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APPRAISAL OF

THE GUATAPE II HYDROELECTRIC PROJECT

EMPRESAS PUBLICAS DE MEDELLIN

COLOMBIA

December 19, 1972

Latin America and the Caribbean Projects Department

CURRENCY EQUIVALENTS

US$1	=	Colombian Pesos (Col$) 21.4
Col$1	=	US$0.047
Col$1 million	=	US$46,729

UNITS AND EQUIVALENTS

1 kilometer (km)	=	0.6214 miles (mi)
1 kilovolt (kV)	=	1,000 volts (V)
1 megawatt (MW)	=	1,000 kilowatts (kW)
1 gigawatt hour (GWh)	=	1 million kilowatt hours (kWh)
1 gallon (gal)	=	3.785 liters (l)
1 cubic foot (ft^3)	=	0.028 cubic meters (m^3)

ACRONYMS AND ABBREVIATIONS

CHEC	-	Central Hidroelectrica de Caldas
CHIDRAL	-	Central Hidroelectrica del Rio Anchicaya, Ltda.
CORELCA	-	Corporacion Electrica de la Costa Atlantica
CVC	-	Corporacion Autonoma Regional del Cauca
DANE	-	Departamento Administrativo Nacional de Estadistica
EEEB	-	Empresa de Energia Electrica de Bogota
EMCALI	-	Empresas Municipales de Cali
EPM	-	Empresas Publicas de Medellin
GDP	-	Gross Domestic Product
ICEL	-	Instituto Colombiano de Energia Electrica
IDB	-	Inter-American Development Bank
IDEA	-	Instituto de Desarrollo Economico de Antioquia
ISA	-	Interconexion Electrica S.A.

FISCAL YEAR

January 1 - December 31

COLOMBIA

EMPRESAS PUBLICAS DE MEDELLIN

APPRAISAL OF THE GUATAPE II HYDROELECTRIC PROJECT

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APPRAISAL OF THE GUATAPE II HYDROELECTRIC PROJECT

SUMMARY AND CONCLUSIONS

i. This report is an appraisal of a Project consisting of the second stage of the Guatape hydroelectric scheme, a 220-kV transmission line, and expansion of the distribution system serving the Medellin area. The recently completed first stage consisted of a small diversion dam and the first four generating units of the Guatape power station. The hydroelectric works under the Project would double the station's present installed capacity of 280 MW and substantially enlarge the Santa Rita Dam to create a reservoir providing multi-annual storage on the Nare River.

ii. The estimated cost of the Project is US$98.2 million equivalent, half of that amount being the foreign exchange cost. Turbines and generators would be financed by suppliers' credits. A Bank loan of US$56 million is proposed which would finance the balance of the Project's foreign exchange cost, interest during construction, and $4.3 million of local currency expenditures for engineering services and civil works.

iii. The borrower would be Empresas Publicas de Medellin (EPM), an autonomous public utility which supplies power in and around Medellin and is also responsible for providing the city's water, sewerage and telephone services. Separate accounts are maintained for the various departments of EPM. The utility has had three power loans from the Bank, which have helped finance about 70% of its present installed capacity of 730 MW. The projects were well executed and the facilities they provided have been operating satisfactorily under EPM's efficient technical and financial management.

iv. The proposed loan would be the Bank's eighteenth loan to the Colombian power sector. Previous loans have assisted, among other things, in achieving interconnection of the power systems of the four major power utilities in central Colombia, one of which is EPM. The creation of Interconexion Electrica S.A. (ISA) in 1967 to construct and operate interconnection facilities has resulted in some rationalization of power planning in Colombia; however, there is a need for fuller coordination of sector development -- a task only recently undertaken by the government planning authorities. In conjunction with the proposed loan the Government has therefore agreed to establish a national power development plan that would be the basis for scheduling future power sector investments and mobilizing finance for them.

v. The Project is the least-cost solution for meeting the load growth of the interconnected system, which constitutes 80% of the country's power market. The return on the Project is at least 16%.

COLOMBIA

EMPRESAS PUBLICAS DE MEDELLIN

APPRAISAL OF THE GUATAPE II HYDROELECTRIC PROJECT

I. INTRODUCTION

1.01 The Colombian Government has requested Bank financing for a project comprising the second stage of the Guatape hydroelectric plant, involving an installation of 280 MW, and associated transmission and distribution facilities. The cost of the Project is estimated at US$98.2 million equivalent excluding interest during construction. A Bank loan of US$56 million is proposed, to be made to Empresas Publicas de Medellin (EPM).

1.02 The Bank has been active in the Colombian power sector for some 20 years. The proposed loan would be its eighteenth loan to the power sector and its fourth to EPM. The previous loans to EPM -- US$12 million in 1959, US$22 million in 1961 and US$39 million in 1964 (extended in 1967 to cover additional works) -- helped finance hydroelectric plants with an aggregate capacity of 531 MW, or 72% of EPM's present installed capacity. All of these facilities are operating satisfactorily.

1.03 The Bank fostered the establishment of the central interconnected system in Colombia by two loans to Interconexion Electrica S.A. (ISA), a company created in 1967 for the purpose of building and administering the interconnected system. A 220-kV transmission system now interconnects the systems serving the cities of Bogota, Cali, Manizales and Medellin -- EPM's area of operations. The Project would operate as part of the interconnected system.

1.04 This report was prepared by Messrs. E. Friedmann and K. Stichenwirth and is based on the findings of missions to Colombia in December 1971 and March 1972.

II. THE POWER SECTOR

Economic Background

2.01 Colombia has a population of 22.3 million, which is growing at 3.2% per year and is almost entirely concentrated in the more highly developed regions -- Costa Atlantica (northern) and Andina (central and western). In 1970 some 56% of the population was urban compared with 40% in 1951. The GDP has been growing rapidly, averaging 6.4% in the 1968-70 period, with manufacturing increasing by 7-8% per year. In 1970 the GDP per capita was about US$325. Despite inflation, which has been a chronic problem (averaging 11% per year during the past decade), the outlook for the economy continues to be good, with estimated rates of growth approaching 7% per year by the mid-1970s.

2.02 The country is well-endowed with energy resources. Coal reserves, estimated at 18 billion tons, are the largest in South America. Oil reserves, of possibly 3 billion barrels, rank Colombia third on the continent after Venezuela and Ecuador. Hydroelectric potential is estimated at 60,000 MW, of which only about 3% is utilized. Hydroelectric generation (76%) is predominant in the central region (Bogota-Medellin-Cali-Manizales), while thermoelectric generation (24%) utilizing coal, oil and gas is concentrated in the northern region.

The Sector

2.03 Over the past 20 years, power demand in Colombia has grown at the relatively high average rate of 11% per year. Installed capacity per capita, however, is still only 103 watts, which is less than in most Latin American countries. Only about 45% of the population enjoys uninterrupted electricity supply; about 30% has no supply at all, and the remaining 25% is supplied part time. The national development plan aims to provide at least 95% of the population with electricity supply by 1980 (see Annex 7).

Organization of the Sector

2.04 Electricity in Colombia is generally supplied by public corporations owned by the central, departmental or municipal governments. Captive industrial plant accounts for about 10% of installed capacity. Since 1967 significant progress toward national integration of supply has taken place. The main areas of service are the Central region, which became interconnected in 1972 (see Map IBRD-3948); the Northeast, which will become part of the interconnected in system in 1974; and the Atlantic Coast region, planned for interconnection to the rest of the country in the late 1970s.

2.05 Four utilities supply 95% of the public electricity: Empresas Publicas de Medellin (EPM), Empresa de Energia Electrica de Bogota (EEEB), Instituto Colombiano de Energia Electrica (ICEL), and Corporacion Autonoma Regional del Cauca (CVC). Public power generation was as follows in 1970 (in GWh):

	EPM	EEEB	ICEL	CVC	Others	Total	%
Hydro	1,965	2,122	990	564	281	5,922	76
Steam	-	149	746	238	-	1,133	14
Diesel	-	-	210	8	83	301	4
Gas Turbines	-	-	482	-	-	482	6
Total	1,965	2,271	2,428	810	364	7,838	100
%	25%	29%	31%	10%	5%	100%	

Public sector supply came from the following sources in 1970:

	%	GWh
Hydro	76	5,922
Natural Gas	10	772
Coal	7	556
Oil	7	588
Total	100	7,838

Sector Finance

2.06 Annual investment in the power sector has been consistently around 15% of total public investment. About 52% of this expenditure on power has been in foreign currency, of which the Bank provided some 73% during 1950-1970. In recent power loans, Bank financing has been supplemented by joint or parallel financing of equipment for the projects.

2.07 Raising sufficient funds for the local currency cost of power projects has been a problem at times, as the normal complements to internal cash generation have been limited. There is only a limited domestic capital market and Government policy is to confine its financing for power to projects which have a low financial return (such as slum-area and rural electrification) but important economic and social benefits. The proposed Project would represent a new departure in domestic capital mobilization: it is planned to finance a substantial part of the local cost by loans from local banks and a domestic bond issue.

Sector Planning

2.08 While Bank support of Interconexion Electrica S.A. (ISA) has helped provide considerable rationalization of the planning process, overall coordination of sector planning is still limited and there is no national power development planning. A national power development plan properly coordinated with Colombia's overall development objectives and with a national energy policy is needed to ensure that the limited financial resources available to the sector are applied to the most needed projects. Such a plan, which should be reviewed annually, would include a generation and transmission program on the basis of which the construction of major facilities would be authorized, and would serve as a guide for investments in urban and rural distribution systems. A start on this has been made with funds under ISA's first Bank loan (575-CO), with which it is carrying out a number of river basin and feasibility studies

for new hydroelectric plants. A broad national plan would suggest institutional reorganization and reforms to increase planning and operational efficiency and would help to improve the coordination of foreign lending to the sector. Consequently, the Government has agreed during negotiations to establish during 1973 a national power development plan along the above lines and the Bank will be given the opportunity to comment on it and on later revisions before they are made final.

Tariffs

2.09 In 1969 the Junta Nacional de Tarifas was set up as part of the National Planning Office to have jurisdiction over tariffs and, by this means, help direct national savings toward development. The utilities submit tariff applications to this agency, which has full authority to act on them. Current policy is that tariffs should be adequate to cover all of the particular utility's operating expenses, including debt service, and generate enough funds to cover a substantial part of its expansion program; tariffs should cover fully the cost of service to different categories of consumers except for low-income residential consumers, for whom a subsidized price is provided.

2.10 The application of this policy has been uneven. Since the Junta's establishment, Bank borrowers generally have received adequate tariff adjustments. Other utilities, however, for political reasons, have not always applied for tariff adjustments and have therefore not received them. The Junta has no legal power to establish new tariffs by itself; it is only when these utilities request Government budgetary support that the National Planning Office can press them to make adequate tariff adjustments.

III. THE BORROWER

3.01 Empresas Publicas de Medellin (EPM), created in 1955 from municipal departments, is one of the best organized and administered public utility enterprises in Colombia. The Bank was instrumental in establishing it as an autonomous public entity responsible for providing Medellin and some of the surrounding areas with electricity, water, sewerage and telephone services, thus minimizing political influence and ensuring independent management.

Organization and Management

3.02 EPM has a nine-member Board of Directors consisting of: the Mayor of Medellin, who serves as ex-officio Chairman; a representative of the Government of Antioquia, the Department in which Medellin is located; the Chief of the Municipal Planning Office; and six members elected by the Municipal Council, three from among the Council members and the other three from business, the professions and labor unions. With the exception of the Mayor, the directors serve for two years; they cannot be reelected more than once. Previous loan agreements with EPM contain an undertaking which requires consultation with the Bank before any amendments to either EPM's statutes or the legislation affecting them are proposed; this has been retained in the proposed loan.

3.03 The Board appoints a general manager who is the company's chief executive officer. EPM's internal structure is organized along functional lines so as to charge each manager, in his respective professional field, with the responsibilities arising from all sectors combined in the enterprise, i.e. power, water, sewerage and telephone (see Annex 1A). EPM's accounts, however, are kept separately by sector, thus providing a precise breakdown of assets and liabilities on the one hand, and expenses and revenues on the other hand. The quality of management is satisfactory. Recent appointees to positions that were vacant because of retirements are well qualified. Political events of the last 2-3 years seem to have hampered the ability of the Board of EPM to appoint the General Manager. Three persons have held this position since July 1970, and at present only an Acting General Manager is in charge. To ensure continued efficient management, and because the statutes are silent in this respect, EPM agreed during negotiations that only persons with appropriate qualifications will be appointed to managerial positions and that the Bank will be consulted in advance with respect to the nominees for the post of General Manager.

3.04 EPM employs a total staff of about 3,300, out of which 870 are directly concerned with the operations of the power department. In addition, about 500 employees of the general services group which serves all the sectors, have to be allocated to power thus raising the total work force engaged in electricity supply to about 1,370 (about 2 per MW installed), which is reasonable considering the scope of the department's activities - generation, transmission and distribution - and compares favorably to similar companies in Colombia and elsewhere. Some training in the field of distribution techniques is required (para. 4.07). For further reference on EPM's activities other than power see Annex 1B.

EPM's Facilities

3.05 EPM distributes energy in the city of Medellin and, in addition, sells power in bulk to Electrificadora de Antioquia, a governmental agency in charge of distribution to other urban and rural areas within the Department of Antioquia. This service area has a total population of some 1.5 million.

3.06 EPM's installed capacity in 1971 was 727 MW and is entirely hydroelectric. As one of the owners and shareholders of ISA, EPM is entitled to a share of the output of ISA's generating capacity; when Chivor, ISA's first plant, is completed in 1976, EPM's share will be about 16%, or 80 MW. Details of EPM's transmission and distribution networks, which serve about 190,000 customers in both urban and rural areas, are in Annex 2.

3.07 The distribution system for Medellin has as its backbone a 110-kV ring. Sub-transmission and distribution lines are generally overhead, except in the high-density center of the city, where underground cables are used. EPM builds the primary feeders for the distribution system, but in new urban areas the building developers install the distribution transformers and secondary feeders, which are then turned over to EPM and become its property 1/. EPM is responsible for providing secondary distribution facilities other than those provided by developers but has not had an entirely free hand in this, for reasons explained in the next paragraph.

3.08 For some years the Government's policy of discouraging rural migration to urban areas was implemented in part by limiting public service, including power supply, to urban "squatter areas" resulting from such migration. Under this policy, EPM was not permitted to provide service to nearby areas. In 1969 the Government changed this policy, and a substantial portion of the proposed distribution expansion included in the Project is for improving electricity supply in such areas.

Electricity Sales

3.09 Sales have been increasing in recent years by some 12% annually, to reach maximum demand of 422 MW in 1971. Losses from theft and illegal connections have been a serious problem in recent years, increasing from about 14% in 1960 to 28% in 1968. A major reason for the increase was the considerable theft of electricity in squatter areas up to 1969, largely due to the lack of service which encouraged the inhabitants to make illegal connections to nearby secondary power circuits. In 1969, regular service to such areas was begun and in 1971, with a concurrent meter control program, losses were reduced to 22%. They are expected to decrease steadily hereafter, by some 2% per year until reaching the 12-14% level which would be normal for the EPM system size and the nature of its market.

Tariffs

3.10 EPM's tariffs (see Annex 13) are the lowest in Colombia because of the favorable hydroelectric resources available to the company. On average, the tariffs amount to US¢1 per kWh. Availability of power at reasonable cost has been an important factor in Medellin's industrial development.

1/ EPM acquires these facilities at no cost and they are shown in its books at nominal value.

3.11 The structure of EPM's tariffs is generally adequate. Charges for industrial consumption are substantially lower than for residential and commercial, and low-income residents enjoy a subsidized tariff (para. 2.09). Large industrial customers are charged separately for day and night-time energy and for peak demand. In the past, tariffs have increased an average of 10% annually to maintain their real value in the face of rising prices.

Accounting, Billing and Collection

3.12 Most of EPM's accounting is computerized. The staff is well qualified and efficient. Collections are prompt as consumers are surcharged 5% if bills are not paid within 10 days.

IV. THE PROJECT

Description of the Project

4.01 The Project (see Annex 6) would consist of:

(i) construction of the 280 MW second stage of the Guatape hydroelectric power station, involving the heightening of the Santa Rita dam and duplication of most of the civil and electromechanical features of the first stage (see Annex 6/Map No. 6742);

(ii) a 230-kV power transmission line from Guatape to load centers and associated sub-stations; and

(iii) expansion of the distribution system in EPM's service area.

4.02 The existing Santa Rita Dam is a small structure, 27 m high, which impounds a headpond permitting only run-of-river operation as the 70 million m^3 storage capacity is very small. The enlarged earth and rock-filled dam would be 26 m higher, with a size of over 3 million m^3. The water storage capacity provided by the enlarged dam would be 1,240 million m^3, providing an additional reliable peaking capability of 280 MW and an energy storage of 3,000 GWh, equivalent to the average yearly production of the site. This energy would be available to supplement the interconnected system's energy production during poor hydrological years. The present intake towers, headrace and tailrace tunnels, underground penstock, and underground power station of Stage I would be duplicated.

4.03 A 230-kV line from the Guatape station to the Miraflores substation in Medellin is proposed. But an alternative which would link Guatape with the Barbosa substation and Guadalupe power station is under study. Costs would not change significantly if the second alternative is chosen.

4.04 The distribution expansion includes additional bays and transformer capacity for about 240 MVA at the 10 main substations of the 110 kV ring. In addition, the underground network for the central part of Medellin, which is overloaded due to the increase in high-rise building construction, would be substantially increased; about one-third of the distribution facilities being provided would be for the squatter reclamation areas.

Engineering

4.05 Hydroelectric development of the Nare River was first studied in the early 1960s by Edison S.P.A. (Italy) and Integral Ltd. (Colombia). The latter, in association with Harza Engineering (USA), designed and supervised the first stage. Its design included all the main elements of the second stage now proposed, including the heightening of the Santa Rita dam.

4.06 EPM has retained Integral, a firm with considerable experience in designing and building hydroelectric projects in Colombia, as its main consultant for the second stage. Foreign specialists will assist Integral in reviewing seismic design and ecological aspects of the Project. The firm will also be assisted by foreign consultants in procurement and supervision of electro-mechanical installation. During negotiations, EPM agreed

to retain consultants acceptable to the Bank to assist in design, preparation and evaluation of bids, and supervision of construction.

4.07 The distribution facilities proposed under the Project were planned by EPM's engineers after detailed analysis of load growth and network studies. EPM's plans for further development of sub-transmission and distribution facilities call for increased personnel training; the proposed loan therefore includes US$100,000 to train EPM staff abroad in the planning, design, and maintenance techniques of distribution systems. The training program will be submitted to the Bank for approval.

Cost Estimates

4.08 The estimated cost of the Project is summarized in the following table:

	(Million Col$)			(Million US$)		
	Local	Foreign	Total	Local	Foreign	Total
A. Generation						
Civil Engineering Works						
Santa Rita Dam	130.1	181.3	311.4	6.1	8.5	14.6
Guatape II Power Station	167.7	265.3	433.0	7.8	12.4	20.2
Miscellaneous 1/	227.2	-	227.2	10.7	-	10.7
Electrical and Mechanical Equipment						
Turbines and Generators	12.6	145.2	157.8	0.6	6.8	7.4
Other	17.7	100.9	118.6	0.8	4.7	5.5
Engineering	77.5	3.4	80.9	3.6	0.2	3.8
Contingencies - Physical	86.2	64.6	150.8	4.0	3.0	7.0
- Price	152.1	79.8	231.9	7.1	3.7	10.8
Sub-total, Generation	871.1	840.5	1,711.6	40.7	39.3	80.0
B. Transmission						
Transmission Line	8.0	27.9	35.9	0.4	1.3	1.7
Sub-station	1.3	28.4	29.7	-	1.3	1.3
Contingencies - Physical	0.7	3.9	4.6	-	0.2	0.2
- Price	3.9	7.7	11.6	0.2	0.4	0.6
Sub-total, Transmission	13.9	67.9	81.8	0.6	3.2	3.8
C. Distribution						
Equipment	124.5	117.6	242.1	5.8	5.5	11.3
Training	-	2.1	2.1	-	0.1	0.1
Contingencies - Physical	8.7	8.3	17.0	0.4	0.4	0.8
- Price	34.4	13.4	47.8	1.6	0.6	2.2
Sub-total, Distribution	167.6	141.4	309.0	7.8	6.6	14.4
TOTAL PROJECT COST	1,052.6	1,049.8	2,102.4	49.1	49.1	98.2
D. Interest During Construction on Bank Loan	-	233.5	233.5	-	10.9	10.9

1/ Roads, relocation of El Penol village, rim treatment of reservoir, land acquisition.

4.09 The cost estimates, which were prepared in detail by the consultants early in 1971, were revised in January 1972 to reflect subsequent local inflation and devaluation of the peso and the U.S. dollar. Physical contingencies to provide for uncertainties during construction of the various items of the Project are based on the considerable experience gained during the construction of the first stage (see Annex 6). The following values were adopted: 20% for the Santa Rita Dam and miscellaneous civil engineering works; 7% for the power station civil works and tunnels; 4% for the foreign costs and 10% for the local costs of electro-mechanical plant; and 7% for transmission and distribution. Contingencies to cover price escalation were based on an assumed annual increase of 4% in foreign costs and 10% for local costs, in line with recent and currently expected trends. Overall, physical contingencies amount to US$8.0 million and price contingencies to US$13.6 million, representing 10% and 17% of direct costs, respectively. This should be adequate.

Unit Cost

4.10 The cost per kilowatt installed of the Guatape II plant would be US$299. The cost of the first 280 MW stage, completed in early 1972, was US$220/kW. The average unit cost for both stages would be about US$260/kW, which is attractive for this type of project.

Amount of the Proposed Loan

4.11 The proposed loan covering 46% of the Project cost, plus interest during construction, would finance the following items:

			US$ Million Equivalent
(i)	62% of the total cost of main civil works contracts -		$27.5
	consisting of: direct foreign exchange cost	$20.9	
	contingencies on foreign exchange cost	4.4	
	local currency cost	2.2	
(ii)	Foreign costs of electromechanical equipment, excluding turbines and generators -		5.5
	consisting of: direct foreign exchange cost	4.7	
	contingencies of foreign exchange cost	0.8	
(iii)	Foreign costs of transmission line and substation materials and equipment -		3.2
(iv)	Foreign costs of distribution and equipment and training -		6.6
(v)	50% of total cost of engineering -		2.3
	consisting of: foreign exchange	0.2	
	local currency	1.8	
	contingencies	0.3	
(vi)	Interest on the Bank loan during construction period -		10.9
			$56.0

With the exception of US$4.3 million for local currency expenditures (US$2.1 million for engineering services and US$2.2 million for civil works), the loan would cover only foreign cost of the Project. The only items involving foreign exchange not included in the Bank loan would be the turbines and generators for which suppliers' credits are envisaged (para. 6.11). Suppliers' credits, however, finance neither the down payments (15%) required at the time of award of a contract nor interest during construction and this foreign exchange therefore (US$2.2 million) will have to be provided by EPM.

Procurement

4.12 Two large civil engineering contracts which will attract international bidding, are contemplated, one of about US$20 million for the intake towers, tunnels, and cavern of the power station and the other of about US$14 million for the heightening of the Santa Rita Dam. The latter would be started about one year earlier than the former in order to fill the reservoir by 1977 when the project is to commence operations. Tenders for the dam contract were opened on October 24, 1972, and are being evaluated by EPM. The contract will not be signed until after the Bank loan is made. Minor civil engineering contracts for roads, town relocation and reservoir rim treatment would not be financed by the loan and would be contracted locally.

4.13 The equipment to be financed by the loan is not manufactured in Colombia and will be procured through international competitive bidding. EPM intends to reserve for local suppliers certain distribution equipment (13.2 kV and below) which is manufactured in Colombia; this equipment would not be eligible for Bank financing. The need for granting preference to Colombian manufacturers does not seem to arise. However, in order to accommodate local industry should it become competitive in the future,[1/] the loan documents, at the request of the Government, provide a preference for domestic suppliers in bid comparisons of the applicable customs duties or 15% of the c.i.f. price, whichever is smaller. Though Colombia as a member of the Latin American Free Trade Association (LAFTA) belongs to a trading bloc granting tariff preferences, the fact that EPM is exempt from import duties eliminates this factor from bid evaluation.

Disbursements

4.14 Disbursements for the two civil work contracts would be made against 62% of the amount billed in the contractors' periodic invoices provided that this 62% of the cost does not exceed the estimated US$27.5 million (para. 4.11). If the 62% of the cost of these contracts were to exceed US$27.5 million, this percentage would be reduced to insure that no more than US$27.5 million be disbursed and that these payments are made over the whole period of execution of the contracts.

4.15 Disbursements for equipment and training would be made only against the foreign exchange costs. For engineering consulting costs, disbursement would be made against 50% of expenditure as in earlier power loans in Colombia. No disbursements would be made for expenditures incurred prior to signing of the loan. The estimated schedule of disbursements is given in Annex 8. Any

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1/ A possible case is the supply of some transmission structures.

loan funds remaining undisbursed upon completion of the Project would be cancelled, unless their disbursement on other works associated with the Project were considered appropriate.

Ecological Aspects

4.16 The heightening of the Santa Rita Dam will flood the small town of El Penol, which has a population of 3,000. EPM and the Municipality of El Penol have already agreed that EPM will compensate and relocate those displaced and will ensure that their standard of living and means of livelihood will not be impaired (see Annex 12).

4.17 A reconnaissance of the ecological aspects of the Project, including a field visit and evaluation of reports relevant to this problem was carried out by a foreign consultant in 1972. No adverse consequences were identified. A number of suggestions were made to preclude problems which might arise if the riparian lands around the reservoir are not adequately protected from undue agricultural or forestry exploitation. A program is also proposed to encourage the multi-purpose utilization of the reservoir for tourism, sports and fishing. EPM has written to the Bank giving assurances that it will take adequate steps to implement the consultant's recommendations (see Annex 12).

V. JUSTIFICATION OF THE PROJECT

5.01 The primary purpose of the Project is to help meet the growing demand for electricity for Colombian industry, commerce and households already connected to the Central interconnected system, but it will also provide for connecting new consumers in and near Medellin who do not now have access to electricity.

Demand

5.02 Although Guatape II will primarily serve the EPM market, the need for the Project is based on the requirements of the power market of the entire interconnected system, representing about 80% of the country's consumption. The 1972-78 forecast of system demand, which was prepared by ISA's partners and reviewed by the Government Planning Office, is based mainly on a review of the historical trends and the economic outlook in each sub-system -- Bogota, Medellin, Cali, Manizales and the Northeast. Average rates of growth have been remarkably stable in these five sub-systems. The individual annual growth rates adopted were: EPM 8.7%; EEEB 12.9%, decreasing to 10%; CVC 9.4%; ICEL/CHEC 7.8%; and the Northeast 10.2%, decreasing to 8%. On this basis the overall growth rate for the interconnected system was forecast at 9.5%, which is reasonable in the light of the 6-7% growth expected in GDP.

5.03 EPM's sales forecast is based on an analysis of past consumption trends, for which there are statistics since 1936, and on an evaluation of prospective industrial activities, urban growth and electricity distribution expansion policy. Because of the relative importance of industry in EPM's market area, its energy demand shows the effects of economic cycles. For this reason, the sales forecast reflects a 10 year perspective on the past, which includes periods of growth as low as 5% and as high as 12%. The forecast is conservative considering Colombia's presently favorable economic outlook. The expected average growth of 8.7% per year comprises industrial growth at 9.8%, residential growth decreasing from 11.5% in 1972 to 6.2% in 1978, and commercial growth at 8.6%. These rates have been applied to each type of consumer considering that industrial, residential, commercial and others are 31%, 50%, 8% and 11% respectively of EPM's sales.

Power Supply

5.04 Annexes 4A-4B show projected peak demand and energy consumption in the interconnected region, with the installed capacity and energy available from the system during dry hydrological years. The reserve capacity provided for is about 15%, a security standard adequate in the Colombian interconnected system.

Alternatives

5.05 ISA studied the least-cost expansion program for the interconnected system after 1975, i.e., after commissioning of the power plants presently under construction. Only projects for which firm engineering

data had been developed could be considered as alternatives. These were Guatape II (280 MW), Chivor II (500 MW), Samana I (572 MW), Mesitas I (515 MW) and a thermal power project. Since all these projects are needed for the period up to 1985, the various permutations in the scheduling of the projects were compared and the sensitivity of the choice to various parameters was analyzed. Comparisons were made with discount rates varying between 8% and 12%, exchange rates varying from US$1 = Col$20 to Col$30, and fuel costs varying between the present price of Col$90 per ton and the Col$108 per ton expected in due course. The sequences of plant construction which scheduled Guatape II as the next generation station were the least-cost solutions within the whole range of variations of the above-mentioned parameters.

Return on Investment

5.06 The return on the Project is estimated to be at least 16% (see Annex 5). In this calculation, the stream of costs includes capital and operating costs, exclusive of all duties, taxes and depreciation. Shadow pricing was not considered necessary for foreign exchange or local labor costs. The stream of benefits consists of the increase in revenues from sales attributable to the Project. The only alternative to the proposed project would imply a decision to avoid meeting the forecast increase in demand, thereby reducing system reliability and affecting adversely economic activity in the entire interconnected system service area.

VI. FINANCIAL ASPECTS

6.01 Bank lending to EPM has been confined exclusively to the Power Department; 90% of the department's borrowing has come from the Bank (para. 6.04). Foreign currency loans to the other departments included IDB-loans totalling US$41 million for the water department and about US$3 million suppliers' credits for the telephone department.

6.02 The consolidated financial situation of EPM as well as that of each of its various Departments (Power, Water and Sewerage, Telephones) has been thoroughly investigated and found satisfactory. Since EPM's accounts are kept strictly separated (para. 3.03), a detailed financial analysis has been made only for the power department; however, the financial implications of the other departments on EPM's situation as a whole or on the Power Department have been investigated and, where necessary, appropriate covenants were agreed on (paras. 6.05, 6.06 and 6.21). Unless otherwise indicated, the following paragraphs deal only with the Power Department. For a brief description of EPM's other Departments see Annex 1B.

Finances, Past and Present

6.03 Management of the Power Department of EPM has been prudent and efficient. Internal cash generation, traditionally the main source of local-currency finance, has contributed on average about 45% of investment in the past few years. This was made possible by substantial tariff increases of 60% in 1963, 39% in 1966 and 37% in 1968, which enabled the level of tariffs to be maintained in real terms in the face of inflation and achieved rates of return of 13%-16% on revalued net fixed assets in operation. More recently, the rate of return has been lower; in 1972 it will be about 9%, the level generally aimed at by the larger utilities in Colombia.

6.04 Local borrowings have had only a secondary role in EPM financing, and accounted for about 6% of the total debt outstanding in 1971. Foreign borrowing consisted almost exclusively of the three Bank loans. Capitalization, after taking into account revaluation of assets (para. 6.13) as of December 31, 1971 was as follows:

	Col$ Million	%
Equity		
Initial Equity Capital and Retained Earnings	896.0	27
Revaluation Reserve	946.6	29
	1,842.6	56
Long-Term Debt		
IBRD Loans	1,320.8	40
Municipal External Debt	29.1	1
Local Loans	86.6	3
	1,436.5	44
Total Capitalization	3,279.1	100

Apart from the revaluation reserve, equity consists of the initial capital, representing the net value of assets transferred to EPM during the period 1955-59, and retained earnings. The Bank loans were made during 1959-64 and are for periods of 25-35 years at interest rates of 5.5% to 6%. Terms of the other outstanding debt are shown in Annex 11.

Inter-Departmental Borrowing

6.05 Due to an insufficient departmental cash situation in the Water and Sewerage Departments, which had not been experienced before, the Power Department's 1969 cash surplus (about Col$14 million) was loaned to these departments. Further borrowing increased this debt to Col$ 51.4 million by the end of 1971. EPM agreed during negotiations to arrangements for repayment of these funds to the Power Department. A financing plan, satisfactory to the Bank, providing for payments of Col$ 5 million in 1973, Col$ 26.4 million in 1974 and Col$ 20 million in 1975 has been submitted. Furthermore, EPM agreed not to make in future loans from the Power Department to other departments for terms longer than six months; the aggregate outstanding amount of such loans will not exceed the total of revenues earned from the sale of electricity during the month preceding the date of such transfer.

6.06 The proposed loan retains the covenant in Loan 369-CO which stipulates that each operating department, other than the Power Department, will set tariffs to yield revenues sufficient to cover all expenses including interest and depreciation and debt service in excess of depreciation, and leave a reasonable surplus to finance new investment. The above covenant should be sufficient to enable the Bank to ask EPM for corrective measures in other than the Power Department should they become necessary. (See para. 6.14 for power covenant.)

Financing Plan

6.07 EPM's financing plan for the power department is, in general based on the proposed Bank loan and suppliers' credits for financing the foreign exchange requirements, and on internal cash generation and local borrowing to cover the local component.

6.08 Annex 10 shows in detail EPM's financing plan for the Power Department for 1972 through 1978. A condensed version covering the project construction period, 1972-77, is given below:

Condensed Financing Plan
Project Construction Period
1972 - 1977

SOURCES	Col$ Million	Equivalent US$ Million	%
Internal			
Internal Cash Generation	2,457.9	114.9	-
Less: Debt Service	1,291.7	60.4	-
Net Internal Cash Generation	1,166.2	54.5	41.1
External			
Borrowings			
Proposed Bank Loan	1,198.4	56.0	42.2
Drawdown Loan 369-CO	47.5	2.2	1.7
Suppliers' Credits	143.3	6.7	5.1
Medium-Term Loans (1973-75)	175.0	8.2	6.2
Overdraft 1972	20.0	0.9	0.7
Total Borrowings	1,584.2	74.0	55.9
Reimbursement Samana Studies	15.4	0.7	0.5
Dividends Received from ISA	19.6	0.9	0.7
Repayments of Internal Loans	51.4	2.4	1.8
TOTAL SOURCES	2,836.8	132.5	100.0
APPLICATIONS			
Construction Expenditures (Excl. Interest During Construction)	2,264.7	105.8	79.8
Investments in ISA	482.2	22.5	17.0
Increase in Working Capital and Cash	90.0	4.2	3.2
TOTAL APPLICATIONS	2,836.9	132.5	100.0

6.09 The Project represents $98.2 million out of the total $105.8 million of construction expenditures (excl. interest during construction) planned for the period 1972-1977. The balance corresponds to other expansions which will be started at the end of this period.

6.10 Net internal cash generation is expected to finance about 41% of the planned investment and increase in working capital, on the basis of tariff increases of 25% in 1973 and 20% in 1976 (para. 6.17).

6.11 Suppliers' credits, amounting to US$6.7 million for a term of 12 years at 7.5% interest, are expected to cover the cost of the turbines and generators except for the 15% down payment. As manufacturing firms have expressed interest in financing this equipment, EPM should be able to obtain such credits without difficulty.

6.12 The additional funds to finance the local expenditure on the Project during 1973-75, amounting to about Col$ 175 million or approximately 6% of the financing plan, would be obtained as follows:

	Col$ Million	Year
IDEA Loan	25.0	1973-74
EPM Bond Issue	50.0	1973-74
Loan from Local Bank Consortium	100.0	1974
Total	175.0	

The loan from IDEA (Economic Development Institute of Antioquia, a development bank) would be at 14% interest for a four-year term, the loan from the Local Bank Consortium (three banks) at 15% interest for a seven-year term, and the EPM bonds at 12% interest for a ten-year term. Evidence of authorization for these transactions on the part of the Government has been received by the Bank as well as the necessary commitments by IDEA and the bank consortium. The bonds will be used mainly to buy from large landowners some of the land required by the Project.

Return on Assets

6.13 It was not until 1967 that Colombian law permitted companies to revalue foreign debts and assets. Prior to this, EPM assets which were all stated at historical cost were undervalued because of the depreciating local value of the Peso and the corresponding, if not always timely, change in the external value of the Peso. Under earlier Bank loans, therefore, tariff covenants were based on a contribution-to-investment rather than a rate-of-return concept. In recent years, however, a flexible exchange rate policy and the establishment of a realistic local cost index have made it possible to establish in Colombia a procedure for revaluation of assets which is satisfactory to the Bank. It should be noted that the Borrower's accounting practices do not include all of the above revaluation procedures and therefore their official financial statements would not be identical with those prepared for Bank use.

6.14 As a consequence, the most recent Bank power loans to Colombia (EEEB and ISA) have contained conventional rate-of-return tariff covenants, stipulating a minimum 9% rate of return on revalued average net fixed assets in operation. This percentage has proven to be adequate for generating sufficient internal funds in companies of the power sector and has also been adopted by the Colombian Government as a yardstick for measuring the adequacy of power tariffs. During negotiations, EPM agreed to a similar covenant for the Power Department. The present contribution-to-investment covenants in prior Bank loans have been rescinded accordingly.

6.15 For determining the rate base and operating income under the new covenant, depreciation would be calculated by the straight-line method, and rates would be based on the useful lives of assets but with an average of not less than 2.5% for hydroelectric plant and 4% for thermal-electric plant. As in earlier power loans in Colombia, a review will be made by EPM every three months of the adequacy of tariffs to meet the rate of return target. Investments in ISA and the revenues received from them (dividends or interest on ISA shares or bonds) need not be included in these rate-of-return calculations since ISA's statutes provide, through such revenues, for an adequate return on the investments (presently 9%).

Future Finances

6.16 EPM's Power Department financial prospect is satisfactory (Annexes 9-11). The forecast of the cost of operations includes increases of 11% per year, based on EPM's past experience, as follows: the labor force is assumed to grow about 3% per year commensurate with the needs of the expanding power system, and wages to increase about 8% per year to provide for a rising cost of living and other higher costs. The cost of material is assumed to increase 11% annually, reflecting past experience and some expansion in the scope of maintenance work.

6.17 Forecast revenues are based on tariff increases of 25% in 1973, 20% in 1976 and 10% in 1978. Authorization is now being sought by EPM for the first increase, which would compensate for the impact of inflation in recent years and enable a rate of return of 9% to be achieved through 1975. The increases projected for 1976 and 1978 are intended to maintain the rate of return at this level.

6.18 The debt/equity ratio (after asset revaluation) was 44/56 at the end of 1971; it is expected to reach about 49/51 in 1975 and subsequently decrease to about 41/59. The capital structure reflects the favorable earning level and prudent borrowing policy of the Borrower and is very satisfactory.

6.19 As shown in the Forecast Sources and Applications of Funds Statement (Annex 10), on an annual basis debt service coverage by internal sources is expected to vary between 1.7 and 2.3, which is satisfactory. During negotiations EPM agreed to replace the 60/40 debt/equity covenant of the previous Bank loan with a debt service coverage test whereby EPM will not incur debt on behalf of the Power Department without the Bank's approval unless its most recent 12-month internal cash generation from power assets is at least 1.4 times the maximum debt service requirement for any succeeding fiscal year.

Audit

6.20 The financial statements of EPM have been audited for a number of years by Deloitte, Haskins and Sells. These arrangements have been satisfactory. To ensure that adequate auditing continues, the Bank standard audit covenant is included in the proposed loan agreement.

Lien Limitation

6.21 In view of EPM's multiple activities, the covenant in Loan 369-CO was repeated which stipulates that none of EPM's operating departments, other than the Power Department, may incur debt unless the creditor explicitly waives any right to repayment from the assets or revenues of the Power Department.

VII. AGREEMENTS REACHED AND RECOMMENDATIONS

7.01 During loan negotiations, the following agreements were reached:

(a) the Government will establish during 1973 a national power development plan and the Bank will be given the opportunity to comment on it and on later revisions before they are made final (para. 2.08);

(b) the Bank will be consulted before any amendments to EPM's statutes or legislation affecting them are proposed (para. 3.02);

(c) only well-qualified persons will be appointed to managerial positions in EPM, and the Bank will be given the opportunity to comment on nominees for the post of General Manager (para. 3.03);

(d) consultants acceptable to the Bank will be retained for the design, procurement arrangements, and supervision of construction of the Project (para. 4.06);

(e) no preferential tariffs for regional suppliers will be taken into account in bid evaluation (para. 4.13);

(f) the loan from the Power Department to the Water and Sewerage Department of EPM will be repaid, and inter-departmental loans by the Power Department will not be made for terms longer than six months nor in excess of 1 month's Power Department revenues (para. 6.05);

(g) tariffs for operating departments other than the Power Department will be adjusted to provide appropriate revenues (para. 6.06);

(h) electricity tariffs will be set to produce a minimum 9% rate of return on the Power Department's average revalued net fixed assets in operation (para. 6.14 and 6.15);

(i) no debt will be incurred by the Power Department without the Bank's concurrence, unless its maximum future debt service is covered at least 1.4 times by historical cash generation (para. 6.19);

(j) EPM will have its books audited by independent auditors acceptable to the Bank (para. 6.20); and

(k) no debt will be incurred by EPM's operating departments, other than the Power Department, unless the creditor explicitly waives any right to repayment from assets or revenues of the Power Department (para. 6.21).

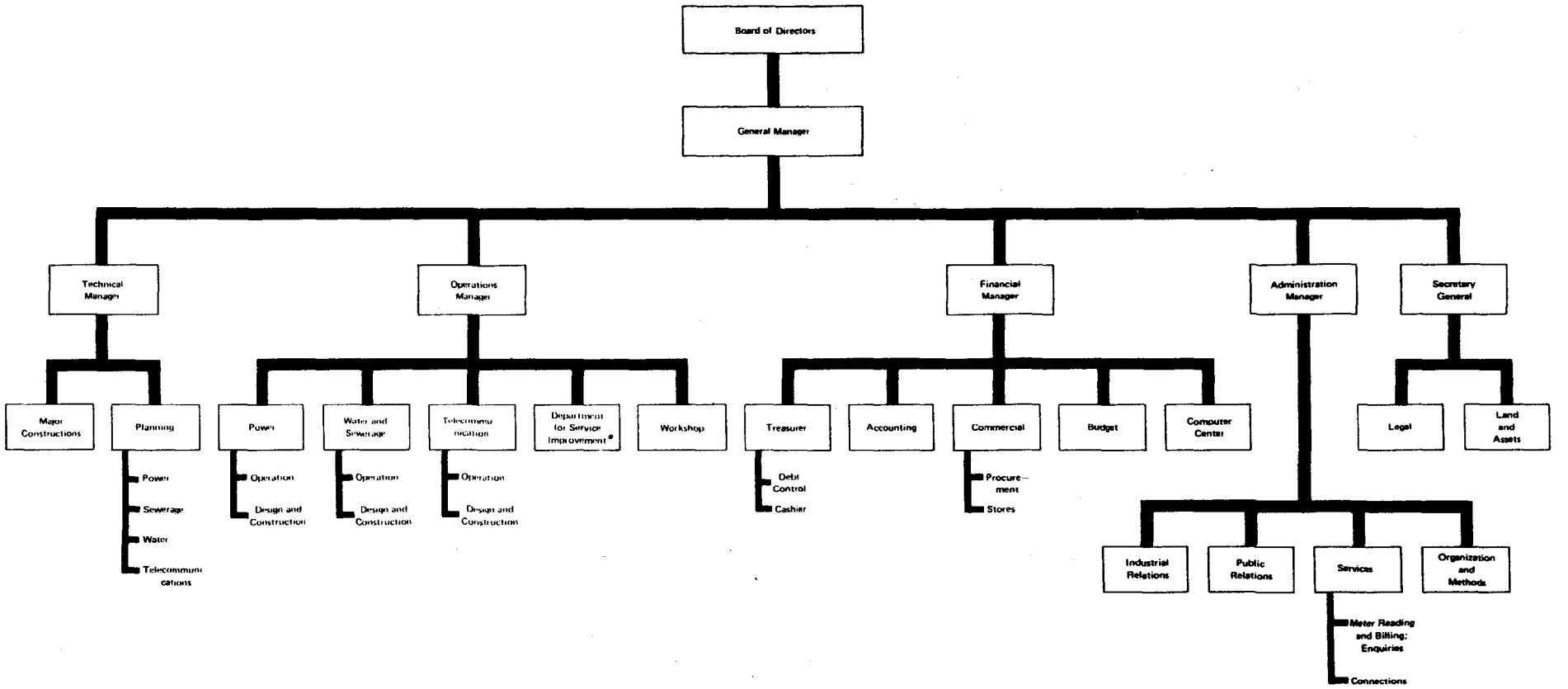
7.02 With the above agreements reached, the Project is suitable for a Bank loan of US$56 million equivalent, for a term of 25 years including a grace period of five years.

December 19, 1972

COLOMBIA

EMPRESAS PUBLICAS DE MEDELLIN (EPM)

ORGANIZATION CHART



* A special department created to plan and improve public utility service to slum areas.

World Bank – 6713

ANNEX 1A

Water, Sewerage and Telephone Departments

Water and Sewerage Departments

1. As of December 1971, the Water Supply Department had 126,500 consumers (up 6%) with a total consumption of 82 million cubic meters (up 8%). Rationing, to which the company had to resort to during the dry periods at the beginning of each year in the late 1950s and early 1960s, has no longer been necessary in the recent past.

2. The current water tariff has been in effect since 1969. Average revenues per m^3 sold reached 96 centavos. The rate of return on investment amounted to about 6.5%. During 1972, a 40% tariff increase will be implemented; this should enable EPM to strengthen the water department's internal cash position and help finance its investment program to a substantial extent.

3. EPM's sewer network was extended by about 55 km in 1971 and has reached 1,160 km by the end of that year. Sewer rates are related to water consumption, increasing sharply for consumptions above 30 cubic meters per month.

4. The Water and Sewerage Department has a direct labor force of 680 employees. In addition, about 390 employees for general services are allocated to this department.

Telephone Department

5. As of the end of December 1971 there were about 125,000 installations serving Medellin and some suburban municipalities. This number includes about 3,000 public telephones. The tariffs consist of a monthly fixed charge per line plus a charge for each call. 1971 revenues (Col$ 83.6 million) earned a rate of return on investment of about 10.5%.

June 8, 1972

COLOMBIA

Empresas Publicas de Medellin

Existing Facilities

Existing Generating Capacity

Generating Stations	River	Number of Units	Regulation	Installed Capacity - MW
Guadalupe I	Guadalupe	5	seasonal	40.0
Guadalupe II	Guadalupe	1	"	10.0
Guadalupe III	Guadalupe	6	"	270.0
Troneras	Guadalupe	2	"	36.0
Piedras Blancas	Piedras Blancas	1	daily	11.0
Rio Grande	Rio Grande	3	"	80.0
Guatape I	Nare	4	"	280.0
			Total	727.0

Average yearly energy output of these plants is 3,890 GWh, giving an average utilization of 59%.

Transmission

The transmission system consists of 128 kilometers of 220 kV circuits and 735 kilometers of 110 kV circuits. In addition, there are 160 km of 44 kV sub-transmission circuits. Substation capacity amounts to about 770 MVA.

Distribution

With the exception of the downtown area of Medellin, where an underground "network-meshed" type distribution system is installed, overhead feeders are employed. There are 1,680 km of primary feeders (13.2 kV), 43,500 km of secondary (low voltage circuit), and approximately 600 MVA of distribution transformers.

June 8, 1972

COLOMBIA

Empresas Publicas de Medellin

Actual and Forecast Energy Sales (GWh) and Peak Load (MW) 1/

I. ACTUAL

	1969			1970			1971		
	Sales (GWh)	Increase over previous year (%)	Share of total sales (%)	Sales (GWh)	Increase over previous year (%)	Share of total sales (%)	Sales (GWh)	Increase over previous year (%)	Share of total sales (%)
Industrial	414	15.6	31.1	448	8.2	29.9	518	15.6	30.7
Commercial	108	12.5	8.1	124	14.8	8.3	136	9.7	8.1
Residential	637	3.2	47.9	742	16.5	49.6	852	14.8	50.6
Others 2/	172	16.2	12.9	182	5.8	12.2	179	(1.6)	10.6
Total Sales	1,331	9.2	100.0	1,496	12.4	100.0	1,685	12.6	100.0
	MW			MW			MW		
Peak Load	350	7.0	-	371	6.0	-	422	13.7	-

II. FORECAST 1/

	1972			1973			1974			1975		
	Sales (GWh)	Increase over previous year (%)	Share of total sales (%)	Sales (GWh)	Increase over previous year (%)	Share of total sales (%)	Sales (GWh)	Increase over previous year (%)	Share of total sales (%)	Sales (GWh)	Increase over previous year (%)	Share of total sales (%)
Industrial	569	9.8	30.4	625	9.8	30.8	686	9.8	31.1	753	9.8	31.3
Commercial	148	8.8	7.9	160	8.1	7.9	174	8.8	7.9	189	8.6	7.9
Residential	950	11.5	50.8	1,017	7.1	50.0	1,087	6.9	49.2	1,160	6.7	48.3
Others	203	13.4	10.9	230	13.3	11.3	262	13.9	11.8	300	14.5	12.5
Total Sales	1,870	11.0	100.0	2,032	8.7	100.0	2,209	8.7	100.0	2,402	8.7	100.0
	MW			MW			MW			MW		
Peak Load	459	8.7	-	499	8.7	-	543	8.7	-	590	8.7	-

	1976			1977			1978		
	Sales (GWh)	Increase over previous year (%)	Share of total sales (%)	Sales (GWh)	Increase over previous year (%)	Share of total sales (%)	Sales (GWh)	Increase over previous year (%)	Share of total sales (%)
Industrial	827	9.8	31.7	908	9.8	32.0	997	9.8	32.3
Commercial	205	8.6	7.9	223	8.8	7.9	242	8.5	7.8
Residential	1,235	6.5	47.3	1,315	6.5	46.3	1,396	6.2	45.3
Others	343	14.3	13.1	392	14.3	13.8	449	14.5	14.6
Total Sales	2,610	8.7	100.0	2,838	8.7	100.0	3,084	8.7	100.0
	MW			MW			MW		
Peak Load	641	8.7	-	697	8.7	-	757	8.7	

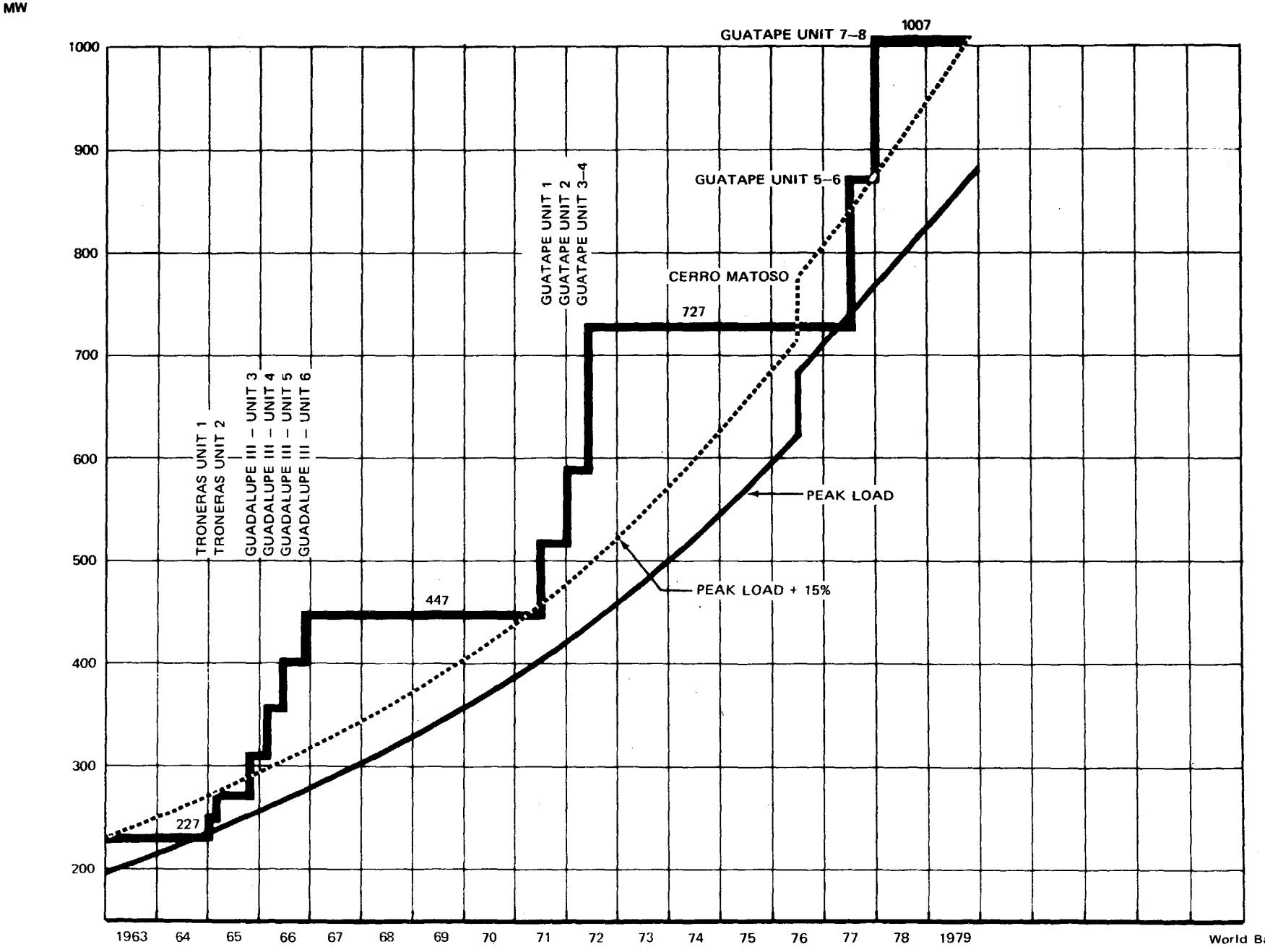
1/ Forecast for EPM's service area, excluding the Cerro Matoso ferro-nickel project load and interchanges with ISA.
2/ Bulk supply to adjacent municipalities and Medellin street lighting.

June 12, 1972

ANNEX 3A

EMPRESAS PUBLICAS DE MEDELLIN

PEAK DEMAND AND INSTALLED CAPACITY

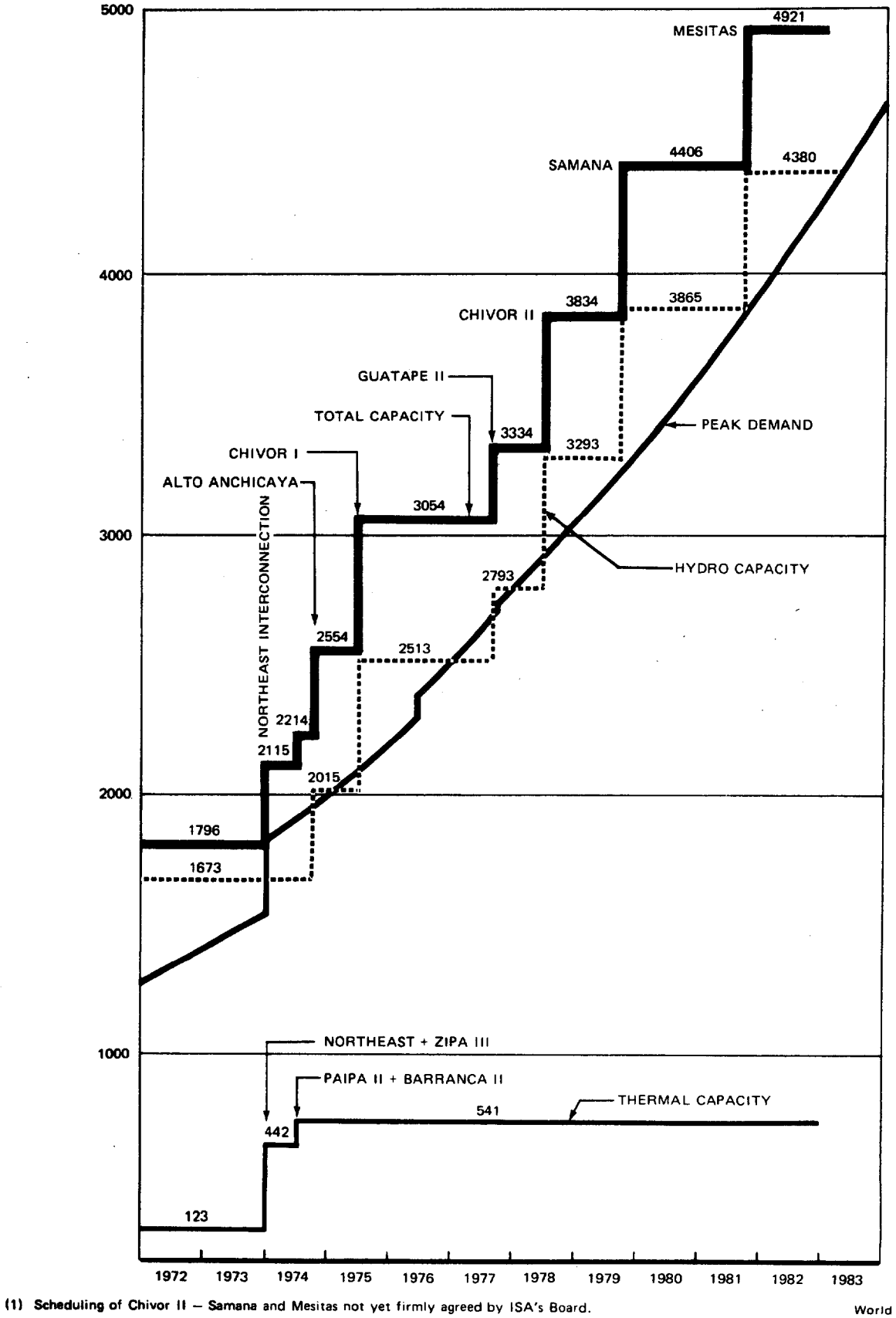


World Bank–6745

ANNEX 3B

EMPRESAS PUBLICAS DE MEDELLIN

INTERCONNECTED SYSTEM
INSTALLED CAPACITY & PEAK DEMAND (1)

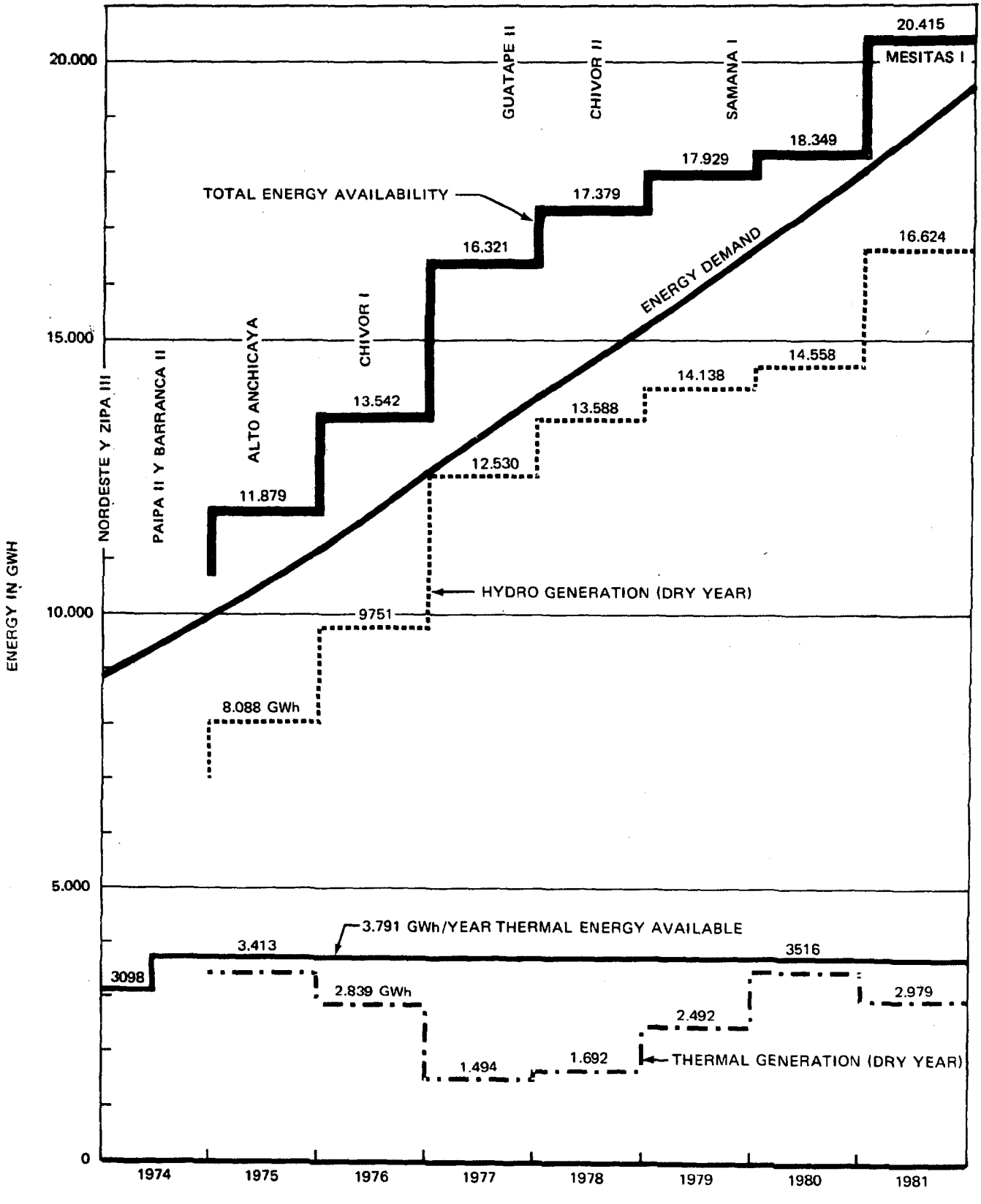


(1) Scheduling of Chivor II – Samana and Mesitas not yet firmly agreed by ISA's Board.

World Bank–6743

EMPRESAS PUBLICAS DE MEDELLIN

INTERCONNECTED SYSTEM (1)
ENERGY DEMAND AND AVAILABILITY
(DRY YEAR)



(1) Scheduling of Chivor II, Samana and Mesitas is not yet firmly agreed by ISA's Board.

World Bank–6746

COLOMBIA

Empresas Publicas de Medellin

Return on Project Investment

1. The method followed to determine the return on the Project consists of discounting the net cost/benefit stream attributable to the Project, to find the rate at which the present worth of the stream becomes zero. In the calculation, which assumes a Project life of 40 years, the following elements have been taken into consideration:

Costs

(i) capital investments, net of all duties and taxes, of the plant and associated transmission and distribution facilities necessary to convey the energy generated by the unit to the consumers; and

(ii) operating and maintenance costs, exclusive of depreciation, estimated at about Col$ 20 million per year, for the plant and for the associated transmission and distribution.

No shadow pricing has been considered necessary for foreign exchange or labor costs.

Benefits

(i) The minimum benefits are deemed to be the revenues from sales attributable to the Project. These revenues account for the fact that the Guatape II expansion includes a valuable multi-annual reservoir which permits a fully regulated operation of the plant. As a consequence the mode of generation of Guatape can be optimized in a way which is reflected in the table below. This table shows how all the annual energy of Guatape I + II can be used during peak and day time hours, while without the Guatape II Project there is less total generation and also different distribution over day and night. The values given to these energies are in accordance with the corresponding EPM retail tariffs: Col¢/kWh 48.2, 29 and 20.5, respectively.

	Energy Generation/Year			Revenue/Year
	Peak (GWh)	Day (GWh)	Night (GWh)	Total (Col$ mill.)
Guatape I	480	1,400	400	716
Guatape I + II	960	2,200	-	1,096
Increment (+) or (-)	+480	+ 800	-400	+ 380

(ii) The regulation of the Nare river which is provided by the enlarged Santa Rita Dam brings additional benefits to the interconnected system when other projects, downstream of the Guatape project, will begin operation. For present purposes

this calculation includes only those benefits attached to the commissioning of the Samana hydroelectric project, for which it assumes a conservative commissioning date (1983).

2. With the above assumptions, the cost and revenue streams are as follows:

(1)	(2)	Item in Col$ Million (3)	(4)
Year	Capital Cost of Project	Difference in System Operating Cost due to Installation of Project	Difference in System Revenues due to Installation of Project
1972	49.6		-
1973	408.8		-
1974	466.6		-
1975	623.1		-
1976	259.2		-
1977	95.1		190
1978-82	0	20	380
1983-2107	0	20	515

3. On this basis, the return on the Project would be at least 16%.

June 8, 1972

COLOMBIA

Description of the Project

General

The second stage of the Guatape project would duplicate the installed capacity of the plant through the construction of an identical and parallel set of intake structures, pressure and tailrace tunnel, underground penstock and powerhouse. The only major new construction feature is the heightening of the Santa Rita Dam to create a large reservoir. This storage would allow the complete regulation of the Nare River inflows and therefore optimum utilization of the plant's total 560 MW installed capacity to provide firm peak and energy for the interconnected system. The storage capacity would be equivalent to one year of average inflow (average rate of 52 m^3/sec.) and therefore could serve as a multiannual reserve to be drawn upon in dry hydrological years.

The appraisal report of the first stage (Jan. 1964) describes the basic hydrological and geological data available at that time. Subsequent data have not suggested changes in the design for the second stage. The main features of the dam and spillway which are peculiar to the second stage and of the other main items are described below.

The Santa Rita Dam

The project involves a substantial enlargement of the existing Santa Rita Dam. This rock and earth-filled dam is to have a height of 59 meters and total fill volume of 3,115,000 m^3. Additional earth fills of 1,000,000 m^3 are to be used for the treatment of low and weak reservoir rim areas.

Spillway

A chute spillway, 369 m long with a width varying from 80 to 30 m and reinforced concrete lining, has been designed to discharge the design flood.. It has an outflow capacity of 1,090 m^3/sec., corresponding to a peak inflow hydrograph of 4,440 m^3/sec.

Headworks

The headworks would be a duplicate of those built for Stage I. The water intake is a cylindrical structure 59 m high connected through a 90-meter vertical shaft to the inlet pressure tunnel. The pressure tunnel is 4.8 km long, 3.6 m inside diameter. The penstock is 908 m long, 3.1 to 2.65 meters variable diameter, installed as a free-standing pipe inside an underground inclined shaft.

Powerhouse

The second stage duplicates and is an extension of the first stage. The extension of the powerhouse consists of two parallel underground caverns, one to house the generating units and the other for the step-up power transformers. The main hall, to be excavated at a depth of 650 m, is 172 m long, 24.35 m high and 16.75 m wide. Access is through an existing 2.2-km vehicular tunnel. In addition, a 4.56-km tail tunnel would be built during this stage.

Experience with the Construction of the First Stage

With the exception of the enlargement of the Santa Rita Dam the rest of the works will be a duplication (see layout in next page) of the Guatape I project. Therefore the experience obtained during the construction of the first stage is most relevant and has been considered in the preparation of cost estimates - including adequate contingencies - construction schedules and methods of work.

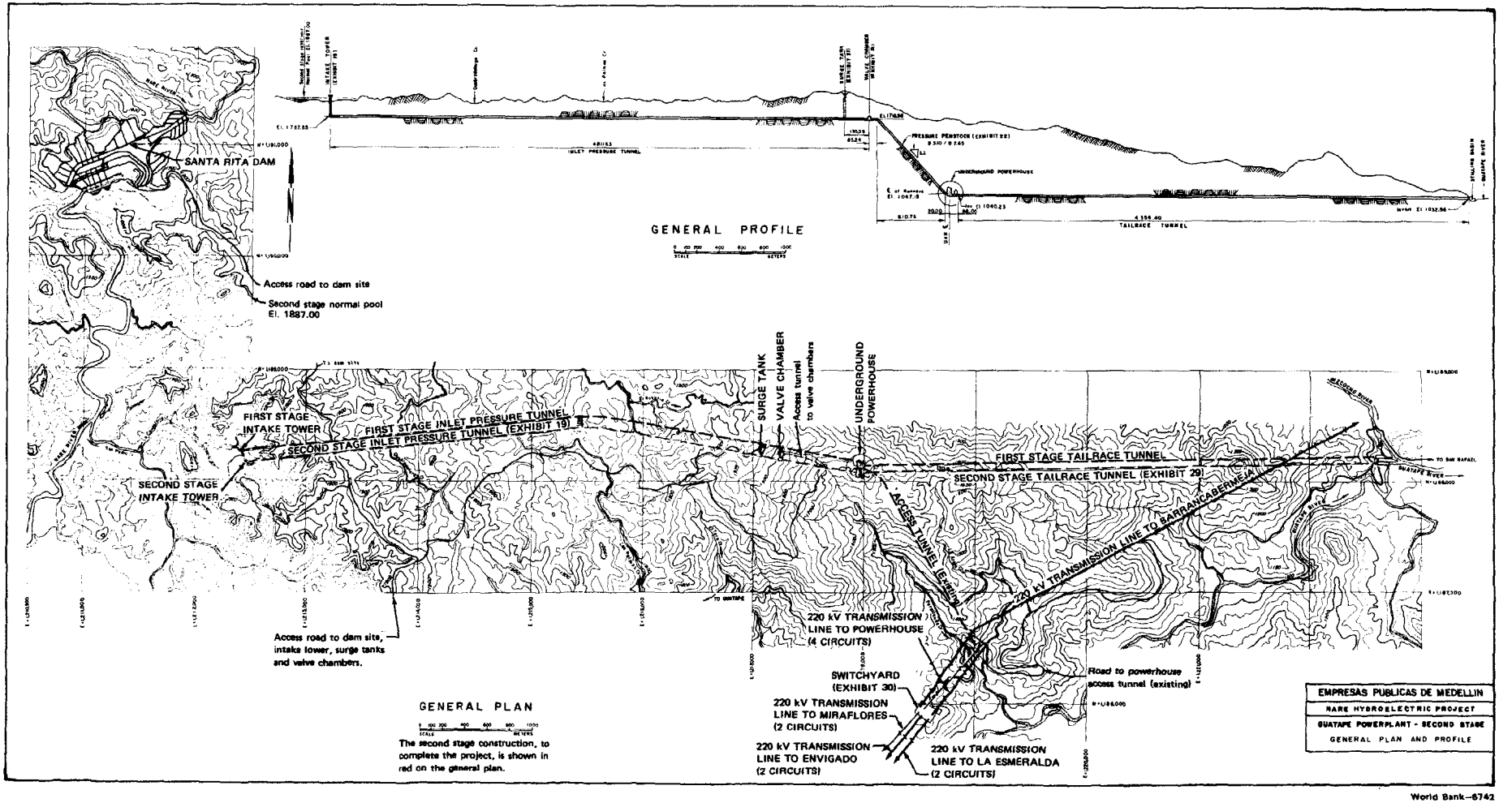
The construction of Guatape I experienced delays of about 2 years. These were due to unexpected large quantities of water in the low end part of the project which require a bigger and more complex pumping system. The excavation methods also had to be changed after a severe accident resulted in the death of several workers. After some studies, this was attributed to the detonation of explosives by atmospheric discharges. Finally, other delays arose from late shipments of foreign manufactured equipment and difficulties of coordination due to an excessive sub-division of equipment orders. All these problems have been taken into consideration for the present project.

The foreign exchange costs of the first stage were lower than the cost estimates and the initial loan was not fully utilized. Local costs were somewhat higher but were covered almost entirely by adequate contingencies. On the whole the total cost did not differ significantly from the estimates mainly due to the favourable equipment prices at the time of bidding and the generally good geological characteristics of the terrain.

Layout

Page 3 (World Bank 6742) of this Annex shows the general plan and profile of the Project.

August 7, 1972



ANNEX 6

World Bank—6742

COLOMBIA

The Colombian Power Sector

Organization of the Sector

1. Public corporations owned by the central, departmental or municipal governments account for about 90% of the electricity supply in Colombia, leaving about 10% to industry-owned plant.

2. Four large utilities supply about 95% of the publicly generated energy:

Empresa de Energia Electrica de Bogota (EEEB)
Empresas Publicas de Medellin (EPM)
Corporacion Autonoma Regional del Cauca (CVC)
Instituto Colombiano de Energia Electrica (ICEL)

EEEB and EPM are autonomous, municipality-owned companies, generating and distributing power in Bogota and Medellin, respectively, and the surrounding areas. CVC is a multiple-purpose, autonomous and regional entity responsible for developing mainly agriculture and power in the Cauca Valley; for the latter purpose it operates Central Hidroelectrica del Rio Anchicaya, Ltda. (CHIDRAL). CHIDRAL sells energy in bulk to Empresas Municipales de Cali (EMCALI), the municipal company which distributes electricity throughout the city of Cali. ICEL is a government company with national responsibility for power supply. It controls 15 subsidiaries which provide service to 20 of the country's 29 Departments, outside the areas of service of EEEB, EPM and CVC. ICEL's main subsidiary is Central Hidroelectrica de Caldas (CHEC), which operates around Manizales in central Colombia. The remaining Departments are in the southeastern region; they have a very small and scattered population (5% of the country's total) and limited power facilities.

3. Two major new institutions, Interconexion Electrica S.A. (ISA) and Corporacion Electrica de la Costa Atlantica (CORELCA), were created in 1967. ISA was founded as a joint-stock company by the above-mentioned four major power utilities, each one contributing 25% of the share capital. Its statutory purposes are the interconnection of the sponsors' transmission systems and the planning, construction, ownership and operation of all major new generating plants and transmission lines serving the interconnected system. Guatape II, together with six other projects, was specifically excluded from ISA's ownership. Interconnection in central Colombia, partly financed by Loan 575-CO to ISA, was achieved in March 1972, and will be extended to interconnect the northeastern part of the central region in 1974 (see Map of Electric Sector). ISA's first major hydroelectric plant, CHIVOR, is now being built.

4. CORELCA is a public company, responsible for interconnecting the major markets of the northern region. Its first important thermal plant (132 MW) at Barranquilla and 230 kV and 115 kV transmission linking Barranquilla, Santa Marta and Cartagena are under construction. Comissioning is scheduled for this year.

5. Only about 45% of the country's population enjoys uninterrupted electricity supply; most of this population is concentrated in the more highly developed Departments of Cundinamarca, Antioquia, Cauca, Caldas and Atlantico, where the country's big cities such as Bogota, Medellin, Cali Manizales, Barranquilla and Cartagena are located. About 30% of the population has no supply at all; the remaining 25% are supplied in a discontinuous manner. The national development program envisages that by 1980 only 5% of the population will have no electricity supply, though about 15% will have discontinuous service.

Sector Planning

6. Under the Administrative Reform Act of 1969, the National Department of Planning has overall responsibility for coordinating development of the power sector with the National Development Plan. Guatape II is part of the national plan. Planning of future generation and high-voltage transmission has now been to some extent coordinated by the creation of ISA. This coordinated planning should be strengthened and extended to the only remaining isolated market, the area served by CORELCA. ISA and CORELCA have agreed to study interconnection between them. Sub-transmission and distribution will still be planned by the regional utilities, but national standardization is being established and a major role for locally manufactured equipment is expected in the future.

7. Major problems remaining in the sector call for:

(i) Further consolidation of ICEL's subsidiaries along regional lines similar to CORELCA; six regions have been identified.

(ii) Improved distribution in urban slum areas. EEEB and EPM are now giving high priority to this problem.

(iii) Improved quality of service in many small towns served by ICEL's subsidiaries; a program for 127 small towns has been started with the help of a US$25 million loan from the Inter-American Development Bank (IDB).

(iv) Rural electrification to serve about six million people living in areas without supply; in this connection basic studies, sponsored by ICEL, to ascertain priorities are now under way.

(v) Nationwide revision of tariff levels and structures.

June 8, 1972

ANNEX 8

COLOMBIA
Empresas Públicas de Medellin
Guatepe II Hydroelectric Project
Estimates Schedule of Disbursements

IBRD/IDA Fiscal Year and Quarter	Cumulative Disbursements at End of Quarter
1972/73	
March 31, 1973	3.2
June 30, 1973	6.4
1973/74	
September 30, 1973	9.7
December 31, 1973	12.8
March 31, 1974	16.4
June 30, 1974	19.9
1974/75	
September 30, 1974	23.4
December 31, 1974	27.0
March 31, 1975	31.2
June 30, 1975	35.4
1975/76	
September 30, 1975	39.7
December 31, 1975	43.9
March 31, 1976	46.0
June 30, 1976	48.1
1976/77	
September 30, 1976	50.2
December 31, 1976	52.3
March 31, 1977	53.2
June 30, 1977	54.1
1977/78	
September 30, 1977	55.1
December 31, 1977	56.0

June 8, 1972

COLOMBIA
Empresas Publicas de Medellin (EPM)
Power Department
Actual and Forecast Income Statements 1969-1978
(in Col.$ millions unless otherwise indicated)

Rate of Exchange: 1US$ = 21.4 Col.$

	ACTUAL			FORECAST						
Year Ending December 31	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
Energy Sales (GWh)	1,331	1,496	1,685	2,551	3,219	2,738	2,645	2,833	3,691	3,798
Average Revenue per kWh Sold (centavos)	18.4	18.4	18.7	15.0 1/	16.0	20.0	21.8	27.4	24.5	28.0
Operating Revenues										
Revenues from Sales of Power	244.7	275.9	315.7	381.9	514.8	543.7	576.5	776.2	905.5	1,064.1
Other Operating Revenues	7.8	10.8	10.5	10.1	11.0	12.0	13.0	14.0	15.0	16.0
Total Operating Revenues	252.5	286.7	326.2	392.0	525.8	555.7	589.5	790.2	920.5	1,080.1
Operating Expenses										
Operation	31.8	28.7	32.4	36.0	40.0	44.4	49.3	54.7	60.7	67.4
Maintenance	6.9	14.9	16.7	18.5	20.5	22.7	25.2	28.0	31.1	34.5
Administration	25.3	30.0	32.6	36.2	40.2	44.6	49.5	54.9	60.9	67.6
Municipal Tax	11.2	12.7	14.1	17.4	23.4	24.7	31.3	36.6	42.6	45.6
Depreciation	36.7	41.1	41.4	75.3	105.7	107.7	109.6	131.2	159.8	180.1
Contributions to ISA	-	-	-	9.3	14.9	15.1	31.6	35.2	41.0	48.1
Power Purchases from ISA	-	-	-	-	-	5.7	4.0	119.8	145.8	166.5
Total Operating Expense	111.9	127.4	137.2	192.7	244.7	264.9	300.5	460.4	541.9	609.8
Operating Income	140.6	159.3	189.0	199.3	281.1	290.8	289.0	329.8	378.6	470.3
Dividends Received from Investment in ISA	-	-	-	-	-	-	-	-	19.6	19.6
Interest	70.0	72.8	82.4	84.0	101.6	125.8	153.7	171.2	192.1	168.1
Interest During Construction	(37.3)	(39.8)	(48.1)	(1.5)	(19.3)	(47.9)	(79.8)	(99.1)	(61.3)	(0.5)
Interest Expenses	32.7	33.0	34.3	82.5	82.3	77.9	73.9	72.1	130.4	167.6
Net Profit	107.9	126.3	154.7	116.8	198.8	212.9	215.1	257.7	267.8	322.3
Rate of Return on Revalued Average Net Fixed Assets in Operation	13.5%	14.8%	16.2%	9.3%	9.2%	9.6%	9.4%	9.2%	8.8%	9.9%

October 30, 1972

1/ The reduction is due to interchanges in the interconnected system, the revenues of which are lower than the ones in the EPM market.

COLOMBIA

Empresas Publicas de Medellin (EPM)

Power Department

Notes and Assumptions on Income Statements

1. Revenues from Sales of Power

EPM's revenues from sales of power are based on the generation and sales forecast of EPM's local market given in Annex 3, the estimated sales to Interconexion Electrica S.A. (forecast of energy interchanges in the interconnected system) and, starting mid-1976, the assumed sales to the proposed ferro-nickel development in Cerro Matoso.

Revenues derived from sales to the local consumers and to the ferro-nickel development were calculated on the basis of presently prevailing tariffs, increased by 25% (overall) in 1973, 20% in 1976 and 10% in 1978 in order to maintain a 9% rate of return and a reasonable level of self-financing. The energy interchanges are based on the ISA tariffs. The 25% tariff increase is presently being applied for and is scheduled to be effective at 10% by January 1, 1973, another 10% by April 1, 1973, and the remaining 5% by July 1, 1973; the resulting impact on revenues is thus estimated to be of a 20% increase in 1973 and the full 25% in 1974.

2. Municipal Tax

This is a franchise tax payable to the Municipality of Medellin. According to present legislation it amounts to 4.45% of the total operating revenues. EPM is otherwise tax exempt.

3. Depreciation

A review of the useful lives of EPM's assets showed that the average rate of depreciation in the past amounted to about 3.5% per year. With the hydroelectric plant of Guatape I commencing operation, the average depreciation rate will drop to about 3% per year, a rate which has been used in the projections.

4. Contributions to ISA

This item consists of EPM's forecast share of the operating cost of the interconnected system, its debt service and ISA's administration cost. The expenses have been calculated in accordance with the requirements of ISA's statutes.

5. Power Purchases from ISA

The power purchases from ISA represent sales of the partners in the interconnected system to EPM and, after 1975, EPM's purchases from Chivor (ISA's first hydroelectric power station).

6. Dividends Received from Investments in ISA

ISA's statutes provide that 9% dividends on the share capital and 9% interest on the bonds have to be paid to ISA's sponsors; they are ISA's sole shareholders and provide for the larger portion of local currency financing of ISA's projects by funds for which they receive the before-mentioned shares and bonds in exchange. Dividend and interest payments are made only on capital invested in plant which has started operation.

June 8, 1972

COLOMBIA
Empresas Publicas de Medellin (EPM)
Power Department
Forecast Sources and Applications of Funds Statements 1972-1978
(in Col$ millions)

Rate of Exchange: 1US$ = 21.4 Col$

Year Ending December 31	1972	1973	1974	1975	1976	1977	1978	Total 1972-1978
SOURCES								
Internal Sources								
Operating Income	199.3	281.1	290.8	289.0	329.8	378.6	470.3	2,238.0
Depreciation	75.3	105.7	107.7	109.6	131.2	159.8	180.1	869.4
Total Internal Sources	274.6	386.8	398.5	398.6	461.0	538.4	650.4	3,108.3
External Sources								
Drawdown of Loan 369-CO	47.5	-	-	-	-	-	-	47.5
Proposed IBRD-Loan	-	274.2	303.0	361.9	180.8	78.5	-	1,198.4
Short-Term Credit	20.0	-	-	-	-	-	-	20.0
IDEA-Loan	-	15.0	10.0	-	-	-	-	25.0
Bonds	-	25.0	25.0	-	-	-	-	50.0
Loans from Bank Consortium	-	-	100.0	-	-	-	-	100.0
Suppliers' Credits	-	9.4	32.9	68.3	21.6	11.1	-	143.3
Total External Sources	67.5	323.6	470.9	430.2	202.4	89.6	-	1,584.2
Dividends Received from Investments in ISA	-	-	-	-	-	19.6	19.6	39.2
Repayment of Internal Loans	-	5.0	26.4	20.0	-	-	-	51.4
Reimbursement of Samana Studies	1.3	3.2	3.0	2.8	2.6	2.5	2.2	17.6
TOTAL SOURCES	343.4	718.6	898.8	851.6	666.0	650.1	672.2	4,800.7
APPLICATIONS								
Construction Expenditures								
The Project								
Guatape II Hydroelectric Station	26.2	424.2	526.3	502.9	185.5	46.5	-	1,711.6
Transmission Line Guatape -Medellin	-	-	7.2	57.4	15.2	2.0	-	81.8
Distribution, Training	23.4	84.6	33.1	62.8	58.5	46.6	-	309.0
Total Project	49.6	508.8	566.6	623.1	259.2	95.1	-	2,102.4
Guatape I	71.6	-	-	-	-	-	-	71.6
Distribution and Others	-	-	-	-	18.0	72.7	129.4	220.1
Interest During Construction	1.5	19.3	47.9	79.8	99.1	61.3	0.5	309.4
Total Construction Expenditures	122.7	528.1	614.5	702.9	376.3	229.1	129.9	2,703.5
Investments in ISA	56.5	66.6	78.0	62.3	95.6	123.2	159.5	641.7
Debt Service								
Interest	84.0	101.6	125.8	153.7	171.2	191.7	168.1	996.1
Amortization	56.1	65.5	67.3	80.9	93.7	100.1	138.8	602.4
Total Debt Service Gross	140.1	167.1	193.1	234.6	264.9	291.8	306.9	1,598.5
Interest During Construction	(1.5)	(19.3)	(47.9)	(79.8)	(99.1)	(61.3)	(0.5)	(309.4)
Total Debt Service Net	138.6	147.8	145.2	154.8	165.8	230.5	306.4	1,289.1
Variations in Working Capital								
Items other than cash	1.7	(2.0)	1.0	4.0	24.9	12.9	21.0	63.5
Cash and Banks	23.9	(21.9)	60.1	(72.4)	3.4	54.4	55.4	102.9
TOTAL APPLICATIONS	343.4	718.6	898.8	851.6	666.0	650.1	672.2	4,800.7
Times Debt Service (Gross) covered by Internal Sources	2.0	2.3	2.1	1.7	1.7	1.8	2.1	

October 30, 1972

COLOMBIA
Empresas Publicas de Medellin (EPM)
Power Department
Debt Service Requirements
(in Col$ millions)

Year Ending December 31	1972	1973	1974	1975	1976	1977	1978	Total 1972-1978
INTEREST								
Loan 225-CO	11.2	10.6	9.9	9.3	8.5	7.8	6.9	64.2
Loan 282-CO	21.6	20.5	19.4	18.2	16.9	15.6	14.2	126.4
Loan 369-CO	44.0	43.3	42.5	41.7	40.8	40.0	39.0	291.3
Proposed IBRD Loan	-	17.3	35.4	56.1	74.2	101.0	85.8	369.8
Municipal External Debt	0.9	0.9	0.9	0.9	0.9	0.9	0.9	6.3
Instituto de Fomento Industrial	4.9	4.4	4.0	3.5	3.1	2.6	2.2	24.7
Caja Agraria	0.2	0.2	0.2	0.2	0.1	0.1	0.1	1.1
Instituto de Credito Territorial	0.1	0.1	-	-	-	-	-	0.2
IDEA	0.6	1.2	2.8	3.0	2.6	2.2	1.8	14.2
Federacion Nacional de Cafeteros	0.2	-	-	-	-	-	-	0.2
Bonds	0.2	0.8	2.5	3.7	4.7	4.4	3.8	20.1
Departamento Administrativo de Valorizacion	0.1	0.1	0.1	0.1	0.1	-	-	0.5
Suppliers' Credits	-	0.4	1.9	5.7	8.8	9.4	8.5	34.7
Short-Term Credit	-	1.8	0.9	-	-	-	-	2.7
Loans from Bank Consortium	-	-	5.3	11.3	10.5	7.7	4.9	39.7
	84.0	101.6	125.8	153.7	171.2	191.7	168.1	996.1
Interest During Construction	(1.5)	(19.3)	(47.9)	(79.8)	(99.1)	(61.3)	(0.5)	(309.4)
Interest Expense	82.5	82.3	77.9	73.9	72.1	130.4	167.6	686.7
AMORTIZATION								
Loan 225-CO	9.9	10.6	11.2	11.9	12.6	13.4	14.2	83.8
Loan 282-CO	18.4	19.4	20.5	21.7	23.0	24.3	25.7	153.0
Loan 369-CO	12.8	13.5	14.3	15.2	16.0	16.8	17.8	106.4
Proposed IBRD Loan	-	-	-	-	-	-	28.6	28.6
Municipal External Debt	2.3	2.3	2.3	2.3	2.3	2.3	2.3	16.1
Instituto de Fomento Industrial	4.2	4.2	4.2	4.2	4.2	4.2	4.2	29.4
Caja Agraria	0.4	0.4	0.4	0.4	0.4	0.4	0.4	2.8
Instituto de Credito Territorial	0.7	0.6	-	-	-	-	-	1.3
IDEA	5.2	2.7	3.0	6.3	6.3	6.3	6.1	35.9
Federacion Nacional de Cafeteros	1.2	0.8	-	-	-	-	-	2.0
Bonds	0.6	0.6	1.0	3.5	5.0	5.0	5.0	20.7
Departamento Administrativo de Valorizacion	0.4	0.4	0.4	0.4	0.4	0.4	0.2	2.6
Suppliers' Credits	-	-	-	-	3.5	7.0	14.3	24.8
Short-Term Credit	-	10.0	10.0	-	-	-	-	20.0
Loans from Bank Consortium	-	-	-	15.0	20.0	20.0	20.0	75.0
TOTAL AMORTIZATION	56.1	65.5	67.3	80.9	93.7	100.1	138.8	602.4

October 30, 1972

COLOMBIA
Empresas Publicas de Medellin (EPM)
Power Department
Actual and Forecast Balance Sheets 1969-1978
(in Col$million)

Year Ending December 31:	ACTUAL 1969 1/	1970 2/	1971 3/	1971 4/	FORECAST 1972	1973	1974	1975	1976	1977	1978
ASSETS											
Fixed Assets											
Total Fixed Assets in Operation	1,256.7	1,371.0	1,510.1	1,523.3	3,419.1	3,544.9	3,590.0	3,895.2	4,796.3	5,670.8	6,004.7
Accumulated Depreciation	(216.0)	(257.1)	(302.4)	(309.5)	(384.8)	(490.5)	(598.2)	(707.8)	(839.0)	(998.8)	(1,178.9)
Net Fixed Assets in Operation	1,040.7	1,113.9	1,207.7	1,213.8	3,034.3	3,054.4	2,991.8	3,187.4	3,957.3	4,672.0	4,825.8
Work in Progress	1,235.1	1,558.4	1,840.2	1,866.7	93.6	495.9	1,065.3	1,463.0	938.2	292.8	88.8
Total Net Fixed Assets	2,275.8	2,672.3	3,047.9	3,080.5	3,127.9	3,550.3	4,057.1	4,650.4	4,895.5	4,964.8	4,914.6
Investments in ISA	11.0	24.8	60.8	60.8	117.3	183.9	261.9	324.2	419.8	543.0	702.5
Current Assets											
Cash on Hand and in Banks	4.1	9.4	10.5	10.5	34.4	12.5	72.6	0.2	3.6	58.0	113.4
Accounts Receivable	22.7	24.7	39.1	39.1	43.5	56.7	64.4	70.1	96.8	110.2	130.7
Stores	45.5	42.8	46.5	46.5	47.9	48.9	49.9	50.9	51.9	53.9	56.9
Internal Debtors	14.1	20.4	51.4	51.4	51.4	46.4	20.0	-	-	-	-
Total Current Assets	86.4	97.3	147.5	147.5	177.2	164.5	206.9	121.2	152.3	222.1	301.0
Other Assets	26.2	40.7	48.9	48.9	47.6	44.4	41.4	38.6	36.0	33.5	31.3
TOTAL ASSETS	2,399.4	2,835.1	3,305.1	3,337.7	3,470.0	3,943.1	4,567.3	5,134.4	5,503.6	5,763.4	5,949.4
LIABILITIES											
Equity											
Retained Earnings, etc.	606.0	738.3	896.0	896.0	1,012.8	1,211.6	1,424.5	1,639.6	1,897.3	2,165.1	2,487.4
Revaluation Reserve	605.2	737.2	946.6	946.6	946.6	946.6	946.6	946.6	946.6	946.6	946.6
Total Equity	1,211.2	1,475.5	1,842.6	1,842.6	1,959.4	2,158.2	2,371.1	2,586.2	2,843.9	3,111.7	3,434.0
Long-Term Debt											
IBRD Loans	1,015.3	1,162.5	1,290.6	1,320.8	1,327.2	1,557.9	1,814.9	2,128.0	2,257.2	2,281.2	2,194.9
Suppliers' Credits	7.1	11.6	11.9	11.9	11.9	21.3	54.2	122.5	140.6	144.7	130.4
Other Long-Term Debt	104.7	109.2	101.4	103.8	108.8	126.8	240.5	208.4	169.8	131.2	93.0
Total Long-Term Debt	1,127.1	1,283.3	1,403.9	1,436.5	1,447.9	1,706.0	2,109.6	2,458.9	2,567.6	2,557.1	2,418.3
Current Liabilities											
Accounts Payable	38.9	38.5	31.2	31.2	34.2	44.2	48.2	49.9	51.7	53.2	54.7
Other Current Liabilities	22.2	37.8	27.4	27.4	28.5	34.7	38.4	39.4	40.4	41.4	42.4
TOTAL LIABILITIES	2,399.4	2,835.1	3,305.1	3,337.7	3,470.0	3,943.1	4,567.3	5,134.4	5,503.6	5,763.4	5,949.4
Debt/Equity Ratio	48:52	47:53	-	44:56	42:58	44:56	47:53	49:51	47:53	45:55	41:59

October 30, 1972

1/ Rate of Exchange = US$ = Col$17.85
2/ Rate of Exchange = US$ = Col$19.10
3/ Rate of Exchange = US$ = Col$20.91
4/ Rate of Exchange = US$ = Col$21.40

COLOMBIA
Empresas Publicas de Medellin (EPM)
Power Department
Long-Term Debt as of December 31, 1971

	Original Amount 1/ US$ Million	Original Amount 1/ Col$ Million (US$1 = Col$21.4)	Outstanding Col$ Million (US$1 = Col$21.4)	Terms Interest	Terms Years
A. In Foreign Currencies					
1) IBRD Loan 225-CO	12.0	256.8	193.5	6%	25
2) IBRD Loan 282-CO	22.0	470.8	386.7	5.75%	25
3) IBRD Loan 369-CO	39.0	834.6	740.6	5.5% and 6%	35
4) Municipal External Debt 1948	2/ -	2/ -	29.1	about 4%	about 33
B. In Local Currency					
1) Instituto de Credito Territorial (various loans)	-	2.1	1.4	4%/9%	4-10
2) Instituto de Fomento Industrial (various loans)	-	50.0	45.8	10%-11.5%	12-15
3) Caja Agraria	-	4.2	2.8	10%	14
4) IDEA (various loans)	-	8.0	7.8	11%	4-5
5) Bonds 1951/53	-	12.0	1.2	8%	20
6) Departamento Administrativo de Valorizacion	-	3.5	3.2	9%	10
7) Local Suppliers	-	11.9	11.9	16%	7
8) Federacion Nacional de Cafeteros	-	8.0	2.0	14%	about 7
9) Consolidated Bank Accounts (Terms not yet decided upon)	-	-	10.5	-	-
			1,436.5		

1/ After cancellations.

2/ Exact original amount not obtainable.

April 3, 1972

COLOMBIA
Empresas Publicas de Medellin (EPM)
Power Department

Notes and Assumptions on Balance Sheets

1. Fixed Assets - Revaluation Reserve

Colombian legislation provides for only partial adjustment of the value of assets insofar as it permits the foreign outstanding debt to be revalued using the variations in the rate of exchange between the Colombian peso and the various foreign currencies; no adjustment of the asset value concerning the local component is provided for.

In order to arrive at a reasonable rate base which reflects local inflation and permits arriving at an adequate value of asset reproduction cost, the following revaluation method was adopted:

(a) foreign exchange component of assets revaluation, using the variations in the rate of exchange between the Colombian peso and US dollar;

(b) local exchange component of assets revaluation, using the variations of the national cost-of-living index (Obreros).

Basis for the revaluation procedure is the value of assets as of December 31, 1959; at that time the process of asset transfer from the municipality to EPM had been completed.

The balancing figure resulting from the above-described revaluation process is shown as "Revaluation Reserve" and represents part of the "Equity".

2. Investments in ISA

Investments in ISA comprise exclusively the estimated EPM portion of the local construction cost of the interconnected system, Chivor, Samana and Las Mesitas I. EPM receives shares and bonds in exchange.

3. Billing Cycle (Accounts Receivable)

EPM's billing procedures are excellent. This is the reason why, at the end of any fiscal year, the amounts outstanding and unpaid represent only about 1½ months' billing.

June 8, 1972

ANNEX 12

COLOMBIA

Empresas Publicas de Medellin

Ecological Aspects

1. The construction of the second stage of Guatape involving the creation of a large reservoir with a surface area of about 60 sq.km. and the relocation of about 3,000 people mostly of the town of El Peñol required careful attention to the ecological and human resettlement aspects of the project. These problems had been under investigation for a good number of years and various reports had been prepared by Corporacion Social de Desarrollo y Bienestar (1965), Comite del Peñol, EPM (1962), Instituto Colombiano de Planeacion Integral (1970), Univ. Nacional (1970), Univ. de Antioguia (1970), Tecnicas Turisticas de Colombia (1970).

2. In 1969 an agreement was signed between EPM and the municipality of El Penol providing the following:

i) The establishment of a new town of El Peñol with adequate roads, water, sewerage and electric service.

ii) Procedures for compensation in kind (land) and/or money for inundated property.

iii) The preparation of development programs in the fields of fishing, agriculture, forestry and tourism, including training of the local population and the creation of some cooperatives.

The 1969 agreement has been followed up and at present most of the programs have been defined and implementation is being started on some of them (land purchasing, town construction, roads, etc.).

3. At the request of the Bank a reconnaissance of the ecological aspects of the Project has been carried out by a U.S. ecological expert in April 1972. He visited the region and studied all the previous reports as well as the contractual agreement referred to above. His report makes a number of suggestions regarding potential problems in watershed conservation, natural resources (mainly soil) management, urban waste disposal and livelihood prospects of the increasing local population. The consultant's survey concluded that none of the identified potential problems are such as to require changing the present plans but proposed that EPM create a special office to handle these matters on a continued basis not only in connection with the present projects but also regarding the existing EPM's reservoirs. EPM has confirmed in a letter that it will create this office and will take action on the basis of the consultant's recommendations. The cost estimate of the project includes a substantial amount (about Col$ 170 million) to cover the expenditures required by the relocation of people and environmental control measures needed during the period of construction.

November 20, 1972

COLOMBIA

Empresas Publicas de Medellin

Tariffs

The current tariff structure of EPM is as follows:

Residential

First	100 kWh	12 centavos/kWh
Next	100 kWh	14 " "
Next	100 kWh	17 " "
Next	100 kWh	20 " "
Next	100 kWh	22 " "
Next	100 kWh	25 " "
Next	400 kWh	26 " "
Above	1000 kWh	25 " "

There is a surcharge of 10% for service outside of Medellin for monthly consumption of up to 500 kWh. For higher consumption the surcharge is 20%.

Commercial

23 centavos/kWh, plus

Pesos 16/kW connected or measured peak demand.

Industrial

17 centavos/kWh (day)
12 centavos/kWh (night), plus

Pesos 4/kW of connected load for less than 10 kW, and pesos 16/kW of peak demand for larger loads.

High Voltage (110 kV) Industrial

70% of the above industrial rates and charges, measured on the highest loaded phase, if out of balance.

Official

17 centavos/kWh, or
35 Pesos per kW of connected load.

Advertising

Pesos 9 per month, for each 100 Volt-Ampere, for the first 1000 volt-Amperes of connected load.

Pesos 7 per month, for each 100 Volt-Ampere, for the following 1000 connected Volt-Amperes.

Street Lighting

Pesos 42/kW of connected load

Preferential Services

(Hospitals, Schools, Churches)

14 centavos/kWh

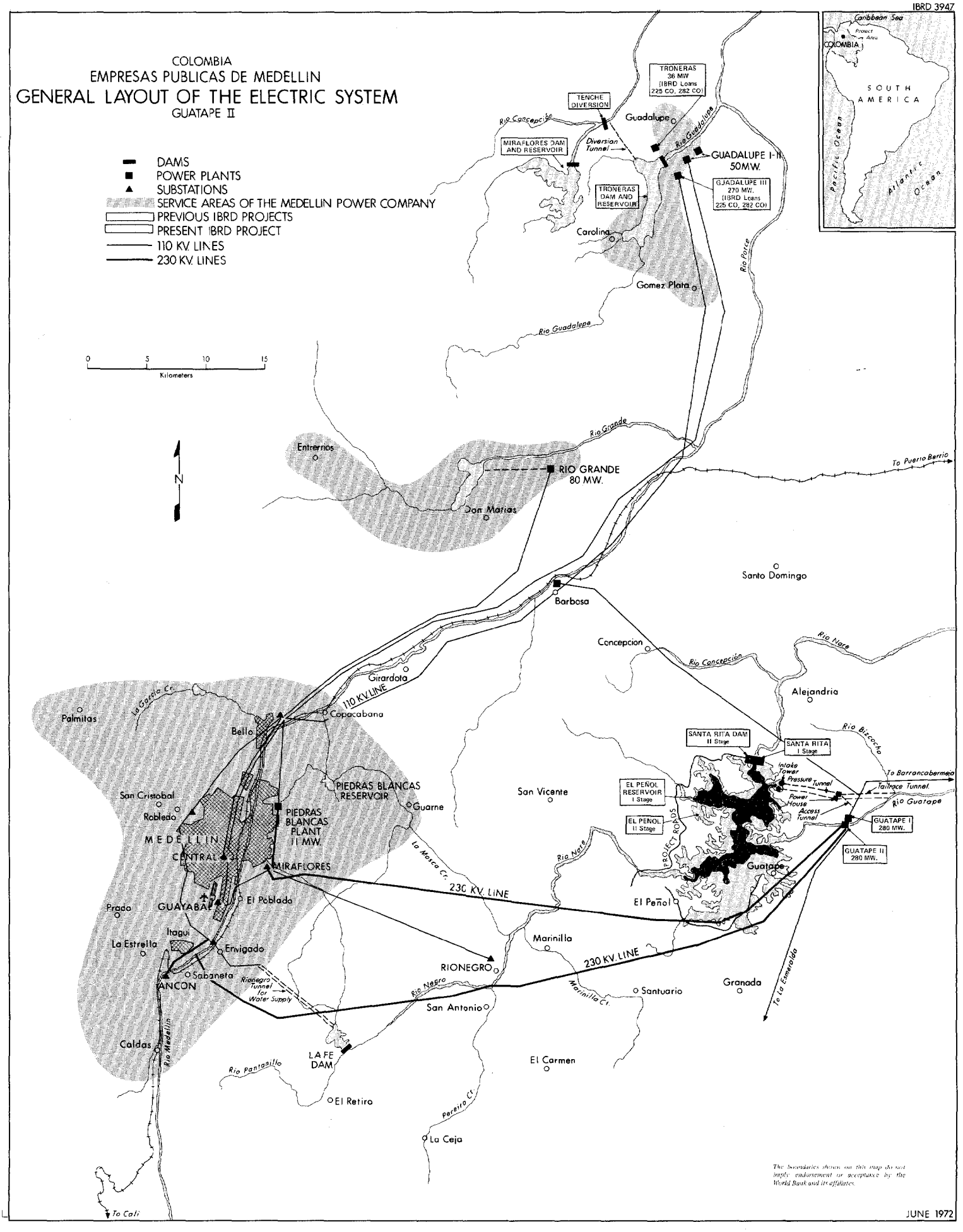
Bulk Sales of Power

11 centavos/kWh.

June 8, 1972

IBRD 3947

COLOMBIA
EMPRESAS PUBLICAS DE MEDELLIN
GENERAL LAYOUT OF THE ELECTRIC SYSTEM
GUATAPE II



The boundaries shown on this map do not imply endorsement or acceptance by the World Bank and its affiliates.

JUNE 1972

IBRD-3948
JUNE 1972