful to extend this work, systematically examining the relationship between cost and tariff structures. Analysis of this relationship in Bogota indicated that it was quite likely that excessive investment in power had resulted and it seemed clear that subsidies were not in fact going entirely in the direction ~~which the Bank had been prepared to accept~~. It might be considered to make simple tables analyzing the relationship between approximate social marginal costs of power supply and the tariff structure regular features of project appraisal reports. Then it would be possible to justify explicitly deviations from social marginal costs in terms of (a) effective means of taxation of inelastic consumers, (b) subsidies warranted to induce consumption of electricity because of resultant economic benefits or (c) price distortions elsewhere in the economy.

7.17 Central Power Institutions: The history reviewed suggests that there is much to be said, where circumstances in a country permit, for the Bank selecting as an explicit objective for itself the development of a

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(possibly or regional institutions in exceptionally large countries).

strong central institution in the power sector, through which it might later channel any lending in a sector program manner, as has become the habit with CFE. It is not so much potential economies in the Bank's staff time that seem to make this advantageous as the fact that existence of such an institution appears essential in order to develop (a) sound and well-coordinated investment planning, (b) balanced plan implementation (among regions) and (c) effective and economical use of the other sources of foreign financing such as supplier credits, that may become more important in the future. In retrospect, it seems unfortunate, on these various counts, that the Bank did not succeed in its effort in the early 1960s with Electraguas(ICEL), the national power holding company in Colombia, but perhaps the new institution, ISA, which the Bank has helped to create in the meantime, will come eventually to fill this gap.

7.18 Unified Jurisdiction of Local Power Companies: The experience reviewed suggests that the Bank has made a major contribution, in dealing with power companies responsible for an urban region, when it has insisted on unified control of generation, transmission and distribution. The diverse experiences of Buenos Aires, Cali, Cartagena, Manizales and Bucaramanga all tend to support this thesis: in some the Bank insisted on full unification in others on partial unification and in others on no unification.

7.19 Utility Efficiency Indicators: Since most power utilities are (and need to be) in a monopoly position and their profitability is assured by minimum rate of return covenants with the Bank, if observed, there may

be need to give more systematic and thorough attention than seems to have been the case in the past to other technical and financial indicators of efficiency. The protection afforded by minimum rate of return covenants will be partially offset by political pressure against tariff increases, but possibly not sufficiently -- especially in an inflationary situation. Some preliminary indication of trends in efficiency may be obtained from trends in cost per unit of energy sold, and here the various utilities studied display contrasts. In general terms, and over the long term (10 - 15 years) the utilities reviewed in Latin America have shown stable or even increasing unit costs (in real terms), despite very large increases in system sales (five- or six-fold) which should have enabled economies, while those in other areas have generally shown decreases, sometimes very substantial, as in the case of PUB in Singapore and at a lesser extent, NEB. In the most recent years average unit costs of SEGBA and the Mexican power sector have shown a slight downward trend as a result of special efforts to improve efficiency, but EELPA's average costs have shown an upward trend, with system losses (as percent of generation) and sales/employee levelling off since 1964, when the Bank's first loan was made. It might be worth systematically including in appraisal reports simple standard summary tables of efficiency indicators, showing trends for the past ten years; small cost analyses could be presented if there were abnormal features; and, if there were serious problems, performance targets could be agreed in loan negotiations (along with specific steps or studies to attain them) and regularly checked by project supervision missions. The ~~Public Utilities~~ Bank

Projects Department has recognized the need for greater use of efficiency indicators for some time and, since the subject is difficult to come to grips with satisfactorily, it plans to include appropriate provision in its research program for 1973/74.

7.20 Utility and National Power Planning Units: The experience reviewed indicates that it is important to give attention in sector missions, appraisal missions and institution-building efforts to the adequacy of planning units as well as of plans and that attention to this in the past may sometimes have been rather uneven. One of the advantages of the sector lending to Mexico was that this subject received considerable attention there, and some attention was given in Medellin, Buenos Aires and Brazil as well; on the other hand it seems to have received inadequate attention throughout the Bank's long association with the Cali power institutions and also in the early years of the Bank's work with PUB in Singapore. Had the matter received more study at the appropriate times the persistent power shortages and other problems in Cali and the current excessive investment in the Singapore power network might have been reduced. If the Bank were to be able to do more work on power planning problems such as those mentioned earlier -- the economics of system extension and system reliability -- then this would of course help too.

7.21 Training: The evaluation underlines the importance of giving systematic consideration in project appraisal and reviews of consultant terms of reference to training and opportunities for promoting and assisting it. Adequate training programs do depend heavily, it seems, on the

enthusiasm of the utility's management. The evidence suggests that more attention has been given to training by those companies which were stronger (NEB, Furnas, for example) and less in those which were weaker and more in need (PUB, EELPA and some of the Colombian companies). However training received rather continuous attention in the case of CFE in the late 1950s and early 1960s and in VRA, and the deficiency with respect to the other companies mentioned seems to have been filled in more recent years.

7.22 Institution Building: The various cases reviewed seem suggestive of certain lessons about what might be called the techniques of assistance in institutional development, or the means for securing institutional changes sought by the Bank. Various of the points made earlier, about the need for persistence in support of major concepts, for leaving essentially political frameworks to borrowers, and for detailed assistance with internal institutional problems and efficiency, obviously relate. There seems little question but that where the Bank has achieved much in institutional development as, for instance, in Colombia, Brazil, Mexico and Singapore, continuity of the relationship between the Bank and the borrower has been important, whether the Bank's principal effort was on introduction of a few major concepts (Colombia and Brazil), detailed institutional improvement (Singapore) or both (Mexico). All the evidence naturally shows the importance, too, of precise identification of problems and precision in financial targets and covenants -- the latter well illustrated by the history of the Bank's main financial covenants briefly recounted earlier. Precision in terms of reference for consultant with special attention to

their training responsibilities, is another need underlined by the experience studied; it is noteworthy that most of the unsatisfactory experiences encountered with consultants in the cases studied have been with firms hired without Bank review of terms of reference. Finally there is the difficult question of how long it is worthwhile withholding a loan, in the attempt to force an institutional change or changes. On the whole the experience reviewed suggests that in some instances loans may have been withheld more than was really worthwhile -- for example, in the cases of EEEB and EPM in the late 1950s, awaiting changes in their constitutional status that now seem of doubtful validity, but resulting in quite serious shortages of power in the early 1960s; in the case of PUB in 1964-66, awaiting changes in the top management situation, and diverting Government funds from other uses; in the case of CFE in 1959, in the attempt to force tariff increases that were needed but were not introduced, resort being had instead to supplier credits and other short-term foreign borrowing, which created a recurrent debt-service problem for later years; in the case of SEGBA in 1966-67, when several issues remained under discussion but lack of funds apparently resulted in sharp reduction in the distribution expansion program, in turn worsening the quality and quantity of the company's service and hence reducing earnings. On the other hand it is quite clear that there have been occasions when refusal to lend until certain conditions had been met played a vitally useful role, for instance in expediting creation of ISA in Colombia and in convincing the Argentine Government to apply the Concession Agreement with SEGBA (1964-65).

7.23 Financial Recording and Planning: The accounting systems of all the companies reviewed seem to have improved over the years and in many cases the Bank has stimulated and assisted this development, but there appear to be some weaknesses remaining which may need additional emphasis. Classification of assets, by function and by lives, seems still rather weak in the Colombian companies, especially CVC/Chidral, and this makes sound financial planning more difficult than it would otherwise be. Recording of financial information, both on fixed assets and on financial obligations, still appears weak in the case of CFE and may be partly responsible for the poor financial planning and under-forecasting of debt-service obligations which has added to cash problem at times.

7.24 Construction Cost Estimates: Sometimes in recent years the Bank has employed specialized consultant firms to check project construction cost estimates, especially for major civil engineering works. The importance of this, and possibly the need to make it even more usual practice, seems to be underlined by the considerable cost overruns which have occurred on many of the projects reviewed in Colombia and Mexico, and in particular by the experience of Calima for which the cost overrun was so great that, in combination with other factors of lesser importance, it raises some doubt now as to whether the project was the most economical means of meeting system load growth.

7.25 Shadow Prices: The importance of adjusting construction cost estimates and some other costs (eg. fuel) for purposes of economic analyses of project validity, as the Bank has increasingly come to do under

appropriate circumstances, is also emphasized by one or two of the cases studied here. Even though 1961/62 was a time when the Bank was increasingly concerned about the overevaluation of the Colombian Peso, it does not seem that this was taken into account in preparing the recommendation to EEEB to replace the Canoas hydroelectric project in its construction program with the Zipaquira 2 thermal unit, which in retrospect appears to have had even greater economic disadvantages than thought at the time. Sometimes it is suggested that shadow prices are not applicable in a market economy because they are not the effective prices which actually confront decision-makers, contractors, etc.; this would not seem to be relevant for a decision of the type described, entirely in the hands of a major public sector institution, which can moreover reflect shadow prices in its tariffs.

7.26 Fiscal Contribution of Power Companies: Examining the power company from the point of view of the contribution it can make to development, it might be useful to include in appraisal reports regularly a paragraph or two about fiscal aspects of the company's operations. The companies covered show great variation in the extent of their contributions to Government revenues, Furnas and SEGBA already making substantial contribution, for instance, NEB and PUB beginning to make some, VRA about to start, and CFE and the Colombian companies not presently making any. Insofar as the Bank's urging of increased cash flow by higher tariffs seems generally to have been rather successful, there may be increasing need to look at this fiscal aspect in the interests of sound resource allocation.

none of these companies appears to have followed an explicit policy of charging tariffs above the cost of supply to inelastic consumers — an efficient means of taxation.

The Bank appears to have made a useful suggestion to the Ethiopian Government that greater contribution to general revenues should be obtained from EELPA. ~~The point also relates with others made before. As mentioned, charging inelastic consumers tariffs above cost may be an efficient means of taxation.~~ Most of the companies reviewed do not pay duties on their equipment imports and there is evidence in some cases that this may distort procurement patterns, especially where, as is sometimes the case, local manufacturers do have to pay substantial duties on imported materials and parts; it may also distort tariff structures, especially where import taxes are an important element in the rationing of foreign exchange supply. These fiscal and allocative effects of tariffs merit more systematic attention in future appraisals.

7.27 Sales of Participations in Bank Loans: Since participations in Bank loans (the earlier maturities) typically seem to have terms that are effectively fairly close to those of supplier credits (and could of course be made closer in respect of amortization period), ~~it might be worth considering the possibility of using~~ such participations could constitute as a means of Joint Financing; for example, export credit agencies in supplier countries ~~might~~ could undertake to buy participations in an amount related to contracts won by their nationals. Sales of participations in loans to the companies reviewed here have steadily fallen (as a percentage of loan volume) over the last twenty years, and Joint Financing arrangements, although they have raised substantial sums, have remained administratively rather complex. The procedure suggested ~~might tap a new source of finance for sale of participations and~~ would eliminate many of the complexities of present Joint Financing arrangements if export credit agencies were prepared to forego attaching their funds to identifiable export goods.

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7.28 World Trends in Power Financing: As an additional perspective on the role that it should play in power the Bank might want to consider deepening the review of capital requirements for power supply in the developing countries as a whole attempted in this report and developing overall figures regarding prospects for financing from other sources. For, quite apart from the contribution it can make to institutional development or to helping realize previously neglected development potentials in power, another reason for Bank activity in the power field will probably remain the better financing terms that it can offer and the developing countries' need for such terms, from a debt burden point of view. With the likely rapid growth in power requirements in the developing countries, the desire of the Bank to diversify its lending increasingly and the growing availability of financing on good terms from relatively new producers of heavy electrical equipment (such as the Eastern European countries) as well as other factors, a more systematic review of these worldwide trends might be useful as a complement to country and sector considerations in planning power lending.

7.29 Follow-up Evaluation Studies: Two matters emerging from the present study would seem to merit consideration for further, more thorough evaluation work. First are some aspects of equipment procurement. It has not been possible to deal with procurement questions in any depth in this report. The Bank has in fact covered substantial amounts of local procurement out of all its loans to CFE and to SEGBA. It would seem worthwhile to have an evaluation study done focussing specifically on the con-

tribution that the Bank has made to growth of efficient local electrical equipment industry through such financing. Analysis of the Bank's experience to date in this field might be useful for future policy. Second, a more thorough study than has been possible here might be worthwhile on the economic validity of the Volta River Project in Ghana, taking account of the arrangements with the aluminum company, the greater than expected growth of non-aluminum consumption of electricity, the health hazards and severe resettlement problems resulting from the project. In several respects this project seems to have turned out better than expected and in a few worse, but it was not possible to reach any definitive conclusions in the current review.

IBRD/IDA Disbursements through 12/31/71

Total to country (US$ bln)

Power as % Total

AFRICA: ELECTRICAL GENERATING CAPACITY, GENERATION AND IBRD/IDA POWER FINANCING OF DEVELOPING COUNTRIES 1950-70

	1968 Pop'n. (mlns)	1968 GNP per cap. (US$)	Installed Capacity (MW) 1950	1960	1965	1968	IBRD Financed (MW)	Electricity Generation (Gwh) 1950	1960	1965	1968	Growth Rate of Generation 1950-68	1968 Generation per capita (kwh)	1968 Installed Capacity per capita (watts)	IBRD/IDA Financing Through 12/31/70: Capacity Installed by end 1970 (MW)	Disbursements (US$ mln)	Capacity Committed by end 1970 (MW)	Commitments (US$ mln)	Total Program (US$ mln)	No. of Loans	Total IBRD/IDA Disbursements through 12/31/71 (US$ mln)	Power as % of Total
Nigeria	62.7	70	(40)	173	358	485	-	117	528	1177	1105		17.6	7.7	320	122.8	320	126.5	287.7	3	203.5	60.3
Public Supply			23	170	354	480	-	111	512	1161	1090	13.5	17.4	7.7	320		320					
Hydro			-	20	21	29	-	52	91	132	126				320		320					
Egypt	31.7	170	(500)	1167	1469	2725	-	880	2639	5473	6735		212.5	86.0	-	-	-	-	-	-	56.5	-
Public Supply			(220)	944	1176	2486	-	(550)	1991	4574	5975	14.2	188.5	78.4	-		-					
Hydro			n.a.	350	351	1051	-	n.a.	260	1774	2951				-		-					
Ethiopia	24.2	70	n.a.	95	(250)	(330)	32	17	102	246	361		14.9	(13.6)	32	27.3	164	46.6	68.7	2	89.1	30.6
Public Supply			13	84	104	136	32	17	83	226	318	17.7	13.1	5.6	32		164					
Hydro			1	64	75	92	32	2	47	146	233				32		164					
Zaire [Congo (Zayre)]	16.7	90	(260)	(660)	900	n.a.	-	620	(2550)	2686	2756		165.0	-	-	-	-	-	-	-	92.3	-
Public Supply			(18)	(65)	n.a.	(185)	-	(40)	(200)	460	553	15.7	33.1	(222.3)	-		-					
Hydro			(247)	(580)	810	n.a.	-	588	(2450)	2573	2607				-		-					
Sudan	14.8	100	n.a.	n.a.	(76)	124	-	n.a.	n.a.	(174)	(334)		(22.6)	8.4	15	11.5	105	24.0	41.7	1	115.6	9.9
Public Supply			9	44	76	97	-	20	74	174	334	16.9	22.6	6.6	15		105					
Hydro			-	-	n.a.	n.a.	-	-	-	n.a.	n.a.				-		90					
Morocco	14.6	190	n.a.	n.a.	n.a.	n.a.	-	n.a.	n.a.	n.a.	n.a.		-	-	-	-	-	-	-	-	72.7	-
Public Supply			151	366	392	461	-	481	1012	1362	1742	7.4	119.3	31.6	-		-					
Hydro			98	290	302	294	-	252	931	1213	1104				-		-					
Algeria	12.9	220	n.a.	n.a.	n.a.	n.a.	135	n.a.	n.a.	1348	1590		123.3	-	135	10.0	135	10.0	127.0	1	80.5	12.4
Public Supply			329	439	500	639	135	587	1325	1119	1305	4.6	101.2	49.5	135		135					
Hydro			92	186	228	340	114	125	348	400	563				114		114					
Tanzania	12.5	80	n.a.	n.a.	n.a.	130	-	n.a.	n.a.	(227)	(315)		25.2	10.4	21	3.7	136	35.2	67.6	2	62.9	5.8
Public Supply			23	44	71	102	-	43	166	227	315	11.7	25.2	8.2	21		136					
Hydro			14	20	41	41	-	27	94	178	n.a.				-		100					
Kenya	10.2	130	n.a.	n.a.	n.a.	n.a.	-	n.a.	n.a.	(328)	(402)		(39.4)	-	-	-	-	-	-	-	67.9	-
Public Supply			27	82	100	153	-	89	222	328	402	8.8	39.4	15.0	-		-					
Hydro			7	26	28	66	-	n.a.	147	198	249				-		-					
Ghana	8.4	170	61	103	410	631	512	197	374	528	2589		308.2	75.1	512	56.4	512	63.0	219.3	3	57.7	97.7
Public Supply			8	42	336	599	512	27	149	337	2560	28.9	304.8	71.3	512		512					
Hydro			-	-	256	512	512	-	-	107	2524				512		512					
Uganda	8.1	110	n.a.	n.a.	152	(175)	-	n.a.	n.a.	n.a.	n.a.		-	(21.6)	-	8.4	-	8.4	16.1	1	46.0	18.3
Public Supply			(7)	132	134	157	-	16	396	572	731	23.7	90.2	19.4	-		-					
Hydro			n.a.	121	122	150	-	-	396	572	729				-		-					
Malagasy	6.5	100	18	66	82	n.a.	-	(31)	107	152	n.a.		-	-	-	-	-	-	-	-	11.4	-
Public Supply			12	42	48	(62)	-	28	77	107	140	9.4	21.5	(9.5)	-		-					
Hydro			9	24	29	n.a.	-	24	61	84	102				-		-					
Cameroon	5.6	140	(10)	160	170	179	-	(20)	911	1100	1016		181.4	32.0	-	-	-	-	-	-	12.3	-
Public Supply			(5)	(15)	(20)	(20)	-	(15)	50	76	77	9.5	13.7	(3.6)	-		-					
Hydro			(5)	152	152	152	-	(10)	898	1069	979				-		-					
Upper Volta	5.2	50	(1)	(4)	(10)	(11)	-	(1)	(8)	(20)	(23)		(4.4)	(2.1)	-	-	-	-	-	-	-	-
Public Supply			(1)	4	10	11	-	(1)	8	20	23	19.0	4.4	2.1	-		-					
Hydro			-	-	-	-	-	-	-	-	-				-		-					
Mali	4.8	90	n.a.	n.a.	n.a.	n.a.	-	n.a.	n.a.	n.a.	n.a.		-	-	-	-	-	-	-	-	6.0	-
Public Supply			(1)	(5)	(10)	(10)	-	(3)	15	28	35	14.6	7.3	2.1	-		-					
Hydro			n.a.	n.a.	n.a.	n.a.	-	n.a.	n.a.	n.a.	n.a.				-		-					
Tunisia	4.7	220	(75)	n.a.	213	262	-	(162)	316	494	678		144.3	55.7	-	-	-	-	-	-	44.8	-
Public Supply			66	115	163	219	-	141	274	369	546	7.8	116.2	46.6	-		-					
Hydro			-	26	28	32	-	-	47	42	33				-		-					
Malawi	4.3	50	1	(10)	20	49	-	2	(28)	n.a.	n.a.		-	11.4	-	0.3	19	5.3	12.4	1	16.9	1.7
Public Supply			1	10	14	39	-	2	28	52	102	24.4	23.7	9.1	-		19					
Hydro			1	1	1	25	-	1	3	4	96				-		16					
Ivory Coast	4.1	260	n.a.	n.a.	n.a.	n.a.	-	(5)	(67)	(220)	(372)		(90.7)	-	-	-	-	-	-	-	4.5	-
Public Supply			(2)	(20)	(55)	(85)	-	(5)	67	220	372	27.2	90.7	(20.7)	-		-					
Hydro			n.a.	n.a.	n.a.	n.a.	-	(-)	59	141	257				-		-					

Repeat Colum Headings ?

Zambia		4.1	220	133	284	581	531	352	832	1800	3200	3300		804.9	129.5	352	43.9	952	83.9	168.4	3	91.0	48.2
	Public Supply			5	46	431	431	352	8	322	2900	3000	39.0	731.7	105.1	352		952					
	Hydro			35	41	420	420	352	153	n.a.	n.a.	n.a.				352		952					
Niger		3.8	70	n.a.	(3)	(6)	n.a.	-	(1)	(8)	(16)	(28)		(7.4)	-	-	-	-	-	-	-	4.2	-
	Public Supply			(1)	3	6	(11)	-	(1)	8	16	28	20.5	7.4	(3.0)	-		-					
	Hydro			n.a.	-	-	n.a.	-	-	-	-	-				-		-					
Guinea		3.8	90	n.a.	n.a.	n.a.	n.a.	-	(5)	102	174	202		53.2	-	-	-	-	-	-	-	20.4	-
	Public Supply			(2)	(8)	(10)	(12)	-	(3)	(20)	35	40	15.5	10.5	3.2	-		-					
	Hydro			n.a.	n.a.	n.a.	n.a.	-	n.a.	n.a.	n.a.	n.a.				-		-					
Senegal		3.7	170	n.a.	n.a.	(71)	(95)	-	(30)	(127)	(204)	(248)		(67.0)	(25.7)	-	-	-	-	-	-	11.1	-
	Public Supply			(12)	56	71	95	-	30	127	204	248	12.5	67.0	25.7	-		-					
	Hydro			-	-	-	-	-	-	-	-	-				-		-					
Chad		3.5	60	n.a.	n.a.	n.a.	n.a.	-	n.a.	n.a.	n.a.	n.a.		-	-	-	-	-	-	-	-	0.3	-
	Public Supply			(1)	3	10	(15)	-	(1)	8	18	31	21.0	8.9	(4.3)	-		-					
	Hydro			n.a.	-	-	n.a.	-	-	-	-	-				-		-					
Burundi		3.4	50	(1)	7	n.a.	n.a.	-	(1)	8	14	17	inf.	5.0	-	-	-	-	-	-	-	1.1	-
	Public Supply			-	3	4	5	-	-	8	14	17		5.0	1.5	-		-					
	Hydro			n.a.	1	-	-	-	(1)	1	n.a.	n.a.				-		-					
Rwanda		3.4	70	(2)	9	23	n.a.	-	(2)	11	45	69		20.3	-	-	-	-	-	-	-	0.1	-
	Public Supply			(1)	9	23	(35)	-	(1)	11	45	69	26.5	20.3	10.3	-		-					
	Hydro			n.a.	7	21	n.a.	-	(2)	5	43	n.a.				-		-					
Somalia		2.7	60	4	7	n.a.	n.a.	-	5	9	n.a.	n.a.		-	-	-	-	-	-	-	-	7.1	-
	Public Supply			3	6	4	6	-	3	8	12	16	9.7	5.9	2.2	-		-					
	Hydro			-	-	-	-	-	-	-	-	-				-		-					
Dahomey		2.6	80	(2)	6	10	n.a.	-	n.a.	n.a.	n.a.	n.a.		-	-	-	-	-	-	-	-	0.4	-
	Public Supply			(2)	6	10	(12)	-	(2)	10	22	26	15.3	10.0	(4.6)	-		-					
	Hydro			n.a.	n.a.	n.a.	n.a.	-	n.a.	n.a.	n.a.	n.a.				-		-					
Sierra Leone		2.5	150	9	21	n.a.	n.a.	13	n.a.	41	106	144		57.6	-	25	6.9	25	7.7	9.8	2	6.9	100.0
	Public Supply			4	12	27	31	13	6	24	64	79	15.4	31.6	12.4	25		25					
	Hydro			-	-	n.a.	n.a.	-	-	-	-	-				-		-					
Libya		1.8	1020	n.a.	n.a.	n.a.	n.a.	-	n.a.	n.a.	n.a.	n.a.		-	-	-	-	-	-	-	-	-	-
	Public Supply			9	33	58	169	-	39	105	152	274	16.2	152.2	93.9	-		-					
	Hydro			-	-	-	-	-	-	-	-	-				-		-					
Togo		1.8	100	1	n.a.	18	21	-	1	(15)	34	49		27.2	11.7	-	-	-	-	-	-	1.9	-
	Public Supply			1	2	5	8	-	1	5	13	19	17.8	10.6	4.4	-		-					
	Hydro			-	n.a.	2	2	-	-	-	3	5				-		-					
Central African Republic		1.5	120	(1)	(6)	(8)	n.a.	-	(1)	(8)	(21)	(35)		(23.3)	-	-	-	-	-	-	-	0.2	-
	Public Supply			(1)	6	8	(14)	-	1	8	21	35	22.0	23.3	(9.3)	-		-					
	Hydro			(1)	4	7	n.a.	-	1	8	21	35				-		-					
Liberia		1.1	210	(4)	21	116	152	-	12	85	278	573		520.9	138.2	-	0.1	47	7.4	9.7	1	7.4	1.3
	Public Supply			2	8	22	47	-	4	28	105	140	22.0	127.3	42.7	-		47					
	Hydro			2	3	4	38	-	7	16	17	146				-		17					
Mauritania		1.1	180	n.a.	n.a.	n.a.	n.a.	-	n.a.	n.a.	n.a.	n.a.				-	-	-	-	-	-	4.9	-
	Public Supply			(1)	(2)	(15)	25	-	(1)	(3)	30	44	23.3	4.0	22.7	-		-					
	Hydro			n.a.	n.a.	-	-	-	-	n.a.	-	-		-	-	-		-					
TOTAL		292.8						1044								1412	291.3	2415	418.0	1028.4	20	1197.6	24.3
	Public Supply			961	2826		6857	1044	2277	7344		20686	13.0			1412		2415					
	Hydro							1010								1330		2285					

CENTRAL AND SOUTH

AMERICA: ELECTRICAL GENERATING CAPACITY, GENERATION AND IBRD/IDA POWER FINANCING IN DEVELOPING COUNTRIES 1950-70

	1968 Pop'n. (mlns)	1968 GNP per cap. (US$)	Installed Capacity (MW) 1950	1960	1965	1968	IBRD Financed (MW)	Electricity Generation (Gwh) 1950	1960	1965	1968	Growth Rate of Generation 1950-68	1968 Generation per capita (kwh)	1968 Installed Capacity per capita (watts)	IBRD/IDA Financing Through 12/31/70: Capacity Installed by end 1970 (MW)	Disbursements (US$ mln)	Capacity Committed by end 1970 (MW)	Commitments (US$ mln)	Total Program (US$ mln)	No. of Loans	Total IBRD/IDA Disbursements through 12/31/71 (US$ mln)	Power as % of Total
Brazil	88.2	250	1883	4800	7411	8555	2181	8208	22865	30128	38181		432.9	97.0	3681	363.3	6141	622.1	1702.4	20	422.3	86.0
Public Supply			1797	3783	6125	7446	2181	(7500)	18514	26250	34437	8.8	390.4	84.4	3681		6141					
Hydro			1536	3642	5391	6183	1189	(7400)	18384	25515	30550				2689		5149					
Mexico	47.6	530	1235	3048	5393	6071	3739	4423	10813	17245	22781		478.6	127.5	4760	485.1	8327	589.8	1936.4	10	781.0	62.1
Public Supply			1011	2321	4175	4864	3739	3549	8563	14208	19444	9.9	408.5	102.2	4760		8327					
Hydro			607	1357	2214	2613	1928	1950	5174	8864	12642				2648		3821					
Argentina	23.6	820	(1600)	3474	5432	5820	720	5303	10459	15383	17952		760.7	246.6	970	176.1	1660	292.0	1104.0	4	208.0	84.6
Public Supply			1390	2287	3754	4118	720	4430	7864	11149	13506	6.4	572.3	174.5	970		1660					
Hydro			43	340	367	545	-	(150)	927	1225	1498				-		600					
Colombia	20.0	310	270	911	1546	2100	916	1207	3750	5824	7000		350.0	105.0	1066	220.5	1880	294.1	515.8	17	494.9	44.5
Public Supply			240	670	1245	1689	916	987	3105	5034	6522	11.1	326.1	84.5	1066		1880					
Hydro			(150)	505	843	1164	768	n.a.	2587	3900	4770				918		1732					
Peru	12.8	380	(250)	841	1148	1672	240	(900)	2656	3839	5008		391.3	130.6	240	53.5	360	66.5	178.7	4	185.5	28.8
Public Supply			(100)	348	618	869	240	(400)	1209	1775	2349	10.3	183.5	67.9	240		360					
Hydro			(160)	515	680	934	240	n.a.	1730	2625	n.a.				240		360					
Venezuela	9.7	950	n.a.	1250	2109	2448	350	n.a.	4651	8245	10814		1114.8	252.4	350	114.3	525	145.0	241.5	4	242.8	47.0
Public Supply			(160)	(850)	1599	1928	350	(700)	2972	4638	6694	13.4	690.1	198.8	350		525					
Hydro			n.a.	(130)	n.a.	n.a.	350	n.a.	(650)	1369	2748				350		525					
Chile	9.4	480	717	1142	1454	1720	544	2903	4592	6131	6918		736.0	184.9	614	97.7	1014	125.4	300.0	5	199.2	49.0
Public Supply			(350)	599	887	1090	544	1520	2342	3597	4348	6.0	467.5	117.2	614		1014					
Hydro			350	594	710	857	524	n.a.	2977	3954	3565				594		994					
Ecuador	5.7	220	(40)	118	182	239	26	118	387	572	759		133.2	41.9	26	10.0	26	10.0	16.0	2	62.3	16.0
Public Supply			(5)	(80)	142	197	26	13	289	498	662	24.5	116.1	34.6	26		26					
Hydro			(20)	40	67	95	20	n.a.	175	249	330				20		20					
Guatemala	4.9	320	(30)	73	118	144	-	(90)	281	449	589		120.2	29.4	20	13.7	93	22.0	32.4	2	32.0	42.8
Public Supply			(18)	60	102	129	-	70	246	402	542	12.0	110.6	26.3	20		93					
Hydro			(20)	31	28	43	-	(60)	126	98	159				-		40					
Bolivia	4.7	150	(75)	147	164	221	38	n.a.	n.a.	541	698		148.5	47.0	38	15.7	72	22.4	33.7	3	17.8	88.2
Public Supply			(45)	(80)	89	140	38	174	319	351	475	5.7	101.1	29.8	38		72					
Hydro			(50)	(90)	93	144	38	n.a.	(270)	426	580				38		72					
Haiti	4.7	70	(20)	28	27	35	-	n.a.	60	110	(120)		(25.5)	7.4	-	-	-	-	-	-	-	-
Public Supply			(5)	(18)	(20)	(20)	-	(15)	(40)	78	69	8.9	14.7	(4.3)	-		-					
Hydro			-	n.a.	n.a.	n.a.	-	n.a.	n.a.	n.a.	n.a.				-		-					
Dominican Republic	4.0	290	n.a.	n.a.	178	273	-	(120)	350	500	753		188.2	68.2	-	-	-	-	-	-	-	-
Public Supply			(20)	(70)	107	203	-	79	255	380	693	12.8	173.2	50.7	-		-					
Hydro			n.a.	n.a.	8	16	-	-	58	55	54				-		-					
El Salvador	3.3	280	(27)	66	115	164	108	(55)	249	418	582		176.4	49.7	108	24.6	108	25.4	39.9	4	59.4	41.4
Public Supply			19	66	103	148	108	(50)	249	400	554	14.3	167.9	44.8	108		108					
Hydro			9	56	87	109	78	(25)	236	370	416				78		78					
Uruguay	2.8	520	(200)	(406)	483	510	226	616	(1244)	1744	(1925)		687.5	182.1	226	57.4	351	75.4	240.9	4	100.7	57.0
Public Supply			200	406	445	469	226	572	1244	1649	1874	6.8	669.3	167.5	226		351					
Hydro			(100)	236	225	236	108	527	676	610	1141				108		108					
Honduras	2.4	260	(15)	32	73	91	30	51	88	175	268		111.7	37.9	30	19.1	85	32.8	49.1	4	54.4	35.1
Public Supply			(6)	24	59	73	30	(15)	66	138	235	16.5	97.9	30.4	30		85					
Hydro			(1)	5	32	n.a.	27	2	20	104	164				27		67					

Column Headings

Paraguay	2.2	230	33	30	53	108	-	44	96	135	179		81.4	49.1	-	-	-	-	-	-	29.3	-
Public Supply			21	28	34	86	-	30	80	93	123	8.2	55.9	39.1	-		-					
Hydro			-	-	n.a.	45	-	-	-	n.a.	6				-		-					
Jamaica	1.9	460	21	150	196	257	99	n.a.	514	799	1061		558.4	135.3	99	20.7	99	22.0	41.1	1	30.7	67.4
Public Supply			(21)	68	113	157	99	76	262	510	674	12.9	354.7	82.6	99		99					
Hydro			9	22	22	20	-	(46)	126	133	118				-		-					
Nicaragua	1.8	370	18	75	135	157	83	80	183	311	484		268.9	87.2	83	34.5	173	42.4	62.4	7	51.1	67.5
Public Supply			5	48	101	117	83	24	109	234	392	16.8	217.8	65.0	83		173					
Hydro			7	9	59	57	50	n.a.	5	204	(289)				50		100					
Costa Rica	1.7	450	42	109	181	237	94	(160)	438	660	833		490.0	139.4	94	25.0	154	33.3	67.5	3	57.3	43.6
Public Supply			39	97	144	213	94	(150)	412	605	779	9.6	458.2	125.3	94		154					
Hydro			42	78	112	179	86	(160)	393	549	766				86		146					
Panama	1.4	580	n.a.	n.a.	n.a.	n.a.	4	n.a.	n.a.	510	670		478.6	-	4	4.1	200	46.0	65.9	2	18.2	22.5
Public Supply			21	65	88	124	4	85	226	452	604	11.5	431.4	88.6	4		200					
Hydro			-	n.a.	7	15	4	n.a.	n.a.	31	70				4		154					
Trinidad & Tobago	1.0	870	58	125	253	353	100	(150)	470	908	1119		1119.0	353.0	100	22.2	100	25.5	40.7	2	28.2	78.7
Public Supply			17	81	203	203	100	(50)	261	605	805	16.7	805.0	203.0	100		100					
Hydro			-	-	-	-	-	-	-	-	-				-		-					
TOTAL	253.8						9498								12509	1757.5	21368	2492.1	6668.4	98	3075.1	57.1
Public Supply			5490	12049		24283	9498	20489	48627		95781	8.9			12509		21368					
Hydro							5410								7850		13966					

ASIA: ELECTRICAL GENERATING CAPACITY, GENERATION AND IBRD/IDA POWER FINANCING IN DEVELOPING COUNTRIES 1950-70

	1968 Pop'n. (mlns)	1968 GNP per cap. (US$)	Installed Capacity (MW) 1950	1960	1965	1968	IBRD Financed (MW)	Electricity Generation (Gwh) 1950	1960	1965	1968	Growth Rate of Generation 1950-68	1968 Generation per capita (kwh)	1968 Installed Capacity per capita (watts)	IBRD/IDA Financing Through 12/31/70: Capacity Installed by end 1970 (MW)	Disbursements (US$ mln)	Capacity Committed by end 1970 (MW)	Commitments (US$ mln)	Total Program (US$ mln)	No. of Loans	Total IBRD/IDA Disbursements through 12/31/70 (US$ mln)	Power as % of Total
India	523.9	100	2346	5580	10173	14315	1513	(6500)	20123	36825	51531		98.4	27.3	1633	218.1	1633	277.0	900.0	12	1984.9	10.9
Public Supply			1713	4579	9027	12974	1513	5107	16937	32990	47348	13.2	90.4	24.7	1633		1633					
Hydro			562	1846	4127	5910	690	2520	7847	15233	20751				690		690					
Pakistan	123.2	100	n.a.	n.a.	n.a.	n.a.	455	n.a.	n.a.	4440	6500		52.8	-	530	173.7	880	248.2	500.0	8	766.3	22.6
Public Supply			72	658	1074	1741	455	172	1450	3962	6000	22.0	48.7	14.1	530		880					
Hydro			11	253	348	629	225	50	539	1839	3000				300		650					
Indonesia	112.8	100	(200)	391	(820)	(1000)	-	n.a.	n.a.	n.a.	n.a.		-	(8.9)	-	-	-	15.0	20.8	1	5.1	-
Public Supply			157	308	559	652	-	(600)	1161	1584	1756	6.2	15.6	5.8	-		-					
Hydro			(90)	169	258	310	-	n.a.	n.a.	626	1113				-		-					
Philippines	35.9	180	(230)	765	1085	n.a.	356	(760)	2731	4959	7000		195.0	-	431	63.6	481	70.7	144.5	4	144.1	44.1
Public Supply			184	596	835	1243	356	538	2259	4059	5644	13.9	157.2	34.6	431		481					
Hydro			52	290	291	495	356	191	1224	1509	1676				356		406					
Thailand	33.7	150	32	191	559	896	280	n.a.	594	1406	3062		90.9	26.6	508	85.1	1068	130.1	235.8	5	263.4	32.3
Public Supply			30	178	527	860	280	69	502	1342	2980	23.2	88.4	25.5	508		1068					
Hydro			-	-	146	381	280	n.a.	-	841	1405				420		670					
Korea (South)	30.5	180	200	439	947	1453	-	n.a.	1758	3535	6486		212.7	47.6	-	-	-	-	-	-	36.5	-
Public Supply			195	367	769	1274	-	421	1697	3250	6026	15.9	197.6	41.8	-							
Hydro			80	143	215	327	-	97	580	710	929				-							
Iran	27.2	310	n.a.	n.a.	n.a.	n.a.	130	n.a.	(1200)	3120	5008		184.1	-	130	42.0	130	102.0	176.0	2	301.7	13.9
Public Supply			(80)	275	534	1089	130	(200)	(500)	1080	2758	15.7	101.4	40.0	130		130					
Hydro			n.a.	2	255	309	130	n.a.	-	344	855				130		130					
Burma	26.4	70	(32)	250	250	256	-	n.a.	432	557	553		20.9	9.7	-	-	-	-	-	-	33.1	-
Public Supply			(25)	191	189	193	-	(50)	263	380	409	12.4	15.5	7.3	-		-					
Hydro			n.a.	84	105	103	-	n.a.	n.a.	286	347				-		-					
Vietnam (South)	17.4	130	n.a.	n.a.	n.a.	n.a.	-	n.a.	n.a.	540	836		48.0	-	-	-	-	-	-	-	-	-
Public Supply			(50)	99	285	453	-	(100)	304	522	836	12.5	48.0	26.0	-		-					
Hydro			-	n.a.	164	n.a.	-	-	7	58	10				-		-					
Afghanistan	16.1	80	(5)	49	67	275	-	(14)	119	236	325		20.2	17.1	-	-	-	-	-	-	0.3	-
Public Supply			(5)	36	39	221	-	(14)	102	180	271	17.9	16.8	13.7	-		-					
Hydro			(4)	38	43	245	-	n.a.	113	215	301				-		-					
China (Taiwan)	13.5	270	n.a.	782	1276	2062	-	n.a.	3797	6628	10036		743.4	152.7	-	5.2	711	94.5	159.8	2	107.5	4.8
Public Supply			276	709	1186	1940	-	1040	3628	6456	9802	13.3	726.1	143.7	-		711					
Hydro			221	448	628	721	-	972	2065	2586	3864				-		336					
Ceylon	12.0	180	n.a.	n.a.	220	209	125	n.a.	302	498	689		57.4	17.4	125	37.5	280	91.5	155.2	5	40.8	91.9
Public Supply			33	94	195	187	125	81	289	433	629	12.0	52.4	15.6	125		280					
Hydro			16	55	114	113	75	9	272	365	474				75		205					
Nepal	10.7	80	n.a.	n.a.	25	38	-	n.a.	n.a.	25	55		5.1	3.6	-	-	-	-	-	-	0.1	-
Public Supply			(3)	6	11	32	-	(5)	11	20	51	13.6	4.8	3.0	-		-					
Hydro			n.a.	3	8	14	-	n.a.	7	11	n.a.				-		-					
Malaysia	10.4	330	145	312	536	814	380	604	1228	2242	3076		295.8	78.3	500	108.6	1010	156.0	262.5	5	156.5	69.3
Public Supply			128	294	(450)	610	380	494	1156	2128	2953	9.5	283.9	58.7	500		1010					
Hydro			36	38	139	293	260	253	195	587	804				260		260					

Iraq	8.6	260	n.a.	n.a.	n.a.	n.a.	-	n.a.	n.a.	n.a.	n.a.		-	-	-	-	-	-	-	-	19.8	-
Public Supply			(40)	(200)	(275)	(370)	-	136	852	1207	1622	14.8	188.6	(43.0)	-		-					
Hydro			n.a.	n.a.	n.a.	n.a.	-	-	-	-	-				-		-					
Saudi Arabia	7.1	360	n.a.	n.a.	n.a.	n.a.	-	n.a.	n.a.	n.a.	n.a.		-	-	-	-	-	-	-	-	-	-
Public Supply			(5)	(25)	94	188	-	(10)	(50)	268	528	24.7	74.4	26.5	-		-					
Hydro			n.a.	n.a.	n.a.	n.a.	-	n.a.	n.a.	n.a.	n.a.				-		-					
Cambodia	7.1	120	(10)	(20)	(33)	(63)	-	(20)	(60)	(81)	(112)		(15.8)	(8.9)	-	-	-	-	-	-	-	-
Public Supply			(10)	20	33	63	-	(20)	60	81	112	10.5	15.8	8.9	-		-					
Hydro			-	-	-	-	-	-	-	-	-				-		-					
Syria	5.7	210	(45)	119	243	216	-	(200)	368	616	773		135.6	37.9	-	-	-	-	-	-	4.2	-
Public Supply			(25)	76	168	138	-	(100)	232	404	523	9.6	91.8	24.2	-		-					
Hydro			-	n.a.	n.a.	n.a.	-	-	n.a.	n.a.	n.a.				-		-					
Yemen Arab Republic	5.4	70	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-
Public Supply			-	-	-	-	-	-	-	-	-	-	-	-	-		-					
Hydro			-	-	-	-	-	-	-	-	-				-		-					
Hong Kong	3.9	710	(110)	(365)	(593)	(1054)	-	(294)	(1301)	(2732)	(3948)		(1012.3)	(270.3)	-	-	-	-	-	-	-	-
Public Supply			110	365	593	1054	-	294	1301	2732	3948	15.5	1012.3	270.3	-		-					
Hydro			-	-	-	-	-	-	-	-	-				-		-					
Laos	2.8	100	(1)	7	n.a.	n.a.	-	n.a.	13	n.a.	n.a.		-	-	-	-	-	-	-	-	-	-
Public Supply			1	4	10	8	-	1	7	17	26	19.8	9.3	2.9	-		-					
Hydro			-	-	-	-	-	-	-	-	-				-		-					
Israel	2.7	1360	n.a.	n.a.	n.a.	n.a.	-	n.a.	2313	4188	5506		2039.3	-	-	-	-	-	-	-	107.8	-
Public Supply			109	410	720	1012	-	464	(2200)	4061	5327	14.5	1973.0	374.8	-		-					
Hydro			n.a.	-	-	-	-	n.a.	-	-	-				-		-					
Lebanon	2.6	560	n.a.	146	n.a.	n.a.	73	114	422	n.a.	n.a.		-	-	73	27.0	73	27.0	40.8	1	27.0	100.0
Public Supply			(40)	146	356	422	73	114	422	765	1035	13.0	398.1	162.3	73		73					
Hydro			(25)	65	198	246	73	n.a.	109	505	763				73		73					
Papua & New Guinea	2.3	210	(4)	16	25	45	-	(6)	57	85	130		56.5	19.6	-	-	-	-	-	-	1.0	-
Public Supply			2	10	17	33	-	(3)	34	66	94	21.1	40.9	14.3	-		-					
Hydro			-	11	12	30	-	-	43	57	86				-		-					
Jordan	2.1	260	n.a.	n.a.	n.a.	n.a.	-	n.a.	(80)	156	156		72.3	-	-	-	-	-	-	-	9.1	-
Public Supply			(2)	(30)	(35)	(40)	-	(5)	(70)	117	116	19.1	55.2	(19.0)	-		-					
Hydro			n.a.	n.a.	n.a.	n.a.	-	n.a.	n.a.	n.a.	n.a.				-		-					
Singapore	2.0	700	(37)	(152)	(344)	(464)	240	(187)	(659)	(1047)	(1639)		(819.5)	(232.0)	240	49.1	240	60.5	102.9	4	73.7	66.6
Public Supply			37	152	344	464	240	187	659	1047	1639	12.8	819.5	232.0	240		240					
Hydro			-	-	-	-	-	-	-	-	-				-		-					
Southern Yemen	1.2	120	4	44	73	83	-	(10)	150	227	178		148.3	69.2	-	-	-	-	-	-	-	-
Public Supply			4	18	46	56	-	(10)	75	116	105	14.0	87.5	46.7	-		-					
Hydro			-	-	-	-	-	-	-	-	-				-		-					
TOTAL							3552								4170	809.9	6506	1272.5	2698.3	49	4082.9	19.8
Public Supply			3336	9846		27317	3552	10235	36221		102538	13.7			4170		6506					
Hydro							2089								2304		3420					

EUROPE: ELECTRICAL GENERATING CAPACITY, GENERATION AND IBRD/IDA POWER FINANCING IN DEVELOPING COUNTRIES 1950-70

	1968 Pop'n. (mlns)	1968 GNP per cap. (US$)	Installed Capacity (MW) 1950	1960	1965	1968	IBRD Financed (MW)	Electricity Generation (Gwh) 1950	1960	1965	1968	Growth Rate of Generation 1950-68	1968 Generation per capita (kwh)	1968 Installed Capacity per capita (watts)	IBRD/IDA Financing Through 12/31/70: Capacity Installed by end 1970 (MW)	Disbursements (US$ mln)	Capacity Committed by end 1970 (MW)	Commitments (US$ mln)	Total Program (US$ mln)	No. of Loans	Total IBRD/IDA Disbursements through 12/31/71 (US$ mln)	Power as % Total
Turkey	33.6	310	408	1272	1490	1980	54	790	2815	4952	6936		206.4	58.6	54	39.6	104	63.4	122.4	4	181.6	21.8
Public Supply			175	939	1121	1617	54	409	2383	4290	6276	16.4	186.8	48.1	54		104					
Hydro			(20)	412	505	723	54	30	1002	2179	3175				54		104					
Spain	32.6	730	2416	6567	10173	13988	-	6915	18614	31724	45851		1406.5	429.1	-	-	-	-	-	-	165.1	-
Public Supply			(2200)	5964	9400	13146	-	(6400)	16955	29628	43289	11.2	1327.9	403.3	-		-					
Hydro			1772	4600	7193	8543	-	5079	15624	19687	24428				-		-					
Yugoslavia	20.2	510	774	2402	3763	4876	384	2408	8928	15523	20641		1021.8	241.4	384	64.4	384	64.6	165.0	4	300.6	21.4
Public Supply			(500)	2000	3350	4357	384	(1900)	7844	14012	18802	13.6	930.7	215.7	384		384					
Hydro			287	1450	2265	2786	384	1175	5984	8985	11767				384		384					
Portugal	9.5	460	345	1335	1715	2030	385	942	3264	4635	6215		654.2	213.7	690	56.4	690	57.5	130.8	5	56.4	100.0
Public Supply			272	1232	1578	1868	385	859	3113	4340	5856	11.3	616.4	196.6	690		690					
Hydro			153	1085	1423	1425	210	437	3105	3983	5217				390		390					
Greece	8.8	740	236	611	1169	1897	-	(690)	2277	4401	7340		834.1	215.6	-	-	-	-	-	-	10.8	-
Public Supply			223	605	1073	1798	-	665	2197	4145	6949	13.9	789.7	204.3	-							
Hydro			13	196	268	704	-	10	469	759	1354				-							
Ireland	2.9	980	(266)	(724)	(1070)	(1290)	-	(903)	(2260)	(3538)	(4745)		(1636.2)	(444.8)	-	3.6	280	14.5	31.5	1	3.6	100.0
Public Supply			266	724	1070	1290	-	903	2260	3538	4745	9.7	1636.2	444.8	-		280					
Hydro			128	219	219	219	-	351	932	939	770				-		280					
TOTAL	107.6						823								1128	164.0	1458	200.0	449.7	14	718.1	22.8
Public Supply			3636	11464		24076	823	11136	34752		85917	12.0			1128		1458					
Hydro							648								828		1158					

TEN

APPENDIX TABLE 4.1

THE UTILITIES: FORECAST AND ACTUAL PEAK DEMANDS, RESERVES AND LOAD FACTORS, 1970 [a]

	SEGBA [c]	FURNAS	EELPA	VRA	NEB	PUB A	PUB B	Colombia EEEB A	Colombia EEEB B	Colombia EPM	Colombia CHIDRAL	Mexico - CFE [d] Central A	Central B	Integrated System Oriental A	Integrated System Occidental A	Integrated System Total B	Northern A	Northern B	North Western A	North Western B	North Eastern A	North Eastern B
Forecast [b]																						
Installed Capacity	1790	1432	121	588	563	644	617	620	456	582	490	2300	2242	587	735	1601	334	334	338	370	619	501
Peak Demand	1617	-	73	363	363 [f]	481	440	523	452	418	356	1840	1786	523	504	1252	221	212	253	261	480	402
Gross Reserve	173	-	48 [f]	225 [g]	200 [f]	78	177	97	4	164	134	460	456	64	231	349	113	122	85	109	139	99
Actual																						
Installed Capacity	1840	2294	94	588	563	644		588		443	248	2117		1270	659	1929	341		332		516	
Peak Demand	1697	2069	50 [f]	378	363 [f]	377		479		371	228	1935		860	741	1593	290		259		458	
Gross Reserve	143	225	44 [f]	210	200 [f]	267		109		72	20	182		410	-82	336	51		73		58	
Gross Reserve as % of Demand	8.4	10.9	88.0	55.5	55.1	70.8		22.8		19.4	8.8	9.4				21.1	17.6		28.2		12.7	
Actual Effective Peak																						
Available Capacity	1772	2091	67	475	428	455		428 [h]		443	205	2053		n.a.	n.a.	n.a.	286		264		455	
Peak Demand	1697 [e]	2043	45	360	363	346		423 [h]		371	222	1935		n.a.	n.a.	n.a.	273		255		424	
Spare Capacity	75 [e]	48	22	115	65	109		5 [h]		72	-17	118		n.a.	n.a.	n.a.	13		9		31	
Spare Capacity as % of Demand	4.4	2.3	48.9	31.9	17.9	31.5		1.2 [h]		19.4	-7.6	6.1					4.8		3.5		7.3	
Annual Load Factor (%)																						
Forecast	54	-	54	76	74	50	56	49	54	56	58	58	59	63	53	58	71	69	56	60	61	60
Actual	57	54	57	85	73.9	67		54		60	53	62		71	43	58	66		56		65	

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a/ Installed Capacity is shown as of the end of the calendar year, December 31, for all cases except EELPA and NEB, whose fiscal years end on September 10 and August 31, respectively; peak demands are given for the year ending on the corresponding dates.

b/ Forecasts are taken from the latest appraisal reports examined for each utility. An additional set of forecasts in the cases of PUB, EEEB and CFE are included where earlier appraisal report load factor forecasts were substantially different from the more recent ones:

PUB:	A - Loan 473-SI	(1966)	
	B - Loan 503-SI	(1967)	
EEEB:	A - Loan 313-CO	(1962)	
	B - Loan 537-CO	(1968)	
CFE:	A - Loan 316-ME	(1962)	
	B - Loan 436-ME	(1965)	modified for Central and Interconnected systems to be comparable with actual developments excluding frequency conversion.

c/ Figures for installed capacity refer to SEGBA's own system, while those for demand and load factor include supplies purchased from other utilities and resold by SEGBA.

d/ All data for load factors in Mexico are for 1969 due to unavailability of 1970 actual data for gross generation in each system.

e/ Available capacity includes power actually purchased from other suppliers for an amount of 199 MW.

f/ Includes some capacity that may be unavailable in poor hydrological years (about 22 to 26 MW in EELPA, and about 100 MW in NEB)

g/ Large reserve partly to permit guaranteed supplies to aluminum smelter.

h/ For 1969. No data available for 1970.

POWER PROJECTS REVIEW
~~IBRD PROJECTS IMPLEMENTATION~~
DATA ON FORECAST VS ACTUAL IMPLEMENTATION

APPENDIX TABLE 4.2

		FORECASTS						ACTUAL					
		Construction Period a/	Project Scope	Construction Cost (US $ Million) L.C.	F.X.	Total	Cost/KW US$ a/	Construction Period a/	Project Scope	Construction Cost (US $ Million) L.C.	F.X.	Total	Cost/KW US$ a/
HYDROELECTRIC PLANTS													
BRAZIL:	Furnas	60	160 MW	66.96	41.50	108.46	236	85	900 MW	85.42	14.84	130.26	145
	Estreito	73	533 MW	45.00	36.50	81.50	153	59	700 MW	74.40	21.80	96.20	137
ETHIOPIA:	Awash II	27	32 MW	4.15	6.81	10.97	342	31	32 MW	3.37	6.93	10.30	322
	Awash III	42	32 MW	4.17	6.25	10.42	326	79	32 MW	3.55	6.94	10.49	328
GHANA:	Akosombo	58	588 MW	61.60	67.10	128.70	219	55	588 MW	50.33	72.36	122.69	209
MALAYSIA:	Cameron Highlands I	55	79.3 MW	10.80	26.10	36.90	466	52	105.5 MW	14.00	19.20	33.20	315
	Cameron Highlands II	48	154.2 MW	14.20	27.50	41.70	270	41	154.2 MW	17.40	30.30	47.70	309
COLOMBIA:	Calima	63	120 MW	9.80	18.90	28.70	239.2	86	120 MW	20.54	21.65	42.19	351
	El Colegio	85	300 MW	15.49	30.26	45.75	152.5	85	300 MW	19.37	34.29	53.66	178
	Troneras	50	36 MW	3.58	2.63	6.21	172.5	61	36 MW	5.61	2.87	8.48	235
	Guadalupe III	63	210 MW	7.08	15.96	23.04	109.7	82	270 MW	16.58	17.60	34.18	126
MEXICO:	Miguel Aleman System	78	155 MW	13.06	6.84	19.90	128	104	160.8 MW	33.44	6.52	39.96	248
including:	Santa Barbara							51	676 MW	5.56	2.05	7.61	112
	San Bartolo I							68	252 MW	4.47	1.28	5.75	228
	El Durazno							102	18 MW	1.89	1.28	3.17	176
	Ixtapantango							33	50 MW	0.50	1.44	1.94	117
	Puebla-Veracruz System	66	35.3 MW	1.02	0.97	1.99	56		30.5 MW	3.48	1.03	4.51	148
including:	Tepazolco							47	10.9 MW	1.01	0.53	1.54	141
	El Encanto							57	10 MW	1.26	0.44	1.70	170
	Minas I							54	9.6 MW	1.21	0.06	1.27	132
	Bombana	78	2.6 MW	0.43	0.10	0.53	204	50	2.6 MW	1.04	0.16	1.20	377
	Tingambato	45	150 MW	9.21	7.63	16.84	112	65	135 MW	19.28	5.93	25.21	187
	El Cobano	36	55 MW	6.66	1.69	8.35	152	59	52 MW	8.04	1.74	9.78	188 h/
	Oviachic b/							35	19.2 MW	2.00	0.74	2.74	143 h/
	Mocuzari b/							37	9.6 MW	1.35	0.36	1.71	178 h/
	Temaxcal	48	154 MW	7.76	5.42	13.18	85	65	154 MW	17.07	3.41	20.48	133 h/
	El Fuerte b/							52	40 MW	4.56	1.42	5.98	150 h/
	Cupatitzio	55	73.6 MW	5.77	3.53	9.30	126	65	63 MW	18.16	4.72	22.88	363 f/
	Mazatepec	59	156 MW	17.95	5.41	23.36	144 f/	74	156 MW	45.82	11.89	57.71	319 f/
	SUB-TOTAL	57	3,326.0 MW	304.70	311.10	615.80	185	62	4,060.4 MW	464.88	316.63	781.51	193
COLOMBIA:	Anchicaya	50	44 MW			15.14	344	77	44 MW			17.01	387
MEXICO:	El Fuerte		20 MW			1.02	51 f/		20 MW			1.10	55 f/
	Mazatepec 4th Unit	4	52 MW			6.58	144 f/	18	52 MW			8.53	319 f/
	San Bartolo II		20 MW			2.90	145		19 MW			4.61	243
	Infiernillo (316, 436)		602 MW			82.42	137		672 MW			111.18	165
	Santa Rosa		60 MW			14.67	245		60 MW			19.83	331
	Sanalona		14 MW			1.96	140		14 MW			2.26	161
	El Novillo		90 MW			30.41	338		90 MW			40.22	447 h/
	La Venta		30 MW			10.54	351		30 MW			17.76	592 h/
	Chilapan		18 MW			1.89	105		18 MW			3.91	217 h/
	El Retiro		14 MW			4.90	348		21 MW			11.60	552
	El Salto		18 MW			3.14	174		18 MW			5.54	308
	Malpaso		720 MW			31.02	43		720 MW			80.22	115 h/
	TOTAL I c/	54	5,028 MW			822.39	164	61	5,838.4 MW			1,105.28	189
THERMAL PLANTS													
ARGENTINA:	Costanera	60	5x 120 MW	58.00	73.05	131.05	218	61	5 x 120 MW	65.94	71.66	137.60	229
MALAYSIA:	Prai I and II	92	3 x 30 MW	5.70	14.45	20.15	224	95	3 x 30 MW	5.74	12.37	18.11	201
	Port Dickson I	35	2 x 60 MW	6.80	19.00	25.80	215	38	2 x 60 MW	7.00	13.00	20.00	167
	Extension of Johore Bahru	n.a.	2 x 30 MW	2.30	7.10	9.40	157	69	2 x 30 MW	2.10	4.60	6.70	111
SINGAPORE:	Pasir Panjang I & II	45	4 x 60 MW	9.48	25.08	34.56	144	47	4 x 60 MW	9.87	23.15	33.02	138
COLOMBIA:	Yumbo Unit 3	24	1 x 33 MW	1.24	4.40	5.64	170.9	24	1 x 33 MW	2.77	3.70	6.47	196
	Zipaquira Unit 2	19	1 x 33 MW	1.64	7.02	8.66	231.1	31	1 x37.5 MW	2.48	5.60	8.08	215
MEXICO:	Sonora System	n.a.	40 MW	2.88	2.66	5.54	139						
including:	Ciudad Obregon							21	3 x 5 MW	0.96	1.98	2.94	196
	Guaymas I Units 1 and 2							42	2 x 12.5 MW	2.61	4.41	7.02	281
	Guaymas (Extension)	n.a.	1 x 30 MW	1.50	2.93	4.43	148	40	1 x 33 MW	2.14	2.27	4.41	134
	Juarez	57	1 x 5 MW	0.61	0.76	1.37	274	24	3 x 5 MW	0.75	1.99	2.74	183
	Chihuahua	n.a.	2 x 25 MW	2.00	3.57	5.57	111	40	3 x 15 MW	3.67	3.72	7.39	164
	Aldama	n.a.	6 MW	0.35	1.07	1.42	237						
	Motul and La Paz	15	6.5 MW	1.00	1.62	2.62	403						
	Ciudad Victoria d/							33	2 x 1 MW	0.37	0.26	0.63	315
	Ciudad Victoria (Extension) b/							19	1 x 2.5 MW	0.19	0.42	0.61	244
	Merida b/							28	1 x 6.25 MW	0.61	0.67	1.28	205
	Villahermosa b/							23	2 x 2.25 MW	0.73	0.43	1.16	258
	La Laguna b/							24	1 x 33 MW	0.19	0.42	0.61	244
	Monterrey I	22	2 x 15 MW	0.78	2.84	3.62	121	29	2 x 15 MW	2.11	2.82	4.93	164
	Veracruz	23	1 x 10 MW	0.46	1.37	1.83	183	26	1 x 10 MW	1.50	1.43	2.93	293
	SUB-TOTAL	39	1,353.5 MW	94.74	166.92	261.66	193	38	1,401.75 MW	113.97	156.88	270.85	193
ARGENTINA:	Puerto Nuevo Unit 9	29	1 x 250 MW			36.85	147	29	1 x 250 MW			31.20	125
	Peaking Units (Gas Turbine)	20	8 x 15 MW			11.17	93	13	8 x 15 MW			12.80	106
COLOMBIA:	Yumbo Units 1 and 2	30	1x12+1x10 MW			4.83	215	30	2 x 10 MW			5.66	283
MEXICO:	Valle de Mexico		1 x 150 MW			13.62	91		1 x 150 MW			17.91	119
	Poza Rica		3 x 39 MW			15.07	129		3 x 39 MW			22.17	189
	Delicias		3 x 33 MW			13.51	136		3 x 33 MW			18.78	190
	Monterrey II		3 x 75 MW			27.13	121		3 x 75 MW			31.18	139
	Rio Bravo		2 x 37.5 MW			9.20	123		2 x 37.5 MW			10.72	143
	Nava		1 x 37.5 MW			7.00	187		1 x 37.5 MW			13.34	356
	Tijuana Units 1, 2, and 3		3 x 75 MW			28.65	127		3 x 75 MW			36.82	164
	Tijuana Unit 4		1 x 82 MW			10.40	127		1 x 82 MW			10.57	129
	Juchitan		2 x 6.25 MW			3.79	303		2 x 6.25 MW			4.16	333
	Merida Units 1 and 2		2 x 6.25 MW			3.02	242		2 x 6.25 MW			4.00	320
	Topolo-Bampo					6.52	163		1 x 41 MW			10.51	256
	La Laguna Unit 4		1 x 40 MW			5.76	144		1 x 41 MW			8.67	211
	Salamanca II								1 x 150 MW			18.10	121
	Guaymas Unit 4		1 x 40 MW			6.52	163		1 x 41 MW			13.15	321
	Salamanca I (Gas Turbine)								1 x 14 MW			1.48	106
	Pajaritos (Gas Turbine)		2 x 14 MW			3.34	119		2 x 14 MW			4.59	164
	Tampico (Gas Turbine)								1 x 14 MW			2.07	148
	Guadalajara (Extension)(Gas Turbine)								2 x 14 MW			2.85	102
	Merida Unit 4 (Gas Turbine)								1 x 14 MW			1.65	118
	Acapulco (Gas Turbine)								1 x 14 MW			1.57	112
	SUB-TOTAL II	36	2,889.5 MW			468.04	162	36	3,212.25 MW			554.8	173
	Merida Diesel Station								18 MW			6.48	360
	TOTAL II c/ THERMAL	36	2,889.5 MW			468.04	162	36	3,230.25 MW			561.28	174
	TOTAL PLANTS (I and II) c/	47	7,917.5 MW			1,290.43	163	53	9,068.65 MW			1,666.56	184
TRANSMISSION							Cost/km US$ '000s						Cost/km US $'000s
ARGENTINA:	132 kv e/	45	675 km	38.26	25.10	63.36	93.9	45	885 km	74.33	17.50	91.83	103.8
BRAZIL:	345 kv	n.a.	1,740 km	20.75	45.80	66.55	38.2	not completed	1,270 km	26.44	23.17	49.61	39.1
ETHIOPIA:	132 kv	n.a.	323 km	.79	3.99	4.78	14.8	n.a.	282 km	1.21	3.99	5.20	18.4
GHANA:	165 kv	33	985 km	9.9	28.8	38.7	35.9	44	1,045 km	6.23	20.13	26.36	25.0
MALAYSIA:	132 kv	102	1,428 km	11.7	22.1	33.8	24.2	109	1,422 km	23.0	24.9	47.90	33.7
COLOMBIA:	115 kv	54	n.a.	4.14	5.02	9.16		84	n.a.	5.10	9.40	14.50	
MEXICO:	Up to 220 kv	n.a.	3,055 km	12.73	35.21	47.94	15.6	n.a.	4,994 km	25.79	30.96	56.75	11.4
	SUB-TOTAL		8,416 km	98.27	166.03	264.30	31.4		9,898 km	162.10	130.05	292.15	29.5
MEXICO:	Up to 220 kv		n.a.			n.a.			3,400 km			26.87	7.9
	Above 220 KV		n.a.			n.a.			4,200 km			243.02	57.9
	TOTAL TRANSMISSION								17,498 km			562.04	32.1
DISTRIBUTION													
ETHIOPIA:	15 kv or less	n.a.	750 km	1.14	2.74	3.88	5.2	n.a.	750 km	0.51	1.52	2.03	2.7
SINGAPORE:	6.6 kv, 22 kv, 66 kv	24	232 km	10.0	14.3	24.3	104.7	24	315 km	6.06	13.08	19.14	60.8
COLOMBIA:		n.a.	1,100 km	3.06	4.88	7.94	7.2	n.a.	1,065 km	1.78	6.35	8.13	7.6
MEXICO:	2 first loans	n.a.						41	15,785 connect.	1.78	1.18	2.96	
	SUB-TOTAL		2,082 km	14.20	21.92	36.12	17.4	2,130 km+15,785 connect.		10.13	22.13	32.25	
ARGENTINA:			4,718 km g/			311.81	23.1 g/		15,641 km			230.59	14.7
MEXICO:	1962-1969 Programs					269.92						301.50	
	TOTAL		6,800 km			617.85		17,770 km+15,785 connect.				564.35	
RURAL ELECTRIFICATION													
ETHIOPIA:	Diesel Plants and Distribution	n.a.	5.8 MW	.87	1.55	2.42		n.a.	9.5 MW	.84	1.91	2.75	
MEXICO:	first loan	n.a.	16.9 MW	7.25	3.88	11.13		65	12.6 MW	1.53	2.99	4.52	
	SUB-TOTAL		22.7 MW	8.12	5.43	13.55			22.1 MW	2.37	4.90	7.27	
MEXICO:	1962-66 and 68-69 Programs					71.68						73.88	
	TOTAL					85.23						81.15	
	TOTAL PROJECTS					2,257.81						2,874.10	
PROJECTS NOT COVERED BY IBRD LOANS													
MALAYSIA:	Malacca plant (Thermal)							84	4 x 10 MW	2.0	6.5	8.5	212
SINGAPORE:	Jurong station (Thermal)							48	4 x 60 MW	11.9	24.1	36.0	150
BRAZIL:	Santa Cruz plant (Thermal)							48	2 x 80 MW	-	-	33.4	208
	Funil plant (Hydro)							96	210 MW	-	-	84.9	404
ETHIOPIA:	Awash I (Hydro)							n.a.	43 MW	-	-	13.8	321
	Tis Abbai (Hydro)							n.a.	9.6 MW	-	-	6.2	646

a/ For sub-totals and totals, average data are given.
b/ These plants replace Motul and La Paz plants.
c/ Do not include plants in Colombia completed with 216 MW hydro and 1 x 33 MW thermal unit for which actual cost are not available.
d/ This plant replaces Aldama plant.
e/ Forecast includes only that for Loan 308 AR; actual data aggregate the investments made during Loans 308-525 AR
f/ Unit cost for total plant.
g/ Forecast number of km includes only that for Loan 308.AR which concurs with 7,123 km actually laid down; forecast for Loan 525 AR is not available.
h/ Power part of hydro schemes previously built for irrigation or flood control purposes.

POWER PROJECT REVIEW -- SELECTED INDICATORS ON UTILITIES

APPENDIX TABLE 4.3

		Unit	SEGBA 1960	SEGBA 1965	SEGBA 1970	FURNAS 1965	FURNAS 1970	EELPA f/ 1960	EELPA f/ 1965	EELPA f/ 1970	VRA 1965	VRA 1970	NEB i/ 1960	NEB i/ 1965	NEB i/ 1970	CFE 1960	CFE 1965	CFE 1970	PUB i/ 1960	PUB i/ 1965	PUB i/ 1970	BOGOTA 1960	BOGOTA 1965	BOGOTA 1970	MEDELLIN 1960	MEDELLIN 1965	MEDELLIN 1970	CHIDRAL 1960	CHIDRAL 1965	CHIDRAL 1970
	OPERATIONS																													
1.	Installed Capacity (year end)					900	2,090	n.a.	50	82	588	588	3	111	265	727	1,608	2,914				114	201	503	137	308	443	66	96	186
	Hydro	MW					204	n.a.	5	5			123	140	360	297	1,186	2,030	150	317	617	14	85	85				20	53	53
	Thermal	MW	693	1,454	1,840			n.a.	2	7			27	50	41	78	178	456	27	27	27							9	9	9
	Diesel	MW						34 e/	72 e/	119 e/	588	588	153	301	666	1,102	2,972	5,400	177	344	644	128	286	588	137	308	443	95	158	248
	Total	MW	693	1,454	1,840	900	2,294																							
2.	Peak Demand	MW	528	1,169	1,697	570	2,069	10	33	50	73	378	94	156	363	1,840 g/	2,950 g/	5,010 g/	118	192	377	129	244	479	150	267	371	67	144	228
3.	Gross Reserves as % of Peak Demand	%	31	24	8	58	11	209	30	60	-	55	34	41	72	26	52	26	50	79	71	1	17	23	9	15	20	43	10	9
4.	Generation Sent Out h/	GWH	2,810	5,245	7,994	2,837	9,731	50	172	281	102	2,879	610	1,192	2,411	4,123	10,126	22,647	624	993	2,077	690	1,085	2,271	824	1,373	1,965	n.a.	n.a.	n.a.
5.	Total Sales	GWH	2,385	4,270	6,861	2,681	9,255	43	152	246	98	2,806	545	1,073	2,178	4,065	9,800	20,095	578	912	1,942	606	1,027	2,033	710	1,048	1,496	301	672	1,067
	Industrial Sales as % of Total	%	28	30	31				54 g/	34 g/				52 i/	42 i/	13	29	37	n.a.	52	56	31	33	28	25	29	n.a.		BULK	
	Residential Sales as % of Total	%	38	44	39				44	66				16	15	5	10	11	n.a.	16	33	27	30	28	58	54	n.a.		SUPPLIER	
6.	Number of Customers	000's	1,115.0	1,901.0	2,319.0	BULK SUPPLIER		32.44	66.61	112.63	BULK SUPPLIER		180.6	319.9	469.2	455.0	1,019.0	3,822.0	98.2	169.3	267.6	130.82	206.74	284.72	99.91	127.80	174.54			
	FINANCES																													
7.	Average Revenue/kwh Sold	US¢	3.4	4.4	3.3	1.21	1.61	5.76	3.48	3.68	1.01	.40	3.2	3.0	2.6	1.09	1.36 k/	1.79 l/	2.39	2.32	2.19	1.14	1.12	0.98	0.82	0.84	1.01 p/	0.94	0.75	1.07 p/
8.	Average Cost/kwh Sold	US¢	2.5	3.0	2.3	0.40	0.58	3.98	2.44	2.22	.42	.21	2.5	2.2	1.7	0.65 l/	0.80 k/	1.09 l/	1.75	1.70	1.04	0.47	0.65	0.59	0.36	0.48	0.52 p/	0.50	0.57	0.63 p/
9.	Net Revenues	Local Currency mln.	21.24 b/	62.90 b/	67.10 b/	41.25	440.49	1.91	4.69	8.97	.42	5.80	11.7	29.0	63.6	223.3 m/	681.9 k/	1749.1 m/	11.24	17.13	79.98	29.19	67.99	199.52	21.72	52.88	166.26	10.30	20.07	69.35 p/
10.	Gross Fixed Investment	" "	n.a. b/	53.34 b/	64.86 b/	35.86	507.31	34.83	14.38	20.21	n.a.	2.44	33.8	82.2	47.9	973.0	1139.7	3719.2	9.38	53.22	84.29	44.13	154.44	197.53	21.97	149.72	267.16	13.54	122.12	81.24 p/
11.	Average Net Fixed Assets in Operation	" "	130.23 b/	467.35 b/	616.00 b/	330.21	2356.33	32.11	56.66	91.84	95.62	134.39	154.0 k/	353.4 k/	731.9 k/	3084.4 n/	11199.0 k/	19579.6 n/	161.30	246.10	422.28	108.56	210.04	245.73	117.33	426.00	591.86 p/	80.72	196.52	729.22 p/
	MANAGEMENT INDICATORS																													
12.	Rate of Return (9 as % of 11)	%	16.2	13.5	10.9	12.5	18.7	5.9	8.3	9.8	.4	4.3	7.6	8.2	8.7	4.8 o/	5.0 o/	8.5 o/	8.1	7.0	18.9	15.7	9.1	9.9	14.8	7.2	11.0 p/	6.3	3.7	4.2 p/
13.	Financial Rate of Return a/	%	8.6	7.4	5.5	7.7	11.6	4.4	6.5	8.3	.4	4.3	7.8	8.9	9.7	4.7	3.9	6.5	8.7	6.1	14.5	19.3	10.9	11.1	14.6	7.3	10.7 p/			
14.	Self-Financing Rate c/	%	n.a.	27.1	43.1	23.4	47.0	n.a.	37.5	42.5	-	-	33.3	29.8	77.3	7.7	-	-	83.2	28.8	38.0	n.a.	15.1	66.1	92.3	35.8	33.3	neg	n.a.	n.a.
15.	Debt Service Coverage d/	Times	n.a.	1.3	1.7	1.2	2.3	n.a.	20.2	5.0	n.a.	1.3	2.7	2.4	2.6	1.53	0.30	0.99	1.8	1.8	2.1	n.a.	1.4	1.9	4.8	4.8	1.9	-	n.a.	n.a.
16.	Debt/Equity Ratio	c/o	n.a.	53/47	45/55	61/39	56/44	0/100	18/82	43/57	44/56	53/47	67/33	64/36	55/45	22/78	40/60	53/47	n.a.	55/45	53/47	24/76	58/42	61/39	39/61	53/47	62/38	46/54	70/30	69/31 p/
17.	Energy Sales per Employee	Mwh	162	170	290	1,012	2,452	49	112	115	102	2,734 p/	106	136	232	723	1,020	1,086	236	276	418	701	786	1,320	n.a.	1,131	1,865	n.a.	n.a.	n.a.
18.	Distribution and/or Transmission Losses	%	15.1	18.6	14.2	5.5	4.9	18.0	12.6	12.6	4.0	2.5	10.7	10.0	9.7	1.4	3.2	11.2	7.4	8.1	6.5	12.1	5.3	10.9	15.4	23.7	23.9	4.2	2.1	1.5 p/
19.	Average Capacity out of Service as % of Installed Capacity	%	n.a.	14.2	5.4	16.7	7.9	n.a.	12.2	2.6	n.a.	7.9	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	13.1	7.6	18.8	n.a.	n.a.	12.3	n.a.	2.3	0.0	-	1.6	5.2
20.	Current Ratio	No.	?	?	?	?	?	?	?	?																				

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a/ Net revenues after taxes as % of average net fixed assets in operation.
b/ Net revenues, gross fixed investment, average netffixed assets in operation given in US$ mln.
c/ Net internal cash generation as % of total application of funds.
d/ Times debt service was covered by operating income and depreciation.
e/ Total capacity of EELPA in the interconnected and isolated systems. Breakdown is given only for the interconnected system.
f/ Years ending September 10.
g/ Includes commercials and industrial sales
h/ Includes purchases of power from other companies.
i/ Includes industrial and mining sales
j/ Constant rate of exchange US$1 = M$ 3.
k/ Including consumers contribution
l/ If depreciation charges are taken as 3% of gross fixed assets, the corrected average cost/kwh sold will be 0.82 (1960), 0.94 (1965), 1.18 (1970).
m/ If depreciation charges are taken as 3% of gross fixed assets, the corrected net revenues will be 136.2 (1960), 515.1 (1965), 1,516.4 (1970).
n/ If depreciation charges are taken as 3% of gross fixed assets, the corrected average net fixed assets will be 2,830.5 (1960), 10,242.2 (1965), 17,798.5 (1970).
o/ Rate of return after correction for depreciation provision, for comparison purposes.
p/ 1969.
q/ Non coincident peak load in Mexico as a whole.

Very nice! (Should we have a "total/average" for all 10?)

APPENDIX TABLE 4.4

TEN POWER COMPANIES - AVERAGE PRICES, COSTS AND PROFITS PER UNIT OF ELECTRICITY AND RATE OF RETURN TO AVERAGE NET FIXED ASSETS, 1955-1970

(Prices & Costs in U$¢ Equivalent)

	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	Average 1960-70
Argentina - SEGBA																	
Ave. revenue per kwh sold	n.a.	n.a.	n.a.	n.a.	n.a.	3.40	3.50	3.60	3.60	3.70	4.40	4.90	3.80	4.10	3.70	3.30	
Ave. cost per kwh sold	n.a.	n.a.	n.a.	n.a.	n.a.	2.50	2.70	2.50	2.70	2.90	3.00	3.20	2.60	2.30	2.30	2.30	
Ave. profit per kwh sold	n.a.	n.a.	n.a.	n.a.	n.a.	0.90	0.80	1.10	0.90	0.80	1.40	1.70	1.20	1.80	1.40	1.00	
Rate of return on assets (%)	n.a.	n.a.	n.a.	n.a.	n.a.	16.2	14.9	18.0	11.9	8.5	13.5	15.8	11.4	17.3	14.6	10.9	13.9
Brazil - Furnas																	
Ave. revenue per kwh sold	-	-	-	-	-	-	-	-	0.55	0.55	1.21	1.39	1.38	1.38	1.29	1.61	
Ave. cost per kwh sold	-	-	-	-	-	-	-	-	0.19	0.20	0.40	0.44	0.44	0.51	0.53	0.58	
Ave. profit per kwh sold	-	-	-	-	-	-	-	-	0.36	0.35	0.81	0.95	0.94	0.87	0.76	1.03	
Rate of return on assets (%)	-	-	-	-	-	-	-	-	0.9	5.9	12.5	18.5	17.0	18.4	19.8	18.7	15.8 (Over 1964-70)
Ethiopia - EELPA																	
Ave. revenue per kwh sold	n.a.	n.a.	n.a.	n.a.	6.71	5.76	4.14	3.84	3.88	3.58	3.48	3.59	3.50	3.49	3.68	3.68	
Ave. cost per kwh sold	n.a.	n.a.	n.a.	n.a.	4.44	3.98	3.14	2.65	2.55	2.13	2.44	2.44	2.10	2.08	2.20	2.22	
Ave. profit per kwh sold	n.a.	n.a.	n.a.	n.a.	2.27	1.78	1.00	1.19	1.33	1.45	1.04	1.15	1.40	1.41	1.48	1.46	
Rate of return on assets (%)	n.a.	n.a.	n.a.	n.a.	n.a.	5.9	3.0	4.9	6.4	8.4	8.3	8.3	9.2	8.5	9.2	9.8	7.4
Ghana - VRA																	
Ave. revenue per kwh sold	-	-	-	-	-	-	-	-	-	-	1.01	0.97	0.41	0.37	0.38	0.40	
Ave. cost per kwh sold	-	-	-	-	-	-	-	-	-	-	0.42	0.59	0.35	0.22	0.20	0.21	
Ave. profit per kwh sold	-	-	-	-	-	-	-	-	-	-	0.59	0.38	0.06	0.15	0.18	0.19	
Rate of return on assets (%)	-	-	-	-	-	-	-	-	-	-	0.4	1.1	0.6	2.9	3.8	4.3	2.5 (Over 1966-70)
Malaysia - NEB																	
Ave. revenue per kwh sold	n.a.	3.20	3.10	3.10	3.20	3.20	3.10	3.10	3.10	3.10	3.00	3.00	3.00	2.70	2.60	2.60	
Ave. cost per kwh sold	n.a.	2.60	2.50	2.40	2.50	2.50	2.40	2.40	2.40	2.30	2.20	2.10	2.00	1.80	1.80	1.70	
Ave. profit per kwh sold	n.a.	0.60	0.60	0.70	0.70	0.70	0.70	0.70	0.70	0.80	0.80	0.90	1.00	0.90	0.80	0.90	
Rate of return on assets (%)	n.a.	7.2	6.6	7.4	6.8	7.6	8.8	9.0	7.6	7.0	8.2	9.6	10.1	9.2	8.1	8.7	8.5
Mexico - CFE																	
Ave. revenue per kwh sold	0.67	0.69	0.95	0.99	0.85	1.09	1.34	1.41	1.47	1.38	1.36	1.42	1.87	1.77	1.80	1.79	
Ave. cost per kwh sold	0.48	0.49	0.63	0.65	0.60	0.65	0.72	0.80	0.91	0.88	0.80	0.80	1.08	1.00	1.10	1.09	
Ave. profit per kwh sold	0.19	0.20	0.32	0.34	0.25	0.44	0.62	0.61	0.56	0.50	0.56	0.62	0.79	0.77	0.70	0.70	
Rate of return on assets (%)	0.8	1.7	3.8	4.2	2.4	4.8	6.5	7.2	5.4	4.1	5.0	6.8	9.7	9.9	9.2	8.5	7.0
Singapore - PUB																	
Ave. revenue per kwh sold	n.a.	n.a.	n.a.	2.46	2.45	2.39	2.42	2.38	2.41	2.39	2.32	2.28	2.34	2.29	2.25	2.19	
Ave. cost per kwh sold	n.a.	n.a.	n.a.	1.76	1.65	1.68	1.68	1.56	1.52	1.52	1.74	1.59	1.46	1.26	1.21	1.04	
Ave. profit per kwh sold	n.a.	n.a.	n.a.	0.70	0.80	0.71	0.74	0.82	0.89	0.87	0.58	0.69	0.88	1.03	1.04	1.15	
Rate of return on assets (%)	n.a.	n.a.	n.a.	6.4	7.5	7.0	8.1	9.9	11.6	10.8	7.0	8.1	11.0	14.2	16.9	18.9	11.5
Bogota - EEEB																	
Ave. revenue per kwh sold	1.23	1.17	1.04	0.92	0.87	1.14	1.11	1.33	1.12	0.96	1.12	1.05	1.24	1.13	1.07	0.98	
Ave. cost per kwh sold	0.51	0.55	0.56	0.53	0.56	0.53	0.56	0.57	0.66	0.60	0.65	0.65	0.81	0.69	0.66	0.59	
Ave. profit per kwh sold	0.72	0.62	0.48	0.39	0.31	0.61	0.55	0.76	0.46	0.36	0.47	0.40	0.43	0.44	0.41	0.39	
Rate of return on assets (%)	22.0	21.6	13.5	8.3	6.1	15.7	13.0	18.0	9.1	7.4	9.1	7.1	7.8	8.1	9.0	9.9	10.4
Medellin - EPM																	
Ave. revenue per kwh sold	0.89	0.95	0.65	0.70	0.76	0.82	0.87	0.80	0.93	0.90	0.84	0.85	0.91	1.01	1.06	1.01	
Ave. cost per kwh sold	n.a.	n.a.	n.a.	0.31	0.38	0.36	0.41	0.44	0.49	0.45	0.48	0.54	0.59	0.62	0.52	0.47	
Ave. profit per kwh sold	n.a.	n.a.	n.a.	0.39	0.38	0.46	0.46	0.36	0.44	0.45	0.36	0.31	0.32	0.39	0.54	0.54	
Rate of return on assets (%)	n.a.	n.a.	n.a.	12.2	11.4	14.8	15.3	8.8	8.7	9.9	7.2	5.4	6.0	8.2	11.0	n.a.	9.5
Cali - CVC/Chidral (bulk)																	
Ave. revenue per kwh sold	1.07	0.94	0.82	0.69	0.63	0.94	0.88	0.82	0.69	0.57	0.75	0.69	0.82	0.88	1.07	n.a.	
Ave. cost per kwh sold	0.57	0.44	0.57	0.69	0.63	0.50	0.50	0.50	0.57	0.57	0.57	0.75	0.63	0.63	0.63	n.a.	
Ave. profit per kwh sold	0.50	0.50	0.25	0.0	0.0	0.44	0.38	0.32	0.12	0.0	0.18	-0.06	0.19	0.35	0.44	n.a.	
Rate of return on assets (%)	n.a.	6.4	3.4	0.6	0.4	6.3	5.6	6.5	2.0	0.9	3.7	neg.	2.5	3.7	4.2	n.a.	3.9

POWER PROJECTS REVIEW: MAJOR COVENANTS AND SIDE LETTERS

APPENDIX TABLE 4.5

	SEGBA	FURNAS	EELPA	VRA	NEB	CFE	PUB	BOGOTA	MEDELLIN	CHIDRAL
Tariffs										
Minimum Rate of Return, %	8[a] (1962)	10 (1965)	7 (1969)	8 in 1974 (1962)[e]	8 (1963)	9 (1958) 8 (1965)[g]	8 (1963)	9 (1968)	-	"reasonable surplus" agreement (1955)
Self-Financing Ratio, %			40 (1964)			33 (1962)[g]		40 (1960)	30 (1959) 40 (1961)	-
Test for Incurrence of Long-Term Debt:										
Minimum Debt Service Coverage	1.75[b] (1962)		1.4 (1964)	1.5 (1962)	1.5 (1958)	1.5 (1949) 1.4 (1965)[g]	1.5 (1963)	1.3 (1960)	- -	1.3 (1960)
Maximum Debt/Equity Ratio	40/60 (1962)	67/33[d] (1965)							60/40 (1959)	50/50 (1955)[i]
Maximum Incurrence of Short-term Debt					X (1966)[f]		X (1966)[h]			
Bank Agreement on Appointment of Executives	X (1962)	-	X (1964)	X (1969)	X (1963)		X (1963)			
Audit by External Auditors	X (1962)	X (1965)	X (1964)	X (1962)	X (1958)	X (1962)	X (1963)	X (1960)	X (1959)	X (1960)
Guarantee from Governments to Provide Necessary Funds	X	X	-	X (1962)	X (1958)	X (1949)	X (1963)	X (1960)	X (1959)	X[j] (1960)
Local Procurement with International Bidding	X (1968)	X (1965)				X (1962)		X (1960)		X (1963)
Improvement in Sector Policies	-Joint Planning (1968) -Distribution expansion -Revaluation of Assets (1962)[a] -Planning of interconnection and distribution expansion (1962)	-Joint Planning (1958) -Distribution expansion (1965) -Revaluation of Assets (1958)	-	-Reorganization of ECG (1962)		-Joint Planning (1958) -Consolidation small systems into uniform tariff zones (1958) -Frequency unification program (1965) -Establish one dispatch control in each system (1965) -Financial Coordination(1965)		-Revaluation of Assets (1968) -Interconnection (1968) -Junta Nacional de Tarifas (1968)		-Agreement with EMCALI that CHIDRAL will be sole supplier of power to city (1950) -Distribution Expansion (1955)
Internal Organization and Management	-Sales of shares to private investors -Labor force[c] -Depreciation Policy (1968) -Changes in by-laws and concessions (1962)					-Review financial & budgetary procedures (1958) -Acceptance tests (1962) -Training program for new plants operating staff (1962) -Revision of Expansion Program (1962) -Review of Depreciation Rates (1965)	-Reorganization of Accounts System (1963) -Implementation of consultants reports on management (1967) -Creation of technical posts (1969) -Tariffs Review (1967) -Review of Distribution Investment Program (1967)	-Composition of Board of Directors (1960) -Reorganization of Financial Programming (1962)	-Separate Operations and Auditing for the power service divisions (1959) -Consultation with Bank before changes in Company statutes, and notice to Bank of legislation affecting status (1961)	-Reorganization of all CVC & CHIDRAL power activities into single entity (1963) -Adequate depreciation policy (1955) - Restriction in dividend payments during construction periods (1958)
Consultants	-Supervision of Technical construction works (1961)			-Management consultants for review of operations, organization, accounting and staffing (1969)		-Construction design (1958) -Assistance on Frequency Unification (1965) -Review of Operating & Financial Procedures (1958)	-Distribution investment program (1967) -Tariffs Structure (1967)	-Engineering Consultants (1962)	-Manager's Technical Assistant for Design & Construction Supervision (1959)	-For Design Supervision & Construction (1960)

a/ Actually Loan Agreement requested only to respect SEGBA's concession allowing SEGBA to earn 8% return on assets expressed in US$.
b/ Annual Income to cover only interest payments.
c/ A verbal agreement was reached between Bank and SEGBA to have the latter reduce its labor force by 1,000.
d/ Long-term debt must be at most 2/3 of total net revalued fixed assets.
e/ Return on equity investment to be earned only after 1974.
f/ Total short-term debt not to exceed M$ 10 million.
g/ In 1958, the 9% return was to be computed for CFE excluding the proceeds of the power consumption tax. In 1962, CFE was supposed to cover 33% of the construction cost over a 4-year basis with its revenues including the proceeds of the power tax. In 1965, the 8% return was to be computed for the whole Power Sector including these proceeds. Also the minimum debt service coverage test was after 1965 to be computed including the proceeds of the power tax.
h/ Total short-term debt (including bank overdraft) must not exceed S$ 12 million.
i/ This covenant proved impracticable and was eliminated under 339-CO in 1963.
j/ CVC must provide Chidral with funds to carry out the projects if funds available to Chidral become inadequate.

APPENDIX TABLE 6.1

GROWTH AND PATTERN OF ELECTRICITY SALES IN THE REGIONS SERVED BY THE TEN COMPANIES

(in millions of kwh)

	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	Percentage Share in 1970
Argentina - SEGBA													
Residential	n.a.	n.a.	n.a.	n.a.	1,683	1,777	1,885	1,981	2,122	2,285	2,488	2,707	39.5
Industrial					867	1,112	1,291	1,381	1,455	1,636	1,915	2,150	31.4
Commercial					388	422	470	503	536	597	670	732	10.7
Public Lighting					68	75)		(103	118	144	160	194	2.8
Official					134	151)		(187	201	239	253	260	3.7
Public Pumping					166	190)	624	(203	206	232	240	247	3.6
Public Traction					179	189)		(136	139	185	211	223	3.2
Bulk					-	-)		(108	98	111	223	348	5.1
Total				3,094	3,485	3,916	4,270	4,602	4,875	5,429	6,160	6,861	100.0
Residential % of Total					48.2	54.3	44.1	43.0	43.5	42.0	40.4	39.5	
Brazil - South Central Region													
Residential	n.a.	n.a.	n.a.	n.a.	3,362	3,600	3,861	4,167	4,584	5,129	5,674	6,112	22.9
Industrial					7,707	7,865	7,972	9,145	9,291	10,838	12,338	13,584	50.9
Commercial					2,307	2,356	2,579	2,722	2,890	3,254	3,616	3,901	14.7
Rural					242	258	297	307	339	366	192	223	0.8
Public Lighting, Traction, Official					2,060	2,055	2,121	2,114	2,411	2,587)			
Others					314	366	400	146	148	167)	2,591	2,858	10.7
Total					15,992	16,500	17,230	18,601	19,663	22,341	24,411	26,678	100.0
Residential % of Total					21.0	21.8	22.4	22.4	23.3	23.0	23.2	22.9	
Ethiopia - EELPA													
Residential	n.a.	n.a.	n.a.	n.a.	35	41	46	52	60	69	73	77	36.3
Industrial/Commercial					53	65	78	80	99	110	119	131	61.8
Public Lighting					2	2	2	3	3	3	3	4	1.9
Total					90	108	126	135	162	182	195	212	100.0
Residential % of Total					38.8	37.9	36.5	38.5	37.0	37.9	37.4	36.3	
Ghana - VRA/ECG													
Residential	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	102	116	130	140	153	173	6.3
Industrial - VALCO							-	14	923	1,866	1,972	2,012	73.5
Industrial - General							50	57	89	145	182	223	8.1
Mines (from VRA)							13	127	164	177	186	206	7.5
Other							82	94	98	106	117	126	4.6
Total							247	408	1,404	2,434	2,610	2,740	100.0
Residential % of Total							41.2	28.4	9.2	5.7	5.9	6.3	
Malaysia - NEB													
Residential	n.a.	n.a.	n.a.	108	120	140	163	184	203	225	249	269	12.4
Industrial/Mining				370	416	465	544	621	697	808	858	926	42.5
Commercial				232	267	314	366	423	473	530	577	628	28.8
Bulk				-	-	-	-	-	-	205	255	355	16.3
Total				710	803	919	1,073	1,228	1,373	1,768	1,939	2,178	100.0
Residential % of Total				15.2	14.9	15.2	15.1	14.9	14.7	12.7	12.8	12.4	
Mexico - National													
Residential	n.a.	n.a.	n.a.	1,422	1,612	1,816	1,971	2,256	2,534	2,804	3,152	3,582	165
Industrial				4,198	4,757	5,566	6,199	6,856	7,755	8,783	10,321	11,795	545
Commercial				1,428	1,656	1,830	1,992	2,185	2,385	2,592	2,849	3,111	143
Agriculture				621	708	809	865	872	930	979	1,199	1,349	62
Public Lighting				275	306	360	436	509	558	624	747)	1,846	85
Public Pumping				391	409	459	514	543	590	652	777)		
Others				273	213	157	164	180	246	271	361)		
Total				8,608	9,661	10,997	12,141	13,401	14,998	16,705	19,406	21,683	100.0
Residential % of total				16.5	16.7	16.5	16.2	16.8	16.8	16.7	16.2	16.5	
Singapore - PUB													
Residential	n.a.	n.a.	n.a.	345	382	436	424	471	496	518	567	638	32.9
Industrial/Commercial				331	334	377	470	583	720	903	1,058	1,273	65.5
Public Lighting				13	14	15	18	21	23	26	28	31	1.6
Total				689	730	828	912	1,075	1,239	1,447	1,653	1,942	100.0
Residential % of Total				50.0	52.3	52.6	46.4	43.8	40.0	35.7	34.3	32.9	
Bogota - EEEB													
Residential	144	164	175	191	228	262	307	337	386	438	494	566	27.9
Industrial	159	187	194	217	253	300	343	370	397	449	494	570	28.1
Commercial	130	148	148	157	176	200	217	229	238	257	268	293	14.4
Bulk	21	28	24	15	17	23	28	47	66	122	207	344	16.9
Public Lighting	19	25	29	32	35	40	42	44	46	56	70	78	3.8
Official	44	54	55	65	74	84	90	91	119	131	157	182	8.9
Total	517	606	625	677	783	909	1,027	1,118	1,252	1,453	1,690	2,033	100.0
Residential % of Total	27.8	27.0	28.0	28.2	29.1	28.8	29.8	30.1	30.8	30.1	29.2	27.9	
Medellin - EPM													
Residential	358	405	397	422	491	511	547	576	592	602	625	n.a.	50.0
Industrial	157	177	184	212	246	283	300	320	332	347	405	n.a.	32.5
Commercial	46	51	53	57	61	64	69	76	81	86	99	n.a.	7.9
Bulk	5	-	-	-	3	3	5	5	6	7	8	n.a.	0.6
Public Lighting	38	40	42	40	38	39	40	41	42	43	39	n.a.	3.1
Official	21	17	26	23	26	27	31	49	48	43	58	n.a.	4.7
Other	15	15	16	18	17	19	19	19	20	19	15	n.a.	1.2
Total	640	705	718	772	882	946	1,011	1,086	1,121	1,147	1,249	n.a.	100.0 a/
Residential % of Total	55.9	57.4	55.2	54.6	55.6	54.0	54.1	53.0	52.8	52.4	50.0		
Cali - EM Cali													
Residential	75	89	101	119	142	160	180	196	210	227	228	255	34.3
Industrial	95	108	116	147	189	202	210	226	251	272	309	349	46.9
Commercial	33	38	47	54	62	67	72	76	78	82	76	79	10.6
Bulk	10	8	14	23	15	6	6	7	7	6	6	8	1.1
Public Lighting	5	8	13	18	19	21	21	23	24	26	28	29	3.9
Official	8	10	11	12	16	18	20	21	23	26	27	24	3.2
Total	226	261	302	373	443	474	509	549	593	639	674	744	100.0
Residential % of Total	33.1	34.0	33.4	31.9	32.0	33.7	35.3	35.7	35.4	35.5	33.8	34.2	

a/ Percentage breakdown based on 1969 figures.