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INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT
INTERNATIONAL DEVELOPMENT ASSOCIATION

ECONOMIC GROWTH OF COLOMBIA:
PROBLEMS AND PROSPECTS
(in XII Volumes)

VOLUME VIII
POWER AND TELECOMMUNICATIONS

November 1, 1970

CURRENCY EQUIVALENTS

(Certificate Market Selling Rate of Exchange)

End 1968

1 US\$ = 16.91 Pesos

1 Peso = US\$0.05913

End 1969

1 US\$ = 17.90 Pesos

1 Peso = US\$0.05586

End-March 1970

1 US\$ = 18.20 Pesos

1 Peso = US\$0.05494

POWER AND TELECOMMUNICATIONS

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PART A

POWER

I. INTRODUCTION

1. Colombia occupies a territory of 1,139,000 km², crossed on the western part by a mountain system with three north-south cordilleras, ranging up to 5,000 m in altitude, which divide the country into three main geographic regions: Costa Atlantica (northern), Andina (central and western) and Llanos Orientales (eastern). Near 99 percent of the population live in the Costa Atlantica and Andina regions, which comprise about 40 percent of the area of the country and are divided politically into Departamentos and the Distrito Especial de Bogota. The rural population represents about 43 percent of the total. The Llanos Orientales region has an extremely low population density and minimum economic development, with practically no electrification. The electric sector is therefore geographically located in the northern, central and western regions of the country, which are endowed with remarkable complementary resources for power generation: important hydroelectric potential in the extensive central mountain system, with different hydraulic regimes in the Amazonas-Orinoco, Atlantic and Pacific river basins; oil in the north and southwest; natural gas in the north; and coal in several parts of the cordilleras.

2. In 1969 the public utilities generated a total of 7,100 GWh and at the end of the year had a total installed generating capacity of 1,870 MW; about 75 percent of the generation was of hydro origin, 15 percent was generated in steam thermal plants and 10 percent in gas-turbine and diesel plants. In addition to the public service, 250 MW were installed in industrial facilities which generated 1,000 GWh. The location, type and size of the principal existing generating plants and transmission lines in the country are shown in Map 1, which also shows those under construction, planned and under investigation. The evolution in the last 25 years of the total installed generating capacity and annual generation by the country's public utilities is shown in Figures 1 and 2. The development of the Colombian electric sector in recent years has been remarkable: in the last 12 years the energy demand has increased at an average rate of approximately 11 percent per year, which is expected to be at least maintained in the next decade. In spite of this, the average per capita annual consumption in 1969 was about 400 kWh, below the Latin America average in 1968 of approximately 474 kWh.

3. The levels of electric development and consumption are substantially different between regions, and even more so between urban and rural areas. The average per capita annual consumption in some Departamentos is of the order of 500 kWh, but in others does not reach 100 kWh. While in the 30 cities of more than 30,000 inhabitants the average consumption in 1969 was about 600 kWh, about 30 percent of the country's population (70 percent of the rural population) did not have any electric service at all. The following table is illustrative of the differences between regions; it indicates the percentage shares of each electric region of the country's total generation and installed capacity in 1968, as compared with the respective percentage shares in the area and population:

<u>Electric Region</u> /a	<u>Area</u>	<u>Population</u>	<u>Generation</u>	<u>Installed Capacity</u>
Antioquia (Medellin)	7.9	15.3	28.9	28.3
Central (Bogota)	10.6	30.4	28.3	33.2
Occidental (Cali)	8.8	17.3	18.1	17.5
Norte (Cartagena, Barranquilla)	10.5	18.8	13.3	12.1
Caldas (Manizales)	0.9	8.2	7.3	5.0
Nordeste (Barrancabermeja- Bucaramanga)	6.2	8.7	3.8	3.6
Rest of the Country: Los Llanos and San Andres	55.1	1.3	0.3	0.3

/a See para. 16 for the definition of each electric region. Main population centers in the regions are indicated in brackets.

II. THE PUBLIC SECTOR

Generation and Transmission

4. The public service is practically wholly supplied at present by the following four entities:

- (a) Empresa de Energia Electrica de Bogota (EEEB), a municipal utility for electrical service only, which supplies energy to Bogota and the Departamento de Cundinamarca, directly and bulk supply to departmental rural distributing agencies and subsidiaries of ICEL. At the end of 1969, the total installed capacity of EEEB's own plants was 440 MW, of which 85 MW were thermal and the rest hydro.
- (b) Empresas Publicas de Medellin (EPM), a municipal utility providing electricity, water/sewerage and telecommunication services, which supplies electric energy to Medellin and the Departamento de Antioquia, directly and by bulk supply to the rural distributing subsidiary of ICEL. The total installed capacity in EPM's plants at the end of 1969 was 450 MW, all of them hydro.
- (c) Corporacion Autonoma Regional del Cauca (CVC), a multi-purpose, autonomous, nationally-chartered regional entity for the development of the Cauca Valley, which supplies energy to the Departamento de Valle, mainly by bulk supply to Empresas Municipales de Cali (EMCALI) and to other rural distributing agencies, subsidiaries of ICEL and CVC. CVC is the major owner of Central Hidroelectrica del Rio Anchicaya Limitada (CHIDRAL), a local agency for generation only, which is also owned by EMCALI. At the end of 1969, the total installed capacity in CVC/CHIDRAL's plants was 270 MW, of which 76 were thermal and the rest hydro.
- (d) Instituto Colombiano de Energia Electrica (ICEL), a National Government Institute, formerly called Electraguas, which through 15 departmental and 13 minor subsidiaries supplies electric energy to the rest of the northern, central and western regions of the country. At the end of 1969, the total installed capacity in ICEL's subsidiaries was 684 MW, 330 MW in thermal plants and the rest hydro. One of the major subsidiaries of ICEL is Central Hidroelectrica de Caldas (CHEC), which serves an area of Departamentos de Caldas, Quindio and Risaralda around Manizales, in Central Colombia, and has at present a total installed capacity of 200 MW in hydro plants.

5. The extensive geography of the country and its rugged mountain chains have isolated the various regional centers, which traditionally have developed separately their own customs, regional institutions and economic resources, and also their own electric systems. Furthermore, the parochial

attitude prevailing in the various regional electric systems sometimes has caused uneconomic development of the country's power sector. This has been more noticeable in recent years, when the need to supply higher and rapidly increasing demands has shown the advantages of the integration and joint planning of the sector to permit the development of larger and more economic projects and a better utilization of the country's energy resources. The Departamento Nacional de Planeacion (Planeacion) has been promoting actively for a number of years the coordinated organization and expansion of the sector, and in 1967 important steps towards this end were initiated by the establishment, with the Government's support, of Interconexion Electrica S.A. (ISA) and the Corporacion Electrica de la Costa Atlantica (CORELCA).

6. ISA, a stock corporation sponsored and owned in four equal parts by EEEB, EPM, CVC/CHIDRAL and ICEL/CHEC, was formed in September 1967 for the interconnection of the sponsors' electric systems and for the planning, construction, ownership and operation of new power generating plants in the interconnected system. In 1968, ISA undertook its first project, a 535 km 230 kV transmission network to interconnect the systems of EEEB, CHEC, EPM and CVC/CHIDRAL, which is presently under construction with financing from the I.B.R.D. and supplier countries; its completion is expected by mid-1971. ISA's interconnection network has made possible the first joint planning in Colombia of a long-range, large-size power generation program at supra-regional scale. ISA and Planeacion carried out several studies, using computer models, to determine the most suitable and economic schedule of new generating plant construction in the interconnected system to meet its forecast demand up to 1980. In accordance with the results of the studies, ISA and its sponsors agreed to the construction of two major hydroelectric plants, as follows:

- (a) Alto Anchicaya (340 MW) in the area of Cali, to be built by CVC/CHIDRAL to start operation in 1974; and
- (b) Chivor (first stage, of 500 MW) in the area of Bogota, the first generating plant to be built, owned and operated by ISA, to start operation in mid-1975.

Both projects are presently under construction, Alto Anchicaya with financing from Canada and the Inter-American Development Bank (IDB), and Chivor with IBRD's financing expected to be complemented by bilateral financing from major equipment suppliers' countries. ISA, its sponsors and Planeacion will be continuing and updating the studies to schedule new additions to generating capacity, which it is foreseen will be required in the interconnected system in the present decade. Various possibilities are being considered, particularly thermal units for short-term construction, and the second stage (280 MW) of Guatape Project in the area of Medellin for longer-term operation, not before 1977/78.

7. CORELCA, an autonomous regional agency, was established in December 1967 for the planning, construction and operation of new power generating plants and transmission lines in the northern region, which includes seven Departamentos, from Cordoba to La Guajira, and is not considered yet integrable in ISA's system because of the distances involved.

CORELCA is in the process of being organized to assume its responsibilities, which in the interim have been assigned to ICEL. There is urgent need to install additional generating capacity and interconnect individual systems in the area of the Atlantic Coast. A program towards this end has been undertaken, which includes initially the construction by CORELCA of a 132 MW thermal plant in Barranquilla (Termonorte I) and the transmission lines Barranquilla-Sabanalarga-Cartagena (230 kV) and Barranquilla-Santa Marta (115 kV); the construction of these projects, which are scheduled for completion by early 1972, was started in early 1970 with financing from supplier countries. More recently, in order to supply industrial consumers, particularly the expanding Soda Plant, CORELCA-ICEL undertook the emergency construction of a 19 MW gas-turbine unit in Cartagena to start operation by mid-1971. CORELCA's longer-term plan includes the construction of three 100 MW thermal units -- two of them in Cartagena (1974 and 1978) and the other one in Barranquilla (1976)--, and of the transmission lines Cartagena-Sincelejo (230 kV, 1972), Sabanalarga-Fundacion-Santa Marta (230 kV, 1975), Fundacion-Valledupar (115 kV, 1975) and Santa Marta-Riohacha (230 kV, 1976). It is planned to study and undertake the interconnection of CORELCA and ISA systems in coordination with the actual developments in both systems in the next few years.

The Electric Service

8. The areas of the country presently served by EEEB, EPM, CVC/CHIDRAL and the 15 departmental subsidiaries of ICEL are shown on Map 2. The urban and industrial areas of Bogota, Medellin and Cali, the three principal cities of the country, are thus served by autonomous agencies. The service in rural areas is provided by ICEL subsidiaries, except for the areas around Bogota and Medellin and the important rural area served by CVC. In some population centers, electricity is provided by municipal undertakings which in many instances rely upon ICEL systems for bulk supply. The principal cities, particularly Bogota and Medellin, have enjoyed the benefits of sophisticated planning by the utilities serving them, whereas the development of other parts of the country has at times been haphazard and uncoordinated. Although in the past the planning and efforts for the development of the sector have been concentrated much more in generation and transmission than in distribution, the expansion has not been sufficient to meet the demand in some important areas of the country, which at times have experienced power shortages. In many areas the distribution systems present serious deficiencies, and rural electrification is indeed scarce. This situation of the public sector in the past underlies the comparatively extended practice by industrial consumers of electricity of installing their generating facilities, which as mentioned above aggregate at present to a total of 250 MW.

9. The annual peak loads and gross generations in the period 1965-69 for the three major electric systems in the country were as follows:

<u>System</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>
<u>EEEEB</u>					
Peak Load (MW)	243.4	267.7	315.1	350.1	422.8
Gross Generation (GWh)	1,085.2	1,218.6	1,383.6	1,629.7	1,920.6
<u>EPM</u>					
Peak Load (MW)	267.0	289.0	309.8	327.0	349.5
Gross Generation (GWh)	1,373.3	1,478.4	1,579.0	1,698.4	1,829.1
<u>CVC/CHIDRAL</u>					
Peak Load (MW)	164.3	n.a.	196.0	211.0	n.a.
Gross Generation (GWh)	825.4	n.a.	n.a.	1,033.9	911.3 /a

/a In addition, about 170 GWh were supplied in 1969 to CVC/CHIDRAL system from EEEB (43 GWh) and other systems.

The composition of the energy sales in the three systems in 1969 was:

<u>System</u>	<u>Total Sales</u> GWh	<u>Composition (%)</u>			
		<u>Residential</u>	<u>Industrial</u>	<u>Commercial</u>	<u>Other</u>
EEEEB	1,600	32	32	17	19
EPM	1,330	48	31	8	13
CVC	912	36	42	12	10

10. Examination of historical data reveals wide fluctuation in growth rates, reflecting economic problems of the country which depressed market growth in some years and brought about financial difficulties in the sector contributing to shortages of power. However, remarkable stability has been manifested in later years, as above data on EEEB and EPM systems show, and a more orderly development in the future is expected. The unavailability of data for the CVC/CHIDRAL system shown above corresponds to periods with power shortages in the system. The overall annual rates of growth experienced by the three systems in the last decade have been approximately 12 percent in generation and peak load for EEEB and CVC/CHIDRAL systems, and 10 percent in generation and 9.3 percent in peak load for EPM system. No significant trend towards a change in the pattern of electric consumption has been manifested in the last five years in the public sector. Industrial consumption served by the utilities has been maintained in those years at an average level for the country of about only 24 percent of the total public service consumption. This is a reflection of the extended practice by large industrial consumers of installing their own generating facilities (para. 8), particularly in areas not served by EEEB, EPM and CVC. Serious power shortages were experienced during 1969 in four areas of the country, indicated below; some emergency actions have been taken to correct them temporarily, while long-range solutions presently under way can be put in service.

11. Cali and Cauca Valley: CVC system presented important generation deficits during 1969 aggravated by unfavorable hydraulic conditions, and the help received from CHEC was not sufficient to prevent serious power shortages. The 115 kV line Ibaguè-Zarzal (see Map 1), in operation since September 1969, is being intensively used to supply surplus energy from EEEB to CVC, thus helping to solve temporarily the problem. The situation will remain critical until the operation, scheduled for mid-1971, of ISA's interconnection network with sufficient capacity for the necessary transfers from EEEB, EPM and CHEC. CVC system itself will present generation deficits until the operation of Alto Anchicaya, scheduled for 1974.

12. Atlantic Coast: This area has experienced chronic deficits of generation and corresponding power shortages in recent years. An emergency program of installation of gas-turbine units in Barranquilla, Cartagena and Chinu presently under way will help to solve the problem temporarily, for 1970 and 1971. The situation will not be definitely improved until the completion, scheduled for 1972, of the 132 MW steam plant in Barranquilla and the transmission lines Barranquilla-Cartagena and Barranquilla-Santa Marta. Additional thermal units and transmission lines are planned to meet the demand in the area from 1974 (para. 7).

13. Northeast: A delay in the start-up of a new 25 MW steam plant in Barrancabermeja (Termobarranca), initially scheduled for September 1969, caused power shortages in the area of Bucaramanga. This is illustrative of the deficient situation of the electric service in the area of the Departamentos de Santander, Norte de Santander and Boyaca, where lack of coordination between their electric systems, of small size and isolated from each other, has caused inadequate planning and development of the sector. It is expected that the operation since early 1970 of Termobarranca, together with an additional 15 MW gas-turbine plant under construction in Bucaramanga scheduled to start operation by mid-1970, will permit to meet the demand in Santander until about 1972, when the 230 kV lines Paipa-Bucaramanga and Bucaramanga-Cucuta are scheduled to start operation (see Map 1). These lines are the first development towards the much-needed electric integration of the Northeast's power systems and with ISA's system (future 230 kV lines Guatapé-Barrancabermeja and Chivor-Paipa). The integration of a Northeast integrated system with ISA's interconnected system appears as the most feasible and economic longer-term solution to assure satisfactory electric service in the region, and with a view towards the future interconnection with Venezuela (230 kV lines Bucaramanga-Cucuta-Zulia-Venezuela).

14. Departamento de Narino: Serious power shortages were experienced during 1969 in the area of Pasto because of a delay of about one year in the start-up of Rio Mayo Hydro Plant (21 MW), in operation since early 1970. A new 24 MW hydro plant (Florida II) under construction near Popayan and the 115 kV line Popayan-Cali are scheduled to start operation by end-1972 and 1971, respectively. No problems are foreseen to meet the demand in Narino system during the next few years.

Organization and Development of the Sector

15. One of the major problems of the sector is the existing jurisdictional desintegration of the electric service, which is provided by numerous entities. These entities are in many cases too small, have financial difficulties, service areas of uneconomic market size and insufficiently connected with other areas, and are therefore unable to provide satisfactory service. A Government's decree of December 1968 reorganized ICEL, until then called Electraguas, and defined its functions, which include, among other responsibilities, the specific one of carrying out a plan to re-structure the electric service by regional integration. According to Planeacion's studies, the new structure is to be based on the grouping of the regional and local electric systems into six zones covering all the Departamentos. The regional zones were tentatively defined on the basis that each one should have appropriate geographic limits and be large enough to permit its integrated electric development and become financially self-sufficient. The responsibility for coordination of supply within each zone will rely upon a basic system in the zone, to which the local distribution systems will be connected by regional transmission lines. The basic zonal systems will be interconnected by high voltage transmission lines to form a national network, which will permit the realization of economies of scale through the planning, construction and operation of large generating plants.

16. The six regional electric zones presently contemplated and their respective basic systems (in brackets) are: Central (EEEEB), Caldas (CHEC), Occidental (CVC/CHIDRAL), Antioquia (EPM), Norte (CORELCA) and Nordeste (basic system not established yet). The areas covered by these zones are shown on Map 2. Four of the basic systems will be interconnected from 1971 by ISA's network, which will form the keystone for the development of the national network. It is expected that ISA's network will soon be expanded to interconnect from 1973 the basic system presently under gestation in the Nordeste. The interconnection with CORELCA is planned for further in the future, because of the distances involved. The construction of Chivor will help to consolidate the establishment of ISA as the agency responsible for the planning, construction and operation of interconnection and generation facilities on a national scale. ICEL is working towards the institutional and physical integration of the electric service within the zones; much work remains to be done in this field, still in incipient state.

17. Two parallel studies are at present being performed by the same consultants dealing with the expansion and interconnection of the Nordeste: (a) a study for ICEL, which includes analysis of the electric market and projections of power demand in the Northeast region, and identification and evaluation of prospective generation and transmission projects and alternative programs of construction to meet the demand up to 1977; and (b) a study for ISA to determine the technical and economic feasibility of the 230 kV interconnection line Guatape-Barrancabermeja. These studies are expected to provide the bases for a comprehensive analysis of the Nordeste and ISA systems, to be jointly performed by Planeacion, ISA and ICEL using their computer models, to determine the most economic schedule of projects to carry out the integration of the systems and at the same time meeting the forecast demands in both systems and in the integrated ISA-Nordeste system.

Preliminary conclusions of those studies indicate that additional thermal generation capacity and 230 kV transmission lines will be required to accomplish this. They indicate a prospective schedule of new projects, which would include the construction of three 66 MW steam units -- two of them in Paipa and Barrancabermeja, ICEL/Nordeste, and the other one in Zipaquirá, EEEB -- to start operation in 1973/74, and of the 230 kV lines Barrancabermeja-Bucaramanga-Cucuta (ICEL/Nordeste, for 1972), Guatapé-Barrancabermeja (ISA, for 1973) and Chivor-Paipa (ISA, for 1974). The actual schedule of project construction to be undertaken will be determined from the analysis by Planeacion/ISA/ICEL.

18. The future interconnection of the CORELCA system with the integrated ISA-Nordeste system (see para. 7) will have to be planned in coordination with the developments taking place and planned in those systems. In addition to the power projects under construction and planned mentioned in preceding paragraphs, there are other prospective developments, particularly new power supplies to large industrial consumers (see para. 23), which are likely to influence the schedule and nature of projects to carry out the interconnection. It is expected that by 1972 many of the developments presently planned and foreseen in both systems will have been defined; it will then be possible to undertake a technical and economic feasibility study of prospective alternative projects for the interconnection of ISA and CORELCA systems. It seems advisable to plan this preinvestment study, which would provide the bases for a subsequent comprehensive analysis by CORELCA/ISA, using computer models, to determine the most economic schedule of construction of transmission and generation projects to carry out the electric integration of both systems.

19. As mentioned in paragraph 8, priority has been given in the past to the development of generation and transmission facilities, and until recently, only isolated, non-coordinated efforts were devoted to the development of local distribution and rural electrification, which in many areas are acutely deficient, to the point that about six million people in the country do not have electric service. ICEL undertook in 1969 a plan to improve and expand in a first stage subtransmission (facilities at 13.2 kV and 33 kV) and urban distribution (service to cities and population centers of more than 1,500 inhabitants); and in a second stage, rural electrification, practically non-existing at present except in coffee-growing areas, where some successful developments have been carried out in cooperation with the Federacion Nacional de Cafeteros (FEDECAFE).

20. In mid-1969, ICEL with Planeacion's support and FONADE's financing, retained consultants to (a) prepare a comprehensive national plan which will identify subtransmission and urban distribution projects, establish priorities, estimate financial requirements, etc.; and (b) draw up codes and standards for distributions systems, facilities and equipments. Part (a) of the consultants' study is at present well advanced. The program under preparation of construction of subtransmission and urban distribution projects is based on a planned investment of US \$40 million equivalent in the period 1971-74; the Government intends to request the IDB to participate

in financing of this program, and an IDB's loan of about US \$25 million is expected. It is foreseen that the program will include, among others, projects to improve the service in Cartagena, Santa Marta, Sincelejo, Monteria, Valledupar, Riohacha, Bucaramanga, Villavicencio, Pie de Monte (Meta), Quibdo, Ibague, Neiva, Popayan and Pasto.

21. Part (b) of the study is also in progress, and it is planned to apply the resultant codes and standards to the projects in the program. The standardization of types and sizes of equipments and materials, in conjunction with the schedule of procurement for the construction program, will facilitate greater participation in the supplies by local manufacturers. They may need some adjustments in their present capacities and programs of production to be able to participate substantially in the program, as it is desirable and expected. The Colombian manufacturing industry is qualified to supply to the electric sector equipments and materials for subtransmission and distribution, in particular transformers up to 33 kV, cables, insulators, conduits and fittings, poles, steel towers, minor switchgear and control boards, lighting fixtures, etc. Practically all of these local manufactures include foreign components or materials in various degrees, and their prices are usually higher than those of foreign supplies for public utilities, which are exempt of import duties. The quality of local manufactures has not always been satisfactory; lack of appropriate quality control of fabrication has been generally experienced. The work in progress by INCOTEC to establish quality standards of fabrication should be intensified and accelerated, in order to assure the reliability of national supplies to the subtransmission and distribution program.

22. Rural electrification in Colombia presents special difficulties, because of the difficult topography of the country and the wide dispersion of its rural population (centers of up to 1,500 inhabitants). As indicated in para. 3, about 70 percent of the country's rural population does not have electric service. There is a growing consciousness in the country of the need to improve this situation; this atmosphere has culminated in the organization by ICEL and EEEB of the first "Congreso de Electrificación Rural Colombiano" (I CERCO), to take place in Bogota in July, 1970. It seems that the solutions to the problem would have to be worked out through close coordination between the electric agencies, particularly ICEL, and agricultural entities such as INCORA, FEDECAFE, Banco Cafetero, Caja de Credito Agrario, Banco Ganadero, etc. Because of the magnitude and complexity of the problem, it is recommended that a comprehensive preinvestment study on rural electrification on a national scale be undertaken as soon as possible. The purpose of this study would be to prepare and evaluate alternative programs of rural electrification projects in priority areas and corresponding investment plans, which would serve as the basis for deciding and determining the possible undertaking of a development plan of rural electrification. ICEL's study on sub-transmission and urban distribution, as well as the prospective resultant project construction programs, deal in fact with fields electrically interrelated, and would have to be coordinated with each other. ICEL is the agency to naturally assume also the primary responsibility for the rural electrification study.

23. The progress being achieved by the public sector, particularly in ISA's interconnected system, in assuring the reliability of the electric service obviously underlies the present intention of important industrial consumers of electricity to use the public supply, instead of installing their own generating facilities as it has been the practice in the past. Such are the cases of Siderurgica de Paz del Rio in Belencito and ECOPETROL Refinery in Barrancabermeja, both in the Nordeste, which plan important expansions in coming years, with corresponding increases in power demand to be served by the public sector. The power consumption in Paz del Rio and ECOPETROL will increase, according to their forecasts, from about 200 GWh (peak load 31 MW) and 260 GWh (peak load 42 MW) consumed in 1969, to about 360 GWh (peak load 75 MW) and 440 GWh (peak load 70 MW) in 1973, respectively. An expansion of Siderurgica del Pacifico in Cali will increase by 2 GWh/month the demand from EMCALI in 1971. EPM is in the process of entering into an agreement with Hanna Mining Company to supply electric power to the Cerro-Matoso Nickel Plant, planned to be built in Monte Libano (Cordoba), with a peak demand of 65 MW, 90 percent load factor and strict requirements for very high reliability of supply. The construction term of the Nickel Plant is three years, but no firm decision to build it has yet been reached. This new approach will be very beneficial for the public sector, because of the base-load nature of industrial demand, and for the industries themselves, which will thus be freed from the complexities and higher costs usually associated with the small, isolated plants. The benefits of course, will materialize only if the public sector is able to comply economically with its commitments, and for this a continuing process of planning and expansion is required. There is no doubt that this can be accomplished in the systems integrated in ISA, which is already applying long-term, updated planning on a large scale for those commitments. All this emphasizes the need and urgency of carrying out the integration of the Nordeste and its interconnection with ISA system (paras. 13, 16 and 17).

Financial Situation

24. At present, only EEEB and EPM are financially self-sufficient to carry out their operations and construction investments; external financing for foreign exchange costs of their main projects has been available to them. ISA was created by its sponsors to achieve joint objectives of coordinated planning, construction and operation which would have been difficult to realize without the intermediary of a commonly-owned corporation. In particular, the sponsors have agreed to make available to ISA funds for expansion which they would have been unable to lend to, or invest in, other sponsors for the same purpose. Thus, ISA is wholly dependent upon the sponsors, which must contribute to ISA's operating expenses and construction investments. ISA has obtained external financing for the foreign exchange cost of its two projects. CVC/CHIDRAL, ICEL and its subsidiaries, on the other hand, have needed in the past, and still do, substantial budgetary contributions and credits to cover part of their expenditures and investments, as well as to service external credits and loans. These agencies have in the past perennially experienced difficult financial circumstances, due in part to their failure to make timely application for tariff increases, and subsequent delays by the Government in granting them.

25. The establishment and implementation of a comprehensive, rational public utility tariff policy in Colombia has been needed for many years. Until recently, tariff adjustments have been granted on an ad hoc basis, and sometimes they have been too small and too late. In December 1968, the Government instituted the Junta Nacional de Tarifas de Servicios Publicos (Junta), as part of Planeacion, to regulate public utility tariffs, appropriately structuring and adjusting them to cover operating expenditures and provide a reasonable return on revalued assets to permit orderly financing of expansion. The preparation by the utilities and the study and processing by the Junta of tariff adjustment applications have been organized by the use of comprehensive data forms and computer programs which permit fast and complete evaluation of alternative structures and levels of adjustment. The Junta thereby has been able to process a good part of the backlog of applications by power agencies. Much work is at the same time being done by Planeacion and ICEL, in close coordination, to bring about national uniformity in accounting, reporting, valuation techniques, etc. Since the beginning of 1970, a new accounting plan prepared by ICEL is being used by all its subsidiaries and affiliates. The plan is coordinated with the data forms used by the Junta for the processing of tariff adjustment applications. Planeacion and ICEL have been helping those utilities to initiate the use of the new techniques, particularly with regard to the collection of statistical data and the preparation of tariff adjustment applications. Planeacion is at present considering the revision of the basic structure of tariffs, but no information on this is yet available. The problem to be resolved by all these activities is important. The National Government's budgetary subsidies to service ICEL's debt have increased from Ps 45 million in 1968 to Ps 73 million in 1969 and are programmed at Ps 120 million for 1970. These subsidies represent a drain on resources, which curtails the Government's capacity to finance new investments.

III. CONSTRUCTION AND INVESTMENT PROGRAMS

26. As it can be inferred from preceding paragraphs, an impressive, but necessary process of expansion of power generation and transmission facilities is underway throughout the country. In 1969, 6 new generating plants, aggregating a total of 200 MW, and 270 km of 115 kV lines were put in service. The size, schedule, cost estimate and status of external financing of the generating plant and major transmission line projects presently under construction and planned are indicated in Annex 1, Table 1 to 4. The location of these projects is shown in Map 1. According to this program, 14 new plants or extensions to existing ones aggregating a total of 1,624 MW, and 1,545 km of 230 kV and 115 kV lines are under construction for completion during 1970-75. Additionally, 7 plants aggregating a total of 778 MW and 1,160 km of 230 kV and 115 kV lines are planned for start of construction during 1970-1976. Following is a summary of the total cost estimates and external financial requirements for these projects; the investment and financing planned for ICEL's program of subtransmission and urban distribution projects (see para. 18) is also included.

	<u>Cost Estimate</u>		<u>External Financing</u>	
	<u>Foreign Exchange</u>	<u>Total</u>	<u>US\$ million</u>	
	<u>US\$ million</u>	<u>COL\$ million</u>	<u>Obtained</u>	<u>Additional Required</u>
Generating Plants:				
under construction	232.0	6,096	204.7	28.1
planned	77.1	2,070	-	77.1
Transmission Lines:				
under construction	37.2	913	26.3	10.9
planned	26.9	619	-	26.9
Subtransmission and Urban Distribution Program (planned)	<u>undefined</u>	<u>800</u>	<u>-</u>	<u>25.0</u>
TOTAL	373.2, plus amount undefined	10,498	231.0	168.0

27. Of the total external financing obtained for above construction program, the credits and loans obtained since January 1, 1969, as listed in Table 5, amounts to a total of US\$140.9 million equivalent. The amounts of additional external financing required for each project and their scheduled periods of construction are indicated in Tables 1 to 4. The new projects for external financing during 1970-72 and the amounts required as indicated in those tables are as follows:

	External Financing		
	Obtained US\$ million	Add. Required US\$ million	Year Required
<u>Generation Plants</u>			
Chivor I - Hydro (ISA)	52.3	22.8	1971/72
Paipa Thermal (ICEL/Nordeste)	-	7.4	1971/72 (*)
Zipaquira Thermal (EEEB)	-	7.4	1971/72 (*)
Barrancabermeja Thermal (ICEL/Nordeste)	-	7.6	1971/72 (*)
Cartagena Termonorte I (CORELCA)	-	10.5	1972
<u>Transmission Lines</u>			
Bucaramanga-Cucuta (ICEL)	-	1.0	1970 (*)
Bucaramanga-Barrancabermeja (ICEL)	-	2.3	1970 (*)
Guatapé-Barrancabermeja (ISA)	-	3.4	1971 (*)
Cartagena-Sincelejo (CORELCA)	-	7.5	1971
Chivor-Paipa (ISA)	-	3.2	1972 (*)

(*) Prospective schedule of projects for ISA-Nordeste integration (see para. 17).

28. The program of total investments in the public power sector for the period 1970-72 and the forecast investments for 1973-75 are indicated in Table 6. The expected sources of funds to finance the 1970-72 program are also indicated in Table 6. The program includes the investments to carry out the projects listed in Tables 1 to 4 and all other investments by the public power entities in the country.

29. The present and forecast financial situations of EEEB and EPM appear satisfactory to carry out, without need for budgetary contributions, their operations and investment programs and also to make the necessary contributions to ISA's investment program. CVC/CHIDRAL will need considerable national assistance to meet its investment program and its obligations to ISA; this is due mainly to the need to make substantial investments in Alto Anchicaya. ICEL/CHEC will fulfill its obligations to ISA with appropriations from the national budget. During 1970-72, ICEL subsidiaries and CORELCA will continue to rely heavily on national budgetary contributions and credits to finance their investment programs, as their internal generation of funds is expected to cover not more than half of the planned local financing. It is expected that this situation will be gradually improving as result of progress achieved in the organization and development of the sector and in the implementation of appropriate tariff policies.

IV. PLANNING

30. The active participation of Planeacion in the sector's planning in later years and the consolidation of ISA's role in planning long-range generation and transmission projects have helped to promote the development of a remarkable atmosphere among the country's major power agencies to organize and expand their planning activities. Some of them have formed recently new planning departments in their organizations.

31. As indicated in para. 6, ISA's interconnection network has made possible the first joint planning in Colombia of a long-range power generation program; computer models were used to determine the most suitable and economic schedule of plant construction in the interconnected system. Planeacion and ISA are continuing and extending the use of these techniques, which permit to simulate, for each alternative program of construction, the operation of reservoirs, plants and transmission lines of the system under study, and calculate the present value of the investments and life-time operating costs associated with each program. To undertake such analyses, it is necessary that appropriate feasibility and other preinvestment studies be available; the use of local and foreign consultants by power agencies to carry out these basic studies is also being extended. It is notable that FONADE's financing of preinvestment studies in the power sector represented in later years about 50 percent of total FONADE's financing.

32. Although a good number of studies have been performed and are presently underway in the power sector, the process of continuing evolution and development that the sector is undergoing implies the need for additional preinvestment studies and also for a careful programming and definition of their priorities and scopes. Throughout the review of the sector presented in preceding chapters, specific indication has been made of the need to undertake preinvestment studies on the interconnection of ISA and CORELCA systems (para. 18) and on rural electrification on a national scale (para. 22). On the other hand, planning of power generation programs requires that appropriate plant feasibility studies be available to permit the consideration of sufficient alternative construction schedules. In the case of Colombia, which has important hydroelectric resources, the availability of studies of prospective hydro developments is specially interesting, and even more considering the prospects for a high rate of growth of power demand in coming years. These studies require long-term surveys and investigations and considerable corresponding expenditures. It is therefore advisable that a good number of hydroelectric feasibility studies be undertaken, in addition to those already underway. Those considered of higher priority have been included in the preinvestment study program proposed in the next paragraph.

33. A program of 7 new preinvestment studies is recommended for the power sector for the immediate future. It is described in detail in the attached Study Data Sheets Nos. 5-1 to 5-7. A summary is presented below:

<u>Study</u>	<u>Year to Start</u>	<u>Duration (months)</u>	<u>Cost Estimate (US\$ million)</u>
1. Rural Electrification (ICEL) /a	1970	12	0.2
2. Rio Cauca Hydroelectric Potential (ISA)	1970	36	0.7
3. Chingaza Water Supply/Bogota River Basin Power Development (EEEE/EAAB)/a	1970	12	0.3
4. Rio Patia Hydroelectric Potential (ISA)	1971	24	0.6
5. Rio Saldana Hydroelectric Potential (ISA)	1971	12	0.2
6. Rio Guavio Hydroelectric Development (ISA)	1971	20	0.6
7. CORELCA System Interconnection to ISA System (ISA/CORELCA)/a	1972	12	0.3

/a Studies considered of highest priority within the recommended program.

V. GENERAL COMMENTS

34. From the foregoing review, it is apparent that the Colombian power sector is undergoing a remarkable process of comprehensive organization and development, which was actually initiated in 1967, when the concepts of inter-regional cooperation and coordinated planning won acceptance and began to be implemented. This process consists of a number of institutional developments, studies, plans and projects carried out in recent years, underway or planned. Major institutional and organizational developments since 1967 have been the establishment of ISA, the institution of the Junta Nacional de Tarifas, and the start to implement, by the formation of CORELCA and the reorganization of ICEL, the concept of electric service zones and regional integration. Some of the projects under construction, particularly ISA's interconnection network and Chivor plant, and the high voltage transmission lines in the North and Northeast, as well as some of the preinvestment studies, in particular ISA's power generation program and ICEL's subtransmission and distribution program, mark also major steps forward in the sector's development.
35. To achieve in the future the necessary continuing progress in the organization and development of the sector along the guidelines and with the general objectives being at present satisfactorily pursued, it seems essential to maintain and improve as required the existing collaboration and coordination between Planeacion, ICEL and the operational power agencies. The present institutional arrangements incorporate some duplication of functions by these entities, particularly between ICEL and Planeacion and between ICEL and the autonomous agencies. This has been more noticeable since ISA initiated its activities and since the plan to establish an autonomous basic system in each electric zone has begun to be implemented. These developments may justify a reconsideration of the role of ICEL in the sector.
36. There are at present two important aspects of the sector in which ICEL's efforts could be concentrated and be specially valuable: (a) development of subtransmission, distribution and rural electrification; and (b) preparation of CORELCA, CHEC and the new autonomous agency to be formed in the Nordeste to become fully qualified, institutionally and technically, to assume efficiently their responsibilities as the basic power systems of their respective electric zones. The commendable internal reorganization experienced by ICEL during the last two years and its character of National Institute in control of the Electrificadoras make it specially suitable to undertake with priority these two basic tasks. The operational and institutional autonomy of those three basic power systems will facilitate their institutional integration in ISA in concurrence with the interconnection of their systems. With these integrations, the establishment of ISA as the agency responsible for the planning, construction and operation of interconnection and generation facilities on a national scale will have been accomplished. It is foreseen that in concurrence with these developments the institutional and operational participation of ICEL in ISA may have to be reconsidered.
37. Another important issue concerns the need to reduce and eventually eliminate operating subsidies from the national budget as soon as possible.

Table 1. GENERATING PLANTS UNDER CONSTRUCTION

	Installed Capacity MW	Scheduled Initial Operation	Cost Estimate		Foreign Financing		Additional Requirement	
			Foreign Exch. US\$ million	Total Col\$ million	Obtained US\$ million	Source	US\$ million	Source
Colegio II - Hydro (EEEE)	150	1970	7.5	159	7.5	IBRD & Suppl.	-	
Bucaramanga-Turbogas III (ICEL-CORELCA)	15	1970	1.6	30	1.4	Suppliers	0.2	Suppliers
Barranquilla-Turbogas IV (ICEL-CORELCA)	15	1970	1.6	30	1.4	Suppliers	0.2	Suppliers
Chinu-Turbogas III (ICEL- CORELCA)	15	1970	1.6	30	1.4	Suppliers	0.2	Suppliers
Barranquilla-Turbogas III (ICEL-CORELCA)	23	1970	2.5	49	2.4	Suppliers	0.1	Suppliers
Guatape I-Hydro (EPM)	280	1971	42.0	680	42.0	IBRD	-	
Canoas-Hydro (EEEE)	50	1971	5.8	200	5.8	IBRD & Suppl.	-	
Cartagena-Turbogas III (ICEL-CORELCA)	19	1971	1.7	35	1.5	Suppliers	0.2	Suppliers
Rio Prado - Hydro (ICEL)	51	1972	13.0	400	13.8	IDB & Suppl.	-	
Florida II - Hydro (ICEL)	24	1972	2.4	78	0.9	Suppliers	1.5	Suppliers
Barranquilla-Termonorte I (ICEL-CORELCA)	132	1972	16.1	340	13.2	Suppliers	2.9	Suppliers
Rio Negro - Hydro (ICEL)	10	1973	-	75	-		-	
Alto Anchicaya - Hydro (CVC/CHIDRAL)	340	1974	61.1	1,609	61.1	IDB & Canada	-	
Chivor I - Hydro (ISA)	500	1975	75.1	2,381	52.3	IBRD	22.8	Suppliers
TOTAL	1,624		232.0	6,096	204.7		28.1	

Table 2. MAJOR TRANSMISSION LINES UNDER CONSTRUCTION

	Voltage kV	Length km	Scheduled Completion	Cost Estimate		Foreign Financing			
				Foreign Exch US\$ million	Total Col\$ million	Obtained US\$ million	Source	Additional US\$ million	Requirement Source
Guatape - Medellin (EPM)	230	64	1970	1.0	23	1.0	Suppliers	-	
Interconnection Network (ISA)									
Bogota-Manizales									
Manizales-Guatape									
Manizales-Cali	230	535	1971	21.0	503	14.6	IBRD & Supp.	6.4	Suppliers
Paipa-Bucaramanga (ICEL)	230	165	1971	1.0	44	0.9	Suppliers	0.1	Suppliers
Barranquilla-Sabanalarga-									
Cartagena (ICEL-CORELCA)	230	120	1972	5.5	121	5.5	Suppliers	-	
Flandes-Prado-Neiva (ICEL)	115	170	1970	2.0	50	2.0	IDB & Supp.	-	
Bogota-Villavicencio (EEEEB)	115	75	1970	0.3	9	0.3	Suppliers	-	
Medellin-Bolombolo (ICEL)	115	45	1971	0.4	13	0.4	Suppliers	-	
Medellin-Santa Fe de									
Antioquia (ICEL)	115	45	1971	0.2	8	0.2	Suppliers	-	
Zipaquirá-Chivor (EEEEB)	115	96	1971	0.4	10	-		0.4	Suppliers
Popayan-Cali (ICEL)	115	120	1971	1.0	37	0.2	Suppliers	0.8	Suppliers
Barranquilla-Santa Marta									
(ICEL-CORELCA)	115	110	1972	4.4	95	1.2	Suppliers	3.2	Suppliers
TOTAL	-	1,545		37.2	913	26.3		10.9	

Table 3. GENERATING PLANTS PLANNED

	Installed Capacity MW	Estimated Schedule		Cost Estimate	
		Initiation	Completion	Foreign Exch. US\$ million	Total Col\$ million
Paipa - Thermal (ICEL/Nordeste)	66))	7.4	190
Zipaquira - Thermal (EEEB)	66)1971/72)1973/74	7.4	190
Barrancabermeja - Thermal (ICEL/Nordeste)	66))	7.6	200
Guatapé II - Hydro (EPM)	280	1973	1978	26.0	740
Cartagena - Termonorte (ICEL-CORELCA)	100	1972	1974	10.5	270
Barranquilla - Termonorte II (ICEL-CORELCA)	100	1974	1976	9.1	240
Cartagena - Termonorte II (ICEL-CORELCA)	100	1976	1978	9.1	240
TOTAL	<u>778</u>	<u>--</u>	<u>--</u>	<u>77.1</u>	<u>2,070</u>

Table 4. MAJOR TRANSMISSION LINES PLANNED

	Voltage kV	Length km	Estimated Schedule		Cost Estimate	
			Initiation	Completion	Foreign Exch. US\$ million	Total Col\$ million
Bucaramanga - Cucuta (ICEL)	230	120	1970	1972	1.0	35
Bucaramanga - Barrancabermeja (ICEL)	230	100	1970	1972	2.3	50
Guatapé - Barrancabermeja (ISA)	230	200	1971	1973	3.4	76
Cartagena - Sincelejo (CORELCA)	230	150	1971	1973	7.5	165
Chivor - Suba - La Mesa (ISA)	230	180	1971	1974	Part of Chivor I - Hydro Proj.	73
Chivor - Paipa (ISA)	230	110	1972	1974		
Sabanalarga - Fundacion - Santa Marta (CORELCA)	230	170	1973	1975	9.0	200
Fundacion - Valledupar (CORELCA)	115	130	1973	1975	0.5	20
TOTAL	--	1,160	--	--	26.9	619

Table 5. EXTERNAL FINANCING OBTAINED
SINCE JANUARY 1, 1969

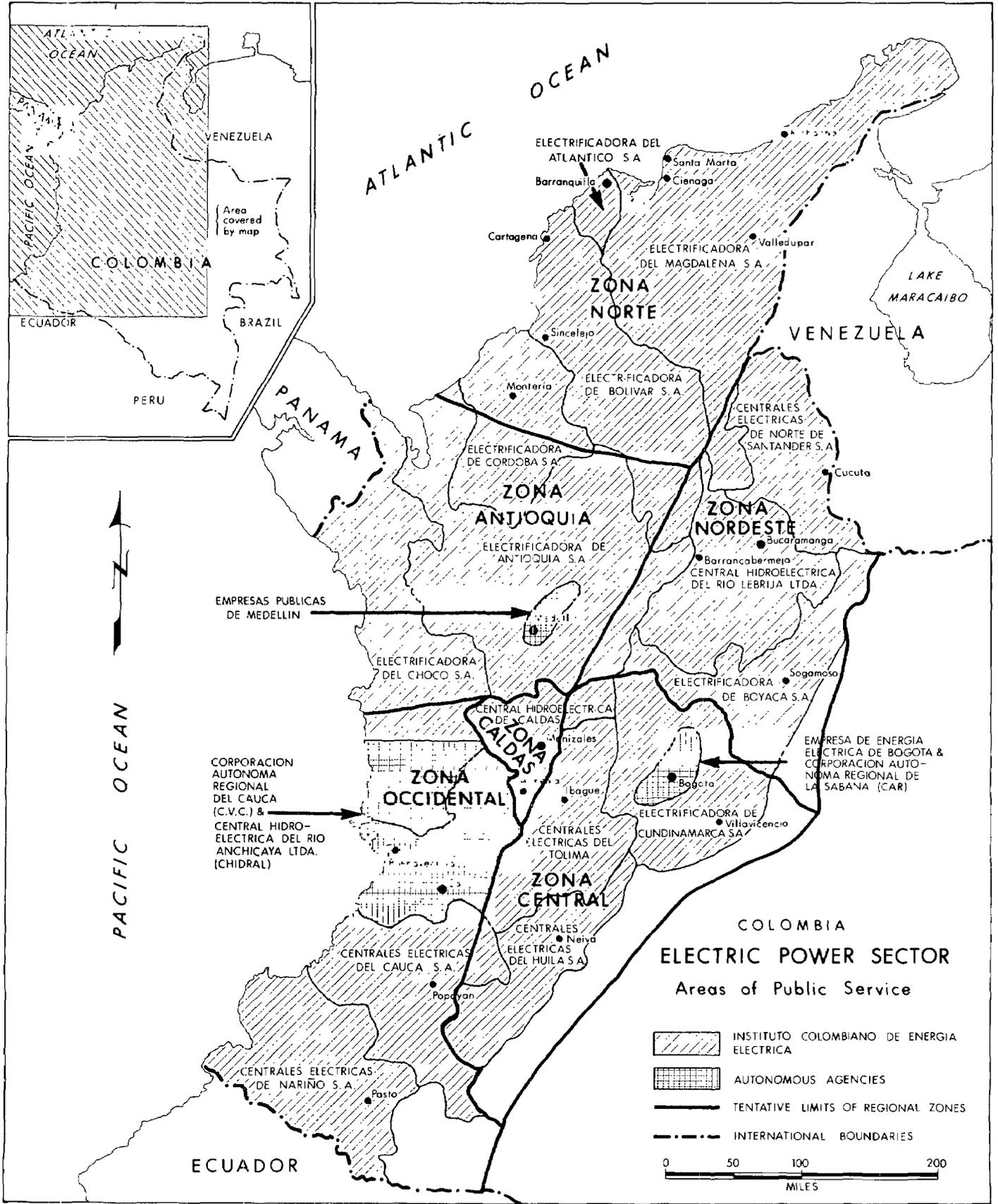
	<u>US\$ million</u>	<u>Source</u>
<u>A. Generating Plants</u>		
Barranquilla-Termonorte I (ICEL)	13.2	Germany
Alto Anchicaya - Hydro (CVC/CHIDRAL)	61.1	IDB and Canada
Chivor I - Hydro (ISA)	52.3(1970)	IBRD
	<u>126.6</u>	
<u>B. Transmission Lines</u>		
Interconnection Network (ISA)	4.6	Several Suppliers' Countries
Guatapé-Medellin (EPM)	1.0	Several Suppliers' Countries
Paipa-Bucaramanga (ICEL)	0.9	France
Barranquilla-Sabanalarga-Cartagena (ICEL-CORELCA)	5.5	Several Suppliers' Countries
Bogotá-Villavicencio (EEEB)	0.3	Several Suppliers' Countries
Medellin-Bolombolo (ICEL)	0.4	France
Medellin-Santa Fe de Antioquia (ICEL)	0.2	France
Popayan-Cali (ICEL)	0.2	Spain
Barranquilla-Santa Marta (ICEL-CORELCA)	1.2	Several Suppliers' Countries
	<u>14.3</u>	
TOTAL	<u>140.9</u>	

Table 6. PUBLIC POWER SECTOR INVESTMENT PROGRAM

(Col\$ million)

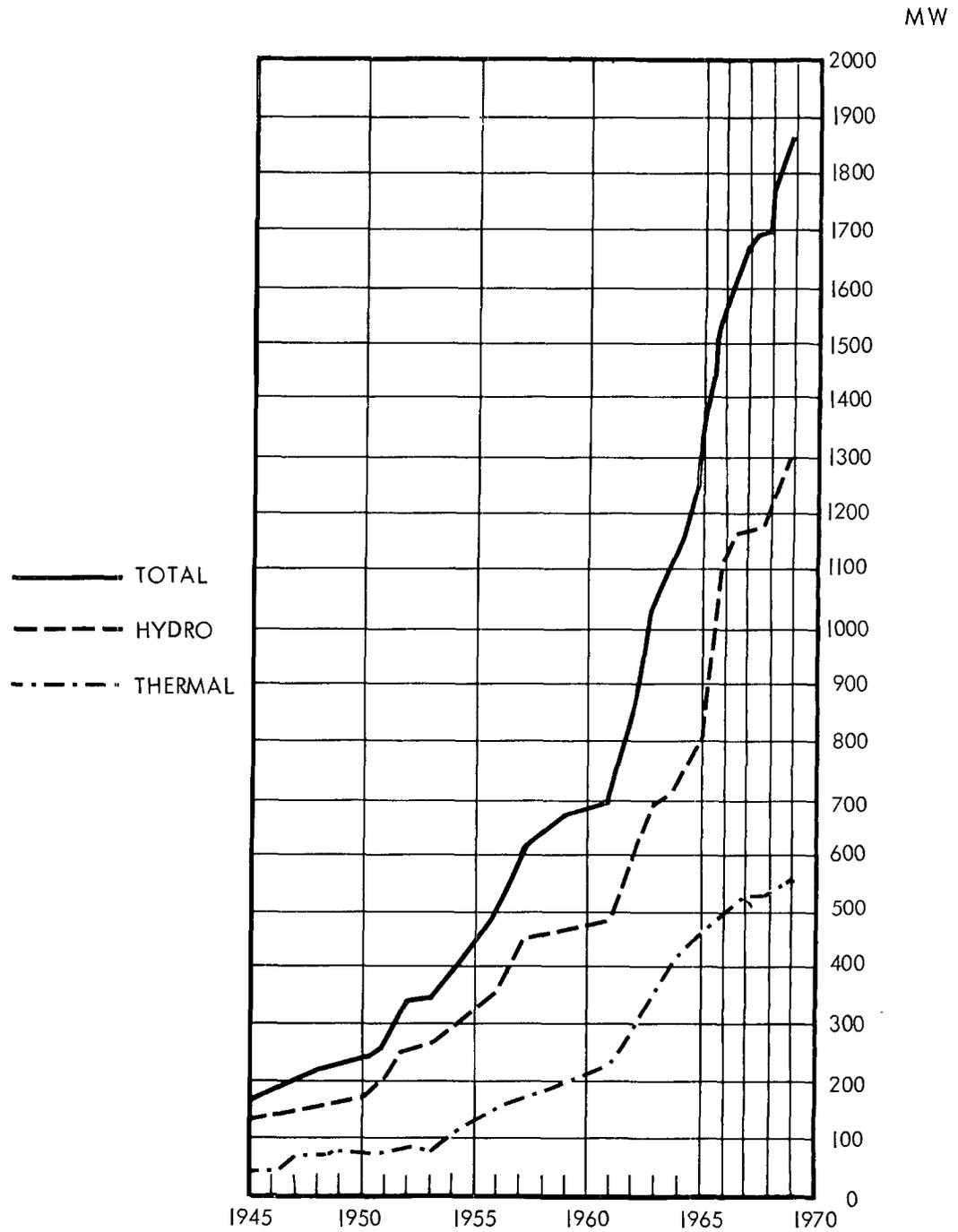
	----- 1970 -----			----- 1971 -----			----- 1972 -----			Forecast		
	Total Invest- ment	Expected Financing		Total Invest- ment	Expected Financing		Total Invest- ment	Expected Financing		Total	Investments	
		Local	External		Local	External		Local	External	1973	1974	1975
ICEL Subsidiaries and CORELCA	840	301	539	576	327	249	532	394	138	651	662	801
ISA, EEEB, EPM and CVC/CHIDRAL	1,314	470	844	1,300	739	561	1,844	1,114	730	1,855	2,205	1,795
Others (Municipalities)	<u>72</u>	<u>69</u>	<u>3</u>	<u>83</u>	<u>83</u>	<u>-</u>	<u>97</u>	<u>97</u>	<u>-</u>	<u>120</u>	<u>135</u>	<u>204</u>
TOTAL	<u>2,226</u>	<u>840</u>	<u>1,386</u>	<u>1,959</u>	<u>1,149</u>	<u>810</u>	<u>2,473</u>	<u>1,605</u>	<u>868</u>	<u>2,626</u>	<u>3,002</u>	<u>2,800</u>

MAPS 1 and 2

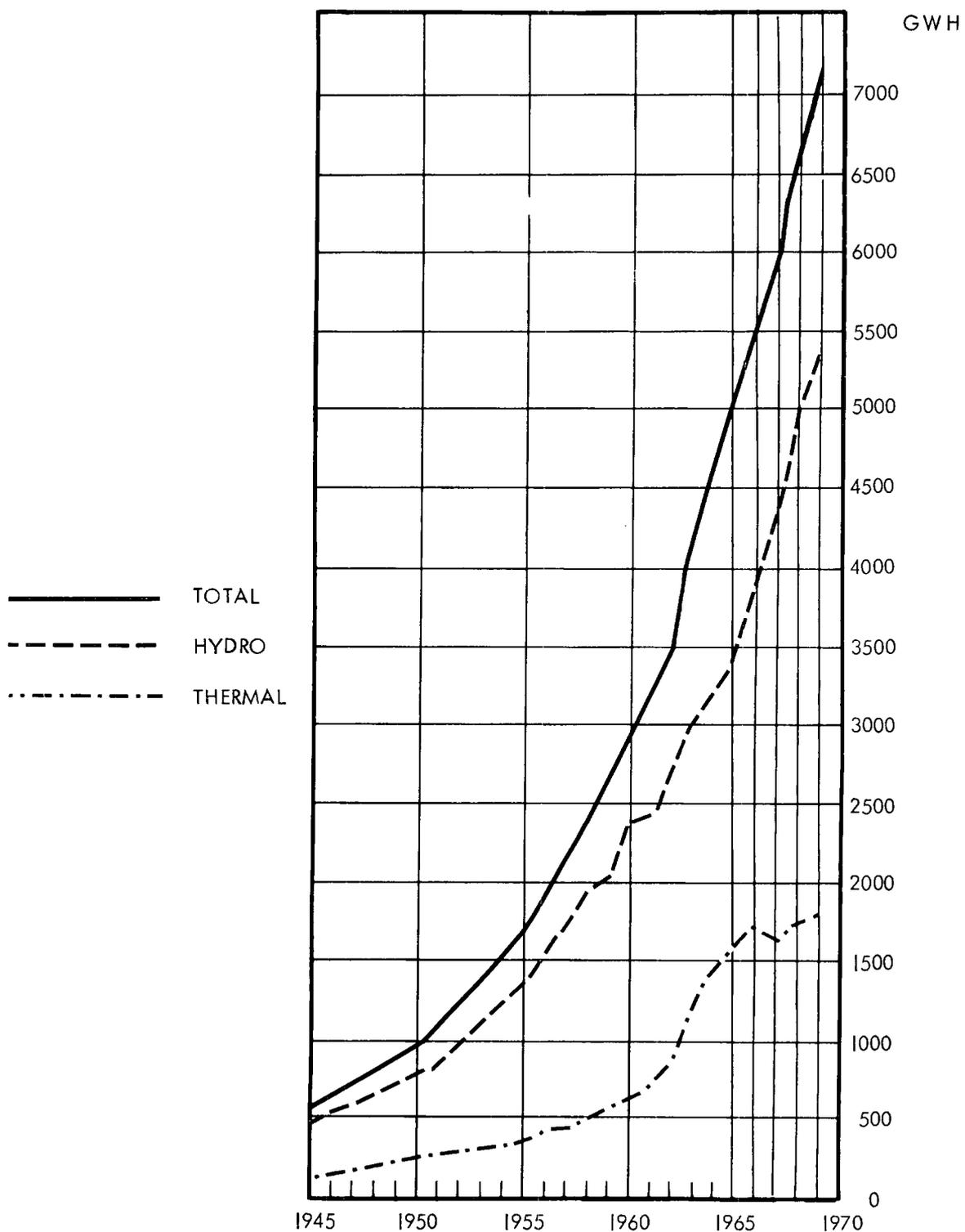


Figures 1 and 2

COLOMBIA INSTALLED GENERATION CAPACITY IN THE PUBLIC SECTOR 1945-1969



COLOMBIA - POWER GENERATION BY THE PUBLIC SECTOR 1945-1969



Preinvestment Program Study Data Sheets

PREINVESTMENT PROGRAM - STUDY DATA SHEET

No.: 5-1 (1)

Area:	Country:	Sector(s):
SOUTH AMERICA	COLOMBIA	POWER
1. NAME OF PROPOSED STUDY: RURAL ELECTRIFICATION		
2. PURPOSE: To prepare and evaluate alternative programs of rural electrification projects in priority areas and corresponding investment plans, to serve as the basis for deciding and determining the possible undertaking of a development plan of rural electrification on a national scale.		
3. SCOPE: 1) To evaluate the present situation of the country with regard to rural electrification, identifying areas with potential electric demand not being served; 2) to prepare potential demand forecasts in identified rural areas and select priority areas; 3) to identify rural electrification projects for selected priority areas, prepare preliminary designs and estimate construction terms and costs; 4) to evaluate alternative project schedules for prospective investment plans.		
4. BACKGROUND: (a) Related Studies (b) Other Available Data (c) Expected Data Problems Rural electrification in Colombia presents special difficulties because of the difficult topography of the country and the wide dispersion of its rural population (centers of up to 1,500 inhabitants). Some successful projects of rural electrification have been carried out in certain areas in cooperation with FEDECAFE and INCORA, but about 70% of the rural population has no electric service. Close coordination between the electric agencies, particularly ICEL, and the agricultural entities (INCORA, FEDECAFE) would be needed to undertake a possible development plan, and also to carry out the proposed study. This study should also be coordinated with ICEL's study on subtransmission and urban distribution presently underway.		
5. TIMING: (a) Duration and Phasing of Study (b) Desired Starting Date 1970 Total Duration: 12 months		
6. COMMENT ON POTENTIAL STUDY SPONSORS: ICEL is the agency expected to assume the primary responsibility for the study.		
7. PROJECT(S) EXPECTED TO RESULT FROM STUDY (if known): (a) Description A program of projects of electrification of selected rural areas. The projects would normally include the installation of distribution transformers and switching and protection equipment, aerial pole lines, meters, supply feeders, etc. It is expected that the codes and standards for distribution systems presently under preparation would be applied for these projects. (b) Estimated Investment (US\$ equivalent) The program of projects would be coordinated with the investment plan. (c) Financing Need and Potential Source		
8. ORDER OF MAGNITUDE OF STUDY COST (US\$ equivalent): 200,000	Sheet Prepared by:	Manuel Isla
	Dept. or Agency:	IBRD/PUPD
	Date:	June 14, 1970
9. STAFF'S COMMENT ON PRIORITY RANKING OF STUDY: This study is considered of highest priority and should be started as soon as possible.	Sheet Revised by:	
	Item(s) Revised:	
	Dept. or Agency:	
	Date:	

PREINVESTMENT PROGRAM - STUDY DATA SUPPLEMENT
(to be filled in when possible)

No.: 5-1 (2)

1. TENTATIVE STAFFING		Type of Specialist	Number on Team	Total Man-Months
(a)	Professional Staff:	Project Manager	1	12
		Engineers	6	54
		Assistant Engineers	8	72
	Advisers:	Agriculturalists	3	18
		Economist	1	12
Total:			17	168
(b) Local Supporting Staff :				72

2. TENTATIVE STUDY BUDGET (US\$ equivalent)		Foreign Currency	Local Currency	Total
(a)	Professional Staff Costs :		140,000	140,000
(b)	Equipment :		-	-
(c)	Other (Travel, non-prof. staff, etc.):		60,000	60,000
(d)	Total :		200,000	200,000

3. OTHER COMMENTS

Supplement Prepared by:	Manuel Isla
Dept. or Agency:	IBRD/PUPD
Date:	June 14, 1970
Supplement Revised by:	
Item(s) Revised:	
Dept. or Agency:	
Date:	

PREINVESTMENT PROGRAM - STUDY DATA SHEET

No.: 5-2 (1)

Area:	Country:	Sector(s):
SOUTH AMERICA	COLOMBIA	POWER
1. NAME OF PROPOSED STUDY: RIO CAUCA HYDROELECTRIC POTENTIAL		
2. PURPOSE: To evaluate the hydroelectric potential of the middle part of the Cauca River (Rio Cauca Medio) and determine the technical and economic feasibility of constructing reservoirs and power plants to utilize that potential.		
3. SCOPE: 1) Recapitulation of existing basic information on the topography, hydrology, meteorology, geology, etc., of the area; 2) Installation and operation of a network of hydro-meteorological stations; processing and interpretation of data obtained. 3) Topographic surveys and complementary aereophotographic surveys; analysis of region's natural resources and ecology; 4) General geologic survey, more detailed in preselected dam and plant sites; 5) Preliminary selection of dam and plant sites and determination of their main parameters; 6) Preliminary basic designs of dams, plants, transmission lines and accesses to sites, and corresponding cost estimates; 7) Comprehensive report with conclusions and recommendations.		
4. BACKGROUND: (a) Related Studies (b) Other Available Data (c) Expected Data Problems Very preliminary estimates indicate a hydroelectric potential of the middle part of the Cauca River (Departamentos of Caldas and Antioquia) of the order of 11,000 MW, in about 360 km from La Virginia (average flow of 570 m ³ /sec) to Caucasia (average flow of 1,200 m ³ /sec).		
5. TIMING: (a) Duration and Phasing of Study (b) Desired Starting Date 1970 Total Duration: 3 years Parts 1), 3) and 4): first two years Parts 5) and 6) : second year and ten months of third year Part 2) : throughout the three years Part 7) : last 3 months		
6. COMMENT ON POTENTIAL STUDY SPONSORS: Interconexion Electrica S.A. (ISA), the executing agency for this study, has requested the I.B.R.D. to finance 50% of the cost of the study with proceeds of Loan 575-00, and the Bank is expected to agree. FONADE is presently studying a request by ISA to finance 25% of the study. The remaining 25% would be financed by ISA.		
7. PROJECT(S) EXPECTED TO RESULT FROM STUDY (if known): (a) Description (b) Estimated Investment (US\$ equivalent) (c) Financing Need and Potential Source Several hydroelectric generating plants and related high voltage transmission facilities Not known		
8. ORDER OF MAGNITUDE OF STUDY COST (US\$ equivalent): 740,000		Sheet Prepared by: Manuel Isla Dept. or Agency: IBRD/PUPD Date: May 13, 1970
9. STAFF'S COMMENT ON PRIORITY RANKING OF STUDY: Studies of new generating sources are needed for proper selection of future plant construction. Because of the estimated potential and location of the Cauca River in ISA system, this study should be started in 1970.		Sheet Revised by:
		Item(s) Revised:
		Dept. or Agency:
		Date:

PREINVESTMENT PROGRAM - STUDY DATA SUPPLEMENT
(to be filled in when possible)

No.: 5-2 (2)

1. TENTATIVE STAFFING		Type of Specialist	Number on Team	Total Man-Months
(a)	Professional Staff:	Project Manager	1	36
		Engineers	7	160
		Assist. Engineers	7	160
	Foreign Advisers:	Dam and Power Plant Specialist	1	4
		Geologist	1	3
		Hydrologist	1	3
		Soil Mechanics Specialist	1	3
		Total:	19	369
(b) Local Supporting Staff		: Topographers, draftsmen, administrative, etc.	15	224

2. TENTATIVE STUDY BUDGET (US\$ equivalent)		Foreign Currency	Local Currency	Total
(a)	Professional Staff Costs	27,000	385,000	412,000
(b)	Equipment	56,000	109,000	165,000
(c)	Other (Travel, non-prof. staff, etc.):		163,000	163,000
(d)	Total	83,000	657,000	740,000

3. OTHER COMMENTS

ISA sent to the Bank, with its request for financing 50% of the study, a proposed contract with the Colombian consulting firm Integral Limitada to carry out the study. Integral would use the services of specialist advisers when appropriate and as agreed with ISA.

Supplement Prepared by: Manuel Isla	
Dept. or Agency: IBRD/PUPD	
Date: May 13, 1970	
Supplement Revised by:	
Item(s) Revised:	
Dept. or Agency:	
Date:	

PREINVESTMENT PROGRAM - STUDY DATA SHEET

No.: 5-3 (1)

Area: SOUTH AMERICA	Country: COLOMBIA	Sector(s): WATER SUPPLY/POWER
1. NAME OF PROPOSED STUDY: CHINGAZA WATER SUPPLY/BOGOTA RIVER BASIN POWER DEVELOPMENT		
2. PURPOSE: To prepare and evaluate alternative coordinated construction schedules of projects for water supply to Bogota from Chingaza and flow regulation and power generation in the Bogota River Basin, to be used as the basis for a comprehensive, joint analysis by EAAB/EEEB to determine the most economic schedule of project construction and establish the arrangements to undertake it (see page (2), item 3).		
3. SCOPE: 1) Review of all available data and studies on existing, under construction and planned projects for water supply to Bogota and flow regulation and power generation in the Bogota River Basin; supplemental surveys as required for the purpose of the study; 2) Selection of alternative schedules of coordinated construction of projects; 3) Technical feasibility analyses of the selected project schedules, and determination of the main parameters of the respective projects; 4) Preliminary basic designs and cost estimates of the projects in selected schedules.		
4. BACKGROUND: (a) Related Studies (b) Other Available Data (c) Expected Data Problems (See page (2), item 3)		
5. TIMING: (a) Duration and Phasing of Study (b) Desired Starting Date 1970 Total Duration: 12 months		
6. COMMENT ON POTENTIAL STUDY SPONSORS: It is expected that FONADE would finance 50% of the proposed study, to be jointly undertaken by EAAB/EEEB. UNDP might also be interested to provide funds for the study.		
7. PROJECT(S) EXPECTED TO RESULT FROM STUDY (if known): (a) Description (b) Estimated Investment (US\$ equivalent) (c) Financing Need and Potential Source - Water supply expansion for Bogota from Chingaza Not known - Pumping/reservoir developments and power generation expansion in the Bogota River Basin		
8. ORDER OF MAGNITUDE OF STUDY COST (US\$ equivalent): 300,000	Sheet Prepared by: M. Isla/J. Krombach Dept. or Agency: IBRD/PUPD Date: June 17, 1970	
9. STAFF'S COMMENT ON PRIORITY RANKING OF STUDY: It is planned to undertake some of the prospective projects, particularly Chingaza Project and pumping/reservoir developments in the Bogota River Basin, within the next two years. This study is considered of high priority and should be started as soon as possible.	Sheet Revised by:	
	Item(s) Revised:	
	Dept. or Agency:	
	Date:	

PREINVESTMENT PROGRAM - STUDY DATA SUPPLEMENT
(to be filled in when possible)

No. : 5-3 (2)

1. TENTATIVE STAFFING		Type of Specialist	Number on Team	Total Man-Months
(a)	Professional Staff:	Project Manager	1	12
		Engineers	4	40
		Assistant Engineers	6	60
	Foreign Advisers:	Dam, tunnel and power plant Specialist	1	2
		Hydrologist	1	3
		Geologist	1	2
Total:			14	119
(b)	Local Supporting Staff :	Topographers, Draftsmen, Administrative, etc.		100

2. TENTATIVE STUDY BUDGET (US\$ equivalent)		Foreign Currency	Local Currency	Total
(a)	Professional Staff Costs :	25,000	150,000	175,000
(b)	Equipment :	25,000	20,000	45,000
(c)	Other (Travel, non-prof. staff, etc.):	20,000	60,000	80,000
(d)	Total :	70,000	230,000	300,000

3. OTHER COMMENTS The Empresa de Acueducto y Alcantarillado de Bogota (EAAB) has presently under construction in the Bogota River Basin, north of the city of Bogota, the Tibito II Project which will increase the water supply to Bogota by about 8 m³/s (average). According to the forecasts, additional supply will be needed from 1976 to meet Bogota's water demand, and for this EAAB is planning to undertake the construction of the "Chingaza Project," for an additional average supply, in its first stage, of about 12 m³/s from the Guatiquia River tributaries in the Chingaza Highlands, West of Bogota. The feasibility study of the Chingaza Project being carried out by consultants for EAAB is scheduled for completion by March 1971. Both projects will affect the utilization of the Bogota River Basin for power generation; its hydroelectric potential below Bogota will be increased substantially by Chingaza's flow contribution. On its part, EEEB is considering some pumping/reservoir projects in the Bogota Basin to improve the regulation of the River; it also plans to study the installation of additional generating capacity in the Bogota River to use the prospective increase of its hydroelectric potential by the Chingaza Project. It seems advisable that all these studies, undertaken at present separately by EAAB and EEEB, be combined and supplemented as required to provide the basis for a comprehensive analysis of the prospective Chingaza Water Supply/Bogota River Basin Power Development, to be jointly performed by EAAB/EEEB, with the co-operation of Planeacion and ISA and the use of their computer models, to determine the most economic schedule of project construction and establish the technical and financial arrangements to undertake it.

Supplement Prepared by:	M. Isla/J. Krombach
Dept. or Agency:	IBRD/PUPD
Date:	June 17, 1970
Supplement Revised by:	
Item(s) Revised:	
Dept. or Agency:	
Date:	

PREINVESTMENT PROGRAM - STUDY DATA SHEET

No.: 5-4 (1)

Area:	Country:	Sector(s):
SOUTH AMERICA	COLOMBIA	POWER
1. NAME OF PROPOSED STUDY: RIO PATIA HYDROELECTRIC POTENTIAL		
2. PURPOSE: To evaluate the hydroelectric potential of the Patia River, in Southwestern Colombia, and determine the technical and economic feasibility of constructing reservoirs and power plants to utilize that potential.		
3. SCOPE: 1) Review of a preliminary survey made in 1967, and recapitulation of available information on the topography, hydrology, meteorology, geology, etc., of the area; 2) Installation and operation of a network of hydro-meteorological stations; processing and interpretation of data obtained. 3) Topographic surveys and complementary aereo-photographic surveys; analysis of region's natural resources and ecology; 4) General geologic survey, more detailed in preselected dam and plant sites; 5) Preliminary selection of dam and plant sites and determination of their main parameters; 6) Preliminary basic designs of dams, plants, transmission lines and accesses to sites, and corresponding cost estimates; 7) Comprehensive report with conclusions and recommendations.		
4. BACKGROUND: (a) Related Studies (b) Other Available Data (c) Expected Data Problems At the request of ICEL, a Japanese official mission made in the first half of 1967 a preliminary survey of the Patia's hydroelectric potential, identifying two possible developments with a total capacity of about 1,200 MW. However, that survey was of a very preliminary nature and limited scope, and will only serve as initial reference for the comprehensive study which is proposed. Other preliminary estimates indicate higher potential of the Patia, of the order of 4,000 MW.		
5. TIMING: (a) Duration and Phasing of Study (b) Desired Starting Date 1971 Total Duration: 2 years Part 1) : First six months Parts 5) and 6) : Second year Part 2) : Throughout the two years Part 7) : Last (2) months Parts 3) and 4): First fifteen months		
6. COMMENT ON POTENTIAL STUDY SPONSORS: At the request of ICEL, FONADE agreed to finance 50% of the cost of the study. Financing for the rest may depend on the final arrangement to carry out the study. If ISA assumes the responsibility for the study, as it is recommended (see page (2), item 3 (a)), proceeds of I.B.R.D.'s Loan 575 to ISA might be used to finance the remaining 50%.		
7. PROJECT(S) EXPECTED TO RESULT FROM STUDY (if known): (a) Description (b) Estimated Investment (US\$ equivalent) (c) Financing Need and Potential Source A hydroelectric development of one or more dams and generating plants, and related high voltage transmission facilities Not known		
8. ORDER OF MAGNITUDE OF STUDY COST (US\$ equivalent): 630,000 (See page (2), item 3 (b))	Sheet Prepared by: Manuel Isla Dept. or Agency: IBRD/PUPD Date: June 11, 1970	
9. STAFF'S COMMENT ON PRIORITY RANKING OF STUDY: Studies of new generation sources are needed for proper selection of future plant construction. Because the Patia River is the prospective large-size hydroelectric source in Southwestern Colombia, this study should be started in 1971	Sheet Revised by:	Manuel Isla
	Item(s) Revised:	9
	Dept. or Agency:	IBRD/PUPD
	Date:	October 1, 1970

PREINVESTMENT PROGRAM - STUDY DATA SUPPLEMENT
(to be filled in when possible)

No.: 5-4 (2)

1. TENTATIVE STAFFING		Type of Specialist	Number on Team	Total Man-Months														
(a)	Professional Staff:	Project Manager	1	24														
		Engineers	5	100														
		Assist. Engineers	5	100														
	Foreign Advisers:																	
		Dam and Power Plant Specialist	1	4														
		Geologist	1	3														
		Hydrologist	1	3														
		Soil Mechanics Specialist	1	3														
			Total:	15	237													
	(b)	Local Supporting Staff :	Topographers, draftsmen, administrative, etc.		160													
2. TENTATIVE STUDY BUDGET (US\$ equivalent)		Foreign Currency	Local Currency	Total														
(a)	Professional Staff Costs :	30,000	275,000	305,000														
(b)	Equipment :	50,000	90,000	140,000														
(c)	Other (Travel, non-prof. staff, etc.):		185,000	185,000														
(d)	Total :	80,000	550,000	630,000														
3. OTHER COMMENTS																		
<p>(a) The possible future utilization of the Patia River's hydroelectric potential would have to be part of a power generation program for ISA's interconnected system, and ISA would be the agency responsible for its planning and construction. It seems therefore that ISA should also assume the full responsibility for this preinvestment study, with the appropriate initial help of ICEL.</p> <p>(b) ICEL's preliminary cost estimate of US\$1.5 million equivalent appears too high. The terms of reference for the study have not been prepared yet, but if they are based on the proposed scope of work, which appears appropriate for this stage, a reasonable cost estimate would seem to be of the order of US\$630,000. (see 2 above).</p>																		
<table border="1"> <tr> <td>Supplement Prepared by:</td> <td>Manuel Isla</td> </tr> <tr> <td>Dept. or Agency:</td> <td>IBRD/FUPD</td> </tr> <tr> <td>Date:</td> <td>June 11, 1970</td> </tr> <tr> <td>Supplement Revised by:</td> <td></td> </tr> <tr> <td>Item(s) Revised:</td> <td></td> </tr> <tr> <td>Dept. or Agency:</td> <td></td> </tr> <tr> <td>Date:</td> <td></td> </tr> </table>					Supplement Prepared by:	Manuel Isla	Dept. or Agency:	IBRD/FUPD	Date:	June 11, 1970	Supplement Revised by:		Item(s) Revised:		Dept. or Agency:		Date:	
Supplement Prepared by:	Manuel Isla																	
Dept. or Agency:	IBRD/FUPD																	
Date:	June 11, 1970																	
Supplement Revised by:																		
Item(s) Revised:																		
Dept. or Agency:																		
Date:																		

PREINVESTMENT PROGRAM - STUDY DATA SHEET

No.: 5-5

Area: SOUTH AMERICA	Country: COLOMBIA	Sector(s): POWER
1. NAME OF PROPOSED STUDY: RIO SALDAÑA HYDROELECTRIC POTENTIAL		
2. PURPOSE: To evaluate the hydroelectric potential of the Saldaña River, located in the South of Departamento de Tolima, and determine the technical and economic feasibility of constructing a hydroelectric development to utilize that potential.		
3. SCOPE: 1) Recapitulation of existing basic information on the topography, hydrology, meteorology, geology, etc., of the area; 2) Installation and operation of a network of hydro-meteorological stations; processing and interpretation of data obtained. 3) Topographic surveys and complementary aereophotographic surveys; analysis of region's natural resources and ecology; 4) General geologic survey, more detailed in preselected dam and plant sites; 5) Preliminary selection of the site for the dam and plant and determination of the main parameters of the proposed development; 6) Preliminary basic design of the development and associated transmission lines, and corresponding cost estimates; 7) Comprehensive report with conclusions and recommendations.		
4. BACKGROUND: (a) Related Studies (b) Other Available Data (c) Expected Data Problems Preliminary estimates indicate a hydroelectric potential of the Saldaña River, above the irrigation works in its lower part, of the order of 400 MW. There are some uncertainties about the general suitability of the geology of the area for a hydroelectric development; prior to undertaking the proposed comprehensive feasibility study, a general geologic survey of the area is planned to assess its basic geologic prospects.		
5. TIMING: (a) Duration and Phasing of Study (b) Desired Starting Date 1971 Total Duration: 12 months Parts 1), 3) and 4): first seven months Parts 5), 6) and 7): last six months Part 2) : throughout the twelve months		
6. COMMENT ON POTENTIAL STUDY SPONSORS: Interconexion Electrica S.A. (ISA), the executing agency for this study, has requested the IBRD to finance 50% of the cost of the study with proceeds of Loan 575-CO, and the Bank is expected to agree. FONADE is presently studying a request by ISA to finance 25% of the study. The remaining 25% would be financed by ISA.		
7. PROJECT(S) EXPECTED TO RESULT FROM STUDY (if known): (a) Description (b) Estimated Investment (US\$ equivalent) (c) Financing Need and Potential Source A hydroelectric development of a dam and generating plant, and related transmission facilities Not known		
8. ORDER OF MAGNITUDE OF STUDY COST (US\$ equivalent): 200,000	Sheet Prepared by: Manuel Isla Dept. or Agency: IBRD/PUPD Date: June 10, 1970	
9. STAFF'S COMMENT ON PRIORITY RANKING OF STUDY: Studies of new generating sources are needed for proper selection of future plant construction. Because of the location of the prospective Saldaña development in ISA system, between Cali and Bogota, this study should be carried out, contingent upon the geologic survey (item 4).	Sheet Revised by:	Manuel Isla
	Item(s) Revised:	4 and 9
	Dept. or Agency:	IBRD/PUPD
	Date:	October 13, 1970

PREINVESTMENT PROGRAM - STUDY DATA SUPPLEMENT
(to be filled in when possible)

No.: 5-5 (2)

1. TENTATIVE STAFFING		Type of Specialist	Number on Team	Total Man-Months	
(a)	Professional Staff:	Project Manager	1	12	
		Engineers	3	22	
		Assistant Engineers	2	18	
	Foreign Advisers:	Dam and Power Plant Specialist	1	5	
		Geologist	1	5	
		Hydrologist	1	3	
		Engineers	2	6	
		Total:		11	71
	(b)	Local Supporting Staff : Topographers, draftsmen, administrative, etc.			60

2. TENTATIVE STUDY BUDGET (US\$ equivalent)		Foreign Currency	Local Currency	Total
(a)	Professional Staff Costs :	70,000	84,000	154,000
(b)	Equipment :	5,000	29,000	34,000
(c)	Other (Travel, non-prof. staff, etc.):		12,000	12,000
(d)	Total :	75,000	125,000	200,000

3. OTHER COMMENTS

ISA sent to the Bank, with its request for financing 50% of the study, a proposed contract with the Colombian consulting firm Compañía de Estudios e Interventorias Ltda. associated with the Canadian firm Acres International to carry out the study. ISA's present plans to start the study are contingent upon the results of the general geologic survey of the area (re. item 4, sheet 5-5(1)).

Supplement Prepared by:	Manuel Isla
Dept. or Agency:	IBRD/PUPD
Date:	June 10, 1970
Supplement Revised by:	Manuel Isla
Item(s) Revised:	3
Dept. or Agency:	IBRD/PUPD
Date:	October 13, 1970

PREINVESTMENT PROGRAM - STUDY DATA SHEET

No.: 5-6 (1)

Area: SOUTH AMERICA	Country: COLOMBIA	Sector(s): POWER
1. NAME OF PROPOSED STUDY: RIO GUAVIO HYDROELECTRIC DEVELOPMENT		
2. PURPOSE: To complete the evaluation of the hydroelectric potential of the Guavio River and its tributaries and determine the most feasible and economic development of reservoirs and power plants to utilize it, preparing preliminary dam and power plant designs, cost estimates and construction and investment schedules.		
3. SCOPE: 1) Review of existing studies on the Guavio River; 2) Completion of the topographic survey, particularly of selected reservoir and power plant sites, construction areas and routes of transmission lines and access roads; detailed topographic or aereophotographic surveys as required for the preliminary design of the development; 3) Expansion as required of the existing network of hydro-meteorological stations; processing and interpretation of data obtained; 4) Geologic survey of selected dam and plant sites, including sub-surface exploration to determine their feasibility and possible sources for construction materials; 5) Preliminary designs of dams and power plants and corresponding cost estimates and basic construction schedules; 6) Evaluation of alternative developments; 7) Comprehensive report with conclusions and recommendations.		
4. BACKGROUND: (a) Related Studies (b) Other Available Data (c) Expected Data Problems As part of the studies for a power development on the Bata River which led to the decision to build the Chivor Hydroelectric Plant, Empresa de Energia Electrica de Bogota (EEEB), one of the sponsors of Interconexion Electrica S.A. (ISA), initiated with their Colombian consultants Ingetec Limitada the investigations on the Guavio River, including its possible future diversion to the Chivor reservoir on the Bata, a tributary of the Guavio. It was concluded that the Guavio presents more economic possibilities of its own for a power development of the order of 1,200 MW. ISA would be the executing agency for the new study and the future project.		
5. TIMING: (a) Duration and Phasing of Study (b) Desired Starting Date 1971 Total duration: 20 months		
6. COMMENT ON POTENTIAL STUDY SPONSORS: ISA, the executing agency for this study, has requested the I.B.R.D. to finance 50% of the cost of the study with proceeds of Loan 575-00 and FONADE to finance another 25%. ISA would finance the remaining 25%. The present termination date of Loan 575-00 is February 1972; the requested financing from this loan would therefore depend on the actual timing of the study.		
7. PROJECT(S) EXPECTED TO RESULT FROM STUDY (if known): (a) Description A hydroelectric development of several dams and reservoirs and one or more generating stations, and related high voltage transmission facilities. (b) Estimated Investment (US\$ equivalent) Not known. (c) Financing Need and Potential Source		
8. ORDER OF MAGNITUDE OF STUDY COST (US\$ equivalent): 584,000	Sheet Prepared by: Manuel Isla Dept. or Agency: IBRD/PUPD Date: May 13, 1970	
9. STAFF'S COMMENT ON PRIORITY RANKING OF STUDY: See page (2), item 3.	Sheet Revised by:	
	Item(s) Revised:	
	Dept. or Agency:	
	Date:	

PREINVESTMENT PROGRAM - STUDY DATA SUPPLEMENT
(to be filled in when possible)

No.: 5-6 (2)

1. TENTATIVE STAFFING		Type of Specialist	Number on Team	Total Man-Months	
(a)	Professional Staff:	Project Manager	1	20	
		Engineers	5	60	
		Assist. Engineers	5	60	
		Foreign Advisers:			
		Dam and Power Plant Specialist	1	2	
		Geologist	1	2	
		Total:	13	144	
(b) Local Supporting Staff		: Topographers, draftsmen, administration, etc.		140	
2. TENTATIVE STUDY BUDGET (US\$ equivalent)		Foreign Currency	Local Currency	Total	
(a)	Professional Staff Costs	10,000	169,000	174,000	
(b)	Equipment	103,000	17,000	120,000	
(c)	Other (Travel, non-prof. staff, etc.):		290,000	290,000	
(d)	Total	113,000	471,000	584,000	

3. OTHER COMMENTS

ISA sent to the Bank, with its request for financing 50% of the study, a proposed contract with the Colombian consulting firm Ingetec Limitada to carry out the study. Ingetec performed for EEEB preliminary investigations and studies on the Guavio River. ISA proposed to start the study in mid-1970, but it would seem advisable to defer the study until some time in 1971.

Staff's Comment on Priority Ranking of Study (from page (1), item 9)

Because of its location close to Chivor, it is expected that the use of the Guavio Development would not be needed in the near future, specially if the good prospects for the Chingaza Project are confirmed by the study recommended (No. 5-3). Therefore, it is not urgent to start the Guavio study, which should definitely be carried out by ISA, but could be started at about mid-1971, when the conclusions of the Chingaza study, which might affect the bases for the Guavio Development, would be known.

Supplement Prepared by: Manuel Isla	
Dept. or Agency: IBRD/PUPD	
Date: May 13, 1970	
Supplement Revised by:	
Item(s) Revised:	
Dept. or Agency:	
Date:	

PREINVESTMENT PROGRAM - STUDY DATA SHEET

No.: 5-7 (1)

Area: SOUTH AMERICA	Country: COLOMBIA	Sector(s): POWER
1. NAME OF PROPOSED STUDY: CORELCA SYSTEM INTERCONNECTION TO ISA SYSTEM		
2. PURPOSE: To prepare and evaluate alternative programs of projects for the interconnection of ISA and CORELCA systems, to serve as the basis for a subsequent comprehensive analysis by ISA/CORELCA to determine the most economic schedule of construction of transmission and generation projects to carry out the electric integration of both systems.		
3. SCOPE: 1) Review of power market data and forecasts for CORELCA and ISA systems, and of generation and transmission capacities installed, under construction and planned in both systems; 2) Selection of prospective projects and alternative project construction schedules to carry out the interconnection of the two systems; 3) Technical feasibility analysis of the selected project schedules, and determination of the main parameters of the respective projects; 4) Preliminary basic designs and cost estimates of the projects in selected schedules.		
4. BACKGROUND: (a) Related Studies (b) Other Available Data (c) Expected Data Problems In addition to the power projects under construction and planned in ISA, Nordeste and CORELCA systems, there are other prospective developments, particularly new power supplies to large industrial consumers in those areas, which are likely to influence the schedule and nature of projects to carry out the future interconnection of the CORELCA system to the integrated ISA-Nordeste system. It is expected that by 1972 these developments will have been sufficiently defined to undertake a technical and economic feasibility study of prospective alternative projects for the interconnection.		
5. TIMING: (a) Duration and Phasing of Study (b) Desired Starting Date 1972 Total Duration: 12 months		
6. COMMENT ON POTENTIAL STUDY SPONSORS: It is expected that the study will be jointly undertaken by ISA and CORELCA.		
7. PROJECT(S) EXPECTED TO RESULT FROM STUDY (if known): (a) Description (b) Estimated Investment (US\$ equivalent) (c) Financing Need and Potential Source A program of transmission lines and some generation expansion projects Not known		
8. ORDER OF MAGNITUDE OF STUDY COST (US\$ equivalent): 300,000	Sheet Prepared by: Manuel Isla Dept. or Agency: IBRD/PUPD Date: June 16, 1970	
9. STAFF'S COMMENT ON PRIORITY RANKING OF STUDY: The prospects are that this study will be of high priority in 1972.	Sheet Revised by:	
	Item(s) Revised:	
	Dept. or Agency:	
	Date:	

PREINVESTMENT PROGRAM - STUDY DATA SUPPLEMENT
(to be filled in when possible)

No.: 5-7 (2)

1. TENTATIVE STAFFING		Type of Specialist	Number on Team	Total Man-Months
(a)	Professional Staff:	Project Manager	1	12
		Engineers	4	40
		Assistant Engineers	8	80
		Total:	13	132
(b)	Local Supporting Staff :	Topographers, Draftsmen, Administrative		150

2. TENTATIVE STUDY BUDGET (US\$ equivalent)		Foreign Currency	Local Currency	Total
(a)	Professional Staff Costs :		180,000	180,000
(b)	Equipment :		20,000	20,000
(c)	Other (Travel, non-prof. staff, etc.):		100,000	100,000
(d)	Total :		300,000	300,000

3. OTHER COMMENTS

Supplement Prepared by:	Manuel Isla
Dept. or Agency:	IBRD/PUPD
Date:	June 16, 1970
Supplement Revised by:	
Item(s) Revised:	
Dept. or Agency:	
Date:	

PART B

TELECOMMUNICATIONS

I. INTRODUCTION

1. The topography of Colombia has great bearing on the importance of communications to the economy. The western portion of the country is divided by three mountain ranges, in some places reaching a height of 5,000 meters. The southeastern portion is a vast jungle area with very few inhabitants. The telecommunications sector^{1/} is therefore both an important supplement and in inaccessible areas a crucial alternative to such forms of transport and communications as railways, roads, postal services, etc.

2. Colombia is divided administratively into the Federal District of Bogota, 22 regional departments, and numerous municipal governments in the cities and towns within each region. For purposes of economic planning the country has recently been divided into eight regions by the Regional and Urban Development Division of the National Government's Planning Department - "Departamento Nacional de Planeacion" (PLANEACION).^{2/}

3. This report covers (a) the role of Government in the telecommunications sector, (b) the present facilities, (c) plans for expanding them, and (d) reorganization of the sector to cope with difficulties arising from its fragmentation into independent entities operating telephone services in various parts of the country.

^{1/} The sector in the context of this report covers telephone, telegraph, and telex services. Other communication services such as radio, television, and postal services lie outside its scope.

^{2/} PLANEACION - "Planes y Programas de Desarrollo, 1969-72."

II. THE SECTOR - DELINEATION OF ROLES

The Role of Government

4. The Ministry of Communications exercises governmental authority over the sector. Its powers consist of policy-making, licensing, and regulation of the various entities.

Policy-Making

5. By law, the Ministry is responsible for formulating sector policy. Article 1, Decree No. 3049 of December 1968, which reorganized the Ministry, states:

"It shall be the responsibility of the Minister of Communications, in agreement with the President of the Republic, to adopt the national communications policy in harmony with the overall development policy."

This Decree also provided for a planning office to be set up within the Ministry to make a broad study of the state of the sector and its defects, to get abreast of telecommunication advances in other countries, and to make recommendations to the Minister.

Licensing

6. The Ministry is the licensing authority for all telephone, telegraph, and telex services. Before the 1930's many local services were licensed to and operated by expatriate companies, which often were suppliers of telecommunications equipment. Over the past three decades, however, these licenses have been given to the various municipalities and to the Empresa Nacional de Telecomunicaciones (TELECOM), whose main operations are international and national long-distance telephone, telegraph, and telex services.

7. Annex 1 lists 61 entities, including TELECOM, that have been licensed by Government to provide local services. About 109 centers are being served by these entities. The centers are listed in Annex 2 along with pertinent data on the present and future size of their automatic exchanges (the data will be discussed in Sections III and IV).

8. A municipality can waive the right to provide telephone services in its area in favor of TELECOM. Operating as a Government-owned national entity, TELECOM is licensed to provide international and national long-distance telephone, telegraph, and telex services in Colombia and to provide local telephone services in any area where the local administrative authority permits it to do so. Thus, with prior local and ministerial approval, TELECOM is allowed to take over an existing entity or to develop telephone services in an area where there are none. Decree No. 1184 of July 21, 1969, which consolidated TELECOM's statutes, states that TELECOM --

"may assume responsibility for and provide other communications services whenever the Government shall so decide, in association with official or private institutions ... without prejudice to any rights that may be held in this connection by Departments or Municipalities."

Regulation

9. The Ministry exercises regulatory powers in two ways:

- (i) It has to approve the investment plans of the various entities. Procurement in excess of 40 percent of existing capacity must be by open competition.

Besides its regulatory powers, the Government has this power over TELECOM's investment plans since it is the owner of TELECOM.

- (ii) Applications by the entities for tariff revisions must be approved by the Ministry, which requires that the proposed tariffs be necessary with respect to internal cash generation and debt service requirements. The Ministry does not initiate tariff revisions, nor can it force the introduction of revised tariffs that it might have approved.

10. In addition to the Ministry's role, the Government's Planning Department -- PLANEACION -- exercises a role in the approval of the entities' expansion plans and their contracting of foreign debt. PLANEACION's role includes policy-making for the sector.

11. Nearly all of the local telephone entities are members of Asociacion Nacional de Empresas Telefonos de Colombia (ANET), which was set up to coordinate the interests of the members and to give them technical and other advice. ANET maintains a permanent secretariat in Bogota and employs two telecommunications experts on a full-time basis. As a result of internal disagreements, some entities have withdrawn their membership at times; for example, Barranquilla did so in 1969 and Medellin in 1970.

III. PRESENT FACILITIES

General

12. The number of automatic telephone lines in Colombia has about doubled -- from 270,000 in 1960 to 560,000 in 1969. All but 17,200 lines are automatic; i.e., they do not require an operator when local calls are placed. The telephone density in the country has increased from 1.75 in 1960 to about 2.75 telephones per hundred population in 1969. This compares with approximate figures of 4.2 for Panama, 3.8 for Venezuela, and a range of 30 to 54 for the developed countries.

13. About 109 cities and towns have automatic telephone services. In an additional 360 towns there are a total of 17,200 manual lines. The table below classifies the population centers with telephone services. The breakdown (into four groups of centers plus the rural population) is very approximate.

DISTRIBUTION OF TELEPHONE SERVICES ACCORDING TO POPULATION

<u>Centers in Population Range</u>	<u>Total Population (million)</u>	<u>Number of Centers</u>	<u>Number with Telephones</u>
Greater than 20,000	9.5	79	60
10,000 - 20,000	1	62	27
5,000 - 10,000	1	136	12
100 - 5,000	1.5	639	10
Rural	8	-	-
Total	<u>21</u>	<u>916</u>	<u>109</u>

Source: Population estimates by Government Census Department.

The table shows that only about half of Colombia's approximately 21 million people live in areas with telephone services. There are about 19 areas of greater than 20,000 population that do not have any local telephone services. Less than half of the towns between 10,000 and 20,000 population and very few of the remaining 775 centers have local service; in these areas there are only a long-distance office, a telegraph office, and a small number of manual lines. Some of the commercial enterprises maintain private radio systems, however, with circuits to the nearest telephone exchange. For example, in the area around Barrancabermeja in the northeast corner of Antioquia Department and Santander, due to insufficient local services, 25 private companies mostly in the petrochemical industry are licensed by the Ministry of Communications to operate 250 circuits to Bogota.

Local Telephone Services

14. Data on local services are detailed in Annex 1 and 2, which list the 61 entities and the 109 centers they serve. In some of the larger cities such as Bogota (190,000 lines at present) and Barranquilla (30,500 lines), the municipality has created a separate telephone entity to administer and operate the local telephone service, whereas in the smaller cities and towns the telephone service is often operated in conjunction with such other public services as water supply and electric power. The eight largest entities, ranging from Bogota to Cartagena (9,000 lines), are large enough to be financially viable and are providing good service at reasonable tariffs. The same can be said for TELECOM's local telephone services -- 5,400 automatic lines in 12 towns and another 6,009 lines of manual exchanges in some 210 small localities throughout the country. However, about half of the 61 entities, each of which operates 1,000 lines or less, are in financial and technical difficulties because of the small scale of their operations.

15. Annex 3 lists the local telephone tariffs of 14 cities and the TELECOM tariffs that apply to all of its 12 automatic exchanges. Without a detailed study, however, it is difficult to comment on the adequacy of tariffs in these local areas. Up to now this has not been done, although PLANEACION is now reviewing those tariffs. Its aim is to propose some reforms of the rate structure and to systematize the method for setting the rates. Some of the special features to be noted in the list of tariffs in Annex 3 are:

- (i) Bogota requires a capital contribution from its new subscribers that varies depending on whether they are residential (Col\$500) or business (Col\$2,400). The amount that residential subscribers are required to pay in Bogota also varies in relation to the value of their homes.
- (ii) TELECOM's tariffs also provide for a capital contribution.
- (iii) The deposit, which all the cities require, is ostensibly to protect the entities in the event of unpaid bills.
- (iv) Only five cities provide free calls as part of the rental charges, the numbers are shown in brackets -- Cali (100 - 210), Barranquilla (200), Bucaramanga (150), Ibague (150) and Neiva (150). (The tendency is to discontinue these free calls.)
- (v) Cali and Barranquilla provide good telephone services at very low tariffs. In those cities a rental of about US 30 cents per month can bring up to 210 free calls. They are able to provide such good service without subsidies because of their operating efficiency.

16. As in most countries, developed as well as less developed, the installation of new subscriber lines in Colombia has not kept pace with demand for telephone connections. In Bogota 70,000 applicants await connections, and the average waiting time is four years.

Long-Distance Services

17. Responsibility for international and national long-distance telephone, telegraph, and telex services lies with TELECOM (TELECOM's license is discussed in Section II). Created in 1945, this Government-owned public entity began operations two years later with the purchase of Compania Telefonica Central, a Government-owned company that provided international and national long-distance services. In 1958, with the end of a concession to an expatriate company (All America Cables C.L.), all international telephone and telegraph services were constituted under TELECOM. In 1964, all of the national telegraph services together with 3,500 telegraphic staff were placed under TELECOM.

18. An IBRD loan to TELECOM in 1967 provided for the expansion of national long-distance communications by means of micro-wave radio links and automatic switching equipment, and the expansion of international links by high-frequency equipment. The loan included equipment for a few local telephone exchanges (4,500 lines). An Earth Satellite Station, financed by supplier credits, was completed in March 1970, making for quick and high-quality international connections. Subscriber trunk-dialing (STD) is available in Colombia, although many subscribers prefer to place their calls manually through the operator because the periodic pulse-metering system does not provide details of the long-distance calls.

19. TELECOM maintains seven large regional offices to coordinate its long-lines network, and also hundreds of small offices throughout the country to handle its long-distance telephone, telegraph, and telex connections. The head office in Bogota does all the major planning. Development programs have been financed by the IBRD loan, supplier credits, and internal cash generation.

IV. FUTURE EXPANSION PLANS

20. In telecommunications there are two clear criteria with respect to expansion:

- (a) An entity must maintain good service to its subscribers by continually adding more equipment and circuits in line with the growth of demand.
- (b) Having made provision for this maintenance of good service, the entity must seek to expand its service to new subscribers.

These two criteria apply to both local and long-distance services. Expansion plans should be drawn up for, say, a five-year period and should be revised annually.

21. In Colombia planning is being done by each of the local entities and by TELECOM. While by and large within the present framework the planning is reasonably adequate in the larger entities including TELECOM, the planning in the smaller entities very often reflects lack of competence in the technical and financial areas.

Local Services

22. As part of their ongoing operations the larger entities such as Bogota (ETB), Medellin, and TELECOM have been drawing up plans for expanding local telephone services. Shown in Annex 2 are the present and projected number of telephone lines in 1975 in each center, together with the present and projected urban population. These figures were compiled by PLANEACION from each entity's expansion plan. The total number of automatic telephone lines in Colombia is projected to increase from the present 556,000 to 988,000 a growth of 78 percent over the next five years. A few known features with respect to financing are:

- (i) Bogota (ETB) has recently placed a contract for 92,000 new lines to be installed over the next three years. ETB now has 190,000 lines and by 1975 expects to have 375,000. This expansion will be financed out of supplier credits and internal cash generation.
- (ii) EMCALI expects to increase the number of lines from the present 64,800 to 116,200 by 1975, with financing provided by supplier credits.
- (iii) TELECOM has applied to the Bank for a second loan, about a third of which would be for installing over the 1971-74 period some 270 local exchanges with a total capacity of 30,000 lines in various parts of the country.

- (iv) Corporacion Autonoma Regional de la Sabana de Bogota (CAR) will be installing over the 1971-73 period about 40 exchanges, with a capacity of about 8,000 lines, in the Bogota Plain area. There already are 2,500 lines in operation in that area. CAR's development program is proposed to be financed out of supplier credits.

Long Distance Services

23. TELECOM has applied for a second IBRD loan to cover the foreign exchange costs of additional long-distance channeling and switching equipment, toll-ticketing equipment, and television links, besides the equipment for local exchanges mentioned above. The additional circuits will relieve the present congestion in the circuits and thus enable TELECOM to provide good long distance telephone service to its subscribers for the next five years. Toll-ticketing equipment is being installed in Barranquilla under the first loan and would be installed under the proposed second loan in nine other cities. This will overcome the billing problems and thereby encourage more subscribers to use the subscriber trunk-dialing (STD).

V. REORGANIZATION OF THE SECTOR

24. The major problem to be dealt with in Colombia's telecommunications sector is its fragmentation. The proliferation of small telephone entities makes for duplication of planning efforts, and complicates the technical integration and interconnection of the sector. The smaller entities are not financially viable, nor are they able to employ experienced engineers to do their planning since most of the engineers are working in the large entities. There is a great need for the technical skills needed in planning and developing the sector to be available to all of the entities regardless of size.

25. Another major weakness in the sector is that there is no clearly defined commitment as to who is responsible for undertaking the development of services to the unserved areas. At present TELECOM is the only entity whose license permits it to develop those areas throughout the country. In the 1971-75 period TELECOM proposes to extend local telephone services amounting to 270 exchanges with a capacity of 30,000 lines. Some of these exchanges will be for sizable towns; 19 have more than 20,000 population with no local telephone service.

26. What kind of structure is necessary in Colombia's telecommunications sector -- one national entity, a few regional entities, or continued operation by some 60 entities? In most other countries there is a single national entity that operates all local and long-distance telephone services. This is because of the administrative, technical, and economic difficulties that are encountered whenever there is a fragmentation of the sector, as in the case of Colombia. This situation not only creates economically non-viable entities, but also makes it difficult to administer the sector from the point of view of unified policy and procedures. Economies of scale cannot be attained in bidding and procurement, moreover, and there are substantial technical problems in integrating circuits and switches made for different systems into a national network.

27. Although a single national entity for the whole sector should be the long-term objective for Colombia, several factors inhibiting such reorganization have to be taken into account. For example, the largest and financially viable entities are reluctant to merge with the smaller entities, and with local and regional political influences very strong any form of merger is likely to be resisted by those entities that cherish their autonomy.

28. There are two possible approaches to rationalization of the sector:

- (i) TELECOM could grow toward a national monopoly in telecommunications by installing new exchanges in the unserved areas, and by absorbing those small entities that are in financial difficulties and are amenable to the idea of merging with others. Larger entities such as the ETB may remain independent or may merge at a later time if they are so willing.

- (ii) About eight of the largest centers could expand progressively by developing unserved areas and absorbing the entities around them, until eventually the country is practically covered by eight Regional Authorities.

29. The evolution of the sector in the next 10 years will probably follow both of the above approaches. In the short run, the important aspect of re-organization is not so much that there should be no more than one entity in the sector, but that the entities should be large enough to be financially and technically viable.

30. The Ministry of Communications and PLANEACION are studying the sector with a view to determining the structural changes that could be made. During this year, PLANEACION has been working on a study to come up with proposals and procedures for merging the small local telephone entities. The Urban and Regional Development Division of PLANEACION proposed eight Regional Authorities.¹ Similarly, the Communications Division has been studying the possibility of establishing Metropolitan areas first and Regional areas later.

31. For the short term, PLANEACION is studying a proposal to set up a National Development Fund for Local Telephone Entities, which would channel funds to the small entities and plan and control their expansion. The objectives are to improve national and regional planning to facilitate investment where necessary and to avoid unnecessary investment. It is proposed that the Fund have a Board of Directors made up of technical advisors, representatives of the major local telephone entities, and TELECOM representatives. The proposal together with the draft legislation is expected shortly.

¹/ PLANEACION - "Planes y Programas de Desarrollo, 1969-72."

VI. CONCLUSIONS

32. The major problem confronting the telecommunications sector in Colombia is the fragmentation caused by the many independent entities operating telephone services. The administrative, technical, and economic difficulties being experienced are aggravated by this fragmentation.

33. Two alternative approaches for reorganizing the sector are set out in paragraph 28. It is desirable and urgent that the 52 entities which now have 80,000 lines, outside of the eight largest entities and TELECOM, be merged at an early date. This would not be difficult from the technical or financial point of view. Estimated value of the total assets of the 52 entities is US \$32 million, and appropriate compensation could be paid to them. The difficulties in achieving the merger are due primarily to the factors given in paragraph 27. With the expansion of TELECOM's operations to cover additional areas and with the expansion of the metropolitan areas around the big cities, the sector fragmentation will tend to become less of a problem within a few years. But it is essential that all future action be directed toward achieving a reasonable degree of consolidation, leading in the long run to a single national entity serving all of Colombia.

Providing Local Telephone Service
(Automatic Exchanges)

Number	Name of Entity	Number of Lines (as of December 1968)
1	Empresa de Telefonos de Bogota	185,000
2	Empresas Publicas de Medellin	112,600
3	Empresas Municipales de Cali	54,800
4	Empresa Municipal de Telefonos - Barranquilla	30,500
5	Empresa Municipal de Telefonos - B/manga	15,600
6	Empresas Publicas de Manizales	15,400
7	Empresas Publicas de Pereira	11,050
8	Compania Telefonica de Cartagena S.A.	9,000
9	Empresa de Telefonos Dptales. N/Santander	6,800
10	Empresas Publicas Municipales - Palmira	6,250
11	Empresas Publicas de Armenia	6,000
12	Empresa Departamental de Telefonos Boyaca	5,800
13	Empresas Publicas Municipales de Ibague	5,000
14	Telefonica Municipal de Santa Marta	5,000
15	Empresa Nacional de Telecomunicaciones	4,600
16	Compania Telefonica del Huila S.A.	4,000
17	Empresas Municipales de Cartago	3,900
18	Empresas Municipales de Girardot	3,600
19	Empresa Dptal. de Telefonos de Narino	2,800
20	Telefonica Municipal de Popayan	2,800
21	Empresa Municipal de Telefonos B/bermeja	2,100
22	Empresas Municipales de Buga	2,000
23	Empresas Municipales de Tulua	2,000
24	Empresas Departamentales de Antioquia	1,500
25	Empresas Municipales de Calarca	1,500
26	Planta Telefonica Departamental - Meta	1,500
27	Empresa Telefonica de Bolivar	1,200
28	Empresa Municipal de Telefonos de Armero	1,000
29	Telefonica Municipal de Caicedonia	1,000
30	Empresa Telefonica de Fusagasuga	1,000
31	Empresa Municipal de Telefonos de Ipiales	1,000
32	Empresa Municipal de Telefonos de Rio Sucio	1,000
33	Compania Telefonica de San Gil S.A.	1,000
34	Empresa Municipal de Telefonos del Socorro	1,000
35	Empresas Publicas Municipales - Sta. Rosa Cabal	980
36	Telefonica Municipal de Yarumal	980
37	Empresas Publicas Municipales de Sevilla	900
38	Telefonica Municipal - Espinal	800
39	Telefonica Municipal de Zarzal	800
40	Empresas Publicas Municipales de Honda	700

Number	Name of Entity	Number of Lines (as of December 1968)
41	Empresa Municipal de Telefonos de La Dorada	700
42	Empresa Telefonica Municipal de Salamina	700
43	Empresa Municipal de Telefonos - Garzon	600
44	Planta Telefonica de Valledupar	560
45	Telefonica Municipal de Aguadas	500
46	Planta Telefonica de Cionaga	500
47	Telefonica Municipal de Mariquita	500
48	Telefonica Municipal de Zipaquirá	500
49	Telefonica Municipal de Jerico	450
50	Telefonica Municipal de Florencia	420
51	Telefonica Municipal de Chia	400
52	Empresa Municipal de Telefonos de Riohacha	400
53	Telefonica Municipal de Boldanillo	400
54	Telefonica Municipal de El Cerrito	300
55	Empresa Municipal de Telefonos de Fundacion	300
56	Telefonica Municipal de Cajica	200
57	Telefonica Municipal de Guacari	200
58	Telefonica Municipal de Tumaco	200
59	Telefonica Municipal de Urrao	200
60	Telefonica Municipal de Ginebra	130
61	Telefonica Municipal de Yotoco	<u>50</u>
	Total Lines	522,670
	Total Entities	61

In addition, there are the following manual lines in service:

Operated by TELECOM	6,009
Operated by departmentals (regional governments)	<u>1,569</u>
	7,578

List of Centers with
Automatic Local Telephone Service

	Center	Urban Population		Number of Subscriber Lines		Telephone Density*	
		1969	1975	1969	1975	1969	1975
1	Bogota	2,148,387	3,105,000	190,500	375,000	8.86	12.07
2	Medellin	967,825	1,450,000	115,600	196,000	11.94	13.51
3	Cali	898,000	1,359,031	64,800	116,200	7.21	8.55
4	Barranquilla	662,245	857,968	30,500	48,700	4.60	5.67
5	Bucaramanga	297,982	414,859	15,600	25,200	5.23	6.07
6	Manizales	260,507	364,956	15,500	25,000	5.94	6.85
7	Pereira	189,526	254,273	11,050	17,700	5.83	6.96
8	Cartagena	281,342	379,401	9,000	15,500	3.29	4.06
9	Palmira	137,600	185,665	7,050	10,750	5.12	5.78
10	Armenia	168,424	238,372	6,000	11,250	3.56	4.71
11	Cucuta	194,836	270,333	5,800	10,500	2.97	3.88
12	Ibague	172,016	248,882	5,000	10,000	2.90	4.02
13	Santa Marta	124,563	183,709	5,000	10,150	4.01	5.52
14	Girardot	101,253	133,762	5,000	7,500	4.93	5.60
15	Neiva	104,105	150,370	4,000	6,750	3.84	4.48
16	Cartago	69,527	90,231	3,900	5,700	5.60	6.31
17	Popayan	73,701	96,641	2,800	4,500	3.79	4.65
18	Pasto	100,766	127,428	2,800	4,500	2.77	3.53
19	Barrancabermeja	82,919	123,177	2,100	3,800	2.53	3.04
20	Buga	86,053	118,317	2,000	3,600	2.32	3.04
21	Tulua	73,152	98,874	2,000	3,200	2.73	3.24
22	Tunja	50,131	64,500	2,000	3,000	3.98	4.65
23	Villavicencio	65,527	100,509	1,500	3,000	2.28	2.98
24	Buenaventura	91,164	123,995	1,300	3,000	1.42	2.41
25	Sogamoso	49,777	73,001	1,250	2,400	2.51	3.29
26	Monteria	106,805	172,331	1,000	4,500	0.93	2.61
27	Calarca	38,974	52,631	1,500	2,200	3.86	4.16
28	Fusagasuga	25,518	36,527	1,000	1,450	3.91	3.97
29	Riosucio	13,257	16,052	1,000	1,000	7.54	6.22
30	Ipiales	30,443	41,572	1,000	1,500	3.28	3.60
31	Duitama	54,620	100,953	1,000	2,600	1.83	2.57
32	San Gil	23,281	30,457	1,000	1,500	4.29	4.92
33	Caicedonia	19,186	23,218	1,000	1,250	5.21	5.38
34	Santa Rosa de Cabal	43,860	64,106	980	1,750	2.23	2.72
35	Sevilla	31,645	38,585	900	1,200	2.84	3.10
36	Espinal	31,931	47,225	800	1,400	2.50	2.96
37	La Dorada	32,688	42,446	700	1,100	2.14	2.59

* Telephone Density - Number of lines (not telephones which is sometimes higher) per hundred population

Source: Planeacion.

Center	Urban Population		Number of Subscriber Lines		Telephone Density*		
	1969	1975	1969	1975	1969	1975	
38	Honda	21,662	23,897	700	900	3.23	3.76
39	San Andres	16,018	26,716	700	1,500	4.37	5.61
40	Facatativa	24,436	29,657	600	1,000	2.45	3.37
41	Garzon	15,872	21,997	600	900	3.78	4.09
42	Valledupar	79,284	156,325	560	4,000	0.70	2.55
43	Zipaquirá	28,213	36,509	500	1,000	1.77	2.73
44	Ocana	31,923	40,580	500	1,000	1.56	2.46
45	Pamplona	30,166	36,782	500	1,000	1.65	2.71
46	Chiquinquirá	20,564	25,855	500	800	2.43	3.09
47	Quibdo	27,060	38,516	500	1,000	1.84	2.59
48	Ciénaga	61,622	83,100	500	1,700	0.81	2.04
49	Florencia	23,822	33,658	420	800	1.76	2.37
50	Sincelejo	57,645	79,032	400	2,000	0.69	2.53
51	Magangue	32,694	40,353	400	900	1.22	2.23
52	Cerete	15,194	20,327	200	500	1.31	2.45
53	Chinchina	21,157	29,439	1,000	1,400	4.72	4.74
54	Socorro	14,504	15,506	1,000	1,000	6.89	6.44
55	Armero	21,432	27,212	1,000	1,300	4.66	4.77
56	Yarumal	20,236	25,150	980	1,900	4.84	7.55
57	Zarzal	24,797	36,530	800	1,200	3.21	3.28
58	Salamina	17,821	23,141	700	1,000	3.94	4.32
59	Bolívar	11,280	13,762	600	1,100	5.31	8.00
60	Pitalito	16,410	26,522	500	800	3.04	3.01
61	Mariquita	11,386	13,972	500	650	4.39	4.65
62	Andes	13,354	16,540	500	800	3.74	4.84
63	Aguadas	12,103	13,824	500	600	4.13	4.34
64	Jerico	9,407	11,272	450	900	4.78	7.98
65	Chía	7,493	10,502	400	560	5.33	5.35
66	Riohacha	15,142	20,455	400	700	2.64	3.30
67	Sonson	20,047	24,429	400	1,200	1.99	4.91
68	Puerto Boyacá	10,895	13,009	400	550	3.67	4.22
69	Cerrito	17,413	26,309	300	600	1.72	2.28
70	Santander	14,195	20,367	300	450	2.01	2.20
71	Fundación	18,848	26,375	300	600	1.59	2.27
72	Maicao	12,086	16,326	200	300	1.65	1.83
73	Guacari	8,428	11,529	200	300	2.37	2.60
74	Cajica	3,781	5,809	200	250	5.28	4.30
75	Corozal	17,990	24,122	200	500	1.11	2.07
76	Lorica	15,139	18,320	200	500	1.32	2.72
77	Tumaco	32,610	44,202	200	900	0.61	2.03
78	Mompós	11,726	12,701	200	350	1.70	2.75
79	Paipa	4,332	6,378	150	250	3.46	3.91
80	Pradera	14,158	18,597	100	400	0.70	2.15

* Telephone Density - Number of lines (not telephones which is sometimes higher) per hundred population

Source: Planeación.

Center	Urban Population		Number of Subscriber Lines		Telephone Density*		
	1969	1975	1969	1975	1969	1975	
81	Florida	18,019	26,620	100	550	0.55	2.07
82	Ubate	7,542	9,390	400	400	5.30	4.25
83	Roldanillo	11,966	16,247	400	400	3.34	2.46
84	Leticia	5,335	7,502	200	200	3.74	2.68
85	Urrao	8,507	9,558	200	600	2.35	6.28
86	Meira	8,981	10,849	200	250	2.22	2.30
87	Bolivar	4,326	5,305	100	100	2.31	1.88
88	Garagoa	4,098	5,445	100	100	2.44	1.83
89	Istmina	4,603	5,442	100	100	2.17	1.83
90	Candelaria	7,958	12,412	100	150	1.25	1.20
91	Melgar	5,247	8,689	100	150	1.90	1.72
92	Trujillo	7,671	8,860	100	100	1.30	1.12
93	Guateque	5,965	7,994	100	100	1.67	1.25
94	Ginebra	3,758	4,210	130	130	3.45	3.08
95	Belen	2,564	3,612	50	50	1.95	1.38
96	Boavita	2,203	2,735	50	50	2.26	1.83
97	El Cocuy	2,830	2,786	50	50	1.76	1.79
98	Miraflores	3,626	4,120	50	50	1.37	1.21
99	Moniquira	5,712	6,876	50	100	0.87	1.45
100	Ramiriqui	1,676	2,073	50	50	2.98	2.41
101	Sta. Rosa de V.	4,414	5,533	50	50	1.13	0.90
102	Soata	4,956	5,768	50	100	1.00	1.73
103	Bugalagrande	8,079	11,902	50	100	0.61	0.84
104	Yotoco	2,084	3,323	50	50	1.78	1.50
105	Restrepo	5,919	7,280	50	50	0.84	0.68
106	Riofrio	1,713	1,797	50	50	2.91	2.78
107	San Pedro	1,798	2,181	50	50	2.78	2.29
108	Andalucia	7,658	10,644	50	100	0.65	0.93
109	Darien	8,548	12,607	50	100	0.58	0.79

* Telephone Density - Number of lines (not telephones which is sometimes higher) per hundred population

Source: Planeacion.

September 1970

Local Tariffs in Selected Cities
(Colombian Pesos)

	<u>Present Capacity in Lines</u>	<u>Monthly Rental</u>	<u>Number of Free Calls</u>	<u>Cost per Subscriber Call</u>	<u>Connection Charge</u>	<u>Subscriber Deposit</u>	<u>Capital Contribution</u>
Bogota	190,000	10 - 30	nil	.10	300	900	500 - 2,400
Medellin	115,600	5 - 30	nil	.20	300	250	nil.
Cali	64,800	6 - 35	100 - 210	.05	150	500	nil.
Barranquilla	30,500	5 - 30	200	.10	25 - 50	250	nil.
Bucaramanga	15,600	12 - 32	150	.05	150	500	nil.
Manizales	15,500	10 - 30	nil.	.10	300	900	nil.
Pereira	11,050	15 - 28	nil.	.10	300	900	nil.
Cartagena	9,000	10 - 30	nil.	.05	300	900	nil.
Armenia	6,000	10 - 20	nil.	.10	300	900	nil.
Ibague	5,000	15 - 20	150	.05	70	250	nil.
Girardot	5,000	10 - 15	nil.	.10	300	900	nil.
Neiva	4,000	8 - 20	150	.05	100	250	nil.
Pasto	2,800	10 - 20	nil.	.10	300	900	nil.
Honda	700	10 - 15	nil.	.10	300	900	nil.
TELECOM	4,600	25 - 30	nil.	.10	350	800	1,000 - 1,200

Source: PLANEACION.