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**COLOMBIA**

**LOAN TO INTERCONEXIÓN ELÉCTRICA S.A.  
CONSTRUCTION OF THE CHIVOR HYDROELECTRIC POWER PLANT**

**(CO0010; 214/OC-CO)**

**LOAN PROPOSAL**

**1971**

LOAN TO INTERCONEXION ELECTRICA S. A. CONSTRUCTION  
OF THE CHIVOR HYDROELECTRIC POWER PLANT

C O L O M B I A

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## C O L O M B I A

### INTERCONEXION ELECTRICA, S. A.

(CHIVOR Hydroelectric Station)

1. Borrower: The borrower would be Interconexión Eléctrica, S.A. (ISA), a corporation organized September 14, 1967, by Empresa de Energía Eléctrica de Bogotá (EEMB), Empresas Públicas de Medellín (EMP), Corporación Autónoma Regional del Cauca (CVC), Central Hidroeléctrica del Río Anchicaya, Limitada (CHIDRAL), the Instituto Colombiano de Energía Eléctrica (ICEL), and the Central Hidroeléctrica de Caldas (CHEC). All of these entities are decentralized institutions of the public sector. ISA is empowered to contract for foreign obligations; its domicile is in Bogotá.
2. Amount and Currencies: 1/ Up to US\$34,100,000 or the equivalent in other currencies which are part of the ordinary capital resources of the Bank, to be disbursed in those currencies (except that of Colombia) to pay for goods and services acquired through international competitive bidding and for such other purposes as may be specified in the loan contract.
3. Source of Funds: The ordinary capital resources of the Bank.
4. Guarantee: Full guarantee of the Republic of Colombia.
5. Term, Interest, Fees and Charges, and Disbursement:
  - (a) ISA would amortize the loan over a period of 20 years from the date of the contract, by means of 30 consecutive, semiannual and, so far as possible, equal installments, the first of which would be payable 5-1/2 years from such date.
  - (b) Interest: 8% per annum (including the Bank's 1% special commission), payable semiannually on principal amounts outstanding, 2/ with the first payment due 6 months after the date of the contract. Interest during the disbursement period would be paid from the proceeds of the loan.

1/ The exchange rate used in this document is US\$1.00 = Col.\$18.28, except where another rate is specified. This is the rate that prevailed in October 1970 and which was applied in updating all the costs of the project following the definition of the main construction contract (already awarded), which is being financed in part with resources from the International Bank for Reconstruction and Development (IBRD).

2/ 40% of the loan would consist of currencies of nonmember countries expressly provided for in the loan contract; this would be subject to a special commission of 1/2 of 1% per annum payable semiannually in the currencies loaned and on the same dates as the interest.

- (c) Commitment Fee: 1-1/4% per annum on the undisbursed portion of the loan, commencing to accrue 60 days after the date of the contract and payable proportionately in the currencies committed in the contract, on the same dates as the interest 1/.
  - (d) Disbursement Period: Total disbursement of the loan would be made within a period of 5 years from the date of the contract.
  - (e) Currencies of Payment: Payments of amortization and interest would be made proportionately in the currencies disbursed.
6. Description of the Project: The project calls for construction of a rock-fill dam on the Bata River, from which impounded water will be diverted through a 5.8 km. flow tunnel and a 2.0 km. penstock to the Lengupá River, on the right bank of which is the site for the powerhouse, which will contain four 125-MW generator units. It also includes a 230 KV dual circuit transmission line 155 km. long, extending from the CHIVOR plant to the two terminal substations, one in Suba (Bogotá) and the other at La Mesa (adjacent to the Colegio hydroelectric plant), to feed the Central Interconnection Network. The works included in this project will be located in the Department of Boyacá at a point about 120 km. northeast of Bogotá. The Bank would participate in this project jointly with the International Bank for Reconstruction and Development (IBRD), which signed a loan contract June 4, 1970 for US\$52,300,000 to finance part of the cost of the principal construction works in the project and its engineering and supervision expenses. The IDB resources would be used to finance the foreign currency cost of importation of electrical and mechanical equipment for the power station and substations, of the contract for construction (supply and installation) of the 230 KV transmission line, and of the construction of the penstock. The Bank would also finance the interest on the proposed loan during the disbursement period. All acquisitions and contract awards financed with IDB funds would be made on the basis of international bidding.
7. Total Cost of the Project: The total cost of the project is estimated at the equivalent of US\$146,250,000, as follows:

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1/ The commitment fee on currencies of nonmember countries expressly provided for in the loan contract would be 2% per annum, payable in the currencies of those countries.

(In thousands of US\$ or equivalent units)

<u>Category</u> <u>1/</u>	<u>External</u> <u>costs</u>	<u>Local</u> <u>costs</u>	<u>Total</u>	<u>%</u>
1. <u>Engineering and Administration</u>	800	8,170	8,970	6.2
2. <u>Direct Costs of Construction</u>	-	-	-	-
2.1 Generating Plant	63,830	34,110	97,940	67.0
2.2 Transmission Facilities	5,420	1,140	6,560	4.5
3. <u>Financial Charges</u>				
3.1 IBRD Loan (interest and com- mitment charge)	9,400	-	9,400	6.4
3.2 IDB Loan				
- Interest	5,840	-	5,840	4.0
- Commitment fee	1,500	-	1,500	1.0
- Inspection and Supervision Fund	341	-	341	0.2
5. <u>No Specific Allocation</u>				
5.1 General Contingencies	10,399	5,300	15,699	10.7
Total	<u>97,530<sup>2/</sup></u> (66.7%)	<u>48,720</u> (33.3%)	<u>146,250</u> (100.0%)	<u>100.0</u>

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1/ Includes only those investment categories defined by the Bank in which investments would be made.

2/ This entire amount represents direct costs in foreign currencies.

8. Financial Plan: The project would be financed as follows:

(In thousands of US\$ or equivalent units)

	<u>Currency of Origin</u>		<u>Currency of Use</u>		<u>Total</u>	<u>%</u>
	<u>Foreign</u>	<u>Local</u>	<u>Foreign</u>	<u>Local</u>		
IDB	34,100	-	34,100 <sup>1/</sup>	-	34,100	23.3
IBRD	52,300	-	51,700	600	52,300	35.8
ISA	-	59,850	11,730 <sup>2/</sup>	48,120	59,850	40.9
Total	<u>86,400</u>	<u>59,850</u>	<u>97,530</u>	<u>48,720</u>	<u>146,250</u>	<u>100.0</u>
	(59.1%)	(40.9%)	(66.7%)	(33.3%)	(100.0%)	

9. Justification:

- (a) From the studies made it is concluded that the project is technically feasible. All the works in the project are clearly defined, and the estimated costs are reasonable. The construction timetable is realistic, and no particular difficulties are anticipated in meeting the schedule.
- (b) ISA is performing all its administrative and operative work satisfactorily. Its senior management is in the hands of qualified officials with good experience in the handling of electric power projects and international loans.
- (c) ISA's over-all financial position is considered acceptable; local inflation has not affected the company unfavorably. Internal financial administration is acceptable for present operations. In order to provide for future requirements (after the interconnected systems and the CHIVOR plant go into service), ISA has contracted for the services of various consulting firms, both local and foreign, which are preparing ample and satisfactory systems and procedures for financial administration.
- (d) The financial projections show that ISA would have available, as needed, the sums required to finance the entire local contribution to the project and to pay, promptly and in the manner prescribed, the principal and interest on the IDB and IBRD loans.

<sup>1/</sup> This entire amount represents direct foreign currency costs.  
<sup>2/</sup> Represents part of the foreign exchange costs of construction, engineering, and ancillary works of the items financed with resources from the IBRD loan. (See paragraph 3.22).

- (e) The financial feasibility of the project appears to be amply demonstrated by the showing that in the third year of operation the entire output of the plant can be sold at an average price of 5.5 US\$ mills per KWH and the return on net sunk investment will be 9%.
  - (f) The CHIVOR project is economically feasible, both from the standpoint of the average cost of energy produced (compared to that of an equivalent steam plant), and from the standpoint of the discount rate, 12% in this case, which is equal to the present values of the total costs of each alternative. This rate would be higher than the opportunity cost of capital in Colombia, figured in constant terms.
10. Recommendation: On the basis of the studies and conclusions of the Project Committee, the Operations Department transmits this loan document to the President of the Bank so that, should he deem it appropriate, he may submit the relevant proposed resolution to the Board of Executive Directors for approval.



## ANALYSIS OF THE PROJECT

### I. INTRODUCTION

#### A. Background

- 1.01 On October 8, 1969, the Ministry of Finance and Public Credit, exercising the powers vested in it by Decree 2832 of 1966, authorized Interconexión Eléctrica, S.A., to enter into negotiations to obtain external financing from the International Bank for Reconstruction and Development (IBRD) and other external credit sources for the construction of the CHIVOR hydroelectric station.
- 1.02 On June 4, 1970, the International Bank for Reconstruction and Development (IBRD) signed a loan contract (681-CO) with Interconexión Eléctrica, S.A., for the equivalent of US\$52,300,000 for partial financing of the main construction works of the CHIVOR hydroelectric station and of engineering and supervision costs of the project. This loan was granted for repayment in 30 years, including a grace period of 7 years, and at an interest rate of 7% per annum. It should be noted that before the contract was signed the IBRD held meetings in Paris in December 1969 and March 1970 with countries <sup>1/</sup> that were considered possible suppliers of electrical and mechanical equipment for the plant and of other investment items, for the purpose of negotiating joint or parallel financing. The results of these meetings were negative in the sense that: (i) there was no agreement on the system of financing to be used; and (ii) the conditions of the possible loans were not considered appropriate, as they were not in line with the minimum financial requirements of the project. Nevertheless, the IBRD decided to proceed to approve the loan without waiting for the financing for the required investments to be obtained. With respect to these investments, the IBRD included a provision in its loan contract stating that ISA "shall use its best efforts" to obtain other loans or financing from external sources, on reasonable terms, to cover the foreign currency component of the equipment included in the project and its installation.

#### B. The Application

- 1.03 On October 22, 1970, Interconexión Eléctrica, S.A. (ISA) applied to this Bank for a loan in an amount equivalent to US\$33,900,000 to assist in financing the foreign currency cost of the electromechanical equipment for the CHIVOR hydroelectric station and its substations, of the

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<sup>1/</sup> Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Spain, Sweden, Switzerland, United Kingdom and United States.

230 KV transmission line (supply and installation), and of the civil works for the penstock. Subsequently, in view of the Bank's policy which provides that when a loan application is examined, consideration is given to the prospective borrower's ability to obtain financing from alternative sources on terms which in the Bank's opinion are reasonable, ISA made additional efforts, at the Bank's request, to obtain the needed financing from supplier countries. The results of these efforts were similar to those of the earlier efforts made by the IBRD: the proposals received were unacceptable because they failed to meet the minimum requirements of the project. All of these efforts having been made, and several months having elapsed without the receipt of any reasonable proposals that were likely to lead to concrete results, the Bank decided to proceed with the study of the application discussed herein.

- 1.04 The project to which the loan application refers was included on the list of projects distributed to the Consultative Group on External Financing during 1969-1970. During the Group's meeting in February 1969 the IBRD expressed interest in studying the project. In fact, the IBRD made an evaluation of the project and considered the possibility of its being financed jointly or in parallel fashion with countries supplying the electromechanical equipment for the plant. As indicated earlier, although this financing was not obtained, the IBRD granted a loan for the equivalent of US\$52,300,000 for partial financing of the civil works of the plant and the costs of project engineering and administration providing in the loan contract that ISA was to use its best efforts to obtain loans or financing, on reasonable terms, to cover the foreign currency component of this equipment and its installation. The rest of the financing was later included on the list of 1971-1974 projects for external financing that was submitted to the Consultative Group in February 1971. In this most recent meeting of the Group, the IDB was asked to consider the possibility of financing the balance of the financial requirements for the project, in view of the fact that financing had not been obtained on appropriate terms from supplier countries. Under date of October 26, 1970, the National Planning Department of Colombia addressed a letter (UPEC/21/3834/70) to the IDB stating that it assigned high priority to the CHIVOR project within Colombia's national economic development plans and repeating the favorable opinion it had expressed in authorizing ISA to enter into negotiations to obtain external credit for partial financing of the project.
- 1.05 On January 25, 1971, the IDB sent an operations mission to Colombia for the purposes, among others, of evaluating the available documentation and background on this project and discussing with the authorities the basic conditions on which the Bank might consider participating in its financing. On the basis of further studies and final adjustments of project cost discussed with the mission, it was decided on that occasion that the required financing from the IDB would amount to the equivalent of US\$34,100,000.

## II. THE BORROWER

### A. Description

- 2.01 The borrower and executing agency would be Interconexión Eléctrica, S. A. (ISA), a joint stock company formed on September 14, 1967, by Empresa de Energía Eléctrica de Bogotá (EEEB), Empresas Públicas de Medellín (EPM), Corporación Autónoma Regional del Cauca (CVC), Central Hidroeléctrica del Río Anchicayá Limitada (CHIDRAL), 1/ Instituto Colombiano de Energía Eléctrica (ICEL) and Central Hidroeléctrica de Caldas (CHEC). 1/ 2/ The company is authorized to contract external obligations and is domiciled in the city of Bogotá. ISA has been formed for a period of 50 years, unless the General Meeting of Shareholders resolves to extend its duration.

### B. Purpose and Principal Activities

- 2.02 The purpose of the company is: (a) interconnection of the electrical systems of Corporación Autónoma Regional del Cauca (CVC), Central Hidroeléctrica del Río Anchicayá Limitada (CHIDRAL), Empresa de Energía Eléctrica de Bogotá (EEEB), Empresas Públicas de Medellín (EPM), Instituto Colombiano de Energía Eléctrica (ICEL) and Central Hidroeléctrica de Caldas (CHEC); the main objective of interconnection of the systems is the exchange of energy to meet shortfalls where generating capacity is not fully able to meet the demand; better utilization of reserve capacity by making it available throughout the new system, and the possibility of disposing of excess power output in all the interconnected areas; (b) the establishment of priorities in the building of new generating stations, based on their technical and economic advantages for the entire interconnected system, and (c) the programming and construction of future generating facilities, which will enable the agencies mentioned to assist one another in supplying their own consumers and cover the needs of other areas which can benefit from the greater supply of electric power and the larger generating capacity.

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1/ It should be noted that CHIDRAL is a subsidiary of CVC and that CHEC, for its part, is a subsidiary of ICEL.

2/ The following shareholders in ISA are borrowers of the Bank: EPM (Loans 6/OC, 179/OC, 55/SF and 224/SF), with a capital participation of 25%; CVC/CHIDRAL (Loans 175/OC and 13/CD), with joint participation of 25%; ICEL (Loans 106/OC, 107/OC and 290/SF), with 24.5% participation, and CHEC (Loan 125/OC), with 0.5% participation. (See paragraph 2.46)

C. Organization and Administration

i. Description

- 2.03 The administration, management and supervision of the business of the company are entrusted to the following organs: a) the General Meeting of Shareholders; b) the Board of Directors, and c) the Manager. The organization of ISA may be seen in the functional chart shown in Appendix B to this document.
- 2.04 Final management authority for ISA rests with the General Meeting of Shareholders, made up at present of representatives of the EEEB, EPM, CVC, CHIDRAL, ICEL and CHEC. There are two types of meeting: regular and special. Regular meetings are held at least twice a year, on the day and at the time and place fixed by the Board of Directors. Special meetings are held as required by unforeseen circumstances, upon convocation by the Manager, the Auditor or the Board of Directors. The deliberations of the General Meeting are valid, in the case of both regular and special sessions, when two more shareholders accounting for at least 75% of the subscribed shares are present; valid resolutions require the votes of shareholders representing the same 75% of subscribed shares.
- 2.05 The General Meeting of Shareholders is empowered: a) to draw up its own regulations; b) to amend the bylaws; c) to elect the members of the Board of Directors and their alternates; d) to elect the Auditor and his alternate; e) to fix the fees of the Board members and the remuneration of the Auditor; f) to examine, approve or reject, in the latter case by means of a reasoned resolution, the balance sheet, the quotas and the proposed distribution of profits which the Manager must submit to it at the regular meetings, after approval by the Board of Directors; g) to decide on the formation of special reserves, in addition to the legal reserves; h) to approve regulations for the issue and placement of reserve shares; i) to authorize the construction and acquisition of generating plants; j) to establish, upon proposal by the Board of Directors, the order of construction of the new power stations and arrange distribution of the capacity of each plant to each of the interconnected systems, in such a way that all are able to satisfy at least their own demand; k) to accept lateral arrangements on the exchange of energy by the interconnection lines; and l) to adopt all measures not specifically assigned to the competence of the Board of Directors or the Management.
- 2.06 The Board of Directors of ISA is made up of four members, who are elected by the General Meeting of Shareholders for a term of one year and may be re-elected indefinitely, or freely removed by the Meeting before the completion of their term of office. 1/ Each

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1/ The members of the ISA Board are at present the Managers of the EEEB, EPM and ICEL and the Executive Directors of the CVC.

regular member of the Board has an alternate, appointed in the same way and for the same term as the regular member. The Board of Directors elects a Chairman from among its number, who presides over its meetings and at the General Meeting of Shareholders. The Board meets at least once a month; its deliberations are valid when an absolute majority of the members are present and its resolutions are adopted by the vote of three.

- 2.07 The Board has the following main functions: a) to appoint and remove freely the Manager and his alternates (the Administrative and Technical Assistant Managers) and to fix their remunerations; b) to create the posts it deems necessary for the functioning of the company and to set the corresponding remunerations; c) to submit to the General Meeting of Shareholders the accounts, balance sheets and inventories of the company, propose approval of the reserve funds advisable for the company in addition to the legal reserve and propose the distribution of profits; d) to examine, whenever it deems necessary, the documents and books of the company; e) to set the dates for regular meetings of the General Meeting of Shareholders and to convene special meetings whenever it deems advisable; f) to authorize the Manager, on behalf of the company, to enter into any commitment or contract involving the amount of Col.\$200,000 (US\$10,941) or more and to act as a consultative organ for all matters as required by the Manager; g) to decide on the absences and leave of the Auditor and to call in his alternate should the occasion arise; h) to ensure that the legal requirements are met, together with those of the statutes and enforce the resolutions of the General Meeting of Shareholders; i) to authorize the establishment of branches or agencies in places where it considers this desirable; j) to determine the dates on which the partners must make their cash contributions to the company; k) to announce the issue of bonds, expedite the rules for their placement and ensure that the legal formalities are complied with, and l) to lay down the penalties for nonfulfillment on the part of any of the shareholder enterprises of the obligation to pay in on schedule the contributions due.
- 2.08 The Legal Representative and Chief of Administration of ISA is the Manager who is elected for two-year terms by the Board of Directors and may be re-elected indefinitely. The Manager is empowered: a) to ensure compliance with the statutes of ISA; b) to execute and perform all operations comprised within the purposes of the company; c) to enter into and sign the contracts and commitments and perform the acts provided for in the statutes of the company; d) to designate the persons who are to fill the posts created by the Board and to accept their resignations; e) to place at the disposal of the shareholders with 10 days' notice, at the next regular session of the Meeting, the inventory, balance sheet, accounts and a reasoned report on the course of the company's business, together with the proposed distribution of profits, if any, duly approved by the Board of Directors; f) to examine the books, accounts, correspondence and cash documents of the

company and check the stocks and assets; g) to direct the accounting, ensuring that the relevant legal requirements are complied with; h) to submit, should he deem it advisable, to disputes of the company with third parties to arbitration, or to settle them with the consent of the third party concerned, and i) to appoint attorneys who shall represent the company at law and otherwise.

- 2.09 In accordance with the provisions of its statutes, ISA also has an Auditor with one alternate, elected by the General Meeting of Shareholders for terms of two years and may be re-elected indefinitely, who meet the conditions laid down for such officers by current Colombian legislation. The functions of the Auditor include, inter alia: a) the examination of all operations, inventories, deeds, books, correspondence and business of the company and accounting documents; b) proving the cash at least once per week; c) ascertaining that the operations carried out for the account of the company are in accordance with its statutes, with the resolutions of the General Meeting of Shareholders and with current Colombian legislation; and d) authorizing by his signature the monthly and semiannual balance sheets.
- 2.10 The Manager directs the business of ISA with the cooperation of two assistants: an Administrative Assistant Manager and a Technical Assistant Manager, who take the place of the Manager in his absence in that order. The Assistant Managers are also elected by the Board of Directors for terms of two years and may be re-elected indefinitely.
- 2.11 The Administrative Assistant Manager is responsible for departments in the following areas: a) Administration - the Industrial Relations, Property, Marketing, and Organization and Methods Departments; b) Economics and Finance - the Accounts and Economics and Finance Departments, and c) Operations (Production Programming and Planning) - Department of Energy Economics.
- 2.12 For the perfecting of the methods and systems employed in each of the areas referred to in the preceding paragraph, ISA has engaged the services of the following firms of consultants: Arthur Andersen and Co.; Buenahora, Restrepo y Co.; Cuéllar, Peñalosa y Asociados, and Motor-Columbus Ingenieros Consultores, S.A. A brief description of the scope of the work of each of these firms is given below:
- a. Arthur Andersen and Co. - In addition to the outside auditing services that this firm provides to ISA (see paragraph 2.25), it is also working on matters relating to the company's bookkeeping system, purchasing and inventory control. This work is described in greater detail under 2.22.
  - b. Buenahora, Restrepo y Co. - This is a firm of management consultants engaged by ISA to make a study of the organization and introduction of a programmed wage administration and administrative

grading system. It is also advising the company on the preparation of charts showing the staff rankings and organization of the Industrial Relations Department (Personnel and Industrial Safety). (See paragraphs 2.16 and 2.21.)

- c. Cuéllar, Peñalosa y Asociados - This firm of public accountants was engaged upon a resolution to that effect by the General Meeting of Shareholders, to carry out through the Auditor and his alternate the functions of auditor and to organize and direct the internal audit of the company (see paragraph 2.22).
- d. Motor-Columbus Ingenieros Consultores, S.A. - In compliance with the provisions of Loan Contract 575-CO between ISA and the International Bank for Reconstruction and Development (interconnection project - see paragraph 2.42), this firm has been engaged to carry out the studies and work connected with the calculation of suitable rates for exchanges of power between the partners and the energy generated by the CHIVOR hydroelectric power station, as well as operation of the interconnected system as a whole. All these studies will be ready in the first half of 1971, before the startup of ISA's national interconnected system.

2.13 The Technical Assistant Manager is in charge of the following departments in the Operations Area (Construction and Operation): the Plants, Electrical, Construction, CHIVOR and Operations Departments. He is advised by various consulting engineering firms concerning inspection work, technical feasibility studies and the design of new projects. To assure the technical advisory services required in this area, ISA has engaged the following firms of consultants for the specific purpose stated:

- a. INGETEC e INTEGRAL LTDA., with the collaboration of Merz Associates and Merz McLellan - Supervision of the construction of the central interconnection system;
- b. INGETEC LTDA. - Supervision of the CHIVOR hydroelectric power station (see paragraph 3.26);
- c. Samel Ingenieros - Study of the interconnection of ISA's central system with the Northeast system (Guatapé-Barrancabermeja);
- d. INTEGRAL LTDA. - General survey and prefeasibility studies of the most promising power stations for development of the hydroelectric potential of the middle Cauca;
- e. INGETEC LTDA. - Prefeasibility study for development of the Guavio River;

f. Asesorías e Interventorías Ltda. - Preliminary survey for hydro-electric development of the Magdalena River and the site known as Salto de Honda;

g. Geocolombia Ltda. - Geological survey of the Saldana River in the Saldana Canyon and Palmararga area.

ii. Evaluation

2.14 Although ISA is a recently formed company, in general it is performing the administrative and operational tasks for which it is responsible in an adequate manner. In fact, the work carried out by ISA has been very positive, despite the problems inherent in an enterprise in the course of formation and organization. The most important aspects connected with the evaluation of its internal organization are described below:

a. Organization and functions

2.15 ISA was formed as a response to the need to produce electric power in Colombia with an overall investment that would provide the greatest return at the lowest cost and the most balanced and rational possible utilization of available economic and energy resources, while setting power generation targets for projected growth. Its managers and owners, the chief enterprises responsible for supply of electric power in the country, have, by coordination of their efforts and joint planning, set up an enterprise with a precise plan of action and a clearly defined responsibility, as set forth in its statutes.

The company has clearly defined its technical and administrative areas, its operating and service functions, line and staff departments and, in terms of planning its development, the different stages of growth in accordance with the programs to be carried out.

2.16 ISA has prepared an organization manual which it keeps up to date and which provides an adequate description of the structure of the enterprise and its parts and of the tasks of and authority delegated to each management officer. The process of organization followed by the company was: i) definition of tasks; ii) determination of responsibilities; iii) definition of posts; iv) establishment of areas of operation; v) establishment of levels of difficulty and management; vi) determination of responsibilities and allocation of tasks, and vii) establishment of relationships (reporting, functional, information, etc.). It should be noted that ISA exercises control over its organization by keeping the organization manual referred to up to date, together with an ideal chart showing the status the company expects to reach as soon as possible. The latter permits the Manager to plan the ultimate structure of ISA in accordance with the planning of programs and projects to be executed and serves as a means for checking on changes in the organization. The actual structure is constantly being compared with the ideal one so as to facilitate assessment by top management of



the merits of any proposed changes. Mention should also be made of the fact that ISA is establishing, with the aid of advisers (Buenahora, Restrepo y Co.), a system of management by objectives and is proceeding satisfactorily with preparation of the interpretation manual for psychotechnical tests.

- 2.17 The company also has a procedures manual setting out the manner in which all actions and/or decisions within the enterprise are initiated, executed and halted. It also lays down the procedure for effecting changes in the organization. This manual constitutes a sound control instrument, since it serves to inform ISA personnel of official procedures and provides a ready means of reference and of settlement of internal disputes. The manual is being revised to provide for future (short-term) requirements of the enterprise. It is utilized with the full support of the Manager and the Assistant Managers.
- 2.18 Moreover, it is important to note that ISA has achieved the basic subdivision of work in the administrative and technical areas without becoming top management heavy, as shown in the company chart (see Appendix B). This simple and clearly defined delegation of authority has made possible effective supervision of the organization and programs of the company, together with appropriate utilization of its internal and outside advisers. An efficient organization has been established, which has achieved its objectives at minimum cost to date. As regards future requirements, certain changes are expected to become necessary, together with a division of labor in the middle management departments as ongoing programs and projects progress.

b. Personnel

- 2.19 As of January 31, 1971, ISA's personnel totaled 99 officers and employees, distributed as follows:

<u>Specialization</u>	<u>Number</u>	<u>%</u>
Management	3	3.0
Professionals	36	36.4
Technicians	15	15.2
Administrative	31	31.3
Services	14	14.1
Total	<u>99</u>	<u>100.0</u>

The management and professional staff includes 30 engineers (civil, electrical and industrial), two economists, two professionals in business administration, two attorneys and three public accountants.

- 2.20 ISA's top management is considered very satisfactory. The company's main officers are highly qualified professionals who have received

university educations abroad and attended graduate courses, while some have acquired experience with firms of consulting engineers and power companies abroad. In general, the quality of the technical, administrative and service personnel is also very satisfactory.

- 2.21 The company has initiated in part, and is introducing with the assistance of the consultants Buenahora, Restrepo y Co. (see paragraph 2.12 b.), a detailed policy and an efficient staff evaluation (output of officer and/or employee in his present position for the recommendation of salary increases within the limits for that particular position), promotion (merit-based salary increases plus assessment of the capacity of the officer and/or employee to assume greater responsibility) and selection program (system for selecting candidates both from among the personnel and outside, based on an evaluation of their experience, availability and future superior), together with appropriate measures for recruitment and training. Preparation and updating of, inter alia, the following manuals are nearing completion: evaluation of systems and policies of merit evaluation, industrial safety, personnel standard, training programs, and staff induction and orientation. These systems make it possible to establish available and measurable standards facilitating the control and supervision of personnel.

D. Financial Administration

i. Internal control

- 2.22 The functions relating to the internal financial administration of ISA are entrusted to the Administrative Assistant Manager (Accounts, Economics and Finance and Property Departments); these functions are carried out in an acceptable manner, taking into account the limited size and responsibilities of the enterprise in its early stage. However, it must be noted that the present structure will not meet the company's future requirements, once the interconnected system and the CHIVOR hydroelectric station are in operation. For this reason, ISA resolved to engage the services of the consultants Arthur Andersen and Co. and Cuéllar, Peñalosa y Asociados (see paragraph 2.12) to review and improve the present system and to introduce a modified one to provide a financial administration adequate for future needs. The IDB operations mission examined the work done by these firms and found it satisfactory. The degree of progress on revision and drafting of the operating procedures and financial control systems, to January 31, 1971, was as follows:

- a. Accounting system: A new accounting manual has been prepared (accounts code, accounting and journal entry policies), which will provide a more complete picture of the financial position of the company. The content of the various accounting and operational reports to be produced has been defined more clearly.

Besides the information contained in the general balance sheet and the profit and loss statement, the new reports will provide the following types of data: i) status of projects under construction; ii) details of the utilization of lines of credit and other funds available; iii) classification of expenditures by areas of responsibility and comparison with budgets; iv) identification of operating, maintenance and investment costs for the interconnection projects and CHIVOR, and v) classification and appropriate management of the differences in exchange rates and financing costs. The drafting of the following procedures is 50% complete: 1) accounts payable and payments in Colombian and foreign currency; ii) revenues; iii) payrolls; iv) purchase and sale of energy through the interconnection, and v) calculation and accounting of financing costs. The rest of the procedures now being drafted will be completed during the second half of 1971. Finally, advice has been provided to ISA concerning the purchase of an Olivetti P-203 accounting machine (a mini-computer). It should be mentioned that Olivetti provided the programming training for ISA personnel and, in addition, has already written the payroll programs and those for calculating the financing costs in foreign exchange. These programs were reviewed by Arthur Andersen and Co., which found them satisfactory.

- b. System of registering fixed assets: Various changes have been introduced in the accounts code, particularly as regards the subsidiary ledger for works under construction, capitalization policies, depreciation policies and calculations (except that relating to the possible amortization of easements), work orders, fixed assets records (mechanization of the cards designed for these purposes is shortly to be discussed with Olivetti experts) and the procedures to be used by the Property Department to supervise company designs and easements. A property units manual (interconnection system and CHIVOR plant) has also been prepared.
- c. System of stock purchase and control: The review of the present operations and procedures connected with local purchases and imports has been completed. The detailed draft of this system (flow charts, written procedures, manuals and designs of forms) will be ready by April 30, 1971.
- d. Budget system: The Budget Section of the Economics and Finance Department is responsible for drawing up the draft budget of the enterprise with a view to the preliminary projects submitted to it by the different company departments. Once the draft budget has been prepared, it is submitted to the Management Committee (comprising the Manager and the Administrative and Technical Assistant Managers) for review, after which it is forwarded to the Board of Directors for approval. Every three months the Budget Section balances the budget, studying such departures

from it as have occurred and informing the Administrative Assistant Manager and the departments concerned. It is planned to codify, during the second quarter of the present year, rules relating to preparation, approval, execution and balance of budgets and to initiate prior budget control and adopt the same accounting classifications so as to control budget performance by means of the Olivetti P-203 accounting machine. These modifications will permit more efficient planning and control of ISA's budget.

- e. Internal audit: As noted under 2.09, and in accordance with its statutes, ISA has an Auditor whose job it is - in compliance with current Colombian legislation on joint stock companies - to perform the audit of the company. Despite the fact that auditing of the company's accounts has been efficiently done by the accountants Cuéllar, Peñalosa y Asociados, ISA recognizes the need for an internal audit office of its own. It has accordingly engaged the abovementioned firm to handle the organization, management and supervision of an internal audit office and to prepare the programs and procedures necessary for the effective functioning of that office, which work should be completed by the end of the second quarter of 1971. This office will report directly to the General Meeting of Shareholders. When this unit is operational, an adequate system of internal control will be available.
  - f. Billing procedures: In 1968, ISA initiated construction of the interconnection network for power systems of its shareholders. Once this system enters into service - expected in mid-1971 - the Department of Energy Economics will be responsible for billing the sale of energy through the system and will also keep the records of exchanges of energy within the system and reservoir resources. The new billing procedures are 90% ready and drafted. The procedures now ready are considered satisfactory. The remaining 10% will be completed during the first half of the present year and are expected to be acceptable. It should be noted that no collection problems are anticipated, since ISA's clients - its own shareholders - will not number more than six. This structure results from the fact that ISA purchases and sells energy en bloc.
- 2.23 Since it is estimated that revision and drafting of the operating procedures and financial control systems referred to in the foregoing will be completed before signature of the loan contract, it is recommended that, prior to the first disbursement under the loan, ISA be required to submit evidence to the Bank that the studies being carried out by the firms of consultants mentioned have been substantially completed and that the said methods and systems of financial administration are being introduced (see proposal resolution). All these modifications and expansions to the present system of financial administration will be accomplished, in part, prior to startup of the interconnected system and will be fully completed well before the CHIVOR project is concluded.

- 2.24 ISA's policy in regard to insurance is considered acceptable for the moment, but it will have to be expanded and reviewed as the works now under construction are completed and enter into service. On the other hand, it should be noted that the company's machinery, equipment, telex and furniture are protected against fire, glass breakage, robbery and theft. Insurance on its vehicles provides protection against death and injury for persons and against damage to property, together with coverage of medical costs, fire, robbery and theft. In addition, ISA's personnel is covered by life, disability, accident and fidelity insurances. All these provisions are considered adequate for the company. Finally, it should be mentioned that the loan contract which the Bank would sign with ISA would require the latter to take out and maintain insurances against fire and other risks to its properties, in a reasonable amount which shall at all times adequately protect the interests of IDB in the event of loss.

ii. Outside auditor

- 2.25 The Board of Directors appoints each year the firm of auditors which is required to examine the balance sheets of the company. This is at present done by the independent public accountants Arthur Andersen and Co. With regard to future balance sheets of ISA and those of the project, it is suggested that the loan contract to be signed stipulate that ISA must submit these to the Bank each year, within 90 days of the close of each fiscal year, duly certified by a firm of public accountants acceptable to the Bank (see conclusions and recommendations).

E. Financial Position

i. Capital 1/

- 2.26 The authorized capital of ISA, as of December 31, 1970, was equivalent to Col\$200 million, represented by 2,000 shares for a nominal value of Col\$100,000 each (see paragraph 2.29). The certificates representing these shares are registered and subject to repurchase in favor of the company's shareholders. As of December 31, 1970, the subscribed and paid-in capital was as follows:

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1/ The figures relating to the company's authorized capital are given in Colombian pesos instead of dollars equivalents because no advance information is available regarding the exact dates on which the shareholders will make their contributions or the exchange rate applicable on those dates.

(In Col\$ thousands)

<u>Shareholders</u>	<u>Subscribed Capital</u>	<u>%</u>	<u>Paid-in Capital</u>	<u>Unpaid</u>
EEEB	40,000	25.0	30,000	10,000
EPM	40,000	25.0	24,671	15,329
CVC	39,200	24.5	26,371	12,829
ICEL	39,200	24.5	29,700	9,500
CHIDRAL	800	0.5	300	500
CHEC	800	0.5	300	500
Total	<u>160,000</u>	<u>100.0</u>	<u>111,342</u>	<u>48,658</u>

- 2.27 In accordance with ISA's statutes, the investments required for construction of the generating plants are being financed as follows:
- a. Investments in local currency: 40% by contributions of share capital to be made by the partners, in the following ratios: EEEB, 10%; EPM, 10%; CVC and CHIDRAL, 10% between them, and ICEL and CHEC, 10% between them. The remaining 60% is to be raised by the issue of bonds to be purchased by the partners in such ratios that total shares and bonds for each one corresponds to the capacity assigned it in the new generating plant.
  - b. Investments in foreign exchange: To be financed normally by the contracting of domestic and foreign loans.
- 2.28 Notwithstanding the foregoing, it should be noted that in the particular case of CHIVOR (the first generating plant undertaken by ISA) it is possible that part of the foreign exchange costs will be financed by resources provided in Colombian pesos by the partners, which funds would then be converted into foreign exchange. These contributions would be made in the same proportions as indicated under a above (see paragraph 3.22).
- 2.29 As is apparent from paragraph 2.26, only the equivalent of Col\$40 million remains to be subscribed and the equivalent of Col\$90 million to be paid up, which amounts would not be sufficient to provide the funds needed for the local costs to be incurred in the CHIVOR project. The partners have accordingly taken appropriate measures to amend the statutes with a view to increasing the authorized and subscribed capital of the company. In March 1971, the General Meeting of Shareholders adopted the following resolutions: a) an increase in the authorized capital of the company to Col\$500 million, which would represent an increase of Col\$300 million; b) an increase in the subscribed capital of Col\$160 million to Col\$260 million; c) of that increase of Col\$100 million in the subscribed capital, an authorized issue of Col\$40 million, requiring that the corresponding payments be

made immediately, and d) delegation to the Board of Directors of responsibility for arranging the additional issue of the remaining Col\$60 million, to be effected in the course of the present year. The Meeting will specify in due course the amount and the dates on which the additional capital contributions (Col\$240 million) will be made, according to company requirements, projections of which are given in the table showing the source and use of company funds - Appendix F. In this respect, it should be noted that, in accordance with the projections for source and use of ISA funds prepared for each partner by the IBRD and revised and approved by the IDB, it is estimated that the partners will be able to make their contributions to ISA for the CHIVOR project as required, in view of the large sums they generate internally each year (see paragraph 4.11).

- 2.30 In accordance with ISA's statutes, the legal reserve of the company is to be formed with 10% of the net yearly profits until a sum equal to one half of the subscribed capital has been reached. Notwithstanding the foregoing, it must be noted that, in conformity with ISA's statutes, the shareholders are obliged to reimburse to the company the exact amount of operating and administrative costs incurred in their behalf by the interconnection system. Therefore, except for the interest earned from the temporary placement of funds in easily realized investments, the company will obtain no net profits until the planned CHIVOR hydroelectric power station is commissioned. The General Meeting of Shareholders has ruled that such interest shall be earmarked in its entirety to form part of the legal reserve. As of December 31, 1970, this reserve amounted to the equivalent of US\$11,000. Retained profits at that date totaled the equivalent of US\$7,000. Although these are quite small sums, in view of the nature of the company, which is in the process of formation, they are considered acceptable. In the future, with the startup of CHIVOR, the figures mentioned, as stipulated in the statutes, would be reached.

ii. Financial statements

- 2.31 As stated under 2.25, ISA's financial statements are examined by the auditors Arthur Andersen and Co. This firm, in its opinions on the general balance sheets closed on December 31, 1969 and 1970, and the statement on source and use of funds for the period from September 17, 1967 to December 31, 1969, commented that these documents reasonably presented the financial position of ISA in conformity with generally accepted accounting principles.
- 2.32 A summary of the balance sheets as to December 31, 1969 and 1970, is given below:

(In US\$ thousands or equivalent)

	<u>Dec. 31, 1969</u> <sup>1/</sup>		<u>Dec. 31, 1970</u> <sup>2/</sup>	
	<u>Amount</u>	<u>%</u>	<u>Amount</u>	<u>%</u>
<b>A S S E T S</b>				
<u>Current Assets</u>				
Cash and banks	672	8.9	787	2.4
Others (accounts receivable, investments)	72	0.9	137	0.4
Subtotal	744	9.8	924	2.8
<u>Various Debtors</u>				
Shareholders (share subscriptions and administrative costs)	752	10.0	2,711	8.3
Advances to contractors	-	-	10,115	30.8
Subtotal	752	10.0	12,826	39.1
<u>Net Fixed Assets</u>				
Deferred Charges (technical studies, etc.)	6,046	80.0	18,938	57.8
	12	0.2	96	0.3
Total Assets	7,554	100.0	32,784	100.0
<b>LIABILITIES AND CAPITAL</b>				
<u>Current Liabilities</u>				
	234	3.1	1,993	6.1
<u>Long-term Liabilities</u>				
International Bank for Reconstruction and Development	3,366	44.5	15,430	47.1
Banque Française du Commerce Ext.	-	-	1,523	4.6
Istituto Mobiliare Italiano	-	-	1,790	5.5
Export-Import Bank of Japan	-	-	149	0.5
Withholdings from contractors	581	7.7	2,408	7.3
CHIVOR bonds, 1970 issue, maturity in year 2000	-	-	1,091	3.3
Total Liabilities	4,181	55.3	24,384	74.4
<u>Net Capital</u>				
<u>Capital in Subscribed Shares</u>				
Subscribed but not paid-in	670	8.9	2,549	7.7
Subscribed and paid-in	2,691	35.6	5,833	17.8
Subtotal	3,361	44.5	8,382	25.5
Plus: Legal reserve and retained profits	12	0.2	18	0.1
Total Liabilities and Capital	7,554	100.0	32,784	100.0
<u>Total Ratio of Indebtedness</u>				
(Total Liabilities/Net Capital)	1.24		2.90	

<sup>1/</sup> Exchange rate used: US\$1 = Col\$17.85

<sup>2/</sup> Exchange rate used: US\$1 = Col\$19.09



- 2.33 From the foregoing figures it can be seen that the items forming the assets and liabilities and capital of ISA increased significantly during the period shown (December 31, 1969 to 1970). This was because the company was a new one which was still in the course of establishment and acquiring its assets and completing its capital formation. Consequently, no conventional financial analysis can be made.
- 2.34 Despite the relatively high indebtedness ratio (2.9 to 1.0), the financial position of ISA is considered acceptable, owing to the favorable conditions under which it has contracted its long-term loans (see paragraphs 2.41 and 2.42).
- 2.35 Chapter IV analyzes the financial feasibility of the project from the standpoint of the counterpart resources available to ISA for its execution and the annual return the enterprise would obtain from the results of the planned operation.
- 2.36 The adequacy of the working capital and the liquidity position of an enterprise such as ISA that is in the middle of a period of construction and assembly of equipment depends basically on the sufficiency and prompt availability of funds derived from loans and capital contributions to meet the requirements of projects under execution. In this connection it is stressed that ISA has encountered no financial difficulties to date, since it has received promptly and as required the domestic and external resources needed to make the payments required in respect of the works under way. The liquidity position of the company is as follows:

To December 31, 1970

In US\$ thousands

Current Assets

Cash and banks	787
Easily realizable investments - 86% (Central Mortgage Bank mortgage bonds)	35
Accounts payable - employees	11
Guarantee deposits and charges prepaid	7
Accounts payable - various	84
	<u>924</u>

<u>Various Debtors</u>	<u>Administrative Costs</u>	<u>Share Subscriptions</u>	
EEEEB	59	524	583
EPM	89	803	892
CVC	8	672	680
CHIDRAL	-	26	26
ICEL	6	498	504
CHEC	-	26	26
	<u>162</u>	<u>2,549</u>	<u>2,711</u>

<u>Advance Payments to Contractors</u>	<u>10,115</u>
	<u>12,826</u>
Total Current Assets and Various Debtors	<u>13,750</u>

Current Liabilities

Accounts payable - contractors	1,744
Interest and commissions payable	210
Liabilities to banks (letters of credit)	14
Cumulative social benefits	25
	<u>1,993</u>
Total Current Assets	<u>1,993</u>

- 2.37 It should be noted that, for reasons of presentation, the company has been consolidating, independently of the current assets, the various debtors item made up of the following accounts: reimbursable administrative costs - shareholders, installments payable - share subscriptions, and advance payments to contractors. For practical purposes, the balance of these accounts has to be added to the balances of those making up the current assets, thus making possible comparison with the current liabilities, which include accounts payable to contractors and others.
- 2.38 According to estimates by the National Planning Department, the inflation index has fluctuated between 7% and 9% annually in recent years, while consumer price index has increased as follows: 6.5% in 1968, 8.6% in 1969 and 8.9% in 1970. The exchange rates used in the balance sheets for converting Colombian pesos into U.S. dollars have been based on the quotations for free exchange certificates as of December 31 of each year, as follows: 1968 - US\$1 = Col\$16.88; 1969 - US\$1 = Col\$17.85, and 1970 - US\$1 = Col\$19.09.
- 2.39 For the future, ISA will be protected against any possible unfavorable effects of inflation, since among other protective measures the company agreed in Loan Contract 681-CO between the IBRD and ISA that the rates for the sale of power from the CHIVOR hydroelectric station would produce an annual return of 9% on capital invested, which is considered satisfactory. In computing these rates, ISA agreed, under the loan contract with the IBRD, to base the calculation of fixed investment as its foreign currency cost at the time such expenses were incurred, converted to Colombian pesos at the exchange rate prevailing on the last work day prior to the calendar quarter in which the corresponding adjustment will be made. The abovementioned stipulation would also be included in the loan contract with the IDB (see paragraph 4.09, proposed resolution and Appendix A).
- 2.40 ISA considered that, up to December 31, 1970, all its administrative costs derived from the interconnection system under construction, and therefore, in accordance with its statutes, those costs have been reimbursed by the shareholders. Beginning in 1971, ISA administrative costs will obviously increase because of construction of the CHIVOR plant. Its Directors have agreed that, after December 1, 1971, 21% of the administrative costs will be capitalized by becoming an integral part of the cost of that plant. This percentage is considered to represent the proportional part of ISA administrative costs deriving from the plant during its execution period. Once the power station has been started up, its operating and administrative costs, broken down according to the accounting system shortly to be introduced (see 2.22), will be charged against the revenue from the sale of electricity, while the shareholders will continue to absorb the operating and administrative costs deriving from the interconnection system.

- 2.41 Since the company has not yet entered into its operational phase, no profit and loss statement has yet been submitted. Nevertheless, it should be noted that, in accordance with the financial projections (see Appendix F), as from 1974 the enterprise should produce surpluses for the payment of dividends, which should become considerable after the entry into service of the CHIVOR power station in 1976. For this reason, it is stipulated in the proposed resolution that for ISA to declare or pay dividends, except on its own shares, the following requirements must be fulfilled, unless the Bank authorizes otherwise: i) it must be up to date in the fulfillment of all its obligations to the Bank; ii) it must have shown that it will have available on schedule sufficient resources to meet the obligations falling due in the following 12 months, and iii) after deduction of the amount represented by the dividend declared or paid, its current assets at the close of each year must not be less than 120% of its current liabilities.

The Bank clause on dividends usually includes a prohibition against payment by the borrower of dividends that represent more than 50% of its net accumulated profits, unless it has made an advance payment of the installments due on loan principal in an amount equal to the sum of dividends to be distributed in excess of the said 50%. In the present case it is not considered necessary to include this restriction, since the partners, most of which are borrowers of the Bank, are decentralized nonprofit public enterprises providing an important service to the community, which, therefore, have a duty to effect sizable investments. They accordingly have to recover the large contributions they make to ISA in order to make such investments and to fulfill their duties.

F. External Resources Obtained by ISA

- 2.42 In December 1968, the IBRD granted ISA a loan (575-CO) equivalent to US\$18 million for partial financing of the central interconnection system (transmission lines and substations) which is expected to become operational in the second half of 1971. The IBRD has informed the IDB that ISA has performed satisfactorily in the administration of that loan, both from the administrative angle and as regards implementation of the investment and construction programs. The other loan granted to ISA by the IBRD is for partial financing of the CHIVOR power station, the project which is the subject of this loan document.
- 2.43 In addition to the above loans, ISA has received suppliers' credits financed through the following banks: Banque Française du Commerce Extérieure (FF 12,650,000, 5.95% interest, 20 semiannual installments of principal); Istituto Mobiliare Italiano (Lire 1,725 billion, 6% interest, 20 semiannual installments of principal); Export-Import Bank of Japan (Yen 208,078,000, 6.75% interest, 20 semiannual installments of principal), and Union Bank of Switzerland (SwF 7,300,000, 6%

interest, 19 semiannual installments of principal). These credits have been used to finance part of the equipment for the central interconnection system.

- 2.44 In addition, it is important to note that, on March 31, 1971, the IDB granted eight loans to Colombia in the electric power field, totaling the equivalent of US\$108,258,000, <sup>1/</sup> to help finance projects whose total cost will amount to approximately US\$200 million and which will make it possible to add 541,250 KW to the country's generating capacity and install 2,600 km of transmission and sub-transmission lines and 1,000 km of distribution lines. The loans granted by the Bank are summarized below:

<u>Loan</u>	<u>Date of Resolution</u>	<u>Borrower</u>	<u>Purpose</u>	<u>Amount US\$</u>	<u>Disbursed (to 2/28/71)</u>
106/OC-CO	11-19-64	ICEL	Construction of hydro-electric power station on Prado River	8,000,000	100%
107/OC-CO	12-3-64	ICEL	Expansion of Tibú power station and its interconnection with Ocaña and Pamplona plants and with the CADAPE system (Venezuela)	3,200,000	91%
65/SF-CO	10-21-65	EMC	Expansion of the power distribution system in Cali and environs	3,300,000	100%
125/OC-CO	11-18-65	CHEC	Construction of the San Francisco hydroelectric power station and its supplementary installations	8,100,000	100%
175/OC-CO	12-30-68)	CVC	Construction of	43,300,000	13%
13/CD-CO	12-30-68)		Anchicayá River hydro-electric power station	16,567,460	22%
211/OC-CO <sup>2/</sup>	2-11-71)	ICEL	Subtransmission and	9,000,000	-
290/SF-CO <sup>2/</sup>	2-11-71)		distribution systems	16,000,000	-

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<sup>1/</sup> Since this sum includes cancellations, it is not strictly comparable with the sum of the loans shown in the table following, which shows the original amounts of the various loans.

<sup>2/</sup> Contracts pending signature.

G. Legal Capacity

- 2.45 There are no legal impediments to having ISA contract the requested loan and execute the proposed project.

H. Guarantee

- 2.46 The proposed loan would be guaranteed by the Republic of Colombia.

### III. THE PROJECT 1/

#### A. The Program

##### i. Background

- 3.01. The most serious restriction on development of the electrical sector in Colombia has been the lack of comprehensive planning. Electrical service in the country is furnished by many, often inefficiently small agencies with financial problems serving limited markets and poorly connected to other areas, all of which has made it difficult to provide satisfactory service. The Colombian authorities are aware of this situation and have in recent years taken vigorous steps to secure greater coordination in development of the sector. Outstanding among these, measures in addition to the establishment of ISA, are the reorganization in 1968 of the Instituto Colombiano de Energía Eléctrica (ICEL) as the key agency in the electric power sector and establishment of the Corporación Eléctrica de la Costa Atlántica (CORELCA) for the planning and operation of service in that region. Also important is the formal proposal in the 1970-73 Economic and Social Development Plan for the consolidation of local and regional electrical systems into five areas: the central, the Atlantic coastal, the Northeast, Antioquia and the Southeast. It should be noted that these regions were set up on the theory that each one should be large enough to permit its integrated electrical development and self-financing. The responsibility for coordination of supply in each region would devolve upon its basic system, to which the local distribution systems would be connected by regional transmission lines. The regional systems would be interconnected by high-voltage transmission lines constituting a national system, permitting economies of scale through the planning, construction and operation of large generating plants.

##### ii. Interconnected central system

- 3.02 The central region comprises the geographic area consisting of the Departments of Cundinamarca (and district of Bogota), Antioquia (part), Caldas, Risaralda, Quindío, Valle and Tolima. Now living in this area of approximately 120,000 square kilometers (11% of Colombia's area) are 11 million inhabitants (53% of the national population), approximately 7-1/2 million of whom are classed as urban population. Besides the cities of Bogota, Medellín and Cali, which with their adjacent areas constitute Colombia's major industrial and commercial centers, there are 18 urban communities in the region with over 50,000 inhabitants.

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1/ In the interests of clarity, the technical symbols used in this chapter and throughout the document are defined as follows: kilovolts (KV), unit of electromotive force equivalent to 1,000 volts; kilowatt (KW), measure of force equivalent to 1,000 watts; kilowatt-hour (KWH), energy produced by one kilowatt over a period of one hour, and megawatt (MW), equivalent to 1,000 kilowatts.

- 3.03 Practically all the electric power consumed in the central region is produced and mostly distributed directly by four principal public utility companies, which are: the Empresa de Energía Eléctrica de Bogotá (EEEB); Empresas Públicas de Medellín (EPM); Corporación Autónoma Regional del Cauca (CVC) and its branch, the Central Hidroeléctrica del Río Anchicayá (CHIDRAL), and Instituto Colombiano de Energía Eléctrica (ICEL) and its branches, Central Hidroeléctrica de Caldas (CHEC) and Centrales Eléctricas de Tolima. Collectively, these companies generated nearly 5.7 billion KWH in 1970, representing approximately 80% of the power intended for the public electrical service throughout the country. Directly or through other local distributors, these companies supply power to 860,000 consumers or subscribers in the central region.
- 3.04 Power production and consumption in the region has increased in the past five years at the rate of 11% per annum, on an average, predominantly in the EEEB system, which expanded during the same period by more than 13% per annum. To meet this demand, the supplier companies mentioned above currently rely on a total installed capacity of 1.51 million KW (1,510 MW), 90% of which (1,350 MW) comes from hydraulic plants. At present (1971), the region's electrical systems have sufficient capacity to satisfy demand in their respective service areas, except for the CVC-CHIDRAL system, whose production deficit - estimated for 1971 at 340 million KWH - is being covered through 115-KV interconnections by EEEB and CHEC, which have power surpluses. 1/
- 3.05 ISA was established in 1967 to equalize local imbalances, achieve better and more profitable utilization of the various systems' generating capacity and coordinate their future development. In 1968, this company (whose proprietors are the aforesaid electrical companies) began construction of the central interconnection network, consisting basically of a system of 230-KV double-circuit lines linking the plants of EPM (Guatapé substation), CHEC (Esmeralda substation), CVC-CHIDRAL (Yumbo substation) and EEEB (La Mesa substation). This network will begin service in the second half of 1971. ISA will be responsible for the operation, acquiring energy from systems with surpluses for delivery to those in short supply. In future, when the surpluses of local systems are absorbed, the additional power they need will come from the new plants built by ISA.
- 3.06 Except for the plants begun earlier by EPM (Guatapé), EEEB (Canoas) and CVC-CHIDRAL (Alto Anchicayá) and unless ISA agrees to other capacity expansions in its members' systems, this company will, according to its statutes, be responsible for the programming and

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1/ This shortage will be corrected once the Alto Anchicayá hydro-electric plan begins operating in 1974; its construction was partially financed by the IDB through Loans 175/OC-and 13/CD-CO.



execution of new electrical generating projects required by the central region. Pursuant to this criterion, ISA has begun construction of the CHIVOR hydroelectric plant (first stage 500 MW), whose first units would enter in to service late in 1975. This project is the first generating installation ISA has undertaken for fundamental satisfaction of energy demands of the central region interconnected system and one of the economically most attractive hydroelectric resources in the region.

B. The Project

- 3.07 The project would consist basically of construction of a rock-fill dam on the Batá River, from which the impounded water would be conveyed through a 5.8-km. headrace, and a penstock 2. km. long, to the Lengupá River; the powerhouse, with four generating groups of 125 MW each, is located on the right bank of this river. Also included is a double-circuit 230-KV transmission line, 155 km. long, from CHIVOR to the two terminal substations, one in Suba (Bogota) and the other in La Mesa (next to the Colegio hydroelectric plant), feeding the central interconnection network. The project works are located in the Department of Boyacá, 120 km. northeast of Bogota, on a highly favorable site in terms of the principal load center of the central region.
- 3.08 The harnessing plan consists of diversion of the Batá River into the Lengupá River by means of a dam and adduction tunnel and penstock approximately 8 km. long to the powerhouse for a useful head of about 716 meters. Both rivers are tributaries of the Upia, which is the largest tributary of the Meta River. The average flow of the Batá River at the dam site, based on a survey period of 14 years, has been established at 62.5 cubic meters per second, with the dam-regulated flow during the critical dry season (central region as a whole) estimated at 56 cubic meters per second. A continuous horsepower of 356 MW, equivalent to a production of 3.12 billion KWH per annum, is obtained with this minimum regulated flow; for average hydraulic conditions generation would be 3,480 KWH.
- 3.09 In view of its characteristics (catchment volume and head), the CHIVOR plant should operate in the future as a peaking plant of the interconnected system, which would justify its ultimate installation of 1,000 MW. It should be noted, however, that since there is a sufficient installed capacity in the existing plants to meet anticipated demand, and the main need is to increase energy output, it has been decided to install a capacity of 500 MW in the first stage. With this installed capacity, the power station would operate with a high plant factor (71% for firm power), by supplying "base power".
- 3.10 The items constituting the proposed project are listed below.
- a. Dam and diversion works: The dam would be located on the Batá River next to La Esmeralda, ravine and creek approximately 9 km.

upstream from the town of Santa María. This is a rock-fill structure, with a central core of clay set on a concrete block. Its maximum height to bedrock would be 230 meters, with a crest length of 280 meters. Total dam volume would be 11 million cubic meters and excavations would total approximately 800,000 cubic meters. The volume of the reservoir created by the dam would be 815 million cubic meters and the useful storage capacity 665 million cubic meters. Sedimentation, which would mainly affect the upper part of the 22-km. long lake, is estimated at 2 million cubic meters per annum. In order to isolate the construction area of the dam, two tunnels would be dug on the left bank of the river: one 900 meters wide for water diversion and to serve later as a bottom outlet, controlled by a butterfly and a dissipation valve; the other 620 meters long to divert traffic from the present highway, with the expectation that it will also serve as an additional spillway for the river during the construction period.

- b. Spillway: This would be located on the left bank next to the dam. It would consist of a concrete-lined canal controlled by four 4 x 16 meter radial gates with a total discharge capacity of 13,000 cubic meters per second, much greater than the maximum design flow (10,600 cubic meters per second), to break the force of waves caused by possible landslides in the dam area. This construction would require excavation of approximately two million cubic meters and placement of 45,000 cubic meters of concrete.
- c. Headrace and intake works: The intakes would be located at the La Esmeralda ravine a short distance from the dam. Concrete intake structures would be built for the two headraces (tunnel 2 for the second stage of the plant is not included in the present project). The concrete-lined headrace (tunnel 1), would have an average diameter of six meters (part in circular section and part horseshoe-shaped) and a length of 5,830 meters; this final section of 800 meters between the surge tank and the outlet gate would be lined with steel. A butterfly valve 4 meters in diameter would be installed at the tunnel entrance. Total excavation of the tunnel, including the two access shafts, is estimated at approximately 180,000 cubic meters and would require 40,000 cubic meters of concrete lining.
- d. Surge tank: The subterranean surge tank consisting of a vertical shaft (195 meters high and five meters in diameter), with lower and upper chambers, would be located 880 meters before the headrace outlet. This would require the excavation of approximately 11,000 cubic meters of rock.
- e. Penstock and valve chamber: The headrace, of sheet steel, would have an inner diameter of 3.60 meters and a total length of 2,020 meters. The upper and lower stretches would be set above ground and the intermediate section underground, with a vertical shaft 160 meters high

followed by a tunnel with a 4% grade 970 meters long. The shaft would end in a manifold chamber with four outlets 1.5 meters in diameter, one for each turbine. The total head between the headrace outlet and the entrance to the turbines would be 720 meters. At its upper end, immediately below the outlet gate of the headrace, a butterfly valve 4 meters in diameter with an overspeed device would be installed.

- f. Powerhouse and booster substations: The powerhouse, control building and switchyard would be located on the right bank of the Lengupá River, 6 km. upstream from the town of San Luís. The principal powerhouse equipment would include four six-jet vertical-axis Pelton turbines, at 175,000 hp., 450 RPM; four spherical control valves; four 125-MW, 13.8-KV alternators; four monophase transformer banks, 3 x 54 MVA, 13.8/230-KV., and two traveling cranes weighing approximately 90 tons each. The switchyard would comprise a double-bar system (with the transfer dike set around the main bar for reasons of space). A 10-MVA, 230/115/13.8-KV triple phase transformer would be installed in the yard for local distribution and auxiliary services; the protective equipment includes nine 230-KV automatic switches.
- g. 230-KV transmission line: The power from CHIVOR would be transmitted through two terminal substations: one on the outskirts of Bogotá (Suba substation), for interconnection with EEEB, and another 50 km. west of Suba (La Mesa substation, next to the Colegio plant), for interconnection with the 230-KV ISA central system. The 230-KV transmission would be carried over a double-circuit line on high-resistance steel towers, with a ACSR 1,350 MCM aluminum conductor (for most of its length). The total length is broken down into two sections: CHIVOR-Suba, covering 105 km.; and Suba-La Mesa, 50 km.
- h. Terminal substations: At Suba, near Bogotá, a substation would be built with a 230-KV double bar, where two 3 x 55 MVA, 230/115-KV monophase banks of auto transformers would be installed to feed into the EEEB system. This substation would contain a control building and miscellaneous auxiliary services (workshops, warehouses, etc.). In the La Mesa substation (now under construction as part of the central network), the project would cover only expansion of the bar system for arrival of the two 230-KV CHIVOR circuits.

C. Total Project Cost

- 3.11 The total project cost would be equivalent to US\$146,250,000, as shown in the following breakdown:

(In US\$ thousands or equivalent)

<u>Category 1/</u>	<u>Foreign costs</u>	<u>Local costs</u>	<u>Total</u>	<u>%</u>
1. <u>Engineering and Administration</u>				
1.1 Engineering and direction of works	800	7,170	7,970	5.5
1.2 Administration and general costs	-	1,000	1,000	0.7
2. <u>Direct Construction Costs</u>				
2.1 <u>Generating plant</u>				
2.11 Dam, tunnel, spillway and surge tank				
- Civil works - Contract 1 (IMPREGILO)	38,800	21,110	59,910	41.0
- Hydromechanical equipment	3,390	370	3,760	2.6
2.12 Penstock				
- Civil works - Contract 2	2,770	1,670	4,440	3.0
- Equipment (conduit)	3,820	400	4,220	2.9
2.13 Powerhouse				
- Civil works - Contract 3	1,750	2,830	4,580	3.1
- Mechanical equipment	3,770	530	4,300	2.9
- Electrical equipment	6,420	890	7,310	5.0
2.14 Switchyard				
- Electromechanical equipment	850	140	990	0.7
2.15 Ancillary works				
- Highway (Contract 4), land, camps and miscellaneous installations	2,260	6,170	8,430	5.8
2.2 <u>Transmission works</u>				
2.21 230-KV line (contract)	3,660	580	4,240	2.9
2.22 Suba and La Mesa substations	1,760	360	2,120	1.5
2.23 Land and rights of way	-	200	200	0.1
3. <u>Financing costs</u>				
3.1 IBRD loan (interest and commitment fee)	9,400	-	9,400	6.4
3.2 IDB loan				
- Interest	5,840	-	5,840	4.0
- Commitment fee	1,500	-	1,500	1.0
- Inspection and Supervision Fund	341	-	341	0.2
5. <u>Unspecified</u>				
5.1 General contingencies	10,399	5,300	15,699	10.7
Total	97,530 <sup>2/</sup>	48,720	146,250	100.0
	(66.7%)	(33.3%)	(100.0%)	

1/ Only investment categories defined by the Bank in which investments would be made have been utilized.

2/ This sum represents direct foreign currency costs exclusively.

- 3.12 As shown, the largest investment is in the major civil works of the plant (dam, spillway, headrace and surge tank). These items, financed with the IBRD loan, have already been contracted for with the IMPREGILO Consortium, as a result of international bidding (Contract 1). They were begun in October 1970 and should be completed by mid-1975. It should be noted that, in the opinion of the geologists (and the contractors themselves), no special problems are anticipated in excavation of the headrace tunnel, and the construction schedule for the dam, which will require a large volume of material, has taken account of the heavy rainfall in the area. The amount of this works contract, with a basic price of US\$59.9 million represents 61% of the direct construction costs of the plant and approximately 46% of total estimated project cost, exclusive of interest on the loans. 1/

The rest of the civil works includes three additional contracts to be awarded, with an aggregate budget of about US\$14.2 million: Contract 2 - penstock and grading of switchyard; Contract 3 - powerhouse and drainage canal; Contract 4 - relocation of the Semondoco-La Esmeralda Dam highway (approximately 30 km.). 2/

- 3.13 The cost of electrical and mechanical equipment, for the plant and booster substation, including transportation and assembly, is estimated at US\$20.6 million, of which US\$18.3 million would represent the foreign currency cost (FOB value, marine freight, insurance and assembly supervision).
- 3.14 The amount of the 230-KV transmission line contract is estimated at US\$4.3 million, of which US\$3.7 million represents imported materials and other contractor services payable in foreign currency. Under the substations' cost, US\$1.8 million would correspond to imported equipment and materials and the rest to local transportation and assembly costs.
- 3.15 The engineering and administration item estimated at nearly US\$9 million, accounts for approximately 8.5% of direct project costs, a reasonable and rather moderate percentage and since it includes the field surveys research and feasibility study. The sum of US\$800,000 for engineering foreign currency costs represents the services of foreign specialists to collaborate with the INGETEC consulting firm (see paragraph 3.26). Finally, a margin of US\$15.7 million was included to cover general contingencies, which represent 15% of the estimated direct cost of the project and is deemed sufficient.

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1/ All costs of the current budget were updated in October 1970, after definition of the costs of the principal contract for the civil works (Contract 1). The national currency prices were converted to dollars at the exchange rate of US\$1.00 = 18.28 Colombian pesos in effect at that time.

2/ The financing plan for the various components of total project cost is described in paragraphs 3.18 to 3.22.

- 3.16 In general, after awarding the principal civil works contract, no substantial changes are projected in the rest of the purchases, whose budgets are based on ample current cost data for various electrical projects now under way in the country.

D. Financing Plan

- 3.17 The total project cost would be financed as follows:

(In US\$ thousands or equivalent)

	<u>Origin of funds</u>		<u>Use of funds</u>		<u>Total</u>	<u>%</u>
	<u>Foreign</u>	<u>Local</u>	<u>Foreign</u>	<u>Local</u>		
IDB	34,100	-	34,100	-	34,100	23.3
IBRD	52,300	-	51,700	600	52,300	35.8
ISA	-	59,850	11,730	1/ 48,120	59,850	40.9
Total	86,400	59,850	97,530	2/ 48,720	146,250	100.0
	(59.1%)	(40.9%)	(66.7%)	(33.3%)	(100.0%)	

E. Utilization of IDB Resources

- 3.18 The loan requested from the IDB would cover exclusively direct foreign currency costs and would be used for the following purposes:

1/ Represents some foreign currency costs of the civil works, engineering costs and ancillary works of the items financed with resources of the IBRD loan (see paragraph 3.22).

2/ This sum represents direct foreign currency costs exclusively.

(In US\$ thousands or equivalent)

<u>Category</u>	<u>Foreign costs</u>	<u>%</u>
2. <u>Direct Construction Costs</u>		
2.1 <u>Generating plant</u>		
2.11 Dam, tunnel, spillway and surge tank		
- Hydromechanical equipment	3,130	9.2
2.12 Penstock		
- Civil works - Contract 2	2,770	8.1
- Equipment (conduit)	3,820	11.2
2.13 Powerhouse		
- Mechanical equipment	2,830	8.3
- Electrical equipment	6,100	17.9
2.14 Switchyard		
- Electromechanical equipment	850	2.5
2.2 <u>Transmission works</u>		
2.21 230-KV (contract)	3,660	10.7
2.22 Suba and La Mesa substations	1,760	5.2
3. <u>Financing costs</u>		
3.2 IDB loan		
- Interest	5,840	17.1
- Inspection and Supervision Fund	341	1.0
5. <u>Unspecified</u>		
5.1 General contingencies	2,999	8.8
Total	34,100	100.0

- 3.19 As the foregoing table shows, the loan chargeable to the Bank's ordinary capital resources would be used to cover direct foreign currency costs of the civil works contract for the penstock (Contract 2), provision of all electromechanical equipment for the plant and substations (except miscellaneous auxiliary equipment for the powerhouse and dam depth valves, financed by the IBRD and the 230-KV (supply and assembly) transmission line. Also included are the financing costs of the Bank loan during construction, except for the commitment fee, to be financed by ISA.

F. Utilization of IBRD Resources

- 3.20 The resources of the loan granted by the IBRD would be utilized as follows:

(In US\$ thousands or equivalent)

<u>Category</u>	<u>Foreign costs</u>	<u>Local costs</u>	<u>Total</u>	<u>%</u>
1. <u>Engineering and Administration</u>				
1.1 - Engineering and direction of works	700	-	700	1.4
2. <u>Direct Construction Costs</u>				
2.1 - <u>Generating plant</u>				
2.11 Dam, tunnel, spillway and surge tank				
- Civil works - Contract 1 (IMPREGILO)	28,800	-	28,800	55.1
- Hydromechanical equipment	260	-	260	0.5
2.13 Powerhouse				
- Civil works - Contract 3	1,750	-	1,750	3.3
- Mechanical equipment	940	-	940	1.8
- Electrical equipment	320	-	320	0.6
2.14 Switchyard				
- Electromechanical equipment	-	-	-	-
2.15 Ancillary works	-	-	-	-
- Highway (Contract 4), land, camps and miscellaneous installations	2,130	600	2,730	5.2
3. <u>Financing Costs</u>				
3.1 IBRD loan (interest and commitment fee)	9,400	-	9,400	18.0
5. <u>Unspecified</u>				
5.1 General contingencies	7,400	-	7,400	14.1
Total	51,700 (98.9%)	600 (1.1%)	52,300 (100.0%)	100.0



G. Local Contribution

- 3.21 The resources of the local contribution would be used to cover partially: civil works costs (labor, national materials, etc.); local engineering, direction and administration costs and local transportation and assembly of equipment to be imported, as well as the commitment fee on the IDB loan. The following table illustrates utilization of the local contribution resources, by type of investment:

(In US\$ thousands or equivalent)

<u>Category</u>	<u>Foreign Costs</u>	<u>Local costs</u>	<u>Total</u>	<u>%</u>
1. <u>Engineering and Administration</u>				
1.1 Engineering and direction of works	100	7,170	7,270	12.1
1.2 Administration and general costs	-	1,000	1,000	1.7
2. <u>Direct Construction Costs</u>				
2.1 <u>Generating plant</u>				
2.11 Dam, tunnel, spillway and surge tank				
- Civil works - Contract 1 (IMPREGILO)	10,000	21,110	31,110	52.0
- Hydromechanical equipment	-	370	370	0.6
2.12 Penstock				
- Civil works - Contract 2	-	1,670	1,670	2.8
- Equipment (conduit)	-	400	400	0.7
2.13 Powerhouse				
- Civil works - Contract 3	-	2,830	2,830	4.7
- Mechanical equipment	-	530	530	0.9
- Electrical equipment	-	890	890	1.5
2.14 Switchyard				
- Electromechanical equipment	-	140	140	0.2
2.15 Ancillary works				
- Highway (Contract 4), land, camps and miscellaneous installations	130	5,570	5,700	9.5
2.2 <u>Transmission works</u>				
2.21 230-KV line (Contract)	-	580	580	1.0
2.22 Suba and La Mesa substations	-	360	360	0.6
2.23 Land and rights of way	-	200	200	0.3
3. <u>Financing Costs</u>				
3.2 IDB loan				
- Commitment fee	1,500	-	1,500	2.5
5. <u>Unspecified</u>				
5.1 General contingencies	-	5,300	5,300	8.9
Total	11,730	48,120	59,850	100.0
	(19.6%)	(80.4%)	(100.0%)	

3.22 As the preceding table shows, provision is made for ISA to contribute the equivalent of US\$10,230,000, representing part of the foreign currency costs of the civil works (Contract 1 - dam, tunnel, spillway and surge tank), the engineering costs and the ancillary works of the items financed with the IBRD loan. This foreign currency provision is included since: i) additional works were added to Contract 1 (relocation of bridges and roads), increasing the amount of that contract by the equivalent of US\$6.7 million above the original IBRD estimate; ii) in receiving the various international bidding tenders, the foreign currency component of this contract proved higher than the original estimates by the IBRD on which the respective amount of the loan from that institution was based. Although this provision exists, the actual contribution to be made by ISA in foreign exchange would depend on the use of the general contingency funds included in the IBRD loan (US\$7.4 million). In other words, if these contingency funds are not used to cover cost increases in the project, ISA would contribute only the difference between the amounts available for contingencies in the actual foreign currency cost of the works to be executed. It was deemed prudent to maintain this provision in foreign currency as an ISA contribution, as a conservative safety measure, pending the outcome of utilization of IBRD contingencies and the actual cost of the works. It is important to emphasize that the ISA authorities have wisely taken appropriate steps to ensure this prospective foreign currency contribution.

H. Analysis of Evolution of Project Costs since Original IBRD Evaluation

3.23 The following analysis shows how project costs have evolved from the time of the IBRD estimate in August-September 1969, which appears in the Appraisal Report of that institution published in May 1970, up to the evaluation made by the IDB, which is presented in this loan document. The analysis will make it easier to understand the changes that have taken place and the reasons for these changes.

3.24 The project cost changes are summarized below:

(In US\$ thousands or equivalent)

Category <u>1/</u>	IBRD Appraisal Report (May 1970)			IDB Loan Document (April 1971)			Changes	
	External Costs	Local Costs	Total	External Costs	Local Costs	Total	External Costs	Local Costs
	(a)	(b)	(c)	(d)	(e)	(f)	(d-a)	(e-b)
Engineering and Administration	700	5,900	6,600	600	8,170	8,970+	100+	2,270+
Direct Construction Costs	55,000	36,200	91,200	69,250	35,250	100,500+	14,250-	950+
Financing Costs								
IBRD loan (interest and commitment fee)	9,400	--	9,400	9,400	--	9,400	--	--
IDB loan	2,700 <sup>2/</sup>	--	2,700 <sup>2/</sup>	5,840	--	5,840+	3,140+	-- +
- Interest	2,700	--	2,700	5,840	--	5,840+	3,140+	-- +
- Commitment Fee	--	--	--	1,500	--	1,500+	1,500	-- +
- Inspection and Supervision Fund	--	--	--	341	--	341+	341+	-- +
Specified								
General contingencies	10,000	6,400	16,400	10,399	5,300	15,699+	399-	1,100-
Total	<u>77,800</u>	<u>48,500</u>	<u>126,300</u>	<u>97,530</u>	<u>48,720</u>	<u>146,250+</u>	<u>19,730+</u>	<u>220+</u>
Summary								
Full project cost, ex-								
cluding financing costs	US\$114,2 millions			US\$129,2 millions +			US\$15,0 millions	
Financing costs	US\$12,1 millions			US\$ 17,1 millions +			US\$ 5,0 millions	

Only the investment categories defined by the Bank in which investments would be made have been utilized.  
Interest calculated by the IBRD for parallel or joint financing by supplier countries.

- 3.25 As the preceding table shows, the most important change in project cost is the increase in direct construction costs from US\$91.2 million, according to the IBRD analyses, to US\$104.5 million, based on the revised IDB calculations, that is, an increase of US\$13.3 million. This increment results from the following factors:
- a) a rise in the cost of major civil works for the project - Contract 1 awarded to the Italian company IMPREGILO under the IBRD loan- in the equivalent of US\$6.7 million, owing to the inclusion of additional works relating to the relocation of bridges and roads;
  - b) an increase in the cost of ancillary works -mainly because of more extensive works on the Somondoco-Presa highway- amounting to US\$2.6 million;
  - c) a cost increment for the penstock civil works -when one third of the intermediate line had to be laid underground- amounting to US\$900,000;
  - d) a rise of US\$900,000 in transmission line cost because of expanded capacity at the Suba substation, and
  - e) a general increase in direct construction costs for the project totalling US\$2.1 million when the original costs analyzed by the IBRD in August 1969 were updated in October 1970 following determination of the cost of the main civil works contract (Contract 1) mentioned above. The changes described represent increases in the external costs of these items.
- 3.26 There was also an increase in costs under the item of engineering and administration equivalent to US\$2.37 million. The causes were:
- a) costs incurred by ISA in research, detailed studies and designs (US\$2.27 million) were included as part of the project cost, and
  - b) estimated requirements in foreign currency (use of external consultants) were updated by US\$100,000.
- 3.27 Finally, project financing costs rose from US\$12.1 million to US\$17,081,000, that is, an increase in US\$4,981,000, because of:
- a) an incremental rise in interest during construction from US\$2.7 million (IBRD estimates for parallel or joint financing) to US\$5.84 million (estimated interest on IDB loan ), that is, a difference of US\$3.14 million, since IBRD estimates of the period of execution, amount and interest on credit from supplier countries were lower than the calculation corresponding to the proposed IDB loan, and
  - b) addition of the IDB commitment fee (US\$1.5 million) and the contribution to the IDB Inspection and Supervision Fund (US\$341,000), not included in the original IBRD estimates.
- 3.28 The financing plan for the project cost evolution noted above is as follows:

(In thousands of US\$ or its equivalent)

		IBRD Appraisal Report	IDB Loan Document
IBRD	i. Construction costs	42,900	42,900
	ii. Financing costs	9,400	9,400
	Subtotal	52,300	52,300
ISA	i. Construction costs	48,500	58,350
	ii. Financing costs	2,700	1,500
	Subtotal	51,200	59,850
Parallel or joint financing		22,800	--
IDB	i. Construction costs	--	26,419
	ii. Financing costs	--	7,681
	Subtotal	--	34,100
	TOTAL	126,300	146,250

3.29 As the above table shows: a) the IBRD financing is the same; b) the ISA contribution increases by the equivalent of US\$8.65 million, and c) direct construction costs of the IDB loan (US\$26,419,000) are US\$3,619,000 higher than those projected for the parallel or joint financing by supplier countries (US\$22.8 million). This is because the IDB loan will finance external costs of the penstock civil works (US\$2.77 million), an item not originally included for financing with credits from supplier countries, as well as an increase in the cost of the 230 KV transmission line amounting to US\$900,000, owing to expansion of capacity at the Suba substation.

#### I. Project Execution

##### i) Investment and disbursement schedule

3-30 The project would be completed in a five-year period, including the necessary terms for the bidding processes (see paragraph 3.30). The investment schedule, with its respective sources of funds, would be as follows:

(In US\$ thousands or equivalent)

	1970 1/	1971	1972	1973	1974	1975	1976	Total
IDB	-	140 2/	4,070	6,490	14,620	5,950	2,830 3/	34,100
IBRD	9,260	6,050	8,950	12,910	15,130	-	-	52,300
ISA	2,250	5,780	9,070	11,880	14,440	15,670	760	59,850
Total	11,510	11,970	22,090	31,280	44,190	21,620	3,590	146,250
	(7.9%)	(8.1%)	(15.1%)	(21.4%)	(30.2%)	(14.8%)	(2.5%)	(100.0%)

1/ Investments already made, representing completed stages of the project.

2/ Second half.

3/ First half.

As the above table shows, the investments to be financed with the resources of the proposed loan reveal an upward trend peaking in 1974. This trend and the comparatively small percentage of the loan that would be invested in the project in 1971 and 1972 are the consequence of two closely related factors:

- a. Installation of the electromechanical equipment - to be financed with the proposed Bank loan - depends on the progress made in construction of the civil works, which have been scheduled through application of the Critical Path Method (see paragraph 3.28);
  - b. Almost all the equipment must be ordered with a long lead-time, owing to its nature. Although these orders must be accompanied by sizable advances, the largest payments are made only when the equipment is delivered, which in this case will be basically in the third year of execution and thereafter, starting with the date of the loan contract.
- 3.31 In order to continue with the works relating to project execution and to ensure faithful fulfillment of its work schedule, ISA would have to advance a part of the investments included in the project cost to be underwritten by its own resources. Accordingly, it is proposed that up to the equivalent of US\$4 million invested in labor, national materials, local engineering and administrative costs and transportation and assembly, before the contract date but after October 22, 1970, be acknowledged as part of the local contribution to project financing, provided that requirements substantially similar to those stipulated in the resolution and the loan contract have been fulfilled (see conclusions and recommendations).
- ii. Engineering studies and designs
- 3.32 The engineering research, detailed studies and designs of the CHIVOR project were done by the Colombian consulting firm of INGETEC. In studying certain aspects of the project, INGETEC received assistance from numerous foreign specialists with wide experience in hydroelectrical works. For example, project geology was analyzed by John Tratina and Richard Goodman (United States) and Raúl Marsal (Mexico), hydrology by Franklin Snyder (United States), hydraulic surveys and test models by Motor-Colombus Consulting Engineers (Switzerland), the telecommunications and control by Merz and McLellan (England) and general civil consulting services by Barry Cook (United States). On the basis of the INGETEC feasibility study, ISA obtained an IBRD loan of US\$52.3 million, in June 1970. As indicated, construction work began in October 1970 following award of the principal civil works contract to the IMPREGIIO consortium of Italy. All other elements of the proposed project (contracts for civil work and supply and assembly of equipment) are clearly defined, and bids on almost all of these will be invited in 1971, as described hereafter in the general program of procurement and contracts (see paragraph 3.30).

iii. Project administration and technical supervision

- 3.33 ISA would execute the proposed project through: a) its CHIVOR Department (see paragraph 2.13), established expressly as part of its organization to handle general supervision of field and relations with the consultants contracted for project inspection, and b) the firm of INGETEC Ltda, to which all engineering design, preparation of specifications and bidding documents, study of alternatives, preparation of master plans, inspection and direction of works up to final turn-over tests has been assigned. It must be remembered that a group of widely experienced international specialists is collaborating with INGETEC, as mentioned in the preceding paragraph. Furthermore, under the contract concluded on October 1, 1970, between ISA and the EEEB, all engineering and inspection to be done by INGETEC has been entrusted by ISA to the EEEB, since the latter company was the one originating the project and directly financed the feasibility studies. Accordingly, in contractual form, the EEEB is subcontracting the works to the consultant and is responsible to ISA for their proper execution. The EEEB signed the respective contract with INGETEC on the same date. Both contracts have been approved by the IBRD, which is partially financing the engineering and administration works. These have been reviewed by the Bank and found satisfactory.
- 3.34 It is important to note that the administration planned by ISA for execution of the project is deemed satisfactory and that both ISA and INGETEC have technically competent personnel experienced in similar works and with sufficient executive capacity for supervision and direction of the works. The INGETEC staff handling on-site inspection of the works has already been designated and is at work. The other engineering work is being handled by INGETEC at its Bogota offices. Actually, INGETEC's work has been a continuation of that in progress since the first project studies were initiated in 1955.
- 3.35 Finally, in the process of project execution it has been planned to use the Critical Path Method (CPM). This method has made it possible to identify the critical path for the project, basically the principal civil works forming part of Contract 1 (construction of the dam, spillway, diversion tunnel, headrace and surge tank). These works determine the period for execution of the project. <sup>1/</sup> The CPM method is a useful tool for controlling project execution.
- 3.36 It should also be emphasized that several meetings have been held between IDB and IBRD officers with a view to coordinating project execution as efficiently as possible and avoiding any duplication of efforts or superfluous work surcharges for ISA. No substantially different requirements that could affect coordination of the loans were encountered. To the contrary, it was considered that, in the specific case of this project, the conditions established by both

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<sup>1/</sup> Critical works are those whose execution cannot be delayed without causing a similar delay in completion of the project.

institutions were very similar. Mutual agreement was reached on administration of the loans and supervision of the project which encompasses: a) maintaining permanent contact between the officers of both institutions at headquarters and in the field, with the aim, among others, of providing a mutual exchange of information on any event materially affecting project progress and on disbursements under the respective loans; b) unifying the reports on progress in the project for presentation on the same schedule (the two institutions have already exchanged their report presentation models, which are very similar and mutually acceptable), and c) coordinating the work of the IDB project specialist with the IBRD personnel responsible for project supervision and with the INGETEC consulting firm to ensure a continuing exchange of information in the field (the IBRD will not assign field employees to project supervision permanently; instead, such supervision will be implemented by means of progress reports from INGETEC and missions sent from Washington as needed to deal with specific aspects of the operation). During April of the current year IDB-IBRD-ISA coordination meetings will be held in Washington to stipulate these agreements in writing.

iv. Program of procurement and contracts

- 3.37 For the acquisition of machinery, equipment and other goods relating to the project and the award of contracts for works construction, ISA would utilize the system of international public bidding in all cases where the value of such acquisitions or contracts exceeds the equivalent of US\$20,000. The bid bases would be governed by conditions approved by the Bank, taking into account the laws of Colombia and the purposes of the loan (see proposed resolution).
- 3.38 For contracting civil works for the plant, four contracts have been planned: Contract 1 (awarded) - dam, spillways, diversion tunnels, headrace and surge tank; Contract 2 - penstock; Contract 3 - powerhouse structure, control building and drainage canal; Contract 4 - Somondoco-La Esmeralda dam Highway. The acquisition of mechanical and electrical equipment for the plan and the substations of the transmission system has been subdivided into twelve main supply groups, according to their nature and the date they are required. It should be noted that some of these groups will probably be combined in a single bid. Finally, construction (supply of materials and assembly) of the CHIVOR-Suba-La Mesa 230-KV line would be consolidated in one contract. The general procurement and contract program, with the estimated amounts of the contracts and basic bidding dates is summarized below: 1/

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1/ This program was defined on the basis of studies by the members of the IDB operations mission jointly with ISA directors and staff, who were given a detailed explanation of Bank policy with regard to purchases and contracts that was accepted by this company.



(In US\$ thousands or equivalent)

<u>Item</u>	<u>Foreign currency</u>	<u>Local currency</u>	<u>Total</u>	<u>Call for bids</u>	<u>Receipt of tenders</u>	<u>Final award (with approval)</u>
<u>Civil Works</u>						
- Contract 1 (IMPREGILO)	38,800	21,100	59,910	Jan/11/70	May/11/70	May/28/70
- Contract 2 - pen- stock	2,770 <sup>1/</sup>	1,670	4,440	July/71	Oct/71	Jan/72
- Contract 3 - power- house	1,750	2,830	4,580	April 72	July/72	Nov/72
- Contract 4 - Scmon- doco-Dam Highway	1,560	3,620	5,180	July 71	Oct/ 71	Jan/72
<u>Equipment</u>						
- Steel lining head- race	1,050 <sup>1/</sup>	110	1,160	March/71	May/71	July/71
- Turbines, regulators and spherical valves	2,600 <sup>1/</sup>	360	2,960	May/71	Aug/71	Dec/71
- Generators and accessories	3,410 <sup>1/</sup>	470	3,880	May/71	Aug/71	Dec/71
- Traveling cranes, powerhouse	230 <sup>1/</sup>	30	260	May/71	Aug/71	Dec/71
- Radial gates, spillway	660 <sup>1/</sup>	70	730	May/71	Aug/71	Dec/71
- Penstock	3,820 <sup>1/</sup>	400	4,220	Aug/71	Nov/71	March/72
- Electrical protec- tion and control equipment (CHIVOR, Suba and La Mesa substations)	1,820 <sup>1/</sup>	350	2,170	Aug/71	Nov/71	March/72
- Power transformers (CHIVOR and Suba substations)	2,400 <sup>1/</sup>	370	2,770	Oct/71	Jan/72	May/72
- Butterfly valves (headrace and penstock)	1,410 <sup>1/</sup>	150	1,560	Jan/72	Apr/72	Aug/72
- Bars and 13.8-KV cable (CHIVOR)	1,100 <sup>1/</sup>	150	1,250	Dec/72	Mar/73	July/73
- Dept. valves diver- sion tunnel, head- race gates intake grills	260	30	290	Third or fourth quarter 1972	-	Fourth quarter 1972
- Miscellaneous equip- ment powerhouse (various bids)	1,260	170	1,430	----Various dates....		
<u>Line 230-KV Trans- mission</u>	3,660 <sup>1/</sup>	580	4,240	Dec/71	March/72	July/72

<sup>1/</sup> Amounts eligible for financing with resources of the proposed IDB loan.

- 3.39 All the contracts and purchases listed in the preceding table would be awarded through international bidding. <sup>1/</sup> The amounts of the international bids to be financed with IDB resources would cover, as indicated in paragraph 3.19, the cost in foreign currency: i) of the civil works contract for the penstock (Contract 2); ii) of the importation of all electromechanical equipment for the plan and sub-stations (except the miscellaneous ancillary equipment for the powerhouse and depth valves for the dam, to be financed by the IBRD), and iii) of the contract for the 230-KW transmission line. As can be seen, the different works of the project are clearly identified, and a detailed program of acquisitions and contracts for the items to be financed with the Bank resources has been drawn up.

v. IDB inspection and supervision

- 3.40 For project inspection and supervision it is proposed to utilize the services of the project specialist currently performing similar functions at the field office in Colombia for ICEL projects financed with IDB resources. This specialist will assist IBRD and INGETEC personnel in project supervision duties, as indicated in paragraph 3.29.

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<sup>1/</sup> The international public bidding procedures utilized by ISA conform to the requirements stipulated by the Bank in this area for financing projects from the ordinary capital resources. Consequently, they would permit free competition of bidders from the countries eligible according to the regulations governing the use of these resources.

#### IV. PROJECT JUSTIFICATION

##### A. Technical and Administrative Feasibility

- 4.01 It is concluded from the studies that the project is technically feasible. All works under the project are clearly defined. Estimated costs are reasonable and, with regard to the major civil works, the basic price of the main contract for civil works already awarded has been established. The construction program is realistic, and no special difficulties in its execution are expected.
- 4.02 The bidding schedule has been drawn up on a reasonable basis, in terms of requirements of the execution term planned for the project. No significant changes are expected in the contracting and procurement projected.
- 4.03 No special problems are anticipated in purchasing the electromechanical equipment needed for execution of the project or with regard to the purchase of national materials and supply of local manpower.
- 4.04 ISA is satisfactorily carrying out the administrative and operational tasks assigned it. It has clearly defined the technical and administrative areas, development and service functions, line and staff departments and, in terms of its development planning, the various stages of expansion pursuant to its scheduled programs.
- 4.05 The executive management of ISA is handled by qualified officers experienced in administration of electrical projects and international loans.
- 4.06 ISA has contracted the services of national and foreign consulting firms which are preparing satisfactory financial administration procedures and systems.
- 4.07 The administration provided by ISA for execution of the project is considered satisfactory. The assistance to be furnished by the consulting engineers contracted to supervise all project stages would facilitate the work of the department set up specially within its organization for general supervision of project development.

##### B. Financial Feasibility

- 4.08 Evaluation of the project's financial feasibility consists of two parts: the first analyzes the annual return to be obtained by ISA from exploitation of the CHIVOR plant and the enterprise as a whole, while the second determines the counterpart that would be available to the institution for project execution.

- 4.09 As already noted, ISA should obtain an annual return of 9% on net investment in the project, as stipulated in Loan Contract 681-CO between that company and the IBRD. This condition would also be established in the loan contract to be signed by ISA with the IDB (see proposed resolution and Appendix A). This return should be achieved in the first year in which all energy that can be generated at the plant is sold, which will occur - according to consumer forecasts (see paragraphs 4.19 to 4.22) - in 1978, almost two years after startup of the plant. In 1976 and 1977, the return would be slightly less, 7.5% and 7.18%, respectively. These profitability conditions are considered to be wholly satisfactory and result in an average sale price of about 5.5 US mills per KWH during the first years of operation (see paragraph 4.25 and Appendix D).
- 4.10 In considering the enterprise as whole (transfers of power among the partners, exploitation of the central interconnection network and of CHIVOR), it is apparent that, comparing net operating income resulting from fixed investment, annual returns would vary from 4.5% to 5% during 1971-75, when ISA activities are confined to the transportation of power. Once the CHIVOR plant begins regular service in 1976, profitability would increase to a level of about 8.3% two years later, which is considered reasonable and, of course, adequate for ample compliance with cash commitments in connection with debt service, as concluded from the information presented below concerning source and use of the institution's funds (see Appendix E).
- 4.11 The cash flow calculated for 1971-80 is given in Appendix F. This table shows that ISA would have available the financing resources needed for construction of the CHIVOR hydroelectric plant, as well as to pay the principal and interest on loans contracted to finance that installation, considering the following factors:
- a. The statutes of the company obligates its shareholders to make the contributions needed to finance investments required for construction of generating works - in this case the CHIVOR plant - as described in paragraph 2.27.
  - b. Fund requirements for the CHIVOR project would be provided by the shareholders in the ratios indicated in the statutes. The ISA General Meeting of Shareholders resolved, in March of this year, to increase the authorized corporate capital from Col\$200 million to Col\$500 million. It also raised the subscribed capital from Col\$160 million to Col\$260 million (see paragraph 2.29). Although these increases represent substantial expansions of ISA capital and will constitute a significant source of funds for the company in financing the local contribution to the project (US\$59,850,000), it should be noted that payments of capital by the partners would cover only part of this local contribution. In effect, as mentioned in paragraph 2.27, 60% of the investments chargeable to ISA

are financed through bond issues which the partners are obliged to acquire in the ratios necessary so that the total of shares and bonds acquired by each one corresponds to the capacity assigned it in the new plant.

- c. According to a careful study by the IBRD of financial projections for all shareholders, reviewed by the IDB, it is expected that they would be able to make their contributions to ISA for the CHIVOR project on schedule, in view of the sizable resources they will generate internally each year (see paragraph 2.29). In this connection, it should be pointed out that the fact that the shareholders can in the future amass a considerable amount in cash is a financial indicator that interconnection of the main electrical systems of the central region would provide savings in costs and in their cash needs. In addition, service by the partners will be proportionately less, as expansion needs of the individual generating systems are reduced by the interconnection networks, which will curtail the need of the shareholders to contract new loans while they repay their outstanding obligations.
- d. The IBRD signed with the CVC, EEBB, EPM and ICEL a shareholder's agreement supplementing the loan contract between that Bank and ISA stating the statutory obligations already noted and ratifying these commitments acquired in the statutes. The Bank studied the possibility of recommending preparation of a similar agreement, but since the shareholder's agreement adds nothing new and offers no further guarantees than those already established in the ISA statutes and those to be stipulated in the loan and guarantee contracts of the IDB, it was considered unnecessary to make special recommendations in this regard.

#### C. Economic Evaluation

##### i. Summary of the general economic situation

- 4.12 The Colombian economy continued to expand strongly, with the GDP recording a growth rate of 7% in 1970, according to provisional estimates, comparing favorably with the increases registered in 1968 and 1969, amounting to 6.1% and 6.5%, respectively. This expansion is based mainly on the increased value of coffee exports, whose multiplier effect stimulated domestic demand and economic activity in general, also increasing import capacity, which made it possible to satisfy more fully foreign exchange requirements in the productive sectors.
- 4.13 As of December 31, 1969, Colombia's long-term external debt payable in foreign exchange totaled US\$1,515.6 million, of which 29.8% had not been utilized. Amortization of obligations contracted as of that date was distributed as follows: more than 10 years, 52.1%;

from six to 10 years, 22.6%, and up to five years, 25.3%. According to preliminary estimates (not strictly comparable with the foregoing), Colombia's long-term external public debt aggregated US\$1,697.2 million as of December 31, 1970. The major increases identified correspond to loans from the IBRD (US\$109.3 million) and the United States Government (US\$70 million). Colombia should have no difficulty in meeting its external debt commitments (provided terms for external loans do not become excessively strict). In 1971, service on the debt outstanding at the end of 1969 shows a satisfactory ratio of 13.5% of foreign exchange earnings for exports of goods and services in the latter year, declining in subsequent years (6.6% in 1985).

- 4.14 During the last meeting of the CIAP Subcommittee on Colombia, in February 1971, recent development of the Colombian economy was noted with satisfaction, particularly the steady increase in growth of the GDP during 1967-70. In examining the country's domestic effort during that time, emphasis was placed on the importance of the following achievements, among others: a) rapid expansion of current income of the national government, which has permitted a substantial rise in savings of the sector and public investments; b) effective use of promotion policy for minor exports that has substantially increased these items; c) more rational use of available foreign exchange through introduction of an exchange control system, together with a flexible exchange rate policy; d) proper programming of public investment and its financing, which has served to attract external resources in amounts and on conditions suited to the country's needs and payment capacity. The subcommittee noted with satisfaction the basic guidelines of the 1970-73 Economic and Social Development Plan and remarked that the growth goal adopted, 7.5%, as well as the domestic effort and external cooperation required to achieve it, are essential to the gradual reduction of unemployment. At the same time, the importance of the social improvement objectives covered by the plan was stressed, especially with regard to agrarian reform, education, housing and health. The consensus was that the investment levels provided in the plan might have to be raised. This would mean primarily an effort to promote rapid increase in private savings, adopt measures designed to make tax revenue more dynamic and strengthen incentives for nontraditional exports.

ii. Electric power sector

- 4.15 At the end of 1970, installed electric power capacity in Colombia totaled 2,016 MW for public service, of which 69.6% was provided by hydroelectric plants and 30.4% by thermal plants. The plants with the largest capacity are hydroelectric and are concentrated in the markets of the central region (Bogota, Medellín, Cali and CHEC). Most of the thermal generation is located on the Atlantic coast and in the Northeast. Along the coast, thermal generation is the only kind available, since topographic conditions have not permitted the development of economical hydroelectric projects, while in the Northeast no important hydroelectric plants have been built because of the narrowness of the individual

markets and their isolation. Percentile distribution of current installed electric power capacity in Colombia is as follows:

	<u>%</u>
EEEB	29.2
EPM	22.3
CVC/CHIDRAL	13.4
CHEC	10.2
Northeast	10.1
Atlantic coast	12.9
Others	1.9
Total	<u>100.0</u>

It should be noted that, in addition to public generating capacity, plants belonging to State industrial and commercial enterprises or private companies have an approximate capacity of 250 MW.

- 4.16 Development of the Colombian electrical sector has been appreciable over the last 15 years. During that time, installed capacity rose at a cumulative annual rate of 11.5%, and power generated by 10.4%. However, about 30% of the population still receives no electrical service and only 47% receives this service on a continuing basis. The evaluation of consumption (generation less losses) rose at an annual average rate of 11% over the past 12 years, and will probably increase during the present decade, owing to the high growth goals proposed in the development plans and to heavy population expansion. The level of power consumption varies from one region to another and the gap is even greater between urban and rural zones. Average per capita consumption in the departments with the largest markets is 500 KWH/year. The highest average corresponds to the 30 cities with more than 30,000 inhabitants, where it reaches 600 KWH/year.
- 4.17 Despite the rapid growth of installed capacity in Colombia, this represents in KW only 6 to 7 per cent of the total for Latin America, with a per capita equivalent of nearly 100 W, while the Latin American average was 130 W in 1968. Per capita/year generation in Colombia during 1969 was approximately 400 KWH, which is lower than the Latin American average of 485 KWH per inhabitant/year, also recorded in 1968.
- 4.18 The evolution of installed capacity as a whole has held above maximum demand, with average reserved margins of 20%, showing that the rate of investment has been adequate. However, in considering the systems on an individual basis, periods of rationing are observed which would indicate that investments were not efficiently distributed, owing to the fragmentation of electric service

units (see paragraph 3.01). Nevertheless, these problems are being solved through establishment of a proper national transmission and interconnection system (see paragraph 3.05).

iii. ISA power market

- 4.19 Forecasts of power consumption in the four systems of the ISA partners have been based primarily on an extrapolation, with minor adjustments, of trends observed in recent years. The most important markets are those of the Bogota and Medellín companies (including the local distributor units receiving power from those companies), which as whole account for a little over 70% of total electrical consumption in the central region. Consumption in the EEEB system has expanded in recent years by 13.5% per annum, while growth in the Medellín company has averaged nearly 8% a year over the same period. The estimates accepted by ISA and the IBRD reduce the growth rate of the EEEB system to an average of 11% for the next 10 years, which seems reasonable.

Under the Medellín system, taking into account the connection of a sizable volume of mining consumption (Monte Líbano ferronickel) in 1973, the average annual rate of increase is 10% for 1971-80 (excluding service to Monte Líbano, other consumption would increase by slightly more than 8.5% a year). For the other two systems, CVC-CHIDRAL and CHEC, a uniform growth rate of 10% has been adopted.

- 4.20 Considering the central region as a whole, projected consumer and production requirements for the next 10 years show an average annual increase of 10.6%, slightly below that reported for the past five years. In the absence of a detailed study of power consumption by sector (particularly residential and industrial), the over-all forecast for the central region can be considered acceptable in the light of observed trends to date. The estimate adopted coincides fundamentally with that calculated by the IBRD in its evaluation of the CHIVOR project.
- 4.21 According to the program of works being carried out by ISA, the central region would be interconnected by the end of 1973 at 230 KV (Guatapé-Barrancabermeja line) with this region, <sup>1/</sup> which includes the Departments of Santander, Norte de Santander and Boyacá. This latter region is supplied by ICEL affiliate companies with power generated mostly by thermal plants. The northeast system could satisfy power demands up to 1976 (with a power deficit in that year). With startup of CHIVOR in 1976, surplus power from the central system would be delivered to the Northeast region. Once the CHIVOR capacity was fully utilized, the supply of

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<sup>1/</sup> There is at present a partial interconnection at 115 KV between the systems of the EEEB and Electrificadora de Boyacá, an affiliate of ICEL.



power to the Northeast, with an estimated annual growth of 10%, would be continued by the new plants to be built by ISA in the future. Consequently, for the purposes of primary energy supply, both regions should be considered as a whole, especially after startup of the CHIVOR plant.

- 4.22 Based on the balance between power supply and demand in each of the central region systems and in the Northeast region as a whole, a determination would be made of total shortages that would have to be covered through output by the CHIVOR hydroelectric station. According to the construction program, the plant would begin to operate, with two units, during the fourth quarter of 1975, and would be operating normally with its four units by mid-1976. On this basis, the total production of CHIVOR would be utilized by 1978, as shown in Appendix G.

iv. Rates

- 4.23 Pursuant to current legal provision, ISA, in its capacity as supplier of power (en bloc) for public service, would be subject to approval of its service rates by the National Board of Public Service Rates (JNTSP), established by Decree 3069 of December 16, 1968. The JNTSP consists of the Chief of the National Planning Department, who presides, and three full-time members freely appointed and removed by the President of the Republic, and functions as part of that department. No rate change can become effective without approval by the JNTSP. Actually, the regulation of ISA rates would only take effect when the CHIVOR plant begins operation.
- 4.24 The criteria for establishment of rates, defined in that decree, are those usually applicable to the regulation of electrical companies, that is, that operating income should be sufficient to cover operating costs and to provide an adequate return on investments in the provision of service. The level of return is not stipulated in the decree but is understood to fluctuate, depending on the economic and financial conditions under which the respective supplier operates.
- 4.25 As already noted, ISA has agreed, under Loan Contract 681-CO with the IBRD, to maintain rates producing a return of 9% on net investment in the CHIVOR plant. It would assume the same obligation with the IDB (see paragraph 3.29, proposed resolution and Appendix B). In this connection, ISA is expected to encounter no difficulties in introducing rates adequate to fulfill this purpose. In effect, the average costs of power produced calculated for CHIVOR, with a return of 9%, would be 5.2 US mills per KWH, which compares favorably with the current rate for sales en bloc by the two main partners of ISA (EEEEB and EPM) of 5.8 US mills (in 1970 dollars).
- 4.26 During 1971-75, when ISA will act solely as conveyor of power to its partners, sale prices to systems with shortages will be the same as

those paid by ISA to these systems with surpluses (see Appendix G). Operating costs of the transmission network, plus interest on credits assumed for its construction, will be charged separately to the ISA partners, prorating the volumes of power they distribute annually in their respective systems. Therefore, the allocation of costs for the interconnection network will be independent of the amount of power which the partners buy from or sell to ISA.

- 4.27 The Motor-Columbus consulting firm is presently conducting a study, ordered by ISA, of production costs in each system in order to set the prices which that agency should pay for the power it receives, based on rates that will consider operating conditions (daily periods, type of power, etc.).
- 4.28 It should be noted that the proposed resolution recommends that ISA take the necessary steps acceptable to the Bank to ensure that rates for supply of electric power under its system: a) produce income at least sufficient to cover all operating costs of the system, including those relating to operation, maintenance, administration and depreciation; b) provide a reasonable return on fixed investment in the system, and c) if the cash flow derived from the above should be insufficient to cover prompt amortization of all obligations chargeable to the debtor, generate the additional income required for these purposes. Moreover, Appendix B states that, for the purposes stipulated in subsection b above, the rates should produce a return of at least 9% a year from the time when virtually all power generated by the CHIVOR plant is sold.

v. Analysis of project benefits

- 4.29 The evaluation of project benefits consists of an economic feasibility study of the CHIVOR hydroelectric station, as an isolated project, as compared to a possible alternative, in this case a thermal plant, in order to determine whether the proposed project is the best option with regard to costs of power produced and is at the same time a more efficient use of the resources than its possible technical alternative. To this end, two types of analysis have been conducted: a) comparison of average costs of power produced, and b) calculation of the rate of discount equating current values of the total costs for both alternatives.
- 4.30 In its first stage of operation, the CHIVOR plant will supply a firm power of 500 MW, with a plant factor of 71%, equivalent to an annual output of 3,120 million KWH. Unless the plant is expanded, this would be its normal operating regime during its useful life. Taking into account losses in transmission (approximately 2.5%) to the terminal substations, net power delivered by CHIVOR to the central network would amount to 3,040 million KWH a year. In order to supply the same annual power as CHIVOR, the installed capacity of a thermal plant would have

to be 530 MW, considering that a power station of this type would not be likely to operate during its useful life with a plant factor of more than 65%.

- 4.31 Initial investments, including interest (external credits plus local resources) and annual costs of operation, maintenance and administration for both alternatives are as follows:

	<u>CHIVOR Plant (1st stage)</u>	<u>Thermal Plant</u>
- Installed capacity - MW	500	530
- Annual output (firm power in S.E. for delivery) - KWH millions	3,040	3,040
- Initial investment (including interest) - US\$ millions	157.0	80.0
- Useful life - years	50	25
- Annual costs of operation, maintenance and administration - US\$ millions	<u>1.0</u>	<u>10.4</u> <sup>1/</sup>
i. Fuels	-	9.1
ii. Other expenses	1.0	1.3

- 4.32 Average costs per KWH of power produced would be obtained based on the annual equivalent cost of the investment plus operating, maintenance and administrative costs. In calculating the annual equivalent cost of initial investment, equivalency rates of return of 8%, 10% and 12% were assumed to observe the extent of variation in the two alternatives for different capital returns. The results are as follows:

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<sup>1/</sup> In this case, fuel cost based on coal, was determined, for 6,000 cal/Kg. at US\$6.50/ton, with a cost of 3 US mills/KWH.

Comparison of Average Costs per KWH

	8%		10%		12%	
	CHIVOR	Thermal	CHIVOR	Thermal	CHIVOR	Thermal
Annual equivalent cost (US\$ millions)	14.3	18.2	17.3	19.5	20.4	20.8
Average cost per KWH (US mills/KWH)	4.7	6.0	5.7	6.4	6.7	6.8
Ratio: $\frac{\text{Average Thermal cost}}{\text{Average CHIVOR cost}}$	1.28		1.12		1.01	

- 4.33 As indicated in the preceding table, the average per KWH cost for CHIVOR is consistently less than that of an equivalent thermal plant, with the discount factors assumed. With an assumed 8% rate of return, the average thermal cost is 29% higher; this ratio declines as that rate increases; and at 12% both average costs are virtually the same. In order for this comparison to have economic significance, it must be related to the opportunity cost of capital in the country. Although this information is difficult to obtain, in the case of Colombia, several attempts have been made to quantify the historic return on capital showing that, generally speaking, it would range from 8% to 10% in constant terms. Having taken account of the limitations of the statistical basis for this type of experiment, its results can be considered to be an approximation of the actual situation. Assuming then that the rates given are indicative of the probable return on capital in Colombia, average costs per KWH for CHIVOR at these rates are far below those for an equivalent thermal plant.
- 4.34 Supplementing the preceding analysis, it has been determined whether the technical alternative chosen constitutes the better use of available resources, that is, whether the heavier investment in the hydroelectric plant as compared to the thermal unit is justified by its lower operating and maintenance costs during its useful life. To this end, a calculation has been made of the discount rate equilibrizing the current values of total costs for both alternatives. This is important since, based on the premise that the alternatives considered are equivalent with regard to generation of power required, they are not equivalent in terms of costs and execution period and useful life. According to the calculations made, current values for both alternatives are equalized at a discount rate of 12%. This means that up to a capital return of 12%, the hydroelectric plant constitutes the better use of resources; considering that the capital return rate in Colombia would range from 8% to 10%, as already pointed out, it can be concluded that the alternative selected - CHIVOR - is fully justified and economically feasible.

## V. CONCLUSIONS AND RECOMMENDATIONS

- 5.01 In view of the importance of the project for the economic and social development of Colombia and considering that there are no technical, financial, economic or legal obstacles to its execution, that Interconexión Eléctrica S.A. (ISA) has a satisfactory organization in present terms, and qualified technical and administrative personnel, and that the loan will have the full guarantee of the Republic of Colombia, it is recommended that ISA be granted a loan up to the equivalent of US\$34,100,000, from the ordinary capital resources of the Bank, for the purpose of contributing to the partial financing of the construction of the CHIVOR Hidroelectric Power Plant.
- 5.02 It is also recommended that there be included in the loan and guarantee contracts, as appropriate, in addition to the conditions contained in the proposed resolution, the following conditions, which shall be fulfilled to the satisfaction of the Bank:
- (a) Prior to the first disbursement of the loan, the debtor shall present to the Bank:
    - (i) A communication from the competent authorities of Colombia expressing that the Decree 959 of June 25, 1968 is in full effect and consequently import permits as may be necessary for the acquisition abroad of the goods payable in foreign exchange required for the execution of the project will be granted and,
    - (ii) evidence that the loan has been recorded in the appropriate foreign exchange registry office of the Colombian Government.
  - (b) The Bank may recognize as part of the local contribution to the financing of the project up to the equivalent of US\$4,000,000, invested by the debtor for the payment of labor, national materials, local costs of engineering and administration and of transport and installment, prior to the date of the loan contract, but after October 22, 1970, provided that requirements substantially similar to those in the resolution and the loan contract have been fulfilled.
- 5.03 In the loan contract there shall be established the manner in which the financial statements related to the debtor and the project are to be audited, taking into account the provisions of paragraph 2.25 of this document.

- 5.04 An annex substantially similar in content to Appendix A (Description of the Project) hereto shall be included in the loan contract.
- 5.05 Of the resources of the loan, US\$341,000 shall be set aside for the respective Inspection and Supervision Fund.
- 5.06 The equivalent of US\$13,640,000 in currencies of non-member countries to which Resolution DE-49/62, as amended, is applicable, shall be utilized in the loan.

ANEXO "B" DEL CONTRATO DE PRESTAMO

- A. Descripción del Proyecto: El proyecto propuesto consistirá en la construcción de una presa de escollera en el Río Batá, desde donde se desviarán las aguas embalsadas, a través de un túnel de carga de 5,8 Km y una tubería de presión de 2,0 Km de recorrido, hasta el Río Lengupá, en cuya margen derecha se ubica la casa de máquinas de CHIVOR, con cuatro grupos generadores de 125 MW cada uno. Estas obras se encuentran en el Departamento de Boyacá, a unos 120 Km al nordeste de Bogotá. Como parte integral del sistema de generación de la Central de CHIVOR se incluye también una línea de transmisión de 230 KV, de doble circuito y 155 KM de longitud, desde la Central hasta dos subestaciones terminales, una en Suba (Bogotá) y la otra en La Mesa (junto a la Central Hidroeléctrica Colegio) para alimentación a la Red Central de Interconexión. El Banco participará en este proyecto con el Banco Internacional de Reconstrucción y Fomento (BIRF), el cual firmó un contrato de préstamo el 14 de junio de 1970 por US\$52.300.000, para financiar parcialmente las obras civiles principales del proyecto y los gastos de ingeniería y dirección del mismo (véase literal C, Plan de Financiamiento).
- B. Costo total del Proyecto: Se estima en el equivalente de US\$146.250.000,<sup>1/</sup> de acuerdo con el siguiente detalle:

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<sup>1/</sup> Tipo de cambio utilizado US\$1,00 = Col. \$18,28

APENDICE A-2

(en miles de US\$ o su equivalente)

<u>Categoría</u> <u>1/</u>	<u>Costos</u> <u>Externos</u>	<u>Costos</u> <u>Locales</u>	<u>Total</u>	<u>%</u>
1. <u>Ingeniería y Administración</u>				
1.1 Ingeniería y Dirección Obra	800	7.170	7.970	5,5
1.2 Administración y Gastos Generales	-	1.000	1.000	0,7
2. <u>Costos Directos</u>				
2.1 <u>Central Generadora</u>				
2.11 Presa, Túnel, Vertedero y Almenara				
- Obras civiles-Contrato 1	38.800	21.110	59.910	41,0
- Equipos hidromecánicos	3.390	370	3.760	2,6
2.12 Tubería de Presión				
- Obras civiles-Contrato 2	2.770	1.670	4.440	3,0
- Equipo (Tubería)	3.820	400	4.220	2,9
2.13 Casa de Máquinas				
- Obras civiles-Contrato 3	1.750	2.830	4.580	3,1
- Equipo mecánico	3.770	530	4.300	2,9
- Equipo eléctrico	6.420	890	7.310	5,0
2.14 Patio de Conexiones				
- Equipo electromecánico	850	140	990	0,7
2.15 Obras Accesorias				
- Carretera (Contrato 4), terrenos, campamentos e instalaciones varias	2.260	6.170	8.430	5,8
2.2 <u>Obras de Transmisión</u>				
2.21 Línea 230 Kv (Contrato)	3.660	580	4.240	2,9
2.22 Subestaciones Suba y La Mesa	1.760	360	2.120	1,5
2.23 Terrenos y Servidumbres	-	200	200	0,1
3. <u>Gastos Financieros</u>				
3.1 Préstamo BIRF (intereses y comisión compromiso)	9.400	-	9.400	6,4
3.2 Préstamo BID				
- Intereses	5.840	-	5.840	4,0
- Comisión Compromiso	1.500	-	1.500	1,0
- Fondo Inspección y Vigilancia	341	-	341	0,2
5. <u>Sin Asignación Específica</u>				
5.1 Imprevistos Generales	10.399	5.300	15.699	10,7
Total	<u>97.530<sup>2/</sup></u> (66,7%)	<u>48.720</u> (33,3%)	<u>146.250</u> (100,0%)	<u>100,0</u>

1/ Únicamente se han utilizado las categorías de inversión definidas por el Banco en las cuales se efectuarían inversiones.

2/ Esta suma representa exclusivamente costos directos en divisas.



APENDICE A-3

- C. Financiamiento: El costo total del proyecto se financiará de la siguiente manera:

(en miles de US\$ o su equivalente)

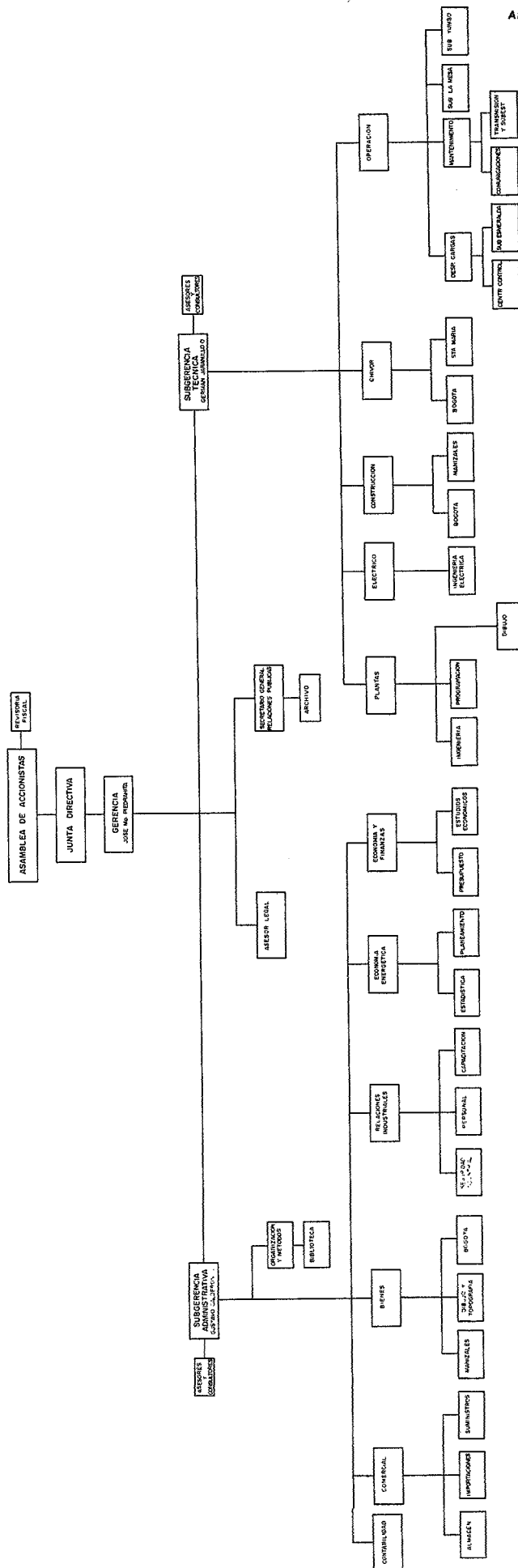
	<u>Origen de Fondos</u>		<u>Gastos a Financiarse</u>		<u>Total</u>	<u>%</u>
	<u>Divisas</u>	<u>Moneda Local</u>	<u>Divisas</u>	<u>Moneda Local</u>		
BID	34.100	-	34.100	-	34.100	23,3
BIRF	52.300	-	51.700	600	52.300	35,8
ISA	-	59.850	11.730	48.120	59.850	40,9
Total	<u>86.400</u>	<u>59.850</u>	<u>97.530<sup>1/</sup></u>	<u>48.720</u>	<u>146.250</u>	<u>100,0</u>
	(59,1%)	(40,9%)	(66,7%)	(33,3%)	(100,0%)	

El préstamo se destinará básicamente a cubrir el costo en moneda extranjera: (i) del contrato de obras civiles para la tubería de presión (Contrato 2); (ii) de la importación de todos los equipos electromecánicos de la Central y Subestaciones (excepto el equipo misceláneo auxiliar de la casa de máquinas y válvulas de fondo de la presa que financiará el BIRF), y (iii) del contrato para el suministro y montaje de la línea de transmisión a 230 KV.

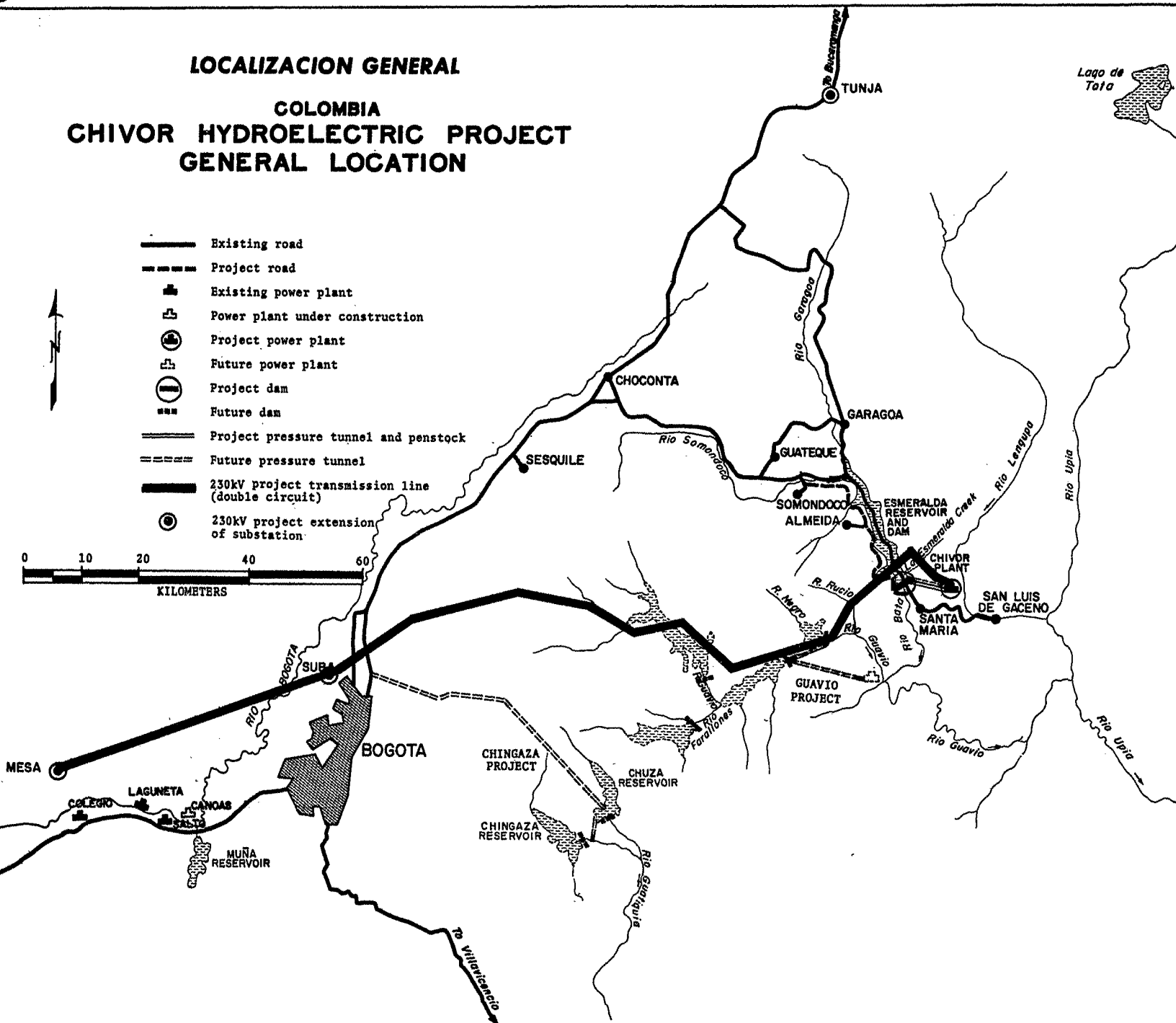
- D. Licitación Pública Internacional: Cuando los bienes o servicios a adquirirse se financien total o parcialmente con divisas provenientes del préstamo del Banco, los procedimientos para las licitaciones y las bases específicas de éstas deberán permitir la libre concurrencia de postores originarios o provenientes de países elegibles, según las normas de elegibilidad que regula el uso de los recursos ordinarios de capital del Banco. Consecuentemente, en los citados procedimientos y/o bases específicas no se establecerán condiciones que impidan o restrinjan la concurrencia de tales postores.
- E. Tarifas: A los fines de lo estipulado en la cláusula 8(f)(ii) del proyecto de Resolución, las tarifas deben ser establecidas para que produzcan una rentabilidad de por lo menos un 9% anual, a partir del momento en que se venda sustancialmente toda la energía generable de la Central Hidroeléctrica de CHIVOR.

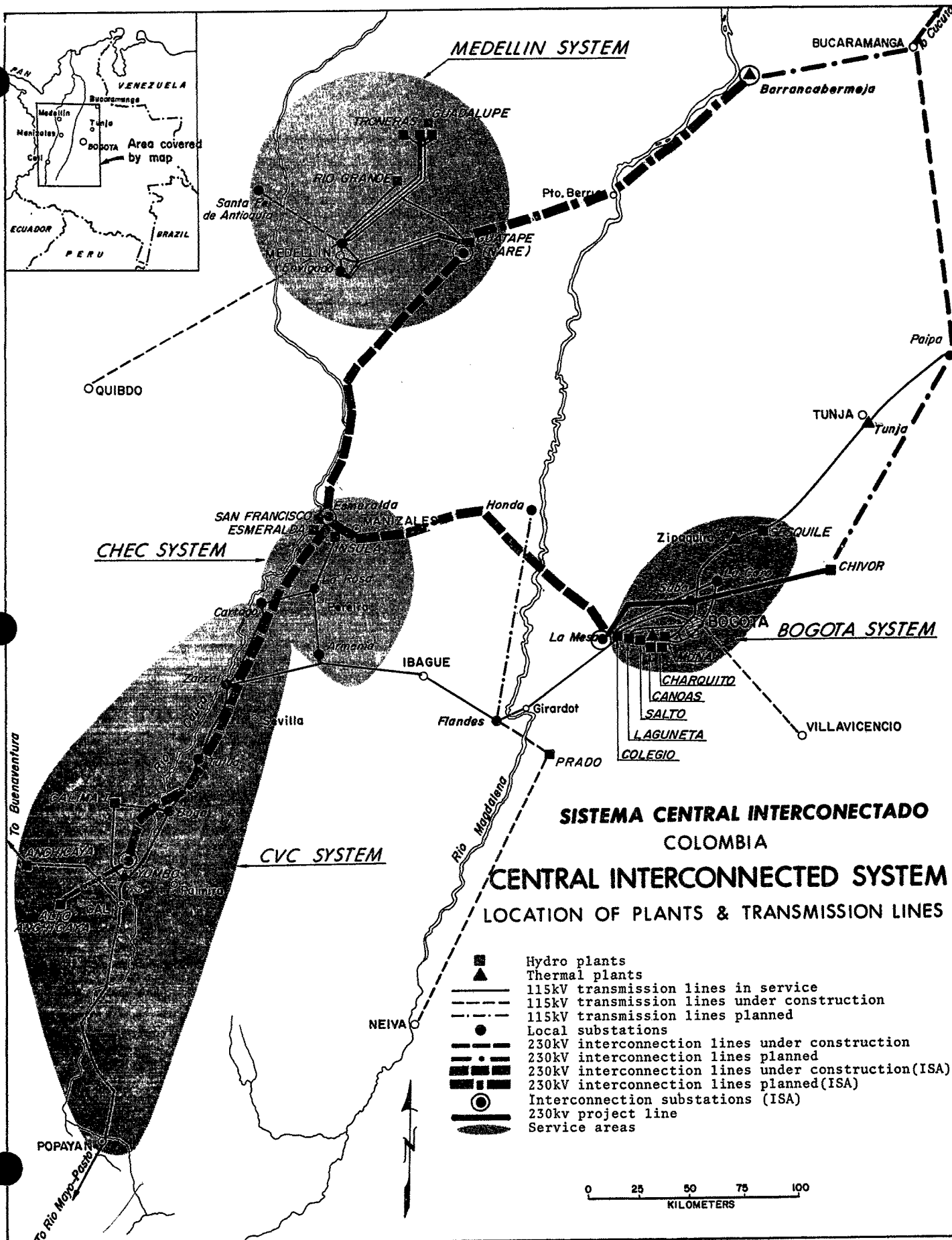
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<sup>1/</sup> Esta suma representa exclusivamente costos directos en divisas.



# **LOCALIZACION GENERAL** **COLOMBIA** **CHIVOR HYDROELECTRIC PROJECT** **GENERAL LOCATION**





APENDICE D

Proyección de Resultados de Explotación Central CHIVOR

	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>
Energía vendida (millones (Kwh)	275	2 660	2 645	3 200	3 200	3 200
Ingresos de Explotación - (millones US\$)	1.54	14.79	16.02	17.64	17.24	17.04
Ingreso medio por Kwh - U. S. mills	5.8	5.6	6.0	5.5	5.4	5.3
<u>Gastos de Explotación</u> (millones US\$)						
- Operación, mantenimiento y administración	0.25	1.00	1.00	1.00	1.00	1.00
- Depreciación	0.65	3.14	3.14	3.14	3.14	3.14
Total de Gastos de Explotación	0.90	4.14	4.14	4.14	4.14	4.14
Ingreso neto de Explotación	0.64	10.65	11.88	13.50	13.10	12.90
Rentabilidad requerida (%)	2.0	7.5	7.8	9.0	9.0	9.0
Inversión Inmovilizada - (millones US\$)	32.0	142.0	152.3	150.0	146.0	142.8

Proyección de Resultados Globales de Explotación ISA  
(en millones de US dólares)

	<u>1971</u> (6m)	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>
<u>Ingresos de Explotación</u>										
Venta de Energía Central CHIVOR	-	-	-	-	1.54	14.79	16.02	17.64	17.24	17.04
Operación Red Interconexión (incluye intereses)	1.19	2.41	2.63	2.94	2.89	2.84	2.79	2.75	2.70	2.65
Transferencia (venta) de energía a socios	0.77	2.07	2.20	4.34	2.64	-	-	-	-	-
<u>Total Ingresos de Explotación</u>	<u>1.96</u>	<u>4.48</u>	<u>4.83</u>	<u>7.28</u>	<u>7.07</u>	<u>17.63</u>	<u>18.81</u>	<u>20.39</u>	<u>19.94</u>	<u>19.69</u>
<u>Gastos de Explotación</u>										
CHIVOR (generación-transmisión)										
- Operación, mantenimiento y administración	-	-	-	-	0.25	1.00	1.00	1.00	1.00	1.00
- Depreciación	-	-	-	-	0.65	3.14	3.14	3.14	3.14	3.14
Red de Interconexión										
- Operación, mantenimiento y administración	0.35	0.71	0.71	0.79	0.81	0.83	0.85	0.87	0.89	0.91
- Depreciación	0.34	0.69	0.69	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Compras de Energía a:										
- LEEB (5.2 mills/Kwh)	0.37	0.87	0.47	-	-	-	-	-	-	-
- EPM (3.6 mills/Kwh)	0.32	0.99	1.62	-	-	-	-	-	-	-
- CVC-CHIDRAL (7.7 mills/Kwh)	-	-	-	4.34	1.95	-	-	-	-	-
- CHEC (5.7 mills/Kwh)	0.08	0.21	0.11	-	0.10	-	-	-	-	-
- Nordeste (5.0 mills/Kwh)	-	-	-	-	0.59	-	-	-	-	-
<u>Total Gastos de Explotación</u>	<u>1.46</u>	<u>3.47</u>	<u>3.60</u>	<u>5.95</u>	<u>5.17</u>	<u>5.79</u>	<u>5.81</u>	<u>5.83</u>	<u>5.85</u>	<u>5.87</u>
<u>Ingreso Neto de Explotación (A-B)</u>	<u>0.50</u>	<u>1.01</u>	<u>1.23</u>	<u>1.33</u>	<u>1.90</u>	<u>11.84</u>	<u>13.00</u>	<u>14.56</u>	<u>14.09</u>	<u>13.82</u>
<u>versión Inmovilizada (promedio anual)</u>	<u>11.00</u>	<u>23.00</u>	<u>25.00</u>	<u>28.00</u>	<u>60.00</u>	<u>169.30</u>	<u>178.80</u>	<u>175.70</u>	<u>170.80</u>	<u>166.80</u>
<u>Estabilidad Anual - %</u>	<u>4.5</u>	<u>4.4</u>	<u>4.9</u>	<u>4.8</u>	<u>3.2</u>	<u>7.0</u>	<u>7.3</u>	<u>8.3</u>	<u>8.2</u>	<u>8.3</u>

INTERCONEXION ELECTRICA, S. A.

ESTADO DE ORIGEN Y APLICACION DE FONDOS

(En millones de US\$) 1/

Origen de Fondos	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
<b>Generación Interna</b>	<b>0.84</b>	<b>1.70</b>	<b>1.92</b>	<b>2.15</b>	<b>3.37</b>	<b>15.80</b>	<b>16.96</b>	<b>18.52</b>	<b>18.05</b>	<b>17.78</b>
Ingreso Neto de Explotación - Red Central	0.50	1.01	1.23	1.33	1.26	1.19	1.12	1.06	0.99	0.92
Depreciación - Red Central Interconexión	0.34	0.69	0.69	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Ingreso Neto de Central CHIVOR	-	-	-	-	0.64	10.65	11.88	13.50	13.10	12.90
Depreciación - Central CHIVOR	-	-	-	-	0.65	3.14	3.14	3.14	3.14	3.14
<b>Transmisión Red Central y Estudios</b>	<b>11.13</b>	<b>5.18</b>	<b>2.06</b>	<b>0.80</b>	<b>0.40</b>	<b>0.40</b>	<b>0.30</b>	<b>0.30</b>	<b>0.25</b>	<b>0.20</b>
Acciones de Capital - ISA	2.40	1.00	0.95	0.50	0.40	0.40	0.30	0.30	0.25	0.20
Préstamo BIRF 575-CO	5.17	2.21	0.68	0.08	-	-	-	-	-	-
Proveedores (Bancos Europeos y Japoneses)	3.03	1.36	0.17	0.17	-	-	-	-	-	-
Préstamos FONADE e ICEL	0.53	0.61	0.26	0.05	-	-	-	-	-	-
<b>Central Hidroeléctrica CHIVOR</b>	<b>12.42</b>	<b>23.09</b>	<b>33.03</b>	<b>46.87</b>	<b>25.36</b>	<b>2.83</b>	-	-	-	-
Acciones de Capital ISA	2.49	4.03	5.45	6.85	7.76	-	-	-	-	-
Bonos CHIVOR (Suscritos: EEBB, EPM e ICEL)	3.74	6.04	8.18	10.27	11.65	-	-	-	-	-
Préstamo BIRF-681-CO	6.05	8.95	12.91	15.13	-	-	-	-	-	-
Préstamo BID	0.14	4.07	6.49	14.62	5.95	2.83	-	-	-	-
<b>Total de Origen de Fondos</b>	<b>24.39</b>	<b>29.97</b>	<b>37.01</b>	<b>49.82</b>	<b>29.13</b>	<b>19.03</b>	<b>17.26</b>	<b>18.82</b>	<b>18.30</b>	<b>17.98</b>
<b>Aplicación de Fondos</b>										
Construcción Transmisión Red Central	10.36	4.61	1.28	0.30	-	-	-	-	-	-
Estudios Hidroeléctricos Cauca Medio	0.17	0.17	0.11	-	-	-	-	-	-	-
<b>Construcción Central Hidroeléctrica CHIVOR</b>	<b>12.42</b>	<b>23.09</b>	<b>33.03</b>	<b>46.87</b>	<b>25.36</b>	<b>3.59</b>	-	-	-	-
Costo de Construcción y Equipo	10.76	20.03	28.48	40.21	16.25	2.23	-	-	-	-
Intereses, Comisión de Compromiso y Gastos de Inspección y Vigilancia durante construcción - BID	0.21	0.76	1.10	1.78	2.47	1.36	-	-	-	-
Intereses y Comisión de Compromiso durante construcción - BIRF	1.00	1.30	1.70	2.20	2.90	-	-	-	-	-
Intereses - Bonos CHIVOR durante construcción	0.45	1.00	1.75	2.68	3.74	-	-	-	-	-
<b>Servicio Deudas - Transmisión y Estudios</b>	<b>1.37</b>	<b>2.14</b>	<b>2.59</b>	<b>2.58</b>	<b>2.49</b>	<b>2.40</b>	<b>2.31</b>	<b>2.14</b>	<b>2.06</b>	<b>1.99</b>
Amortización Principal	0.24	0.68	1.05	1.09	1.09	1.09	1.09	1.01	1.01	1.01
Pago de Intereses	1.13	1.46	1.54	1.49	1.40	1.31	1.22	1.13	1.05	0.98
<b>Servicio Deudas CHIVOR</b>	<b>0.45</b>	-	-	-	<b>0.65</b>	<b>8.75</b>	<b>12.65</b>	<b>13.84</b>	<b>13.67</b>	<b>13.50</b>
BIRF - Préstamo 681-CO - Amortización Principal	-	-	-	-	-	-	0.46	0.96	1.03	1.10
BIRF - Préstamo 681-CO - Pago de Intereses	-	-	-	-	0.65	3.66	3.64	3.58	3.50	3.42
Bonos CHIVOR - Amortización Principal	-	-	-	-	-	-	0.91	1.83	1.83	1.83
Bonos CHIVOR - Pago de Intereses	-	-	-	-	-	3.69	3.65	3.48	3.32	3.16
Deuda EEBB	0.45	-	-	-	-	-	-	-	-	-
BID - Pmo. Amortización Principal	-	-	-	-	-	-	1.22	1.32	1.43	1.55
BID - Pago de Intereses	-	-	-	-	-	1.40	2.77	2.67	2.56	2.44
<b>Constitución de Capital de Trabajo</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>0.20</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>Total Aplicación de Fondos</b>	<b>24.77</b>	<b>30.01</b>	<b>37.01</b>	<b>49.75</b>	<b>28.50</b>	<b>14.94</b>	<b>14.96</b>	<b>15.98</b>	<b>15.73</b>	<b>15.49</b>
Sobrante para pagar dividendos y otras ampliaciones	(0.38)	(0.04)	-	0.07	0.63	4.09	2.30	2.84	2.57	2.49
<b>Sobrante Acumulado (Al 31/XII/70 US\$ 0.79)</b>	<b>0.41</b>	<b>0.37</b>	<b>0.37</b>	<b>0.44</b>	<b>1.07</b>	<b>5.16</b>	<b>7.46</b>	<b>10.30</b>	<b>12.87</b>	<b>15.36</b>

1/ Tipo de Cambio (moneda constante) US\$1,00 = Col.\$19,20

APENDICE G

Producción Anual de Energía ISA  
(En millones KWH)

	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>
<u>Ventas de ISA a:</u> <sup>1/</sup>										
- EEEB	-	-	-	275	238	1 070	1 520	1 587	2 147	2 767
- EPM	-	-	-	147	425	730	-	32	420	840
- CVC-CHIDRAL	173	480	395	-	-	-	-	206	270	540
- CHEC	-	-	-	42	-	30	115	210	305	410
- Nordeste	-	-	165	100	-	830	1 010	1 165	480	720
Total Ventas	<u>173</u>	<u>480</u>	<u>560</u>	<u>564</u>	<u>663</u>	<u>2 660</u>	<u>2 645</u>	<u>3 200</u>	<u>3 622</u>	<u>5 277</u>
<u>Compras de ISA a:</u>										
- EEEB	71	168	90	-	-	-	-	-	-	-
- EPM	88	275	450	-	-	-	-	-	-	-
- CVC-CHIDRAL	-	-	-	564	253	-	-	-	-	-
- CHEC	14	37	20	-	17	-	-	-	-	-
- Nordeste	-	-	-	-	118	-	-	-	-	-
Total Compras	<u>173</u>	<u>480</u>	<u>560</u>	<u>564</u>	<u>388</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>
<u>Generación CHIVOR</u>	-	-	-	-	275	2 660	2 645	3 200	3 200	3 200
<u>Generación Adicional</u> (futuras plantas)	-	-	-	-	-	-	-	-	422	2 077
Total Producción ISA	<u>173</u>	<u>480</u>	<u>560</u>	<u>564</u>	<u>663</u>	<u>2 660</u>	<u>2 645</u>	<u>3 200</u>	<u>3 622</u>	<u>5 277</u>

<sup>1/</sup> Incluidas pérdidas de transmisión en Red Central.