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PART II

POWER IN COLOMBIA AND THE IBRD

CHAPTER IX - THE POWER SECTOR IN COLOMBIA

I. Overall Power Development 1950-70

1.01 The power sector of Colombia expanded at a fast rate between 1950 and 1970: total installed generating capacity increased almost ten-fold, from 270 MW in 1950 to 2330 MW in 1970, while population nearly doubled from 12.2 million to 22.5 million and national income more than doubled from \$ 2.1 billion to nearly \$ 5.4 billion. Growth in electric power was especially high during the last decade when the average increase in capacity was about 140 MW annually. On a list of 11 Latin American countries, ^{1/} Colombia raised itself from sixth place in 1950 in terms of installed generating capacity to fifth place in 1968. With respect to installed capacity per capita Colombia has risen from ninth place, at 22 watts in 1950, to eighth place, at 96 watts, in 1968. The average growth rate for both total generating capacity and generating capacity per capita was probably the highest in all Latin America over the period. Current per capita capacity in Colombia, estimated at 103 watts, is close to the level of 120 watts which prevailed in the United States 50 years ago.

1.02 Economically, Colombia has diversified and strengthened over the last twenty years. It has become much less heavily dependent on coffee, which accounted for about 40% of total export earnings in 1970 but more than 70% in 1950. Agriculture, which still accounts for about 30% of national income, has grown about in line with population, at

^{1/} Brazil, Argentina, Mexico, Venezuela, Chile, Colombia, Peru, Uruguay, Bolivia, Ecuador, Paraguay (countries are listed in decreasing order of total installed capacity in 1960).

somewhat over 3% per annum on average. Manufacturing, though still accounting for only about 18% of national income and significantly less of total employment, has been the most dynamic major sector, attaining an average annual growth of nearly 6.5%. The 1960s have seen an important growth of exports of manufactured goods, though still on quite a small scale. The slow growth in agriculture, despite the country's considerable natural potentials in this field, has been reflected in a very rapid pace of urbanization. The proportion of the population living in towns has increased by about one percentage point a year, reaching by 1970, nearly 60% in total and about 45% in towns over 50,000 inhabitants. Improvements in welfare have been heavily concentrated in the cities and, even there, principally among people with property or with jobs in the modern parts of manufacturing and commerce. Income is exceptionally ill-distributed in Colombia, with only about 13.5% of total personal income going to the bottom 50% of income receivers; most of the latter live in the countryside where the problem of extreme poverty is no less and in some respects greater than it was in 1950. The public sector of the Colombian economy has traditionally been small and weak. Not until the last few years did total tax revenues break out of the traditional range of some 10 - 12% of GDP, but even now they are only about 13.5%. Relative to personal incomes, the total tax burden ranges between 12 - 14% for the lowest ten percent of income receivers and only about 20 - 22% for the top ten percent.

1.03 Table 9.1 gives some comparative data about income and growth

of income and electricity production in the eleven Latin American countries referred to above. The countries are ranked in order of the GNP growth rate attained over the period 1950-68. Colombia lies in the middle in terms of GNP growth but higher for growth of electricity production.

Table 9.1

11 Latin American Countries: 1968 Income and Income per Capita and Growth of Income and Electricity Production 1950-68

	Rate of Growth of GNP at factor cost 1950-68 (% p.a.)	Rate of Growth of Electricity Production (1950-1968)		1968 GNP per capita (1964 \$)	Total GNP in 1968 (billion 1964 \$)	1968 Population (million)
		Total	Public Supply			
Venezuela	6.8	-	13.4	842	8,156	9.7
Mexico	6.3	9.5	9.9	464	21,920	47.3
Brazil	5.5	8.9	8.8	218	19,236	88.2
Peru	5.2	10.0	10.3	301	3,841	12.8
Ecuador	4.8	10.9	24.5	200	1,137	5.7
Colombia	4.7	10.3	11.1	238	4,775	20.0
Chile	3.6	5.0	6.0	430	3,990	9.4
Paraguay	3.1	8.1	8.2	200	447	2.2
Argentina	3.0	7.0	6.4	770	18,190	23.6
Bolivia	2.5	-	5.7	138	644	4.7
Uruguay	1.1	6.5	6.8	460	1,294	2.8

Sources: IBRD World Tables, and Appendix Tables to Chapter I.

In most Latin American countries other than Argentina, public utility supply of electricity has grown more rapidly over the last two decades than total electricity production, and this is true of Colombia. The relationship between growth of GNP and growth of electricity production shows no systematic pattern.

1.04 The power sector in Colombia has benefitted from the existence

of a considerable and often relatively inexpensive hydroelectric potential, estimated at about 60,000 MW in aggregate at known sites. Of the 2,000 MW total installed capacity in the public sector at the end of 1970, about 1,460 MW were of hydroelectric origin, concentrated exclusively in the Andean region. The current installed hydro capacity represents less than 5% of the 30,000 MW hydroelectric potential of this area, demonstrating that the overall potential of the country has barely been tapped. The great majority of the exploited hydro potential of the Andean zone is concentrated within the so-called Bogota-Medellin-Cali industrial triangle (or Central region) which also includes the system of Manizales (see maps at end of chapter); these four centers accounted for 1,320 MW of the public sector hydroelectric installed capacity in 1970, and represented almost 90% of the total installed hydroelectric capacity in the country. Most of the hydroelectric plants now in operation are of limited capacity, having been established on easily exploitable low cost hydro sites to satisfy the limited needs of immediate markets. However, a new era in the power development of Colombia is now beginning which will see the realization of large scale hydroplants whose potentials will be sufficient to assure an adequate power supply for enlarged interconnected markets.

1.05 Colombia also enjoys a high thermoelectric potential. Its coal reserves, estimated at about 18 billion tons, are the largest in South America. Oil deposits, with possible reserves of 3 billion barrels, place the country in second place in South America, following Venezuela.

Most oil fields have a low gas-oil ratio and the exploitation of natural gas has not been of major significance; the extent of actual reserves is still unknown. The share of thermal generation in total generation has remained virtually the same since 1950, at about 24%. The largest proportion of such generation is found in areas having a low or nonexistent hydro potential, such as the whole Northern region. The predominant trend in thermal production has been the increasing share of gas generation since 1954 and the decreasing share held by diesel, which fell regularly from 8.9% in 1954 to 3.8% in 1970. This is easily explainable in view of the low cost of natural gas as compared to the constantly rising costs of fuel oil. Actual fuel consumption in thermoelectric plants has always accounted for only a minor portion of total fuel production in the country: 29% for coal and 4% for fuel oil. Comparable figures are not available for gas generation, which takes place exclusively in the four northern Departments of Atlantico, Bolivar, Cordoba and Norte de Santander, contributing about 46% of the almost exclusively thermal energy production in these Departments. Apart from electricity production in the North, the main demand for gas is related to the manufacture of chemicals. It can be asserted that, given the important reserves of fossil fuels and the relatively low share of thermal generation in Colombia, electricity production has not adversely affected the potential utilization of such resources in other sectors of the economy.

1.06 The high mountain ranges which cover the entire central portion of the country have isolated various regions, causing them to develop

separately their own customs, regional institutions, and natural resources. The Andean region, with a population estimated at about 65% of the total population of Colombia, has a major advantage in terms of overall power availability, due to its high hydropotential and also to the existence of substantial mineral deposits. The development of such resources is well under way, mainly the hydroelectric resources. The Northern region, with about 22% of the total population, has to rely almost exclusively on more expensive thermal generation. The rest of the country has a relatively small population and potential power resources available there have remained virtually unexploited. The failure to give priority to transmission projects until recent years has induced the development of independent regional electric systems, leading to major regional discrepancies characterized by the relatively spectacular expansion of the Bogota, Medellin, Cali and Manizales electric systems which now form the Central Interconnected System.

1.07 Total installed capacity in the four main central systems represented 46% of total installed capacity of 111 MW in the public sector in 1950. This proportion has increased regularly over the last twenty years, reaching 71% in 1970, as shown in Table 9.2. The four main central systems had an installed capacity in 1970 of 1,466 MW. Installed capacity of these systems has grown at average rate of 13.6% per annum over the whole period, as compared with 8% in the rest of the public sector. Installed capacity per capita in the service area of the four systems, which now directly serve a population of about 6 million (27% of

Table 9.2

Growth of Installed Generating Capacity in the Public Sector 1950-70
(as of December 31)

	<u>1950</u>		<u>1960</u>		<u>1970</u>	
	<u>MW</u>	<u>% of Total</u>	<u>MW</u>	<u>% of Total</u>	<u>MW</u>	<u>% of Total</u>
<u>Four Main Central Systems</u>						
Bogota	46.0	19.1	128.0	19.1	587.5	28.3
Medellin	51.5	21.5	137.0	20.4	443.0	21.3
Cali	11.1	4.6	95.1	14.2	248.1	12.0
Manizales	2.8	1.2	22.8	3.4	187.8	9.0
Sub-Total	<u>111.4</u>	<u>46.4</u>	<u>382.9</u>	<u>57.1</u>	<u>1466.4</u>	<u>70.6</u>
<u>Rest of Country</u>	129.6	53.6	287.1	42.9	611.6	29.4
<u>TOTAL</u>	<u>241.0</u>	100.0	<u>670.0</u>	100.0	<u>2078.0</u>	100.0

total population), was about 242 watts in 1970, while the national average for the public sector came to only 92 watts. In other words, the gap which already existed in 1950 between the four central systems and other systems in the country has been progressively widening over the last twenty years. This gap is a reflection of the generally disproportionate rate of economic development in the country, which has traditionally favored the Departments of Cundinamarca, Antioquia, Valle del Cauca and Caldas. In other areas of the country, only the Department of Atlantico with the seaport of Barranquilla can be compared to these four Departments in terms of economic development and electric service. In 1970, the five aforementioned Departments accounted for about 50% of the

country's population and generated 82% of total value added in the manufacturing sector.

1.08 In most areas of the country, the sub-transmission and distribution systems have remained insufficiently developed or poorly adapted. Although some progress has been made in the electrification of new areas, as much as 55% of the total population had no electric service at all in 1970. This proportion was about 74% in 1951. Statistics on this matter are very scarce and often inconsistent when available; an attempt to make interregional comparisons in the progress of electrification would be highly hazardous. A somewhat speculative extrapolation from the latest census (1964) suggests, however, that on the average about 70% of the population residing in the main centers ^{1/} is currently connected to the public network. As regards the remaining municipalities, which can be classified as "rural municipalities", the proportion is probably less than 7%. This tends to show that rural electrification has, on the whole, remained almost completely neglected until now.

II. Organization of the Sector and Major Institutional Developments

2.01 Public electricity is at present almost entirely supplied by four entities: the Empresa de Energia Electrica de Bogota (EEEB), the Empresas Publicas de Medellin (EPM), the Corporacion Autonoma Regional del Cauca (CVC), and the Instituto Colombiano de Energia Electrica (ICEL). ^{2/}

^{1/} Those 46 Centers which had a population of more than 10,000 in 1964.

^{2/} Formerly Electraguas, which ICEL replaced in 1968.

While EEEB and EPM are autonomous, municipally-owned companies, operating almost exclusively at the municipal level, CVC and ICEL are under the direct control of the Central Government. CVC, a multipurpose, autonomous, nationally-chartered, regional entity set up along the lines of the T.V.A., was established in 1954 and assigned the task of developing the resources of the Cauca Valley, mainly in the fields of electric power and agricultural development. To carry on its power development function, CVC became the majority shareholder in CHIDRAL (Central Hidroelectrica del Rio Anchicaya, Ltda.), the power company in charge of supplying electricity to the city of Cali. ICEL, the only nation-wide power entity, is a holding company rather than an operating entity, controlling 15 departmental subsidiaries which provide electric service to 20 of the 29 Departments of the country outside the service areas of EEEB, EPM or CVC. The remaining 9 Departments, with the exception of the Department of Valle which is supplied entirely by CVC, are located in the southeastern plain of the Llanos and have very limited public power facilities and a scattered population representing less than 5% of the country's total population. Central Hidroelectrica de Caldas (CHEC) is ICEL's major subsidiary, serving the Departments of Caldas, Quindio and Risaralda around Manizales in central Colombia. ICEL's main functions have been to promote the development of electric power in the country, formulate comprehensive national electrification plans and coordinate the construction programs of its subsidiaries.

2.02 One of the major institutional achievements of the 1960-70

period was the establishment in 1967 of two new companies, Interconexion Electrica S. A. (ISA) and Corporacion Electrica de la Costa Atlantica (CORELCA), created for the purpose of interconnecting major parts of the national electric network. ISA was founded as a joint-stock company under the sponsorship of the four major power entities of the Central region, i.e. EEEB, EPM, CVC/CHIDRAL and CHEC, which each contributed 25% of the paid-in share capital. ISA's statutory purposes are the interconnection of the sponsors' electric systems and the planning, construction, ownership and operation of new power generating plants serving the whole interconnected system. CORELCA, a decentralized public entity with regional jurisdiction, is responsible for the interconnection of the major markets in the Atlantic Coast region (including Barranquilla, Cartagena and Santa Marta), as well as for the planning, construction and operation of the generating plants supplying its system. The Central Interconnected System will be in operation at the end of 1971, while completion of the Northern Interconnected System is now slated for the beginning of 1972.

2.03 The last major innovation introduced in the institutional setup of the power sector has been the establishment, late in 1968, of a tariff regulatory agency (Junta Nacional de Tarifas de Servicios Publicos) as a part of Planeacion Nacional, the National Government Planning Department. The purpose of the agency was to restructure and adjust the traditionally inadequate public utility tariffs in Colombia in such a way that utilities could gradually become financially more self-sufficient,

thereby permitting orderly financing of their system expansion programs.

2.04 Planeacion Nacional is basically responsible for drawing up national power development plans and for the preparation of the National Investment Budget. After having collected the necessary technical and financial data from the various power companies, the Department reviews the projects proposed by each in light of the recommendations appearing in the national development plan and attempts to establish an order of priority for projects based upon appropriate social and economic criteria, as well as the availability of foreign credit and budgetary resources.

III. Major Problems of the Power Sector

3.01 As indicated earlier, the development of the power sector has been far from uniform throughout the country and severe regional discrepancies have resulted; while cities like Bogota, Medellin, Cali and Manizales have enjoyed efficient electricity service, most other centers have continually suffered from major shortages and were forced to adopt short-term emergency solutions to cope with the growth of demand. This was the case, for instance, for Barranquilla, Santa Marta, Popayan, and to a lesser extent, for Cartagena and Bucaramanga, which were generally unsuccessful in carrying out long term economic planning for their respective electric systems.

3.02 The isolation and overly-emphasized independence of the various systems, coupled with inadequate delineation between the jurisdictions of the power companies, has led to a proliferation of small entities serving areas of uneconomic size, and to overall misallocations and

inefficient uses of resources. The larger companies, which serve privileged urban markets and supply only limited zones outside their respective service areas, have seen their relative positions greatly strengthened over time, thus exacerbating regional discrepancies and widening the gap between urban and rural areas. In an effort to integrate the national electric service, ICEL attempted to regroup regional electric systems according to a more appropriate pattern which would take account of the specific geographic, economic and social characteristics of each region. The country was thus divided into six electric zones, but this measure has not yet resulted in a visible improvement in the organization of the sector.

3.03 The most positive reform introduced in recent years to promote national integration of the sector has probably been the creation of the two inter-Departmental interconnection companies, ISA (Central region) and CORELCA (Northern region). As pointed out earlier, ISA's system will begin operation shortly, while the Northern Interconnection is planned for completion by the beginning of 1972. The interconnection of the Northeastern region (Barrancabermeja, Bucaramanga) with the Central Interconnected System will probably also have been completed by 1972 and serious consideration is currently being given to the subsequent connection of the expanded Central System with CORELCA's network. This national network will provide for efficient and flexible transmission of large amounts of energy from large hydroelectric plants to all the major power markets of the country, thereby permitting important economies of scale. The

completion of this national electric backbone will also ultimately allow a more economical connection of the as yet isolated rural areas.

3.04 Colombia has traditionally suffered from a lack of coordination between the various power planning agencies. The major problem which has arisen in this connection and still remains acute today is the difficulty encountered by ICEL, the official national power entity, in carrying out planning activities. The main reasons for this are the poor organization of the entity, the insufficient qualifications of its technical staff, the isolated and dispersed nature of the systems it controls, and its constant subjection to political pressures. Also, the influence of ICEL over the country's three major power companies (EEEB, EPM and CVC/CHIDRAL), which currently control more than 60% of the country's total generating capacity, has been negligible in the past; the service areas of these three companies, especially in the case of EEEB and EPM, have traditionally been looked upon as private domains. Over the last six years, which have witnessed the reorganization of ICEL, Planeacion Nacional has played a leading role in power planning on the national level. As indicated earlier, Planeacion was responsible for drawing up the budget and therefore held considerable leverage over ICEL's operations, which to a large extent, were financed through central budget allocations. The influence of Planeacion over the investment programs of EEEB, EPM and CVC/CHIDRAL was mainly applied in connection with their securing of foreign loans, because any project financed through such loans had to receive Planeacion's prior approval.

3.05 Planeacion has also greatly contributed to the planning of the Central Interconnected System and to the establishment of ISA which should become, within the next decade, the largest energy-generating authority in the country. The creation of ISA was the first tie ever established between ICEL, EEEB, EPM and CVC/CHIDRAL. It should be noted, however, that ICEL, through the participation of CHEC, became involved in Interconexion only a year after the three other companies had agreed (in 1963) upon the principle of interconnecting their systems, suggesting that the national power entity contributed only marginally to the overall planning of the integrated network. It is now high time to re-define the respective role of ICEL, ISA and Planeacion in the elaboration of national power expansion plans and to coordinate the activities of the three organizations.

3.06 The lack of statistics on hydrology, precipitation, availability and cost of fuel and manpower, etc., has made it difficult for the planning authorities to assess the economic viability of specific projects and has hindered attempts to carry out comparative studies on the attractiveness of prospective alternatives. The failure to collect adequate information on actual demand patterns, trends in public investments, self-financing ability of power companies, availability of local funds, and actual costs of past projects have made it difficult to benefit from past experience and, therefore, to carry out meaningful long term planning in the power sector.

3.07 As a result of this, project evaluations have often been carried

out haphazardly, with some exceptions in cases when the contributing financial agent (whether an external financing agency or the Government) requested the use of sound technical and economic criteria in decision making. It is only recently that Planeacion, ICEL and the National Department of Statistics have undertaken the task of standardizing the collection, classification and dissemination of relevant statistics. Also, the financial assistance provided by the Fondo Nacional de Desarrollo (FONADE) in recent years for the execution of feasibility studies has enabled Planeacion to standardize and improve the terms of reference of the studies.

3.08 The lack of planning at the national level, coupled with the absence of well-defined service areas for the various power utilities, has often led to the adoption of ill-advised investments involving duplication of equipment or insufficient installations. In some cases, investment decisions have been dictated by private or political interests incompatible with the national interest as a whole.

3.09 The choice of equipment, construction methods, maintenance and operation policies were generally not bound to suitable pre-established specifications. For instance, actual specifications for transmission and especially distribution equipment have often not been appropriate for the prevailing type of demand, causing significant system losses. Also, inadequate reservoir operation policies have resulted in major water wastages and unnecessary use of expensive thermal generation. Over the last five years, the development of the Central Interconnected System

has included the systematic use of optimizing techniques in system planning and operation. The software, however, had been abandoned upon completion of the Interconnection Study and about four months of extensive research were required to revive and calibrate the program for the purpose of the evaluation study. Planeacion is currently working on a set of instructions for the use of the model, which will probably aid Planeacion, ICEL and ISA in contending with the increasingly complicated problems of system expansion planning.

3.10 As suggested earlier, the development of unbalanced power markets has made it difficult for the several smaller power entities to carry out their duties efficiently. Also, large centers such as Bogota and Medellin tend to attract the more capable and talented people, often leaving the smaller centers with managerial and technical staff of lower quality. Poorly organized operation and maintenance programs in such centers have led to a rapid deterioration of certain types of equipment, resulting in major deficiencies in electric service and high recurrent expenditures. As yet, ICEL has not made any major effort to improve the quality of its subsidiaries' management. The fact that ICEL is entirely responsible for the construction of major projects further limits the participation of the individual entities and therefore diminishes chances for improving local professional ability. In addition, ICEL rarely takes the opportunity presented by projects it finances to request reforms in the subsidiary's organization. There is an obvious need to improve coordination and standardization of system operations and control as well

as accounting procedures. ICEL and Planeacion seem willing to exert pressure in this direction by setting up a rotating panel of engineers and financial analysts which would visit and assist each power entity for a limited period of time with a view to achieving these goals.

3.11 Past investments in the sector have concentrated mainly on the expansion of generation and, to a lesser extent, transmission facilities, leaving insufficient resources for the improvement and expansion of sub-transmission and distribution networks. Between 1965 and 1970, investments in such networks represented only about 39% of total public fixed investment in the power sector. The poor physical condition of the networks has, in most cases, resulted in important system losses. Such losses,^{1/} which vary greatly from one center to another, generally comprise between about 15%, and 25% of generation sent out, but in some cases reach up to 35%. Bogota is the only case in which such losses have remained below 12%, a limit which can be considered a reasonable operating level. The share of stolen energy in total system losses, although difficult to assess in general, has probably been quite significant for many companies. In the case of Medellin, for instance, the connection of marginal zones has been neglected until recently and stolen energy there accounts for 15% of total energy sent out or more than half of total system losses. As pointed out earlier, more than 55% of the country's population is still unconnected today. The Government, becoming more and more aware of the need to extend

^{1/} Difference between energy sent out and sales, expressed as a proportion of energy sent out.

electrification to more people, has recently launched a nation-wide distribution rehabilitation program for which a \$ 25 million loan has been secured from the IDB. In this connection, ICEL and Planeacion have commissioned a study for the preparation of designs and construction norms, with the objective of standardizing distribution equipment and installation. Finally, the creation of ISA as a major generating entity will probably both enable and force the individual power companies to devote more attention to distribution problems.

3.12 The great majority of power companies in Colombia have always had major difficulties in generating sufficient resources to finance their own expansion programs. Returns on investments, even when positive, have generally been grossly inadequate to cover capital costs and debt service: in 1969, only 6 power companies had positive financial rates of return on non-revalued assets and, of these, only two had returns on revalued assets greater than 5%. The lack of self-financing ability, combined with the difficulties of raising local funds in other ways, has hampered the companies' long term planning ability and has often forced them to adopt emergency solutions to provide electric service; this, in turn, led to inadequate system expansion and low efficiency in system operation, ultimately involving additional financial losses and further difficulties in controlling the worsening situation. Financial outlays for power by the Central Government have therefore been increasing at a high rate but seem to have been used with a declining level of productivity, probably because the growing reliance of the power companies on such funds has weakened their

motivation to improve overall system efficiency. One of the main reasons for the companies' weak financial situation has been the generally low average level of tariffs which could barely keep up with internal inflation and the repeated devaluation of the peso. Tariff increases in Colombia were in fact always fiercely opposed by local political leaders and, in several instances, gave rise to violent social disorders. It was with a view to coping with this delicate issue that the Government created the previously mentioned tariff regulatory agency in December 1968.

IV. Financing of the Sector

4.01 In spite of the scarcity and inconsistency of statistics regarding public and private investment in the various sectors of the economy, the broad trends of fixed investment in the power sector can be isolated with a reasonable degree of reliability. Total public investment in the power sector, after increasing steadily from 1950 to 1963, appears to have remained fairly constant since then at around \$ 60 million equivalent per year. As a proportion of all public investment, it seems to have risen to about 15% in 1963, after which it has probably declined, in view of the large increase in total public investment. These figures reflect the high degree of importance attached to power by the Government, especially after 1958 when it decided to give it highest priority in the development program, in order to catch up with the backlog which had accumulated over previous years and to support industrial growth.

4.02 The aggregate share of EEEB, EPM, and CVC/CHIDRAL in the overall investment program has remained very high over the years, covering between

53% and 59% of total public investment in power. ICEL's fixed investment has experienced major fluctuations but its share in the overall national power investment program has remained more or less the same since 1960 at about 25%. This reflects the difficulties encountered by ICEL in financing the expansion of the numerous systems it controls. The fact that CHEC accounted for about one-fifth of the gross fixed investment realized by ICEL between 1956 and 1969 emphasizes the mediocre picture presented by the other subsidiaries.

4.03 The very scarce information available on investments of private companies in the expansion of their power facilities suggests that fixed investment in such enterprises has remained more or less stationary, at about \$ 6 million equivalent annually. This tends to demonstrate that manufacturing industries, as they expanded, relied more and more upon public electricity service.

4.04 In the past, only EEEB and EPM were able to finance their operation and investment expenditures from self-generated funds and local and foreign borrowing without having to resort to national budget appropriations to a significant extent. This has also been the case for ISA which obtains part of its funds through the contributions of its sponsors. CVC/CHIDRAL, ICEL and more recently CORELCA have, over the years, received substantial budgetary allocations and credits from the Central Government to cover some of their current expenditures and investments, as well as to service credits and loans. The subsidiaries of ICEL seem to have become progressively less self-sufficient as they expanded, thereby

increasingly straining national resources: budgetary allocations to ICEL rose regularly between 1965 and 1970, from \$ 8 million equivalent to \$ 22 million equivalent.

4.05 Local investment funds, in addition to Government subsidies, were obtained either from the companies' profits or from local banks and credit institutions. Appropriations for electric projects from Departmental Government resources declined substantially after the abolition in 1968 of the liquor tax which had originally been imposed for the purpose. Such contributions, as well as contributions from the municipal budgets, are now quite small except in a few exceptional cases. Local currency financing has been one of the major (if not the major) problems encountered consistently throughout the years in the development of the power sector. Average tariff levels were always insufficient to permit orderly financing of system expansion. Tariff increases, although frequent and considerable, were generally offset by inflation, which rapidly escalated local costs, and by repeated peso devaluations, which expanded the foreign debt. The self-financing rates of most power companies have remained quite low, even in the case of the two most efficient companies in the country, EEEB and EPM, which between 1961 and 1970, covered only 27% and 32%, respectively, of their investment expenditures from self-generated funds. Borrowing from local financing institutions has proved especially difficult because of the country's deficient capital market, and such funds never represented more than 5% of total investments in the power sector. The actual role of private banks, including development finance companies, appears quite

limited when one realizes that the major supplier of local currency loans to the sector has been the Instituto de Fomento Industrial (IFI), a governmental credit institution. The extensive complications involved in securing local funds have probably enticed the various power companies into relying more heavily than necessary upon relatively easily secured foreign credits to finance their expansion programs. The recent decision of EPM to float a Ps. 100 million debenture is an important step which deserves special mention, for this is the first time that a power company in Colombia has attempted to tap the credit market directly, thus becoming a mobilizer of domestic savings itself.

4.06 The power sector has been a major user of foreign credits; between 1955 and 1970, 52% of total fixed investment in power was in foreign currency. Over the same period, the annual share of foreign credits in public power investments was from two to five times larger than the share of such credits in total public investment, making power the second most intensive user of foreign loans, after telecommunications and before industry. This tends to underline, aside from the difficulty of raising local funds discussed earlier, the limited development of the national electric equipment manufacturing industry in Colombia. Colombia has been successful in raising long term credits from international and bilateral organizations, such as the IBRD, the IDB and the Eximbank. The IBRD has been Colombia's main source of foreign exchange for the power sector in the past, supplying about 73% of total foreign financing for the sector between 1951 and 1970. This proportion has, however, experienced

major fluctuations over the years: between 1960 and 1965, the IBRD was virtually the only source of foreign currency financing for power, while, since 1965, the relative share of other foreign financing institutions, mainly the IDB, has increased sharply, leaving the IBRD with a share of 53% in 1969.

4.07 The terms of IBRD, IDB and Eximbank loans to the power sector of Colombia have been especially attractive in comparison to other sources of credit. The remainder, representing about 9% of total foreign financing, consisted mainly of suppliers' credits with relatively high interest rates and short repayment periods. It appears that, in general, IBRD loans have been sought in preference over other sources of funds. When the IDB was created in 1959, the IBRD had already been involved in the power sector of Colombia for about nine years and had already made 7 loans to that sector. The fact that the terms, conditions and administrative procedures of IBRD loans were well known explains to a large extent why, in the late 1960s, the IBRD was usually approached first for the financing of power projects. By the time the IDB was in a position to undertake extensive lending to Colombia, i.e. around 1964, the IBRD was already deeply involved in financing the power development programs of EEEB, EPM, CHEC and CVC/CHIDRAL: this most probably explains why the initial loan requests for the San Francisco (CHEC) and Alto Anchicaya (CVC/CHIDRAL) plants were addressed to the IBRD, although both were ultimately financed by the IDB. After 1964, the IBRD made interconnection the keystone of its lending program to Colombian power, while the IDB concentrated its lending on Electraguas, the national

power entity which was responsible for the rest of the country and which never received any really significant support from the IBRD.

V. IBRD Financial Participation

5.01 Several of the first projects for which Colombia requested the assistance of the Bank in 1948 and which were reviewed by the Bank's first economic mission of that year were in electric power. Ever since then the Bank has been involved in the development of the Colombian power sector, particularly heavily in the late 1950s and throughout the 1960s. Through the end of 1970 the Bank made 17 power loans totalling \$ 294.1 million, or nearly 40% of total commitments to Colombia, 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. This included \$ 160.8 million in the form of 13 fully disbursed loans. Table 9.3 lists the various loans.

5.02 Lending to Colombia for power started with three relatively small loans in 1950-51 to three companies subsidiary to Electraguas, the national power holding entity, and responsible for power supply in three of the larger cities: CHIDRAL (Cali), CHEC (Manizales) and Lebrija (Bucaramanga). Further loans were made in the middle 1950s to CHIDRAL, but the Bank's principal lending for power started after 1958. Then it was mainly concentrated on the three largest urban centers (Bogota, Medellin and Cali) first independently and later on in the context of the central interconnected system, for creation of which a loan was made in 1968. CHEC in Manizales, the seventh city in the country in terms of size and the smallest to have

Table 9.3

COLOMBIA - Electric Energy - IBRD Loans to the Power Sector

<u>Company</u>	<u>Date of Agreement</u>	<u>Loan Number</u>	<u>Name of Project</u>	<u>Gene- rating capacity provided (MW)</u>	<u>Amount of Loan (US\$ mln)</u>
<u>Cauca Valley</u>					
CHIDRAL	Nov. 1950	38 CO	Anchicaya	24	3.53
CHIDRAL	March 1955	113 CO	Anchicaya & Yumbo	30	4.50
CHIDRAL	Dec. 1958	215 CO	Yumbo	10	2.80
CVC/CHIDRAL	May 1960	255 CO	Yumbo & Calima I	93	25.00
CVC/CHIDRAL	June 1963	339 CO	Calima I	60	8.80
			Sub-Total	217	44.63
<u>Manizales</u>					
CHEC	Dec. 1950	39 CO	La Insula	20	2.60
CHEC	Jan. 1959	217 CO	La Esmeralda	30	4.60
			Sub-Total	50	7.20
<u>Bogota</u>					
EEEEB	Jan. 1960	246 CO	Laguneta, Salto II & Zipaquira I	117	17.60
EEEEB	May 1962	313 CO	El Colegio & Zipaquira II	188	50.00
EEEEB	June 1968	537 CO	El Colegio & Canoas	200	18.00 ^{a/}
			Sub-Total	505	85.60
<u>Medellin</u>					
EPM	May 1959	225 CO	Guadalupe III & Troneras	108	12.00
EPM	May 1961	282 CO	Guadalupe III & Troneras	198	22.00
EPM	Feb. 1964	369 CO	Guatape I	264	45.00 ^{a/}
			Sub-Total	570	79.00
<u>Interconnection</u>					
ISA	Dec. 1968	575 CO	230 KV Interconnection network	-	18.00 ^{a/}
ISA	June 1970	681 CO	Chivor	500	52.30 ^{a/}
			Sub-Total	500	70.30
<u>Bucaramanga</u>					
Rio Lebrija	Nov. 1951	54 CO	Lebrija	9	2.40
<u>Cartagena</u>					
Electribol	July 1963	347 CO	Cospique	25	5.00
			TOTAL	1,876	294.13

Sources: IBRD; additional details are given in Annex Table 1.8

^{a/} Not yet fully disbursed.

hydroelectric plants at Canoas (50 MW) and Guatapé I (264 MW), are completed, thus bringing total Bank financed installed capacity to 138. This, of course, does not include the 500 MW Chivor hydroelectric plant currently under construction and planned for completion by 1976. Total electricity generation in Bank financed power plants amounted about 4,200 GWh, (an average load factor of 45%), representing 53% of total generation in the country. Of the 1066 MW Bank financed capacity in service at the end of 1970, as much as 918 MW (86%) was hydro, representing 63% of total hydroelectric capacity installed in the country. Table 2.2 below gives, by center, the detailed share of Bank financed generating capacity held by hydro and thermal units.

Table 2.2 shows that the Bank has played a fundamental role in the power development programs of EEEB, EPM and CVC/CHIDRAL, by contributing to the costs of 77% of the aggregate capacity now installed in these three centers; this proportion will be raised to approximately 80% by the end of 1971.

Between 1951 and 1970, the Bank supplied about 73% of total foreign financing to the power sector of Colombia (Table 1.15). The highest relative level of IBRD financial participation occurred in the 1960-65 period, when the Bank provided as much as 93% of total foreign financing in the sector. It is estimated that fixed investment from Bank funds represented about 31% of total public fixed investment in power between 1960 and 1970. Bank disbursements were very heavily concentrated on the four main power systems which now form the central interconnection.

been direct recipient of a Bank loan, received a second Bank loan in 1959 and is also involved in the central interconnected system. Cartagena, the sixth-ranking city of Colombia, benefitted from a small loan for power in the early 1960s.

5.03 By the end of 1970, Bank-financed installed capacity in operation amounted to 1,066 MW or about 51% of total installed capacity in the public sector. This ratio will probably have reached about 55% by the end of 1971 when the two hydroelectric plants at Canoas (50 MW) and Guatape I (264 MW) are completed, thus bringing total Bank-financed installed capacity to 1,380 MW. This does not include the 500 MW Chivor hydroelectric plant currently under construction and planned for completion by 1976. In 1970, total electricity generation in Bank-financed power plants amounted to some 4,200 Gwh (an average load factor of 45%), representing 53% of total generation in the country. It is estimated that, at the end of 1970, approximately 6 million people in Colombia, i.e. about 27% of the total population (22.5 million) and 60% of the population having electricity service (10 million), were supplied with electricity generated in power plants financed through Bank loans. Of the 1,066 MW Bank-financed capacity in service at the end of 1970, as much as 918 MW (86%) was hydro, representing 63% of total hydroelectric capacity installed in the country. The Bank has played a fundamental role in the power development programs of EEEB, EPM and CVC/CHIDRAL, by helping to finance 77% of the aggregate installed capacity in these three centers; this proportion will be raised to approximately 81% by the end of 1971.

5.04 It is estimated that fixed investment from Bank funds accounted for some 31% of total fixed investment in power in Colombia between 1960 and 1971. As mentioned, Bank lending, especially in this period, has been heavily concentrated on the four companies which together make the central interconnected system: as of December 31, 1970 total disbursements for projects in the four systems amounted to \$ 197.8 million or 89.7% of total power loan disbursements; loan commitments on such projects represented 74% of total commitments for power, or 97% if one includes the two loans to ISA.

5.05 The Bank was virtually the sole source of foreign currency for CVC/CHIDRAL between 1950 and 1968, the year in which the IDB extended a \$ 60 million loan for the Alto Anchicaya hydroelectric project. This was also the case for EEEB and EPM over the 1960-71 period when the installed generating capacity of the two companies was multiplied five- and four-fold, respectively. EEEB has recently secured foreign loans from the U. S. Exim-bank, an American commercial bank, and Japanese suppliers, in an aggregate amount of \$ 7 million, which will cover the foreign currency expenditures on the third unit at Zipaquira currently under construction. In the case of CHEC, the Bank remained the exclusive source of foreign currency financing between 1950 and 1965, when the IDB provided a \$ 8 million loan for the construction of the San Francisco hydroplant.

VI. IBRD Policy Advice and Project Selection

6.01 The main Bank involvement in power in Colombia started with the review of the sector that was undertaken in 1949 as part of a comprehensive

survey of Colombia's development problems and prospects. This survey was sponsored by the Bank and carried out by a team headed by Dr. Lauchlin Currie, a former New Deal economist. Most of the principal recommendations made in the mission's report have eventually been followed, after lengthy delays and with varying degrees of success. The report emphasized the need to: (a) give priority to power development projects in some selected main centers;^{1/} (b) create regional and, later, national interconnecting networks; (c) promote financial self-sufficiency of power companies; (d) establish an independent tariff regulating agency; and (e) make Electraguas the national power planning agency with the responsibility for collecting relevant statistics, developing national electrification plans and implementing such plans. Electrification has expanded substantially in the centers regarded by the mission as deserving primary attention, but some of them, namely Barranquilla, Cartagena and Popayan still have inadequate electric service today. It was not until twenty years after the initial recommendation had been made that the first regional interconnection network was implemented and the national tariff agency established. Electraguas (and later on ICEL) have actually played only a minor role in power planning; the 1954 National Electrification Plan prepared under the sponsorship of Electraguas as well as the 1964 improved version of the plan, have hardly affected the actual development of the sector. Furthermore, it is only very recently that ICEL has undertaken the systematic collection of statistics relevant to power planning and even today the national entity still appears insufficiently equipped to efficiently carry out its assigned functions.

^{1/} Bogota, Medellin, Cali, Barranquilla, Manizales, Cartagena, Cucuta and Popayan.

6.02 No Bank report since 1949 has attempted to take as broad and deep a view of the power sector in Colombia. Moreover, there was little or no follow-up to the 1949 mission's broader recommendations cited above; the issues were taken up anew, and probably without reference to that report, in the 1960s. Typically, even in the 1960s, the Bank's economic reports have contented themselves with a vague description of the sector and a more precise historical sketch of previous Bank projects. The only issues tackled in several cases were the necessity for tariff increases and for promoting the central interconnected system. A few reports, as in 1956 and 1962, have attempted to take a more comprehensive outlook in connection with the overall public investment program, but they have not gone much beyond a fairly superficial review of bulk supply projects in preparation and their financial requirements. Basic issues such as appropriate reliability standards, analysis of load forecasts, energy policies, regional allocation of investment, domestic production of electrical equipment, power distribution problems and policies, and tariff structures have never been touched. It can even be asserted that none of the Bank's economic reports has ever made any major recommendations other than with regard to raising tariffs, which have influenced Colombia's policy in power development matters. These facts appear especially striking considering what a large proportion of total Bank lending to Colombia has been for electric power.

6.03 Bank lending to the power sector has, broadly speaking, been on a project basis. Actual project identification has been very limited and

loan consideration has always followed an initial request by the ultimate borrower. In virtually all cases, project evaluation has been made on the basis of engineering and financial criteria alone, with only very limited assessments of the actual long term economic implications of the projects, and of the comparable benefits investments in alternative projects might have brought.

6.04 It should not be concluded from the above that the Bank has taken a shortsighted view of power development in Colombia. On the contrary, Bank lending has been characterized by consistency, singularity of purpose in pursuing objectives, and ingenuity in the implementation of policies toward these objectives. The Bank has been an indefatigable advocate of the Central Interconnected System (see Chapter XIII) and, on several occasions, has risked imperiling its rapport with the three main borrowers, EEEB, EPM, and CVC/CHIDRAL, in order to emphasize the importance of this goal. Neither did the Bank hesitate to confront the open hostility of the central Government and local communities toward its constant insistence on tariff increases and, in the later 1960s, the necessity of establishing a national tariff regulatory agency. In retrospect, both of these objectives appear to have been well founded and important.

6.05 As stated before, Bank loans to the power sector have concentrated mainly on the three largest cities, i.e. Bogota, Medellin and Cali, which accounted, in 1970, for 38% of the country's urban population ^{1/}

^{1/} Centers having population greater than 1,500.

and 22% of the total population. The growth of these centers, traditionally Colombia's main industrial centers, necessitated major power investments, in face of the large influx of population from the smaller towns and the countryside. This was especially true after the deferral of investment in 1957-58 as a result of the financial crisis stemming from poor financial policies and the sharp deterioration in the world coffee market. At that time the IBRD, and to a much lesser extent the U.S. Eximbank, were probably the only lending institutions able to provide the large amounts of long-term foreign currency financing, on good terms, that were required. It would be unwise to cast doubt upon the high priority in the overall economy attached to development of the public utilities in Bogota, Medellin and Cali.

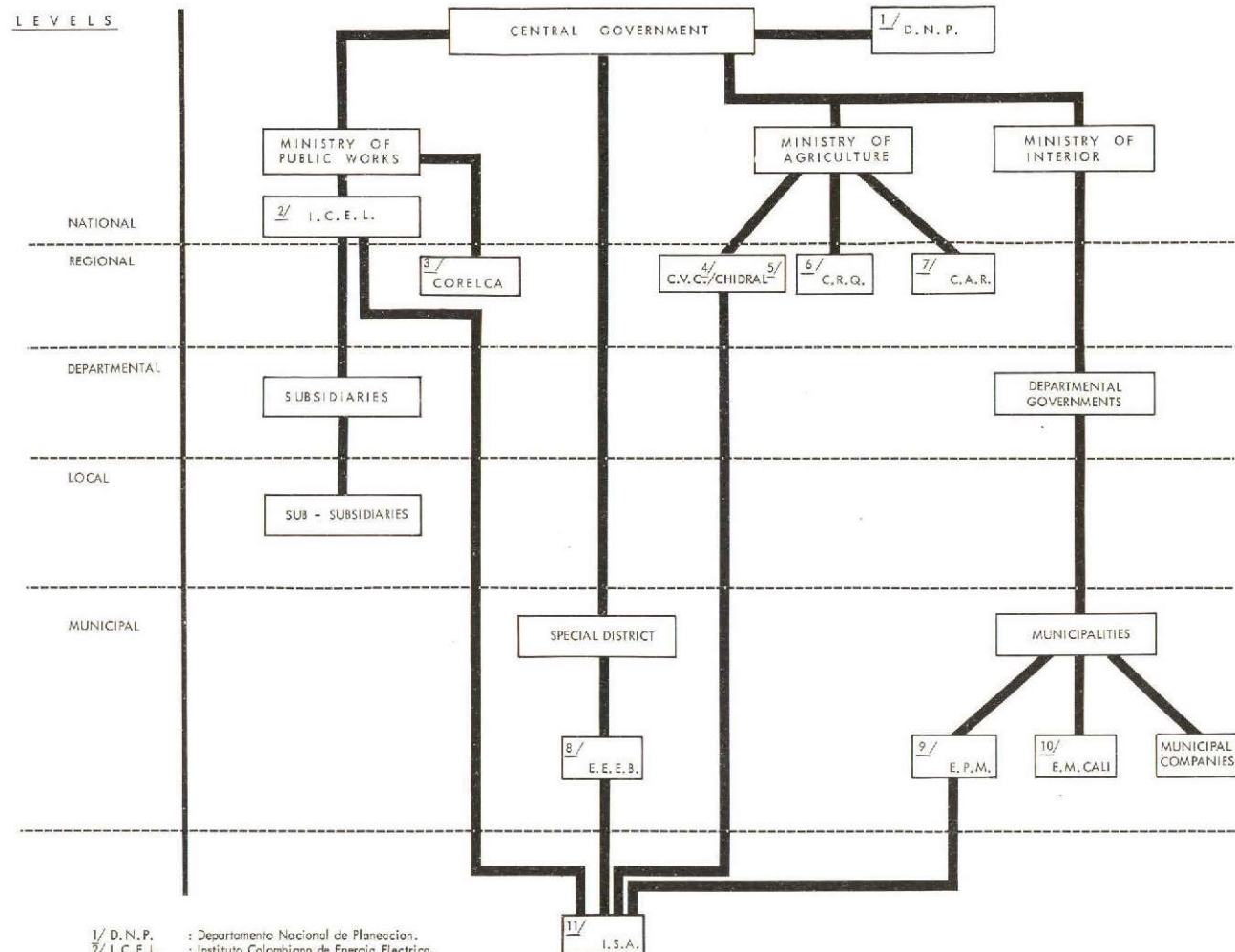
6.06 As mentioned earlier, however, the choice of projects by the Bank has not been based upon detailed evaluations of economic priorities at the overall national level, and financial criteria have, on the other hand, played a significant (if not exclusive) role in the Bank's decision-making process. Actually, the Bogota and Medellin power companies, even before the Bank's involvement, had always been the most viable power companies in the country. The power company serving Cali, although notably less efficient than these two, has, over the years, remained ahead of other utilities in the country, in terms of both financial performance and quality of service. The Bank, through its concentrated lending to EEEB, EPM and CVC/CHIDRAL, has

probably conducted the most financially rewarding investment program public utilities in Colombia could provide. It can be argued that, in the long run, financial and economic efficiency may converge and that financial criteria may be an adequate tool for appraising economic benefits. This would probably be true if the actual pattern of demand within the economy had the opportunity of expressing itself freely. Institutional setups, however, always tend to distort the genuine image presented by spontaneous demand and it is not until the extent of such distortions are known, that meaningful conclusions can be drawn regarding the degree to which financial performance reflects economic welfare. Two areas where such distortions may be particularly relevant in Colombia are the electrification of marginal zones in the main cities, and power development in other parts of the country, mainly the responsibility of the weak ICEL subsidiaries. In the early 1960s, some concern developed in the Bank particularly with respect to the latter, and an effort was made to develop relations, either through Electraguas or directly, with some of the smaller power companies in Colombia. But it was soon determined that this would require more intensive work on institutional improvement than the Bank was in a position to provide, and so the effort was abandoned. This has probably had some small effect on the overall pattern of urban development in Colombia, but it is very hard to say how much. The largest centers have been growing steadily at rates close to 7% -- with more than half of the increase being due to immigration -- while the medium-sized towns have been growing at significantly lower rates, in the neighborhood of 5%, and the smaller towns still less.

6.07 Besides being the three largest cities of Colombia, Bogota, Medellin and Cali are located within the best endowed area of the country in terms of hydroelectric resources. Exploitation of such resources obviously has important implications at the national level. By investing heavily in the heart of Colombia's power resources, the Bank placed itself in a favorable position to influence the country's overall power development policy and it is probable that several of the major achievements in the sector over the last twenty years would not have taken place had the Bank not participated in this manner -- particularly the creation of Interconexion.

COLOMBIA

STRUCTURAL ORGANIZATION OF THE POWER SECTOR (1971)



- 1/ D.N.P. : Departamento Nacional de Planeación.
 2/ I.C.E.L. : Instituto Colombiano de Energía Eléctrica.
 3/ CORELCA : Corporación Eléctrica de la Costa Atlántica.
 4/ C.V.C. : Corporación Autónoma Regional del Cauca.
 5/ CHIDRAL : Central Hidroeléctrica del Rto Anchicaya.
 6/ C.R.Q. : Corporación Autónoma Regional del Quindío.
 7/ C.A.R. : Corporación Autónoma Regional de la Sabana.
 8/ E.E.E.B. : Empresa de Energía Eléctrica de Bogotá.
 9/ E.P.M. : Empresas Públicas de Medellín.
 10/ E.M. Cali : Empresas Municipales de Cali.
 11/ I.S.A. : Interconexión Eléctrica S.A.

