

PUBLIC

DOCUMENT OF THE INTER-AMERICAN DEVELOPMENT BANK

**ECUADOR**

**LOAN TO THE INSTITUTO ECUATORIANO DE ELECTRIFICACIÓN  
FOR A RURAL ELECTRIFICATION PROJECT**

**(EC0104; 669/SF-EC)**

**PROJECT REPORT**

**1981**

ECUADOR  
RURAL ELECTRIFICATION PROJECT  
(EC-0104)

Table of Contents

	<u>Page</u>
I. INTRODUCTION .....	1
A. The Application .....	1
B. Priority .....	1
C. Bank Missions .....	1
D. Conclusions .....	2
II. FRAME OF REFERENCE .....	3
A. Recent Socioeconomic Trends and Outlook .....	3
B. The Electric Energy Sector in Ecuador .....	7
C. Participation of the IDB and other International Agencies in the Development of the Electric Sec- tor of Ecuador .....	16
D. Rural Electrification in Ecuador .....	17
III. THE PROJECT AND ITS FINANCING .....	20
A. Objectives .....	20
B. Description of the Works .....	20
C. Cost of the Project .....	22
D. Costing: Basis and Analysis .....	23
E. Financing .....	27
IV. PROJECT EXECUTION .....	29
A. Executing Unit .....	29
B. Supervision .....	30
C. Method of Execution .....	30
D. Engineering and Designs .....	32
E. Selection Criteria .....	32
F. Purchase of Goods and Services .....	33
G. Period of Execution .....	34
H. Disbursement Schedule .....	34
I. Acknowledgment of Expenditures .....	35
J. Declaration of Public Utility, Expropriation and Easements .....	35
K. Education of the Use of Energy Resources .....	36
L. Operation and Maintenance of the Systems .....	37
M. Ex-post Evaluation of the Project .....	37
N. Inspection and Supervision .....	38

	<u>Page</u>
V. THE BORROWER AND THE EXECUTING AGENCY .....	39
A. Background .....	39
B. Regional Electric Companies .....	54
VI. PROJECT JUSTIFICATION .....	62
A. Technical Feasibility .....	62
B. Institutional Feasibility .....	63
C. Financial Feasibility .....	63
D. Economic Evaluation .....	65
E. Analysis of Project Beneficiaries .....	73
F. Justification for the Use of FSO Resources .....	76
VII. EVALUATION OF PREVIOUS LOANS TO INECEL .....	77
A. Background .....	77
B. Loan 412/SF-EC .....	77
C. Loan 492/SF-EC .....	78
D. Loans 271/OC, 411/SF, 323/OC and 38/IC-EC .....	78
E. Fulfillment of Conditions of Contract .....	79

#### APPENDICES

1. Situación del Desarrollo Sectorial y Plan de Desarrollo
2. El Sector de Energía en el Ecuador
3. Sistemas Eléctricos Regionales
4. Circuito Tipo de Electrificación Rural
5. Términos de Referencia Firma Consultora
6. Organigrama UNEPER
7. Secuencia de Actividades del Proyecto
8. Cronograma Preliminar Actividades de Diseños Circuitos
9. Metodología para el Análisis Costo Beneficio de los Circuitos
10. Cronograma Contratación Obras Civiles y Montaje
11. Reglamento de Licitaciones
12. Plan de Ejecución Preliminar del Proyecto (PEP)
13. Organigrama INECEL
14. Reajuste Tarifas Empresas Eléctricas Regionales
15. INECEL - Inversiones en Compañías Asociadas y Sistemas Propios
16. Proyecciones Financieras de INECEL
17. Deuda Consolidada de INECEL
18. Composición Empresas Eléctricas Regionales
19. Consumo Promedio de Energía

20. Bases para la Elaboración Proyecciones Financieras Circuitos
21. Reglamento Operativo del Decreto No. 459-B
22. Proyecciones de Generación de Fondos para el Proyecto
23. Proyecciones del Consumo Mensual por Abonado
24. Análisis de Sensibilidad
25. Impacto Distributivo de los Beneficios del Proyecto

Units and their equivalents

KW	Kilowatt	1,000 watts
MW	Megawatt	1,000 kilowatts
KWh	Kilowatt-hour	1,000 watts-hour
MWh	Megawatt-hour	1,000 KWh
GWh	Gigawatt-hour	1,000,000 KWh
KV	Kilovolt	1,000 volts
KVA	Kilovolt-ampere	1,000 volt-amperes
MVA	megawatt-ampere	1,000 kilovolt-amperes
Km	Kilometer	0.6214 mile
Km <sup>2</sup>	Square kilometer	0.3860 square mile
TPE	Ton petroleum equivalent	7.2 barrels petroleum equivalent



## I. INTRODUCTION

### A. The Application

- 1.01 On November 15, 1979, the Republic of Ecuador submitted a loan application to the Bank, through the Ministry of Finance and Public Credit, for the equivalent of US\$36,000,000 for partial financing of a project for the first stage of the National Rural Electrification Program. As a result of the analysis of the operation, the total cost has been set at US\$34,300,000, and the recommendation is for Bank financing in the equivalent of US\$27,500,000, out of resources of the Fund for Special Operations.
- 1.02 The purpose of the project is to provide electricity service to the rural population living in the mountain and coastal areas.

### B. Priority

- 1.03 Both in its application and on subsequent occasions, particularly during the Programming Mission which visited the country in February 1981, the Government of Ecuador has indicated the high priority it accords to execution of the project, since it fits in with and complements the rural development programs that the Government has been carrying out. It also represents a fundamental underpinning of the country's development strategy. The project is considered to fall within the 42 basic projects of the 1980-1984 National Development Plan, execution of which the Government feels is essential to the country's economic development.

### C. Bank Missions

- 1.04 The Bank conducted an Orientation Mission in August 1979 to determine the scope of the possible project, and to advise the INECCEL authorities on preparation of the loan application. In January 1980, a Preanalysis Mission made an exhaustive study of the proposed project, and recommended consideration of the project once a representative sample of the final designs of the works corresponding to approximately 30 per cent of the total project cost was available, and the various socio-economic studies had been reviewed. In mid-April 1981, the Bank sent an Analysis Mission to review the additional information for the study of this operation, and to check on the state of readiness of the technico-economic studies of the project. Finally, in August 1980, during the Analysis Mission for the Paute Hydroelectric Project, Phase C, some unresolved details of the rural electrification project were finalized.

D. Conclusions

- 1.05 The conclusions given in the present report are the result of studies conducted by the Project Committee during its visit to Ecuador, subsequent analysis at Headquarters, and the exchange of communications with the INECCEL authorities through the Bank's Field Office. In preparing the report, account was also taken of the recommendations contained in the Evaluation Report on Rural Electrification and Power (document RE-42) as indicated in paragraphs 4.08, 4.18, 4.26 to 4.28 and 4.12.
- 1.06 On the basis of the foregoing and the details given in subsequent chapters, the proposed operation is considered to be viable, subject to the conditions established in the present report.

## II. FRAME OF REFERENCE

### A. Recent Socioeconomic Trends and Outlook

- 2.01 Based on information provided by the Central Bank of Ecuador, in 1980 the GDP increased by 4.6%, which was less than the previous year's increase and below the goal set in the National Development Plan, 5.6%. The decrease in the growth rate was due, for the most part, to a drop in the level of production within the mines and quarries sector, to the sluggish performance in the agricultural and livestock sector and to a slowdown in the rate of industrial expansion. Technical factors and marketing problems adversely affected petroleum production, which accounts for around 90% of the activities of the mines and quarries sector. Value added for construction and electric power, on the other hand, continued to increase rapidly.
- 2.02 For its part, internal demand increased by 7.6%, which was higher than the 6.5% recorded in 1979. The considerable increases in wages and salaries in 1980 stimulated the increase in internal consumption, which expanded at a rate of 9.5%, surpassing the 6.5% increase achieved the previous year. Investment, however, increased by only 0.6% in 1980, because of the slowdown in the rate of expansion in gross fixed capital formation and a significant drop in the level of inventories. Moreover, the volume of exports dropped by 11.5%, while imports increased by 4.3%, thereby exacerbating what was, in real terms, a deficit trade balance recorded the previous year.
- 2.03 The aforementioned salary policy and the cut in the work day of weekly labor, had an effect on the inflationary process in 1980. The consumer price index increased by 12.8% while the increase was 10.1% in 1979. The implicit deflator of the GDP increased by 17.3%; the previous year that increase had been 15.9%.
- 2.04 The public sector's global deficit increased from the equivalent of 5.6% of the GDP in 1979 to 7.2% in 1980 largely as a result of an increase in current expenditures. Further, capital expenditures were equivalent to 10.3% of the GDP, which was higher than the 1979 figure of 9.2%. It should be pointed out that in 1979, internal credit constituted the principal source of financing for the public sector's global deficit, while in 1980 approximately 72% of the public sector's deficit was financed by external credit.
- 2.05 Estimates are that in 1981 the Gross Domestic Product will increase by 4% as a result of a drop in petroleum production, less expansion in the manufacturing industry and the electric power industry. Moreover, trade, transportation services and financial services are expected to increase at lower rates. However, agriculture is expected to perform somewhat better than it did in 1980. The agricultural increase is

expected to be the result of a recovery in export products (bananas and coffee) and domestically-consumed agricultural commodities such as wheat, hard corn, soft corn, rice and cotton and, to a lesser extent, barley and sugarcane. 1/

- 2.06 Consistent with the policies pursued in earlier years, the 1980 monetary program was aimed at maintaining an acceptable rate of growth in the economy, controlling inflation, assigning more credit to productive activities, and controlling the deficits in the balance of payments. However, the money supply expanded at a rate of 28%, compared to 17% in 1979. This growth was primarily due to the increase in international reserves, the expansion in the lines of credit to the agriculture and industry sectors and the liquidity requirements created by the marked salary increases made in 1980. The public sector continued to increase its deposits in the Central Bank since it was able to contract credits abroad in excess of its financing needs. Total domestic credit grew 23.3% compared to 21.7% in 1979. The participation of the Central Bank in that expansion occurred through the rediscounts, advance payments on future exports and bankers' acceptances. Monetary policy during 1981 sought to follow the monetary program which calls for a growth in the money supply of not more than 20% for the entire year. That increase is based on a projected inflation of 15% and a 5% real growth in GDP.
- 2.07 The special situation that affected the country during the first few months of the year gave rise to a withdrawal of deposits of 3,000 million Sucres and considerable pressure on the rate of exchange (of the Sucre with respect to the United States dollar) in the open market. The subsequent lack of liquidity compelled the monetary authorities to open emergency lines of credit and to reduce the legal reserve on demand deposits from 30 to 20%. With the normalization of deposits around the month of May, temporary limits were placed on expansion of bank credits and the legal reserve was increased to 50% on the margin of deposits exceeding the levels prevailing in January. Lastly, in July the legal reserve was restored to the level considered as normal of 30%.
- 2.08 The increasing differences between the maximum legal interest rates in Ecuador and those prevailing abroad, added to the widespread rumors of devaluation, caused a persistent outflow of funds abroad. This caused the authorities to revise the interest rates on savings deposits and on loans on March 18, increasing: (a) from 6 to 8% the interest rate for deposits of 30 to 100 days; (b) from 8 to 10% for the interest rate for deposits of 181 to 360 days; and (c) from 9 to 13% on the interest rate for deposits of more than one year. Furthermore, the maximum interest rate on commercial loans with a term of up to one year was established at 12%. The interest rate on loans of more than one year was established between 13 and 15%, depending on their maturity. It should be indicated that the effective rate for loans of less than one year is 15%, owing to the 1% tax and the 2% commission.

---

1/ The performance by economic sector appears in Appendix 1.

- 2.09 Despite the measures indicated above, capital flight continued. Consequently, the monetary authorities were forced to use \$288 million from net international reserves to finance the increasing demand for credit.
- 2.10 In 1980 inflationary pressures worsened, despite the measures approved by the National Congress in October of 1979, according to which: (a) the rent on homes or sites intended for housing was frozen for the period of three years; (b) the rates for low-income classes could not be raised on water supply, sewerage, electricity, mail, communications and similar services; and (c) the price of vital products of top necessity produced by agriculture as well as industry was frozen. Inflation, estimated by the consumer price index, increased 12.8% in 1980, compared to 10.1% in 1979 and 12.1% annual average growth in the period 1976-78.
- 2.11 With the exception of 1978, the trade balance in goods recorded significant surpluses in the period 1975-1980. The information available suggests that in 1980 the value of merchandise exports exceeded that of imports by an estimated US\$326 million, a figure which is \$252 million more than the year before. However, that surplus was insufficient to offset the disequilibrium in the services account, owing to which the balance on current account had a negative value equivalent to US\$576 million, a figure 6.6% below that of 1979.
- 2.12 Among the main export products, bananas, seafood products and petroleum and petroleum derivatives, experienced increases in values exported. In contrast, coffee, cacao and products prepared from cacao recorded significant declines. Petroleum continued to be the major export category, representing about 61.6% of the value of sales abroad of goods, a figure which was greater than the 54.2% for 1979 and the annual average of 44.5% for the period 1976-78.
- 2.13 The rate of growth in the value of imports of goods declined from 34.5% in 1979 to 5.1% in 1980. Up to October of 1980 approximately 70% of the value of the goods imported was composed of raw materials, intermediate-use goods and capital goods intended for the industrial sector.
- 2.14 The capital account registered a net inflow of US\$909 million in 1980, which compares favorably to a flow of US\$619 million in 1979. The inflow of capital more than offset the deficit on current account of 1980. Therefore international reserves increased by US\$280 million, significantly higher than the US\$20 million resulting from fiscal year 1979. That increase can be explained in part by an operation to reorganize external debt which took place in 1980.
- 2.15 During the first half of 1981 exports reached a level of about US\$1,235 million, a figure US\$12 million above that of the same period of 1980. Petroleum and its derivatives, taken as a whole, represent 68% of the

total exported. Imports grew at a moderate pace, 8%, stemming from the restrictive measures adopted in the beginning of the year. At that time, advance deposits on imports of non-essential goods were increased significantly. Customs duties were also increased on automobile imports. Furthermore, a drainage of foreign exchange of US\$216 million reduced the level of reserves as of June 30 to US\$640 million, sufficient to finance about four months of imports.

- 2.16 External public debt of Ecuador amounted to US\$3,706.5 million as of December 31, 1980. Up to that date, \$2,671.1 million had been disbursed. Furthermore, information provided by CONADE reveals that during 1980 \$1,941 million had been disbursed, of which 61.4% pertained to debt of the public sector and the rest to the private sector. 86.3% of the public debt used came from private banks and suppliers, 11.8% from multilateral organizations and the remaining 1.9% from governments. External public debt service amounted to \$855.4 million, equivalent to 33.8% of exports of goods. Furthermore, CONADE indicated that during 1980 the public sector contracted new loans for a total of US\$1,400 million, 4.2% more than in 1979. The Permanent Group on Studies and Planning of External Debt has established the sum of US\$500 million as the ceiling on new debt of the public sector for 1981.
- 2.17 The growth in current revenue of the public sector was affected primarily by the revenue generated from petroleum in 1980, which amounted to 46.5% thereof. At the same time, revenue of the public sector increased from the equivalent of 20.7% of GDP in 1979 to 23.9% in 1980. However, this increase was not sufficient to reach the revenue goal proposed in the National Development Plan which was an amount equivalent to 25.6% of GDP. In contrast, current expenditures grew from 17.5% of GDP in 1979 to 21% in 1980, exceeding the level of the plan which proposed expenditures equivalent to 18.3% of GDP for the last of the years mentioned. Consequently, savings on current account deteriorated, declining from an amount equal to 3.2% of GDP in 1979 to 2.9% in 1980, that proportion being significantly under the 7.3% of GDP planned for that year. This situation can be explained to a large extent by the policy of salary increases established at the end of 1979 and by a greater absorption of manpower in the public enterprises. It should be pointed out that the salary policy of the government is aimed at maintaining levels of remuneration that do not lose their purchasing power as a result of inflation. Consequently, minimum salaries will be reviewed each year based on vital needs. Furthermore, minimum wages will be established for the various jobs or services of people working for their own account.
- 2.18 Furthermore, capital costs of the public sector increased from the equivalent of 9.2% of GDP in 1979 to 10.3% in 1980. That proportion was below what was established in the plan, 11.7%, and also under the levels recorded in the period 1976-77. These figures suggest that in 1980 the public sector recorded an overall deficit equivalent to 7.2% of GDP, greater than the 5.6% estimated for 1979 and significantly greater than

the disequilibrium anticipated in the plan of 3.8% of GDP. To finance that disequilibrium, the government resorted preferably to external credits, which contributed 72% of the resources required.

- 2.19 On February 18, 1981, the government of Ecuador adopted a number of financial and tax measures to increase the level of public revenue and to make feasible the execution of the economic and social development programs and the national defense programs. Some of the major provisions were: (a) new prices for petroleum derivatives, mass transportation and urban and inter-urban shipping; (b) legislative bills for increasing taxes on vehicles and cigarettes; (c) monetary measures intended to contain the inflationary process; (d) subsidies for transportation of workers and students; (e) freezing of prices on essential goods; (f) basic hospital services free of charge; and (g) inclusion of savings and loan cooperatives into the national financial system. Furthermore, the hours for all officials of the public sector were set at from 8 AM to 4:30 PM.
- 2.20 The fiscal situation of the central government (the Budget of the State approved by Congress, through which 55% of all of the public revenue and 30% of public capital expenditures are managed) constitutes one of the main problems currently confronting the authorities, owing to the decline in collections on petroleum revenue. Furthermore, resources generated by traditional taxes have not grown at the expected pace. In addition, wages of the year before of US\$167 million had to be paid. All of the above created a situation of net dissavings, with a deficit on current account of close to 1.6% of GDP. It is most likely that 1981 will close with a deficit equivalent to 4.6% of GDP, compared to 4.4% in 1980.

B. The Electric Energy Sector in Ecuador <sup>1/</sup>

1. Organization of the sector

a. Planning and coordination

- 2.21 The Consejo Nacional de Desarrollo (CONADE) is the government entity responsible for preparing the National Development Plan, which is approved by the Office of the President of the Republic and is mandatory for institutions of the public sector. The plan in effect covers the period 1980-1984 and each year is subject to the necessary revisions in the operating plan of that year.
- 2.22 The Ministry of Natural and Energy Resources (MRNE) has the objective of executing, controlling and coordinating national energy policy. To this end it has: (i) INECCEL, which is in charge of planning and developing electrification; (ii) the Corporación Estatal Petrolera Ecuatoriana (CEPE), which is entrusted with the exploration and development of

---

<sup>1/</sup> Appendix 2 includes background on the energy sector of Ecuador.

hydrocarbons; (iii) the Bureau of Geology and Mines, for the exploration and exportation of mining resources; (iv) the Instituto Nacional de Energía (INE), which is responsible for the study and establishment of the policy on utilization of the various sources of energy; and (v) the Atomic Energy Commission, for research in atomic energy.

b. Institutional structure

- 2.23 The electric power sector in Ecuador is governed by the Basic Electrification Law, enacted in September 1973. This Law regards electrification as a national project; it holds the government responsible for planning, executing and controlling electrification through the Ecuadorian Electrification Institute (INECEL). In accordance with the Basic Law, the State alone is empowered to generate, transmit, distribute and market electric power, through INECEL; however, it can authorize the operation of private companies. INECEL's other functions expressly stipulated in the Law or taken from its guidelines, are to plan development of the national electric power sector, to interconnect and coordinate the workings of the country's power-producing plants, to set up regional electric power companies to serve as distributors and to establish the rates for electric power service.
- 2.24 In Ecuador, there are 16 electric companies and one electric power cooperative, which together market 98% of the power sold. In 15 electric power companies and the cooperative, where the State is the majority owner, INECEL is the majority shareholder, while the municipalities and certain private parties are the minority shareholders. The other companies, which serve the city of Guayaquil, are privately owned.
- 2.25 In the National Electrification Plan the basic orientation of electric power development in Ecuador has been set up into two systems: (i) the National Interconnected System; and (ii) the Regional Electric Power Systems. The first provides for the integration of the electric power supply for the Mountain and Coastal Regions, which are the most heavily populated and the site of the urban and manufacturing centers. The basic purpose is to streamline the supply of electric power by using the economies of scale of the hydroelectric projects, and in so doing eliminating a large number of small stations whose operation is not only unreliable but also uneconomical. The Regional Electric Power Systems are composed of the facilities and equipment necessary to distribute electric power in geographically-defined areas and under the management of the aforementioned regional companies. Once the National Interconnected System (SNI) is established, these companies, which now generate, distribute and market their own electric power, will be responsible for the bulk purchase, distribution and marketing of the electric power generated by INECEL.
- 2.26 With this in mind, INECEL plans to integrate the existing electric power agencies into nine Regional Electric Power Systems, whose areas of influence do not necessarily coincide with the geography of the country's



political-administrative division. The nine regional electric power systems would be as follows: North, Pichincha, North-Central, South-Central, South, Esmeraldas, Manabí, Guayas-Los Rios and El Oro. <sup>1/</sup> There are also small, isolated supply centers that are not part of the systems. These isolated centers cover the eastern zone of the country and the Galapagos Islands.

## 2. Coverage of electric service

- 2.27 Consumption of electric power in Ecuador is for the most part for residential and commercial use in the major urban centers, with the exception of Guayaquil, Quito and Cuenca, where there is a heavy concentration of industries. Electric power consumption has experienced an average annual increase of 10.3% in the 1965-1972 period and 14.6% in the 1972-1980 period. The evolution of consumption is shown in the following table:

	1972		1980	
	Consumption in GWh	Thousands of Users	Consumption in GWh	Thousands of Users
Residential	340.9	248	1,006.3	565
Commercial	135.4	50	425.3	103
Industrial	375.2	5	1,161.1	12
Others	103.8	4	260.7	5
Total	955.3 =====	307 =====	2,853.4 =====	685 =====

- 2.28 The number of individuals with electric power service varies from region to region within the country, as shown below, as a percentage and by distribution system: North, 46.5%; Pichincha, 63.0%; North-Central, 29.5%; South-Central, 29.7%; South, 24.3%; Esmeraldas, 25.6%; Manabí, 25.8%; Guayas-Los Rios, 55.3%, and El Oro, 37.7%. In general, estimates are that only 43.2% of the country's population has electric power service. The difference is even greater when the total population served is viewed from the standpoint of urban zones (87%) as compared to rural zones (13%).
- 2.29 Pursuant to the Electrification Master Plan prepared by INECEL, it is estimated that the coverage of the electric system would be 54.6% of the population by 1985 and that a per capita annual generation of electric power of 580 Kwh would be achieved, which is approximately 1.4 times the current level of production.

---

<sup>1/</sup> Appendix 3 shows the location of the Regional Electric Systems.

3. Development program of the sector

a. National Development Plan

- 2.30 The objectives of the energy policy established by the National Development Plan 1980-1984 are: (i) rationalization and optimization of the generation, transmission and distribution of electric energy by inter-connecting the various generating plants; (ii) reducing the consumption of fuels in the generation of electric energy, replacing thermal energy by hydroelectric energy; (iii) extending electric energy service to most of the territory of the nation, including the rural areas; and (iv) contributing to the comprehensive development of the rural sector through the installation of substations, transmission and distribution lines and small energy-supply stations.
- 2.31 The Development Program of the Electric Power Sector makes provision for the execution of three programs: (i) the National Interconnected System (SNI), which involves the construction of various hydroelectric stations and thermal stations, power lines and transformes substations; (ii) Regional Electric Power Systems, involving the construction of engineering works to transmit and distribute the electric power that comes from the SNI; and (iii) Rural Electrification at the national level. The investment estimated for these programs is the equivalent of US\$1.636 billion over the five-year period.

b. Electrification Master Plan

- 2.32 Based on the provisions and guidelines of the National Development Plan, INECCEL prepared the Electrification Master Plan for the period 1980-1984, with projections up to 1990. It contains the supporting studies and detailed programs of the works to be carried out or started in the period. Furthermore, the Institute has begun to organize a General Electrification Master Plan, with a planning horizon of not less than 20 years. This project, which should be concluded in 1983, has the following major goals and objectives: (i) to make an evaluation of the water and geothermal resources of the country and to determine the uses which are promising for the establishment of hydroelectric plants, creating furthermore a data bank of basic information, and (ii) the design and implementation of a comprehensive planning model to optimize the utilization of the resources of the country for this sector.
- 2.33 The General Plan of INECCEL is thus composed of: (i) Short-term Master Plan, defining the works to be carried out in the next six years, based on works that have been studied and analyzed thoroughly, with their pertinent financing plans; (ii) Medium-term Master Plan, covering a period of 6 to 12 years, defining in a tentative manner, the works to be carried out in that period and the studies that have to be made in greater depth; and (iii) Long-term Master Plan, covering a period of 12 to 25 years, which would be a guide and would define the resources that must be investigated to be used in the long term in the production of electric energy.

4. Installed generating capacity and transmission system

a. Generation

- 2.34 Ecuador's electric power sector has developed rapidly in recent years. The installed capacity for public service went from 285.3 MW in 1972 to 1,029.3 MW in 1980, which represents an average annual rate of increase of approximately 16.6% in that period. Some 99% of the electric power produced at the end of 1980 came from the public system, while 1% was privately produced.
- 2.35 The electric power generated for public service increased by 241.9% during the period 1972-1980, from 976.5 Gwh to 3,338.4 Gwh. Despite this increase, the annual production per capita is only 408 Kwh and the installed capacity is 120 watts per capital, these figures being less than those of other Latin American countries. <sup>1/</sup> The figures for installed capacity and electricity production in the country for 1980 were the following:

	Installed Capacity (MW)				Generation (Gwh)			
	Hydraulic	Thermal	Total	%	Hydraulic	Thermal	Total	%
Regional systems	137.5	520.6	658.1	64.0	575.8	1,416.7	1,992.5	59.7
National Inter-connective system	70.0	206.2	276.2	26.8	262.2	835.1	1,097.3	32.9
Self-producers	10.0	85.0	95.0	9.2	21.4	227.2	248.6	7.4
Total	217.5	811.8	1,029.3	100.0	859.4	2,479.0	3,338.4	100.0
	=====	=====	=====	=====	=====	=====	=====	=====
Percentages	21.0	79.0	100.0		25.7	74.3	100.0	

- 2.36 As can be seen from the above table, 21% of the installed capacity at the end of 1980 was hydraulic in nature and 79% thermal. Furthermore, the generation was 25.7% hydroelectric and 74.3% thermal. The high proportion of thermal generation at the present time is explained by the fact that the expansion which has occurred in the decade of the 70's was mostly thermal and was in line with the policy existing at that time which consisted in rapid expansion based on gas, diesel and steam plants. According to the goals of the National Development Plan 1980-1984, after the Paute A and B plant comes on stream, the hydraulic generation percentage would reach approximately 65% of total electric power generation.

<sup>1/</sup> Per capita installed capacity in some of the Latin American countries is the following (in watts): Colombia (167); Chile (266); Peru (177); Brazil (235), and Uruguay (261).

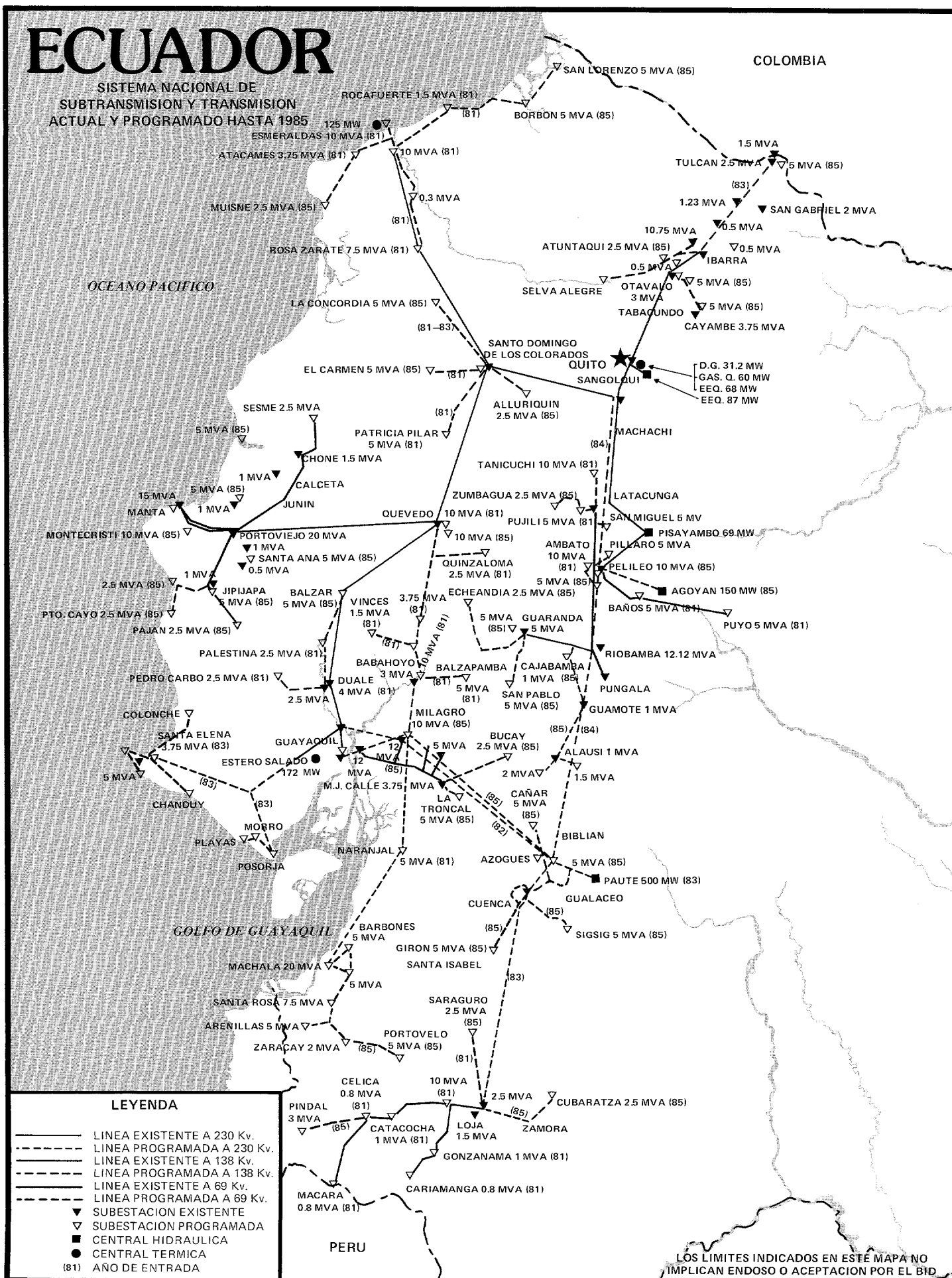
b. Transmission, sub-transmission and distribution

- 2.37 The National Interconnected System (NIS) has been conceived by INECEL so that the energy resources of the country can be developed and utilized efficiently and so that they can benefit all of the regions of the country. After examining various alternatives for the system, it was decided in 1976 to have a basic configuration to be developed in various phases. This basic configuration is composed of: (i) a double-circuit 230 KV ring covering Paute-Milagro-Guayaquil-Quevedo-Santo-Domingo-Quito-Totoras-Paute; (ii) sectionalizing substations and/or stations in each of these sites, either for receiving the energy from the generating plants and/or for delivering energy to the various regional systems; (iii) radial 230 KV or 138 KV transmission lines; and (iv) step-down 69 KV and/or 34.5 KV substations in the consumer centers. The double-circuit 230 KV ring system is reliable and flexible, since each point of the ring will receive under normal conditions energy through four transmission lines; and its physical configuration is such that it can receive, through relatively short lines, the energy from the generating sources. The map ahead shows the configuration called for in the system in 1985.
- 2.38 The make-up of the NIS began with the combining, through 249 kms of 138 KV transmission lines, of the systems of Ibarra, Quito and Ambato, and a double-circuit 230 KV line 326.9 kms long connecting Quito and Guayaquil. The coordination, planning and maintenance of this system are the responsibility of INECEL. Concerning the sub-transmission and distribution system, at December 1980 the country had 6,462 kms of lines with voltages varying from 60 KV to 643 KV. In the voltage most frequently used, 13.8 KV, 5,034 kms are operating. These lines are built, operated and maintained by the regional enterprises.

5. Generating program

- 2.39 The INECEL expansion program anticipates meeting the average demand which is probable in the period 1982-1990 through the installation of the following generating plants:

SISTEMA NACIONAL DE  
SUBTRANSMISION Y TRANSMISION  
ACTUAL Y PROGRAMADO HASTA 1985



<u>Plant</u>	<u>Type of Plant</u>	<u>Installed Capacity (MW)</u>	<u>Start-Up</u>
Esmeralda	T	125	1982
Paute A & B	H	500	1982-1983 <sup>1/</sup>
Agoyan	H	150	1986
Paute C	H	500	1987-1988
Daule Peripa	H	130	1989
Mazar	H	140	1990
Toachi	H	<u>300</u>	1990
Total		1,845 =====	

- 2.40 This plan places special emphasis on hydroelectricity and thus 94% of the new installations will be hydro and 6% thermal. The plants of Esmeraldas and Paute A and B are under construction and their degree of progress indicates that they should be operating on the dates indicated. The Agoyan project has been bid upon and construction should start in January of 1982. Given the characteristics of the project, it should come on stream in 1986.
- 2.41 The invitations to bid for the construction and supply of equipment for Paute C, the project being studied in this report, should occur in the first few months of 1982, so that the project can come on stream on the dates planned. The construction of the Daule-Peripa dam has been contracted through bidding by the Comisión de Estudios para el Desarrollo de la Cuenca del Río Guayas (CEDEGE). <sup>2/</sup> The designs of the energy plant should be contracted soon, so that the bidding on the construction of the plant and the supply of the equipment can occur in due time. INECCEL is currently undertaking supplementary studies and designs for bidding on the Paute-Mazar plant. It also has bidding designs for Toachi.
- 2.42 The generating program of the NIS was studied in two stages. The first stage consisted in an economic appraisal of each project considered separately, that is to say not incorporated into an installation program. This appraisal led to calculating the optimum power of the installations in order to compare them on similar bases. A ranking of the projects based on their internal rate of return was also obtained. In the second stage, various alternative equipping programs were analyzed, making combinations in the start-up of the projects and evaluating the investments and operating costs in order to determine the program or sequence with the most attractive technical and economic features.

<sup>1/</sup> The date anticipated for the start-up is the end of December of 1982 or the beginning of January of 1983.

<sup>2/</sup> The dam is part of the first stage of the multi-purpose Daule-Peripa project, which was financed in part through loans 610/SF-EC, 32/VF-EC and 58/IC-EC.

- 2.43 After the generation program presenting the most favorable technical and economic features for meeting the maximum probable demand had been defined, it was noted that the investments required exceeded the resources earmarked for the electric sector. As the result of this review, the program selected was changed, reducing its scope, setting as a goal the fulfillment of the average probable demand. This program, as changed, is the one presented in the table of paragraph 2.39.
- 2.44 The demand and energy projections of the Electrification Master Plan are as follows for the National Interconnective System up to the year 1990:

Year	Probable Demand (Gwh)	Potential Probable Demand (MW)	Guaranteed Capacity	% Capacity Reserve
1982	3,648.5	803.5	1,089.7	35
1985	5,598.7	1,231.5	1,527.5	24
1987	6,800.1	1,492.8	1,765.6	18
1988	7,497.2	1,645.8	1,985.5	17
1989	8,225.3	1,805.7	2,013.4	11
1990	9,022.2	1,976.8	2,189.9	11

- 2.45 These projections indicate that towards the end of the decade, beginning with 1987, the system would be very well adjusted in its operation and in the case of a critical year it would be necessary to operate the thermal plants at their maximum utilization to be able to cover the requirements of the system. On the other hand, a significant delay in the equipping plan would require the construction of a new thermal plant to meet demand adequately.

#### 6. Transmission, subtransmission and distribution program

- 2.46 INECCEL has the following transmission lines currently under construction that should come into operation up to 1982: (i) Santo Domingo-Esmeraldas, 138 KV, double circuit, 154 kms long; (ii) Quevedo-Portoviejo, 138 KV single circuit, 107 kms long; (iii) Paute-Milagro-Pascuales, 230 KV, double circuit, 230 kms long; and (iv) Paute-Cuenca, 138 KV, double circuit, 70 kms long. <sup>1/</sup>
- 2.47 To complete the NIS, in the period 1982-1985 the Institute will build, with financing from the World Bank, <sup>2/</sup> transmission lines that will enable it to complete by the year the basic configuration of the systems, as indicated ahead: (i) Paute-Totoras, 230 KV, double circuit, 205 kms long; (ii) Milagro-Machala, 230 KV, single circuit, 133 kms long; (iii) Guayaquil-Posorja-Santa Elena, 138 KV, single circuit, 205 kms long; (iv) Cuenca-Loja, 138 KV, single circuit, 135 kms long; and (v) Ibarra-Tulcan, 138 KV, single circuit, 7 kms long.

<sup>1/</sup> The last two lines are financed under loan 323/OC-EC.

<sup>2/</sup> Loan 2045-EC in the equivalent of US\$100 million. (See paragraph 2.52).

- 2.48 Furthermore, and under the Agoyan project, the following will be built: (i) Totoras-Quito, 230 KV, double circuit, 105 kms; and (ii) Agoyan-Totoras, 138 KV, double circuit, 46 kms. Finally, as part of the NIS and to convey the energy of Paute C, the Paute-Milagro-El Guasmo line, 230 KV, double circuit, 179 kms long is expected to come into operation by 1987.
- 2.49 In the period 1982-1985, plans call for the regionals systems for the construction of approximately 1,300 kms of 69 and 34.5 KV subtransmission lines and step-down substations with a capacity of 450 MVA. These works will serve in some cases to connect to the NIS and in other cases for improving the service to areas taken care of by the regional systems. The execution will be the responsibility of INECEL and the electric utilities. These works are of importance to the electrification project considered in this report since they will make it possible to connect the isolated centers in the rural areas to the distribution centers.

C. Participation of the IDB and other International Agencies in the Development of the Electric Sector of Ecuador

- 2.50 The IDB has been the principal source of external financing for Ecuador's electric power sector; it has extended nine loans and provided technical cooperation for a total of US\$156.6 million, earmarked exclusively for the electric power sector. <sup>1/</sup> IDB resources were used to partially finance the construction of the Pisayambo Hydroelectric Station, which has a capacity of 700 MW; the Paute A and B Hydroelectric Station is currently under construction, which will have a capacity of 500 MW, and the Paute transmission plant. IDB funds also financed the studies to determine the feasibility of tapping, for hydroelectric purposes, the Rio Coca and the Rio Guayllabamba and the Jubones Multiple Project.
- 2.51 As the loan request to which this report refers is being examined within the Bank, consideration is also being given to a request presented by INECEL for partial funding to expand the generating capacity of the Paute hydroelectric dam by 500 MW.
- 2.52 Other international development agencies such as the World Bank and the United States Agency for International Development (USAID) have participated in the funding of projects in Ecuador's electric power sector. In 1957 and 1972, the World Bank extended three loans to Quito's Electric Power Company, involving a total of US\$16.8 million, to finance three electric power projects. Recently, on July 21, 1981, the World Bank granted a loan to INECEL, for the equivalent of US\$100.0 million, for partial financing of the transmitter work of the National Interconnected System, involving the installation of 230 KV and 138 KV transmission

---

<sup>1/</sup> An evaluation of these operations is given in Chapter VII of this Report.



lines and the corresponding distribution substations. <sup>1/</sup> The loan also includes: (i) a component for a plan to train INECEL personnel and staff from the regional electric power companies; (ii) a program for institutional reinforcement of INECEL; (iii) the services of consulting engineers for the establishment of a National Electric Power Dispatch Station; and (iv) advisory services for supervision of the construction of engineering works.

- 2.53 Between 1964 and 1972, USAID extended three loans for a total of US\$5.1 million, for projects to expand the generating and transmission capability of the electric companies of Cuenca and the Santa Elena Peninsula, as well as rural electrification projects in Santo Domingo de los Colorados and other rural areas in the country.

D. Rural Electrification in Ecuador

1. Background

- 2.54 Rural electrification in Ecuador is the result of outlying expansions in the major urban centers of the country, effected in previous years by municipal electric power companies. With issuance of the Basic Electrification Law in 1961 and the establishment of INECEL, an effort began to integrate electric power service, first through the establishment of the regional electric power companies and recently through the regional electric power systems, which together with the engineering work done to expand the generating capacity are creating the basic infrastructure for rural electrification.
- 2.55 The electric power system in Ecuador reaches less than 44% of the national population and only 13% of the population in rural areas. With the exception of certain areas along the coast and in the mountains, Ecuador's rural sector, for all intents and purposes, does not have electric power service. This is not only detrimental to the welfare of the rural populace, but also prevents more technical and rapid development of the agricultural and livestock sector and of agroindustrial activities.
- 2.56 Aware of the need to develop programs that make possible harmonious development among the country's various sectors, as set forth in the National Development Plan, and in view of the fact that the agricultural and livestock sector constitutes one of its major sources of production and wealth, the national authorities have taken steps to draw up the National Rural Electrification Program which will make it possible to provide to Ecuador's rural population the social and economic benefits that the electric power sector has to offer. The main objectives of the program would be: (a) to increase the standard of living of the rural population and contribute to adequate orientation of the migration flows in the country; (b) contribute to agriculture-livestock activity; (c) substitute more economical electric energy for certain energy resources (wood and petroleum) currently being used in agriculture.

---

<sup>1/</sup> See paragraph 2.47 for location of those works.

- 2.57 Plans are to execute the program in stages, the first of which will be carried out in the 1981-1985 period, at an estimated investment of approximately US\$80 million. It is composed of two projects: (i) The Coastal and Mountain Project, for which partial financing has been requested from the IDB and which is the subject of the present document; and (ii) the Project involving small stations for the Eastern Zone and the Galapagos, involving power production and distribution works in those zones. These would be financed through bilateral agreements between governments or suppliers' credits.
- 2.58 With the start-up of the two projects comprising the first phase of the National Rural Electrification Program, the electric coverage of the rural sector would be raised from 13% to approximately 26%. The number of rural homes that would be supplied with electric service would be 80,000, 31,000 of which will be included in the execution of the project proposed for the Costa and the Sierra.

2. Resources for the financing of the National Rural Electrification Program

- 2.59 In Ecuador, the sources of funds for the financing of rural electrification projects are clearly established in four Governmental Decrees, the operating regulations of which entrust INECEL with supervising the pertinent collections as well as the purposes for which those contributions were created. <sup>1/</sup> In this context, for the financing of the proposed project, the resources would be used coming from three of the four Decrees, the legal bases and operating aspects of which are mentioned in the following paragraphs.
- 2.60 Decree 306, enacted in the Official Register 794 of May 2, 1975, established the Rural Electrification Development Fund, which calls for a mandatory contribution of 10% of the invoiced value of electric energy from customers paying a commercial and industrial rate, and who have an installed load of more than 10 KW in the case of industries and monthly consumption of more than 2,500 Kwh in the case of commercial firms. Thus, the billing and collection of the value stipulated for the Rural Electrification Fund are done by the regional electric utilities in the monthly bills issued to their customers. Those utilities then deposit those funds collected into the Banco Nacional de Fomento or the Banco Central del Ecuador in special accounts made out to INECEL for eventual distribution among the rural electrification projects in the pertinent regional systems. This decree would be in effect up to March of 1983. The government is currently considering extending the decree on a permanent basis.

---

<sup>1/</sup> As explained in Chapter V on its delegations and functions, INECEL approves each year the rural electrification programs presented by the electric utilities, thus supervising at the national level all of the works that would be carried out.

- 2.61 Decree 459-B, enacted in the Official Register 831 of June 24, 1975, established the Special Fund for electric service connections to low-income consumers, with resources obtained from the differential between the interest and commission paid by the government for various loans contracted abroad and those on which the loans were transferred to INECEL. 1/ The implementation of this decree is governed by Resolution 092 of INECEL of April 7, 1980. The creation of that fund was stipulated as a contract condition of loan 411/SF-EC granted by the Bank to the Republic of Ecuador on September 26, 1974. 2/ According to Clause 7 of Chapter V of that loan contract, the resources of that fund would be used for the financing of: (i) house connections for low-income consumers, including electric installations inside of their homes; and (ii) public lighting installations in urban or suburban areas inhabited by low-income consumers. In general terms, the resources of this fund are deposited in the Central Bank of Ecuador into a special account in favor of INECEL, which in turn distributes it in the form of loan among the various regional electric utilities for the granting of loans to the inhabitants of the rural areas in their respective jurisdictions, to assist them in financing electric service connections.
- 2.62 Ministerial Agreement 051, enacted in the Official Register 29 of September 20, 1979, established national rate regulations with a surcharge of 10% of the billing of regional electric utilities to their customers for generating funds for the financing of rural subtransmission, distribution and electrification works. 3/ Approximately 20% of the resources obtained through this regulation is earmarked to the Rural Electrification Program and the remaining 80% for the subtransmission and distribution works under INECEL. As in the regulations of decree 306, the amounts collected by the regional electric utilities must be deposited each month into an account in the Banco Central del Ecuador in the name of INECEL.
- 2.63 Decree 1042 pertains to the fourth transitional provision of the Basic Law on Electrification and assigns to the eastern provinces and the Galapagos Islands 4% of the 47% of the revenue collected by the treasury under royalties for the exploitation of the hydrocarbon resources of the country and the shipping fees on crude. These funds will not be used for the proposed project.
- 2.64 Paragraphs 6.05 to 6.16 present an analysis of the historical performance and the future projections for the mechanisms described above.

---

1/ The external loans considered under this decree are: Kreditanstalt (1975) United Kingdom (1975) and IDB loan 411/SF-EC.

2/ See paragraph 7.10.

3/ The surcharge of 10% of the monthly billing to the subscribers under this Ministerial Agreement is in addition to the 10% collected through decree 306.

### III. THE PROJECT AND ITS FINANCING

#### A. Objectives

- 3.01 The basic objectives of the project are to improve living conditions for the people who live in rural areas, and to contribute to the development and efficiency of agricultural production. At the same time, there would be substitution of energy sources by reducing the use of hydrocarbons and replacing them with electrical power.
- 3.02 To achieve these objectives, the tentative goal is to expand the supply of energy in rural areas of Ecuador to approximately 31,000 rural homes and a total of 166,000 inhabitants. This represents 39 per cent of the number of rural homes that, according to estimates, will be provided with electricity service under the National Rural Electrification Program between 1981 and 1985.

#### B. Description of the Works

- 3.03 The project will cover rural areas in seven of the nine regional electricity systems that serve most of the country. Given the administrative division of the regional electricity systems, it is anticipated that the project can be divided into subprojects, which will in turn be sub-divided into circuits - the project's smallest units. The map on the following page shows the location of the circuits that might form part of the rural electrification project, and Appendix 4 gives the layout of a typical circuit. The project consists solely of distribution works and hence does not include works for generation or transmission. The area to be electrified will be fed by the regional electricity company that has the concession in the area where the work will be performed.
- 3.04 The regulations established by INECEL, and subsequently updated by the Executing Unit of the Rural Electrification Project (UNEPER), for preparation of the final designs of the work cover the following general criteria: 1/ (a) design of the primary lines and feeders for the demand projected over 15 years; (b) size of the transformers and low-tension systems over 8 years; (c) maximum demand for the program of 23,200 KW, and energy consumption of 70 GWh/year; (d) radial configuration of the rural lines; (e) use of aluminum cables steel reinforced (ACSR); (f) standardized tensions of 22.8 KV, 13.2 KV and 7.6 KV for main lines and 240/120 volts for secondary systems; (g) voltage regulation levels up to

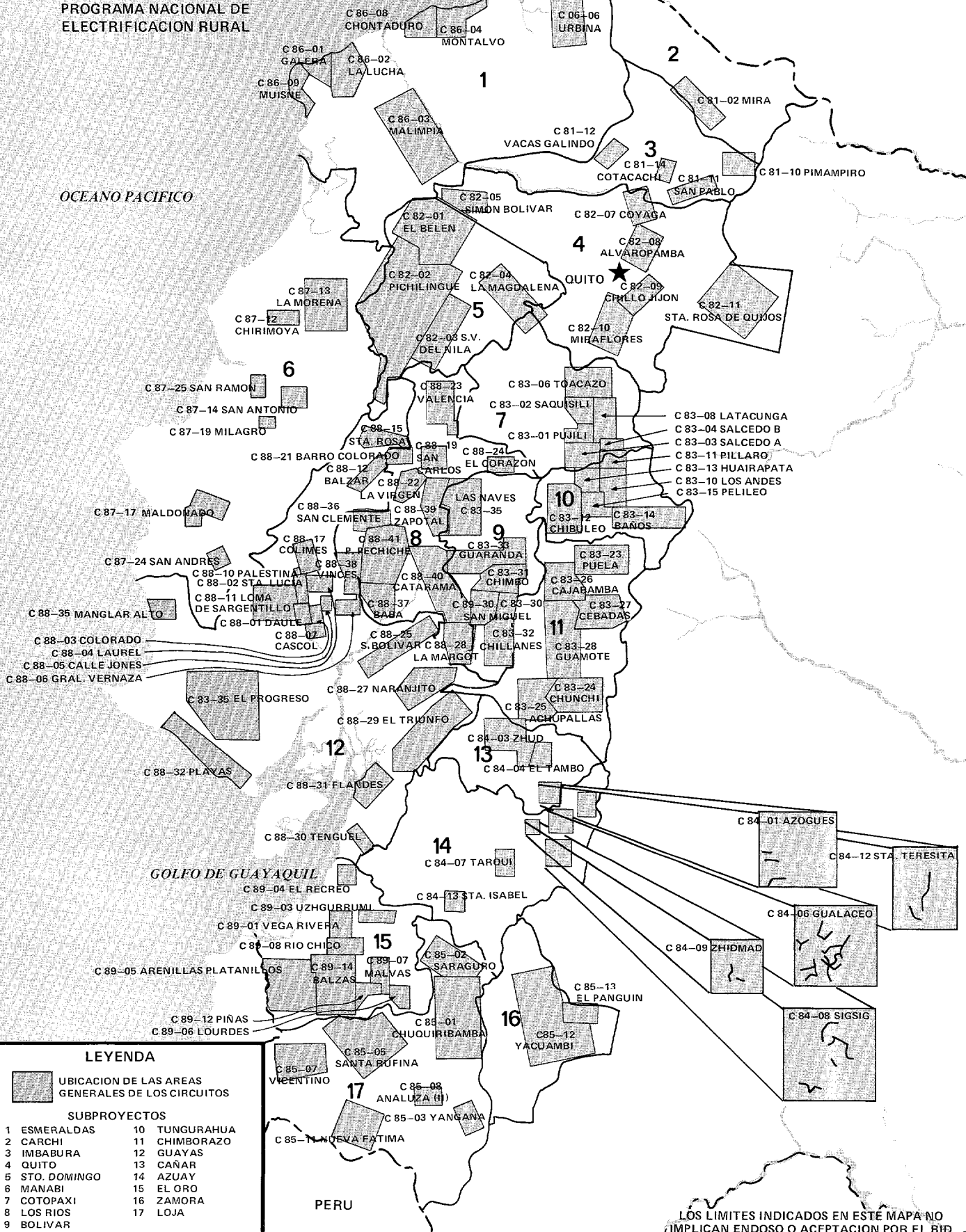
---

1/ These regulations were reviewed by experts from the National Rural Electrification Cooperative Association (NRECA) of the United States, and approved by all the regional electricity companies.

# ECUADOR

UBICACION GENERAL DE LOS CIRCUITOS  
PROGRAMA NACIONAL DE  
ELECTRIFICACION RURAL

COLOMBIA



the maximum permitted by the regulations 1/; (h) use of treated wood or cement poles, as appropriate on the basis of cost, environmental conditions and transportation and installation facilities. 2/

- 3.05 The works planned for the project consist of the installation of the following distribution lines: 1,300 kilometers of 13.2 Kv and 22.8 Kv primary lines; 280 kilometers of mixed lines; 3/ and 580 kilometers of secondary lines. 4/ In addition, approximately 2,700 distribution transformers will be installed and house connections, meters and inside fittings will be provided in the houses connected.
- 3.06 The project also calls for the purchase of spare parts, tools and maintenance equipment for the systems.

C. Cost of the Project

- 3.07 The total cost of the project, at September 1981 prices, is estimated at the equivalent of US\$34,400,000. The breakdown by investment category and source of financing is given below:

---

1/ The maximum level of regulation is 14%, as follows: from sub-station to primary, 7%, in the distribution transformer, 2%, in the secondary systems from the low-tension bushings in the transformers, 4%, and 1% for customer connections.

2/ The poles were selected on the basis of the isohyets (lines indicating equal rainfall) studied, which divide the country into dry and humid areas.

3/ Lines that include primary and secondary circuits in the same section.

4/ Most of the lines would be single-phase, except for some that might be three-phase because of particular load conditions.

(in thousand of US\$ or equivalent) 1/

Category	IDB Financing			Local Contri- bution	Total Cost	Percen- tage
	Foreign Exchange	Local Currency	Total			
1. Engineering and Administration	1,000	-	1,000	1,740	2,740	8.0
1.1 Engineering and supervision	1,000	-	1,000	1,090	2,090	6.0
1.2 Administration	-	-	-	650	650	2.0
2. Direct Construction Costs	22,080	3,500	25,580	5,100	30,680	89.1
2.1 Materials and equipment	21,340	-	21,340	-	21,340	62.0
2.2 Installation of the lines	-	3,500	3,500	4,400	7,900	23.0
2.3 Inside installations	-	-	-	670	670	1.9
2.4 Maintenance equipment	740	-	740	30	770	2.2
3. Financial Costs	820	100	920	60	980	2.9
3.1 Loan Commission	-	-	-	60 2/	60	0.2
3.2 Interest	580	65	645	-	645	1.9
3.3 Inspection and monitoring	240	35	275	-	275	0.8
TOTALS	23,900	3,600	27,500	6,900	34,400	100.0
	=====	=====	=====	=====	=====	=====
Percentages	69.5	10.4	79.9	20.1	100.0	

3.08 The individual project cost items given in the breakdown above each include allotments for contingencies and cost escalation.

#### D. Costing: Basis and Analysis

##### 1. Representative sample

3.09 For purposes of the analysis of the project, technical and economic data were taken from a representative sample of 16 circuits, with a total of 406 kilometers, i.e., 31% of the total mileage of the primary lines called for in the project. The parameters considered in the sample were: (a) final designs; (b) economic return on each circuit of a minimum of 11%; 3/ (c) connection of the region to the Inter-Connected

1/ Exchange rate used: US\$1.00 = S/.25.00.

2/ The loan commission will be paid in foreign exchange.

3/ While according to the selection criteria (see paragraph 4.12), the minimum rate is 12%, circuits on which the rate of return is more than 11% are considered acceptable for inclusion in the representative sample, since the characteristics of this type of works are such that with small adjustments in the lay-outs of the circuits, the internal rate of return called for in the selection criteria can easily be achieved. Thus, only circuits that obtain a return of 12% are to be included in the final project.

National System; (d) executing subtransmission works for the circuit feeder points. The last two parameters took into account all the regions appearing in the transmission program being partially financed by a recent World Bank loan, and the current subtransmission works program of the regional electricity companies and INECEL. The sample included circuits in both the mountains and in the coastal area.

3.10 The characteristics of the sample are shown below:



Characteristics of the Representative Sample

<u>Circuit No.</u>	<u>Name</u>	<u>Province</u>	<u>Connection to the National Interconnected System (SIN)</u>	<u>Length of Lines Kilometers</u>	<u>IRR (%)</u>	<u>Point of Feed to Circuit</u>	<u>Total Cost of Circuit (in US\$00)</u>
82-05	Simón Bolívar	Pichincha	Existing	23.5	12.7	Existing	434.
83-08	Latacunga	Cotopaxi	Existing	37.7	12.9	Existing	833.
83-23	Puela	Chimborazo	Existing	23.0	11.5	Existing	499.
83-26	Cajabamba	Chimborazo	Existing	56.4	11.9	Existing	1,410.
86-02	La Lucha	Esmeraldas	1982	53.5	11.7	1981-1982	797.
86-09	Muisne	Esmeraldas	1982	21.0	11.4	1981-1982	402.
88-01	Daule	Guayas	1982	10.0	16.9	1981-1982	313.
88-02	Santa Lucía	Guayas	1982	7.2	19.6	1981-1982	272.
88-03	Colorado	Guayas	1982	6.2	18.9	1981-1982	268.
88-04	Laurel	Guayas	1982	4.7	18.0	1981-1982	95.
88-05	Callejones	Guayas	1982	15.2	13.0	1981-1982	423.
88-11	Lomas Sargentillo	Los Ríos	1982	22.5	14.2	1981-1982	547.
88-32	Playas	Los Ríos	1982	32.9	11.7	1981-1982	522.
89-04	El Recreo	El Oro	1984	3.4	15.4	1981-1982	64.
89-12	Piñas	El Oro	1984	35.0	17.1	1981-1982	1,804.
89-14	Balzas	El Oro	1984	53.7	12.1	1981-1982	1,589.
Total 16 circuits				405.9			10.280.
				=====			=====

- 3.11 The sample gave the average values of the physical volumes of the works, which were then extrapolated. The sample also produced detailed lists of the equipment and materials in each representative basic unit --the circuit.

2. Engineering and administration

- 3.12 The equivalent of US\$2,740,000 included in this investment category would be used to cover the costs of works supervision and technical control (US\$2,090,000) and project administration (US\$650,000). The costs of supervision have been estimated at 6.8% of the total direct construction costs, which is considered reasonable in terms of experience in Ecuador with works of this kind. These include the cost of all the preliminary studies and the preparation of standards and designs. The supervision costs also include an item for the professional services of an engineering consulting firm that would be engaged by INECCEL to provide advice and technical support to the Executing Unit <sup>1/</sup> on the overall supervision of the project. The administration costs are for the operating costs of the Executing Unit responsible for the project.

3. Direct construction costs

- 3.13 The direct construction costs, the equivalent of US\$30,680,000 (including cost escalation and contingencies), represent 89.1% of the total investment required, and represent the relatively greatest cost item. The budgeting was based on the representative sample described above. That study gave the following approximate parameters; 23 houses per kilometer of primary lines; 35 houses per kilometer of secondary lines; 11 houses per transformer and 570 houses per circuit. The unit costs resulting from the estimate are considered reasonable when compared with other electrification projects considered by the Bank:

(US\$ equivalents)

<u>Country</u>	<u>Loan No.</u>	<u>Cost per Km. Primary Line</u>	<u>Year of Approval</u>
Argentina	358/OC-AR	5,000	1979
Brazil	12/IC y 522/SF-BR	5,050	1979
Colombia	608/SF-CO	5,150	1979
Jamaica	581/SF-JA	6,000	1979
Panamá	399/OC y 649/SF-PN	8,800	1981
ECUADOR	EC-0104 <sup>2/</sup>	7,050	-

<sup>1/</sup> Paragraphs 4.01 to 4.06 of the present report describe the structure and responsibilities of this Unit. The terms of reference for the consulting firm are given in Appendix 5.

<sup>2/</sup> Number of the project discussed in the present report.

- 3.14 The average cost per house benefitting from the project is the equivalent of US\$1,109, which is considered reasonable when it is compared with other electrification projects considered by the Bank.

4. Financial costs

- 3.15 The interest and the loan commission were estimated on the basis of the works execution timetable and the schedule anticipated for disbursement of the resources of the possible loan. The financial costs also include an item for IDB inspection and monitoring, which is calculated, according to normal procedure, as being 1% of the total amount of the Bank's financing.

5. Contingencies and cost escalation

- 3.16 The items for contingencies and cost escalation included in the cost estimates given above were determined in accordance with the Bank's regulations on the matter: (a) considering contingencies as 10% of the items for engineering and administration and for direct construction costs; and (b) using the following rates to calculate possible price escalations: 7.7% for 1982; 7.1% for 1983 and 7% for 1984 onward.

E. Financing

1. IDB loan

- 3.17 The Bank loan for the equivalent of US\$27,500,000, which it is recommended be granted out of the resources of the Fund for Special Operations, would consist of foreign exchange of US\$23,900,000 and sucres in the equivalent of US\$3,600,000.
- 3.18 According to the criteria for application of the matrix for energy projects in a Group D country, the Bank may finance up to 70% of the total project cost in foreign exchange. Thus, given the nature of the project and the country's classification, a component of local currency was considered for inclusion in the Bank's financing, thus raising the amount of Bank funding to 79.9% of the total anticipated cost of the project.
- 3.19 The foreign exchange funds of the loan would be determined to cover: (a) 47.8% of the engineering and supervision costs (US\$1,000); (b) the entire cost of materials and equipment, contingencies and cost escalation (US\$21,340,000); (c) practically all (96%) of the cost of maintenance equipment (US\$740,000), and (d) the total cost of the interest and fee for inspection and monitoring in foreign exchange (US\$820,000). The local currency portion of the loan would finance 44.3% of the cost of installation of lines, contingencies and escalation (US\$3,500,000) and the local currency financial costs for the loan (US\$100,000).

3.20 The basic financial terms of the loan would be as follows:

Source:	Fund for Special Operations
Disbursement period:	4 years
Amortization period:	40 years
Grace period:	10 years
Interest:	1% (10 years) 2% (30 years)
Loan commission:	0.5%
Inspection and supervision	1.0%

2. Local Contribution

- 3.21 The local contribution would amount to the equivalent of US\$6,900,000, or 20.1% of the total cost of the project. These resources would finance: (i) the entire administration costs (equivalent to US\$650,000) and 52.1% of the engineering and supervision costs (equivalent to US\$1,090,000); (ii) 55.7% of the cost of installing the lines, contingencies and cost escalation (equivalent in US\$4,400,000); (iii) the total cost of the inside installations (US\$30,000); (iv) 4% of the cost of metering equipment (equivalent to US\$670,000); and (v) the cost in foreign exchange calculated at US\$60,000 for the loan commission on the possible loan.
- 3.22 As indicated in paragraphs 2.59 to 2.64 the local contribution to the project, which is estimated at the equivalent of US\$6,900,000, would come from funds allocated by Ecuador for rural electrification and administered by INECEL. The analysis of the feasibility of the local contribution to the project is given in paragraphs 6.05 et seq.

#### IV. PROJECT EXECUTION

##### A. Executing Unit

- 4.01 In August 1979, INECCEL established the Executing Unit of the National Rural Electrification Program (UNEPER) to meet needs of the project in the area of planning, execution and administration, and those of other national rural electrification projects being handled by INECCEL. In that capacity, its main functions and responsibilities are among others: (a) to recommend to the Institute's office of the General Manager for consideration rural electrification policies, plans, programs and projects; (b) to prepare and modify the National Rural Electrification Program; (c) to participate in the evaluation of bidding and price competitions for the purchase of materials or for contracting services needed for the program; (d) to promote nationally rural electrification policies; (e) to coordinate with the Office of the Director of Finances of the Institute settlement on any project or work that has been completed, for physical delivery to regional electricity companies and for accounting purposes; and (f) to administer contracts relative to rural electrification works and projects signed by INECCEL.
- 4.02 To discharge its functions, the Executing Unit of the Rural Electrification Program is organized in the following manner: (a) a Technical Supervisory Office composed of two technical divisions, one of which is for the IDB project in the mountains and coastal regions, and another for the eastern region, Galápagos and remote systems; (b) an Administrative Division made up of five departments: Organization and Supervision, Promotion, Supplies, Purchases and Pay Office; and (c) a Programming and Control Office. The unit is managed by a Rural Electrification Director. Appendix 6 gives the corresponding chart for this unit.
- 4.03 The purpose of the Technical Division (mountains and coastal regions) of the IDB project is to direct and supervise the execution of projects and engineering works that will be partially financed by a possible Bank loan. In accordance with the foregoing, this unit is called upon: (i) to prepare the technical standards and specifications for studies, designs and construction of rural electrification projects in areas included in the project; (ii) to exercise budgetary control over the works; (iii) to administer and supervise contracts relative to studies, designs and work contracts to be executed; (iv) to prepare progress reports on the works for use by INECCEL and the Bank. INECCEL's accounting unit would be responsible for keeping the accounting registers for the project and for preparing its financial reports; hence separate registers would be kept for the rural electrification project.
- 4.04 The Executing Unit (mountain-coastal Division) is organized independently of other INECCEL units to facilitate the expeditious discharge of

the functions it is called upon to perform without interferences from outside the projects it is executing. The unit has 45 employees <sup>1/</sup> distributed in the following specialties: engineers (14), assistant engineers (9), economist (1), psychologist (1), attorney (1), technologist (1), administrative staff (4) and the 14 remaining, clerical employees.

- 4.05 Since it was established in 1979, UNEPER has worked vigorously to study and gain detailed information about the areas included in the Rural Electrification Program. On the basis of information acquired, it has determined the characteristics of the works that must be executed in each area and has completed the major part of the necessary designs. In like manner, UNEPER has worked out the organizational aspects which provide for the appropriate allocation of functions and responsibilities for the accomplishment of its purposes.
- 4.06 It may be concluded from the above background that UNEPER is properly organized to execute the project.

B. Supervision

- 4.07 UNEPER will be responsible for executing the works, purchasing and distributing construction materials and for other scheduled project activities. To do so, UNEPER would have recourse to the services of a specialized international consulting firm that would effect technical control of the works and be responsible for supervision. This firm would be contracted before the scheduled date for the first loan disbursement in keeping with the Bank's procedures on the matter (see Draft Resolution, paragraph 8(c)). Against this background, INECCEL submitted to the Bank the terms of reference and the list of firms INECCEL would invite to make offers, which were approved by the Bank. Invitations to consulting firms and the receipt of offers has been scheduled for the end of 1981.

C. Method of Execution

- 4.08 The method of execution of scheduled activities for project execution is evident from the following description of those activities: <sup>2/</sup>
- a. The regional electricity companies prepare the preliminary designs for the works after identifying rural areas that are without electricity services.
  - b. Through its executing unit (UNIPER), INECCEL reviews the preliminary designs and selects the works, for which a final design will be made applying the appropriate selection criteria (see paragraph 4.12).

---

<sup>1/</sup> As of April 30, 1981, UNEPER's total staff was 120 employees.

<sup>2/</sup> Appendix 7 gives a table summarizing these activities.

- c. UNEPER proceeds with its technical team and staff from the consulting firm to determine all the engineering works or circuits that could be mounted in each area, and on the advice of the local consulting firms completes the final designs, which would be studied by the IDB.
- d. UNEPER prepares lists of equipment and materials needed for construction of the works based on the final designs, and calls for bids, receives, stores and distributes the corresponding equipment and materials to the contractors who would be mounting the project. UNEPER will have two warehouses for storage and distribution. One, which is already ready for operation, is in Guayaquil, and the other, 30 kms to the south of Quito, is currently under construction, and would start functioning in July 1982.
- e. At the same time that UNEPER commences the activities referred to in the previous paragraph through its promotion section and in coordination with the regional electricity companies, it will report to the stipulated beneficiaries on work progress.
- f. UNEPER will use the public bidding system to bid for and hire the services of private contractors for the construction of project works. It has been anticipated that in the interest of obtaining the best possible construction costs and facilitating execution with the contracting firms, when proceeding with the respective biddings for mounting the lines, UNEPER would group the circuits according to their geographical proximity, in the form of packages. Those packages will contain approximately 72 kms of primary wires. In the case of project works to be executed on force account, the bidding system would of course not be used (see paragraph 4.16).
- g. With the cooperation of the regional electricity companies, the eventual beneficiaries would obtain loan resources for connections in homes through the special fund established by Decree 459-B <sup>1/</sup>. The beneficiaries could also provide labor for their own home installations, and UNEPER would provide the necessary material at cost price. This latter instance is common in the rural areas of the country.
- h. In their respective areas, the contractors receive the equipment and material provided by UNEPER and the works commence. Up to the time of completion, these works are executed under the supervision of UNEPER and the consulting firm. On completion, the final receipt and delivery to the regional electricity companies take place.

---

<sup>1/</sup> See paragraph 2.61 and Appendix 21 which gives the Operating Rules of the Special Fund for wiring services to low-cost consumers.

D. Engineering and Designs

- 4.09 The projects have been designed in accordance with standards approved by INECEL, at a voltage of 13.2 KV for feeders and 240/120 volts for secondary networks. These standards were reviewed by engineers from NRECA and the international consulting firm which advised UNEPER in preparing the final designs. For the wiring of rural housing, INECEL has standardized designs, which include indoor facilities consisting of two light facilities and two outlets.
- 4.10 The final designs for the representative sample (406 kms) have been entirely completed. The call for bids to supply materials for 30% of the project works may now therefore be extended. In mid-1982, an additional 40% of the designs would be completed, and at year end the remaining 30%; hence the other two bids could be called for similar amounts of goods needed for the project.
- 4.11 Appendix 8 gives a preliminary chart of activities for designs of circuits and subprojects, which could constitute the rural electrification project.

E. Selection Criteria

- 4.12 In view of the technical aspects of the project and its socio-economic features, the Bank will approve the construction of each circuit as INECEL demonstrates to the Bank <sup>1/</sup> that the following selection criteria for each one have been met:
- a. That final designs have been presented, including descriptive and technical information on the circuit.
  - b. A cost/benefit analysis, which uses the methodology and the parameters given in Appendix 9 (similar to that used in the economic appraisal done during the project analysis), and demonstrates that the circuit yields a profit of at least 12%.
  - c. Proof that population centers to be supplied with electricity services have road access or the equivalent waterway access to ensure transit of freight vehicles.
  - d. Evidence that the region on which the circuit depends is connected to the National Interconnected System or has sufficient generating capacity of its own for meeting the requirements of the circuit.
  - e. A report attesting to the fact that the circuit has a suitable hook-up point to the transmission-subtransmission system, including the corresponding substation and proper voltage regulation to ensure that the circuit functions properly for fifteen years.

---

<sup>1/</sup> These criteria are given in Appendix A of the possible loan contract.



F. Purchase of Goods and Services

- 4.13 In order to adapt project execution to the requirements that emerge from application of the selection criteria, plans have been made to group bidding into three packages representing 30%, 40% and 30% respectively of the entire circuits. In turn, each package would be divided into one corresponding to the purchase of equipment and materials and the other for the contracting of engineering works and the construction of systems. Details of execution are given in Appendix 10.
- 4.14 With regard to goods, the first package would be put up for bid in the first quarter of 1982 and the award would be made one year later; this period is considered realistic given the lengthy process that is necessary in the country to process the approvals required by the various government entities. The second package would be put up for bidding in the third quarter of 1982 and the third in the first quarter of 1983; for both bids, for the respective contract awards would be the same one-year period.
- 4.15 Dates for the contracting of assembly operations have been scheduled in relation to the first deliveries of materials; the respective biddings would be called for in the second quarter of 1982, the first quarter of 1983 and the third quarter of 1983. This would ensure that the construction of all subprojects into which the various circuits have been grouped would commence within three years of the signing of the possible loan agreement (see paragraphs 4.18 and 4.19).
- 4.16 It has been estimated that because of the remote location or because of size, some of the works (less than 10 kms of primary lines) may not hold any interest for private contractors and therefore, they should preferably be executed on force account by INECEL through the regional electricity companies. It is consequently recommended that any possible loan contract include the corresponding authorization to execute engineering works on force account up to an amount equivalent to US\$800,000 in local counterpart funds. <sup>1/</sup> It is expected that constructing firms are hardly likely to be interested in the phase of construction and mounting of circuits given the reduced individual amount of each contract that would be awarded for this purpose and the nature of the work to be carried out. These works represent the estimation of costs for mounting those short-length circuits or circuits located in remote areas. (See Draft Resolution paragraph 8(f)).
- 4.17 With the exception given in the preceding paragraph, the system of public bidding would be used to purchase materials, equipment and other goods and to obtain contracts for the execution of works in all cases where the amount of those purchases or contracts exceeds the equivalent

---

<sup>1/</sup> These works also include the connection and installation of meters.

of US\$100,000 (See Draft Resolution). For the purchase of equipment and materials financed with loan funds in foreign currency bidding would be international and subject to the procedures agreed on with the Bank in accordance with the regulations given in Appendix 11. Bidding financed with sucres from the Bank loan may be limited to the national scope; the same is true for bidding to mount lines that is financed with a local contribution. The country has the necessary management capacity to execute these types of works which entail little complexity.

G. Period for Execution

- 4.18 For the actual physical launching of the project works it is considered advisable to predict a 3-year period since established criteria relative to the dates on which feeder points will be available and on which the region to which the circuit belongs will be supplied with electric power from the national interconnected system have to be met. Furthermore, according to the schedule of bids for the procurement of materials and for assembly, the last lot of materials and equipment envisaged for the project, as well as the award of the contracts for assembly, would take place at the end of the second year from the date of the loan contract. Thus, work on all the circuits can begin within three years. Moreover, once the last works are launched, the period of construction is approximately 8 to 10 months; the period for project execution could therefore be extended until the fourth year counted from the signing of the loan contract, which is sufficient time for the settlement and payment of all work certificates. In this particular case, the preparation of designs does not impose any restrictions on execution given their state of progress, and as already noted they would be completed by the end of 1982.
- 4.19 In view of the partial periods for the execution of each stage involved in the purchase of goods and services, referred to in the preceding paragraphs, a Preliminary Implementation Plan was prepared for the project, and is given in Appendix 12 to this report. The final Plan for Implementation of the Project (PEP) would be presented to the Bank before the first loan disbursement and would constitute the model for the follow-up to project execution both by the Bank and by the executor.

H. Disbursement Schedule

- 4.20 Below is a summarized schedule of disbursements indicating investments for the loan funds proposed and from the local contribution:

(In US\$1,000 or its equivalent)

	<u>IDB Loan</u>		<u>Local Contribution</u>		<u>Total</u>
	<u>Amount</u>	<u>Percentage</u>	<u>Amount</u>	<u>Percentage</u>	
Prior to approval of the loan	-	-	697	10.1	697
First year	7,095	25.8	352	5.1	7,447
Second year	11,220	40.8	717	10.4	11,937
Third year	6,875	25.0	2,567	37.2	9,442
Fourth year	2,310	8.4	2,567	37.2	4,877
	<u>27,500</u>	<u>100.0</u>	<u>6,900</u>	<u>100.0</u>	<u>34,400</u>
	=====	=====	=====	=====	=====

I. Acknowledgment of Expenditures

- 4.21 As previously stated, INECCEL has executed the necessary engineering activities for project definition. These activities have involved local currency expenditures amounting to the total equivalent of US\$700,000 during 1980 and 1981. It is recommended that these expenditures be acknowledged as part of the project costs that may be charged to the local counterpart as long as in incurring those expenditures, requirements that are essentially similar to those called for in the resolution and the loan contract have been met and they have been made over a period not exceeding 18 months previous to approval of the loan and subsequent to presentation of the loan application (see recommendations, paragraph 3).

J. Declaration of Public Utility, Expropriation and Easements

- 4.22 Under the Law on Electrification, electric power supply is described as an essential public service. That law establishes that areas of land needed by entities, such as INECCEL, and electricity companies for the normal performance of their activities are considered of public utility and in the public interest.
- 4.23 To that end, Article 38 of that law grants INECCEL and the electricity companies the right to impose easements for the laying of transmission and distribution lines or for the building and placing of other facilities essential to electricity services, in coordination with the Ministry of Public Works. The Law on the Establishment of Encumbrances and Privileges for electrification works, promulgated through Decree 1969 of November 16, 1977, empowered INECCEL and electricity companies in the country, whether they are body corporates in public law or juridical persons in private law and have a social or public purpose, to establish encumbrances and privileges and to have public domain over the area of land needed for electrification works, such as the placing of posts, towers, transformers, the laying of underground and overhead lines.

Articles 10, 11, and 12 of that law also empower INECCEL and the electricity companies to impose for their benefit observance of the rights previously mentioned and through a resolution declare them valid and to have immediate public domain over the necessary area without observing any other requirement.

- 4.24 In view of the fact that the structure of the project and the works will basically affect lands that are adjacent to the access roads of communities to be provided with electricity services, it is not anticipated that there will be any difficulties with the normal execution of the works since it would be admissible to process the corresponding easement for the electricity lines. This is easily obtained once INECCEL so decides for the purposes of the project.
- 4.25 The loan contract would establish the borrower's commitment to submit to the Bank before the call to bid or commencement of the works proof of legal possession of or of the necessary rights over lands on which the works would be constructed (see Recommendations, paragraph 1(b)).

K. Education for the Use of Energy Resources

- 4.26 From the beginning of project execution, INECCEL intends to implement a plan to promote the use of electric power and educate beneficiaries in the use of energy resources. That plan is basically intended to achieve optimum use of the electricity service that would be provided. The plan would have a positive socio-economic impact since its purpose would be: (i) to promote community participation in electrification works; (ii) to increase insofar as possible the productivity of beneficiaries by encouraging and facilitating, where appropriate the use of equipment, which require limited electricity for a series of domestic tasks such as sewing and ironing; (iii) to publicize the use of light for comfort and efficiency, which would facilitate schoolwork at night and make possible the functioning of health centers with refrigeration units to conserve vaccines, antibiotics and other products, and (iv) to promote the use of electricity in production activities, not only in the agroindustrial arena, but also as a substitution for specific rudimentary tools or machinery that are powered by a pedal, or where animals or combustion engines are used.
- 4.27 INECCEL has commenced its promotional activities, in cooperation with the Regional Electricity Company in the North, through a pilot project in a number of communities in Otavalo, Province of Imbabura. The promotion plan will have the assistance of the Professional Training Service (SECAP), in providing instructors and facilities for demonstrations in the field. Other government entities involved in rural development in the country are also expected to participate.
- 4.28 Within 6 months of the date of the loan contract, the borrower would submit to the Bank the final plan for the campaign to promote the project and to educate the users, and an implementation schedule on promoting the effective use of electricity particularly for production purposes. The plan must be implemented according to a schedule approved by

the Bank. In this way, implementation of the educational program could be made to coincide with the provision of the electricity services (see Recommendations, paragraph 5).

L. Operation and Maintenance of the Systems

- 4.29 The regional electricity companies via their technical and administrative units would be responsible for operating and maintaining the rural electrification systems that would be put in service following project execution. Those companies would have available to them the advisory services of UNEPER on a permanent basis. Nonetheless INECCEL will commit itself to administer and maintain the works, equipment and facilities included in the project in accordance with previously-established rules for which it must present to the Bank, on an annual basis, over a ten-year period from completion of the work, measures taken for those purposes, and submit a report evaluating on a yearly basis the degree of operating efficiency and the quality of the service (See Recommendations, paragraph 4).

M. Ex-post Evaluation of the Project

- 4.30 To evaluate the socio-economic impact of the project, an ex post analysis must be made, covering among other aspects the following:
- a. Costs: (i) investment; (ii) operation and maintenance; (iii) replacement costs over a period of time, such as treated wood posts, concrete posts and transformers; (iv) administration (reading, billing and collection); (v) purchase of power; and (vi) subscription costs for each circuit.
  - b. Technical data: (i) differentiated losses; (ii) reduction in tension; and (iii) annual increase in demand.
  - c. Benefits and beneficiaries: (i) substitutions in consumption; (ii) evaluation of consumption and of the monthly volume and cost per consumer by income category; (iii) fixed user contributions for project and installation costs; (iv) number of consumers connected by circuit and regional electricity company; (v) nonresidential uses; and (vi) social and community services introduced after the project.
- 4.31 Within 12 months of the date of the loan contract, INECCEL will present to the Bank: (a) initial basic data for evaluation; and (b) a description of the system for the compilation and processing of data that would be used for annual comparisons with initial data in order to evaluate the results achieved in project execution. The baseline data for the evaluation can be obtained from a sampling of the circuits in the Sierra and the Coast (See Recommendations, paragraph 8).
- 4.32 As of the first year following the date of the last disbursement of Bank financing and on an annual basis for three years, INECCEL must submit to the IDB the annual comparative data indicated in the preceding paragraph (see Recommendations, paragraph 10).

- 4.33 At the end of the third year after the date of the last disbursement, the borrower shall submit a report giving an ex post evaluation of project results based on the methodology and guidelines agreed upon with the Bank, which would be the same as were used for the ex ante evaluation of the project (see Recommendations, paragraph 9).

N. Inspection and Supervision

- 4.34 Any responsibility for inspection and supervision by the IDB in this project would be assigned to the Bank's Representation in Ecuador.

## V. THE BORROWER AND THE EXECUTING AGENCY

### A. Background

- 5.01 The borrower and executing agency for the project would be the Instituto Ecuatoriano de Electrificación (INECEL). This agency was established in 1961 and, pursuant to the Basic Electrification Law, it enjoys legal status under public law, with economic and administrative autonomy; has its own assets and resources; and reports to the Ministry of Natural and Energy Resources (MRNE).
- 5.02 The basic purpose of the Instituto is to coordinate and carry out national electrification plans. To this end, it is empowered to design, finance, construct and operate facilities for generation, transmission and distribution, and to promote the establishment of regional electric companies, in which it is authorized to make investment through the purchase of shares.

#### 1. Organic structure

- 5.03 The organization of INECEL, which may be considered appropriate for electric companies, is included as Appendix 13. As shown in the organizational chart, the main organs of the Institute are the Board of Directors, the Office of the General Manager and the Departamental Directorate. Liaison with the executive branch is conducted through the Minister of Natural and Energy Resources, who is the Chairman of the INECEL Board of Directors. The Board also includes the Ministers of Finance, Industry and Commerce; the president of the National Development Council (CONADE); the Chief of the Armed Forces Joint Command; a representative of the electric companies; and a representative of the Collegas of Electric Engineers.
- 5.04 The General Manager is responsible for carrying out decisions made by the Board and for general coordination of the various administrative, economic-financial and technical activities designed to achieve the objectives of the Institute. To do so, it has the support of five Departamental Directorates:
- (i) Industrial relations: responsible for the formulation and application of personnel administration policies, wages, and salaries and training;
  - (ii) Finance: responsible for securing internal and external financial resources to execute the Institute's plans and programs and for the administration of such resources. It also supervises the economic and financial activities of INECEL and the regional electric companies, pursuant to provisions of the Basic Electrification Law;

- (iii) Engineering and construction: carries out studies, designs and construction of generation and transmission system projects included in the National Electrification Plan;
- (iv) Operation of the National Interconnected System: operates, maintains and administers generating plants, transmission lines and substations comprising the National Interconnected System (SNI). It also markets the energy generated and transmitted by the SNI and conducts rate studies relevant to the sale of energy; and
- (v) Distribution and marketing: responsible for coordination of generating, subtransmission, transformation and distribution works executed by the electric companies, plus overall supervision of regional electric systems, on the basis of which it prepares management reports. It also takes part in the preparation of rate schedules for electric companies and, after they have been approved, oversees the application thereof.

5.05 Various advisory units complete the INECEL organization picture. The most important of these is the Committee for Technical, Administrative and Financial Coordination, basically comprising the General Manager and the department chiefs. The Committee's essential purpose is to coordinate overall management of the Institute to ensure compliance with the National Electrification Plan. Other advisory units include the Department of Organization and System, the Legal Counsel and the Planning Department. The latter is responsible for preparing annual and medium and long-term investment plans, pursuant to the goals of the National Electrification Plan, specifying the human, financial and physical resources required for their implementation. It also establishes general guidelines for the integration of the regional systems into the SNI, and helps prepare studies to set utility rates for the sale of energy.

5.06 As stated in paragraph 4.01, the Rural Electrification Executing Unit (UNEPER) was set up in 1979 to carry out the National Rural Electrification Program.

## 2. Personnel

5.07 The total number of INECEL staff has increased at the reasonable growth rate of 7% for each of the last four years, reaching a total of 1,546 as of 31 December 1980. The staff carries out its assigned duties acceptably. A breakdown of the distribution of those duties follows:



INECEL Employee Roster  
31 December 1980 1/

<u>Functional Area Classification</u>	<u>Execu- tive</u>	<u>Profes- sionals</u>	<u>Techni- cians</u>	<u>Adminis- trative</u>	<u>Workers</u>	<u>Total</u>	
						<u>No.</u>	<u>%</u>
General Management <u>2/</u>	18	60	9	34	11	132	9
Indust. Relations	9	53	4	45	10	121	8
Finance	21	57	34	100	12	224	14
Engin. and Construc.	50	282	88	135	14	569	37
SNI Operation	30	98	28	63	10	229	15
Distrib. and marketing	29	95	20	53	15	212	14
Rural electrif.	<u>12</u>	<u>28</u>	<u>6</u>	<u>11</u>	<u>2</u>	<u>59</u>	<u>3</u>
Totals	169 ===	673 ===	189 ===	441 ===	74 ==	1,546 =====	100 ===
Percentage	11	44	12	28	5	100	

5.08 The following table shows the rise in productivity indexes of INECEL personnel as a result of the upturn in installed capacity and construction starting in 1978, with the consequent increase in the volume of energy sales:

INECEL Staff Productivity  
1977 - 1980

<u>Year</u>	<u>Average number of employees</u>	<u>Total capacity (operat. + construc.)</u>	<u>Energy sales (Mwh)</u>	<u>Tot.capacity per employee</u>	<u>Sales per employee</u>
1977	1,176	734	166,030	0,624	141.2
1978	1,234	845	496,606	0,684	402.4
1979	1,273	961	806,808	0,755	633.8
1980	1,404	999	1,114,754	0,712	793.9

1/ Source: Budgetary execution 1980.

2/ Including advisory units.

- 5.09 As indicated above, the upward trend of these indicators is explained by the increase in generating capacity. The Pisayambo hydroelectric plant went on stream at the end of 1977 and its full impact was felt in 1978, the year of partial start-up of the Estero Salado steam plant. Estero Salado units two and three went on stream in mid-1979 so that 1980 shows the results of a complete year of operation by that plant. In accordance with the goals set by the Master Electrification Plan, by 1985 it is hoped to boost staff output approximately 5% for the sector as a whole, measured in terms of sales per employee.

### 3. Financial and accounting administration

- 5.10 The Finance Directorate is responsible for all economic and financial matters of the Institute and administration of its accounting system, pursuant to the principles and procedures established for the local electric industry. This Directorate is now subdivided into two Subdirectorates:
- (i) The Economic and Financial Analysis Subdirectorate (comprising the Divisions of Studies and Financing, Financial Programming and Financial Evaluation and Control). Its basic duties include the preparation of applications for internal and external financing, evaluation of bids and subsequent administration of the resources obtained; formulation and execution of the INECEL annual budget; examination of the managerial performance of regional electric companies; and, finally, support to the Planning Directorate for periodic preparation of financial projections which are produced by INECEL, primarily to comply with the requirements of international financing organizations rather than for their own use as a management control tool. The Institute still needs to improve its organizational system, apply modern business administration techniques and implement a management information system as a basis for timely decision making. These tasks have been hindered by the shortage of staff with the necessary experience in the design and management of such managerial tools and insufficient coordination of the various functional areas as well as the lack of procedures for keeping timely and accurate records of transactions. To solve these problems, the contract signed with the World Bank for financing of an SNI transmission and subtransmission project included a subproject for institutional development and management information systems (see paragraphs 5.13-5.15).

In accordance with the Basic Electrification Law, the Institute's Board of Directors appoints voting directors to represent INECEL at each of these agencies, as a part of its supervision of the progress of the electric companies. In addition, the recently created Managerial Control Department consist of "commissioners," appointed by the General Board of each company as required by the law governing companies to "...supervise all aspects of administration..." To supplement current legal provisions, the Institute

has specified the duties to be performed by the Managerial Control Department and those of the "commissioners," and those duties are considered adequate for this purpose.

- (ii) Financial Administration Subdirector (consisting of the Financial Resources, Accounting, and Assets Administration Divisions) is basically responsible for overseeing operation of the treasury, procurement procedures, warehouse and inventory control and bookkeeping. In this area, too, certain internal control weaknesses are evident that not only affect the presentation and analysis of the annual financial statements but also impede the preparation of financial projections. It is hoped that the institutional development program mentioned above will remedy these shortcomings.

- 5.11 Bookkeeping by INECEL and other companies in this sector utilizes the Uniform Accounting System for Electric Sector Agencies, approved by a resolution of the MRNE and put into effect in 1966. Budgetary accounting, based on the Classifier of Public Sector Revenue and Outlays established by the Ministry of Finance, has not yet been completely integrated into INECEL general accounting, which has prevented effective application of a budgetary control system by area of responsibility.
- 5.12 Aside from the reference to the handling of certain transactions included in the Uniform Accounting System, the Institute has no accounting procedure and budgetary accounting manuals. The accounting system is partially automated; but because of the lack of a timely flow of information, the monthly balances are subject to delays ranging from 60 to 90 days after the close of each accounting period. Various procedural manuals have recently been prepared that provide adequate coverage of the needs of the various operating areas (finance, industrial relations, etc.). The Organization and Systems Department's work plan includes a detailed formulation of the policies and objectives corresponding to the various functional areas of the organization, which will later be presented in the form of an Administrative Manual.

#### 4. Institutional strengthening

- 5.13 INECEL hired an international consulting firm in 1974-1976 to conduct a study on updating its administrative, accounting and financial areas. The work of the consultants was not satisfactory and their recommendations were only partially implemented.
- 5.14 In conjunction with consideration of a recent loan operation by the World Bank, mentioned earlier, an institutional development subproject was included. Its basic purpose is to design and implement a comprehensive automated information system, and review the organizational structure of INECEL and the regional electric companies with a view to implementing modern and efficient methods, systems and procedures. This will cover the financial, marketing, administrative and project control and planning areas.

- 5.15 The institutional development subproject is divided into two major phases. The first includes diagnosis and preliminary design, along with implementation of a comprehensive information system. It will last approximately 18 months from the time these tasks are begun. The second phase covers the detailed design of systems, including the preparation and implementation of manuals, staff training, evaluation of the results achieved, and presentation of a final report. This phase will require an estimated additional 18 months. For proper coordination of consultants' activities, INECEL will appoint a counterpart team which will include properly experienced personnel in each of the specific areas, in addition to the basic crew. In view of the importance of the institutional development program of this sector, the Bank will have its Field Office in Ecuador maintain close and permanent surveillance of the progress made in this area.

5. Insurance system

- 5.16 The Institute recently set up an Insurance Unit within the Finance Directorate. The policies issued cover plants in operation, substations, warehouses, vehicles and other items against various risks, based on replacement values. Where construction work is involved, the construction companies are responsible for insuring the goods and facilities up to the time they are turned over to INECEL. The external auditors have not issued any opinion regarding the adequacy of insurance coverage.

6. Procurement and contracting system

- 5.17 Contracts for construction and procurement of goods and services are subject to provisions of the Basic Electrification Law and the law on public bidding. These laws establish the monetary and authority levels required for the corresponding approvals and contract awards, and set forth procedural standards. Supplementing those provisions, the Finance Directorate prepared a manual in 1980 which lists detailed procedures for local and foreign procurement in adequately systematic fashion.

7. Internal control

- 5.18 The Institute's internal control system, for operations as well as finance and accounting, may be considered merely acceptable, since as noted in previous paragraphs, there are weaknesses that affect each of the components of the system in varying degrees. As stated earlier, INECEL is aware of these shortcomings and hopes to correct them gradually through the institutional development program. The company's control system includes an internal auditing unit. Its head is the chief internal auditor, who is appointed by and reports directly to the State Controller General, without prejudice to the legal requirement that he also submit a semiannual report on his work to the INECEL Board of Directors.

- 5.19 Internal auditing has an authorized staff complement of 24, but actually has only 18, of whom 13 have professional degrees. According to the Basic Electrification Law, this unit "...will exercise control of the Institute's economic and financial administration..." To this end, a work plan is drawn up each year and presented for the consideration of the General Controller's office. Among the activities included are those arising from recommendations made by that office, with which adequate coordination is maintained. Internal auditing does not cover the Directorates of Engineering and Construction; Operation of the National Interconnective System; Planning; and the Automatic Data Processing Department. As may be seen, the work performed by internal auditing focuses on accounting and financial matters, with incipient orientation toward operational aspects, particularly as a result of the practice established in 1981 of handing down an opinion relevant to internal control on proposals for new procedures submitted by the organization and systems sector. Within the limited context described, internal auditing performs its work acceptably.
- 5.20 The shortage of personnel has prevented this unit from carrying out an in-depth audit of the regional electric companies whose internal control mechanism is rated less than satisfactory. It is hoped that such examination can be included in the annual plan when the staff complement reaches the necessary level.

#### 8. External control

- 5.21 INECEL's external control function is essentially performed by the State Controller General's office, which also performs this duty in connection with projects in progress that are partially financed by the Bank. The problems arising from the qualitative and quantitative shortage of professional auditors in the local work market has affected the timeliness and quality of the auditing conducted by this control unit. INECEL financial statements and those for projects in progress have been submitted with considerable delay. At the time this document was prepared, INECEL financial statements for the 1978 fiscal year had not yet been presented. Those for the 1979 fiscal year were received in January 1981. Effective and timely monitoring of the economic-financial evolution of the company and its future prospects is thus very difficult.
- 5.22 In view of these circumstances and considering that the contracting of a private auditing firm is envisaged under a recent loan operation with the World Bank, it is recommended that: i) the financial statements for the project under review during its execution; ii) the financial statements of INECEL, throughout the life of the prospective loan contract; and (iii) the financial statements of the participating regional electric companies, starting in the year that the last part of the circuits under their jurisdiction is delivered to each of them until ten years after the date of final disbursement, be presented audited by a firm of independent public accountants acceptable to the Bank and selected by the Contraloría General del Estado. This notwithstanding, the borrowers and the Bank may agree that the Contraloría General del Estado is to perform the auditing work (see Recommendations, paragraph 11).

## 9. Rate system

- 5.23 The Basic Electrification Law assigns to the INECEL board of directors the duty of approving rates for electric power service, which must be applied "...without exception" by concessionnaires. It also stipulates that these rates should cover all costs of operation, maintenance, administration, depreciation, taxes, debt servicing and a reasonable amount of profit to be used to expand its services.
- 5.24 The "Regulations for Setting of Electric Utility Rates" embody the criterion that rates should produce enough revenue to cover the cost of service and produce a reasonable profit, which may not be less than 8.5% per annum, calculated as the ratio between net operating profit and average net capital investment (net electric plant in service, intangible goods and working capital). The regulations espouse the principle of revaluation of the rate base, predicated on replacement value, at intervals of not more than five years, based on inventories and appraisal by experts. In the intervening periods, annual adjustments will be made, using indicators based on variations in the official exchange rate between the national currency and the United States dollar. Although these principles of revaluation and reasonable profitability have not been systematically applied in Ecuador's electric sector, the national authorities have announced that they plan to incorporate these precepts into future rate policies.
- 5.25 Companies in the sector may, without prior authorization from INECEL, apply interim rate adjustments when there are variations of 5 to 10% in the average cost of the work hour, the real cost of each Kwh of energy purchased or the average cost of fuel. When such variation exceeds 10%, the adjustments must be approved in advance by INECEL. Rates for the Institute's energy sales to sector companies and for sales among those companies are set forth in sales contracts, which also govern the conditions of supply, power level, metering, billing and payment.
- 5.26 In September 1979, the MRNE approved Decree 051 <sup>1/</sup>, eliminating variations between companies in bulk consumption and establishing a single national rate, while introducing a staggered system of increasing rates for large-scale consumption. The ministerial decree also provided that, except for EMELEC, sector companies should make monthly deposits to the account of INECEL of 10% of their revenues from the sale of energy to form a supplementary financing fund for rural electrification works. This provision has not been put into effect, which in practice means that INECEL receives no revenue from that source. Nevertheless, INECEL is revising the new rates to comply with provisions of Decree 051. Those rates must be approved for each of the companies by the INECEL Board of Directors.

---

<sup>1/</sup> See paragraph 2.62.

- 5.27 In May 1981, the INECEL board of directors called for a rate hike for the sector (with the exception of the privately owned EMELEC) to allow the companies: (i) to absorb the additional fuel costs, resulting from the new prices set in February 1981; and (ii) to achieve on a nationwide basis the maximum profitability of 8.5% a year established by the Tariff Regulations. The method adopted effective with May 1981 consumption, consists of monthly adjustments of 3% as a national average, with a maximum of 5% a month per company. This increase does not apply to subscribers who consume up to 70 Kwh a month, since those rates were frozen for the period from November 1979 to November 1981. The monthly increase rates for each company are shown in Appendix 14, and will be applied until 8.5% profitability on the revaluated rate base is achieved nationally. Estimated rates for electric companies involved in the rural electrification project appear starting in paragraph 5.71.
- 5.28 It was also established that the average selling price for the Interconnected National System would be S/1 per Kwh starting with May consumption and throughout 1981. Since the average price in April was S/.0.77 per Kwh, this increase represents a 30% jump in one fell swoop, which has elicited resistance from the electric companies who are allowed to increase their prices in progressive stages only. Because this situation could eventually affect prompt payment of INECEL's monthly billing, it has been authorized to negotiate with the electric companies for deferred collection of the increase resulting from the 30% rate hike. INECEL's average selling price to the companies in June 1981 are shown below:

Average Price of INECEL Sales to Companies in 1981

<u>Electric Companies</u>	<u>June</u>	<u>Average January to June</u>
Sistema Eléctrico Latacunga	1.013	0.8547
Empresa Eléctrica Ambato	1.052	0.8190
Sistema EMELEC	0.983	0.7533
Empresa Eléctrica Quito	1.006	0.8531
Sistema Eléctrico Riobamba	1.690	1.0963
Sistema EMELNORTE	1.011	0.9750
Sistema INECEL-Guayas	1.006	0.8241

Source: Estudios Económicos del DOSNI

- 5.29 Based on recent agreements with the World Bank, the SNI profitability and rate level would evolve in the following manner:

	<u>1981</u>	<u>1982</u>	<u>1983</u>
Average sales price S/kWh	1.00 <sup>1/</sup>	1.30	1.71
Estimated profitability (%)	2.00	4.00	8.50

<sup>1/</sup> Starting with May 1981 consumption.

- 5.30 As may be seen, in 1983 the SNI could arrive at the 8.5% profitability level established by the National Utility Rate Regulations.

10. Historical financial analysis

(a) Background

(i) General

- 5.31 As mentioned earlier, INECEL is a legal entity with its own resources and assets, under the Ministry of Energy and Natural Resources. The Minister of Finance, representing the national government, is empowered to guarantee internal and external loan agreements entered into by INECEL for electrification projects.

(ii) Equity and financing system

- 5.32 The basic resources and assets of the Institute consist of:

- (1) The National Electrification Fund, set up to finance SNI works and regional systems. It is funded by 47% of the oil royalties collected by the State (equivalent to 18.5% of hydrocarbon production and transportation rights via oil pipeline) and paid on the basis of the reference price of US\$23.50 a barrel. The resources thus provided by tax receipts are considered as capital contributions from the State.
- (2) Revenue from energy sales by SNI and its own systems.
- (3) The "Rural Electrification Development Fund" <sup>1/</sup> established by Decree 306 in 1975, and fed by a contribution of 10% of the invoice value of electric power consumption in excess of 10 Kw for industrial consumers and 2,500 Kw a month for business establishments. In practice, however, these funds are withheld and invested directly by the electric companies who subsequently submit evidence to INECEL that the money was used for National Rural Electrification Program works, whereupon they are recorded as a capital contribution from the Institute.
- (4) Funds equivalent to 10% of the proceeds of energy sales by sector companies, established by Ministerial Decree No. 051 which, as mentioned earlier (see paragraph 5.26) has not been applied to date.

(5) Tax regimen

- 5.33 Tax exemption is granted by the Basic Electrification Law to INECEL and all electric companies 85% of whose stock is owned by public entities or privately-owned public utility companies.

---

<sup>1/</sup> See paragraph 2.60.



(6) Profit

- 5.34 Although the law that established INECCEL does not specify the use to be made of profits, company policy is to pay no dividends as a return on capital investment.

(b) Statements of condition

- 5.35 Analysis of INECCEL financial statements for 1978-1980 was based on statements that, except for fiscal year 1979, had not been reviewed by the Office of the Controller General of the State which, pursuant to current contracts with the Bank, serves as external auditor for INECCEL and for current projects partially financed by the Bank.
- 5.36 The financial statements -- including those for 1979, certified by the Controller -- nevertheless had to be adjusted during the analysis process to: (i) give a clear picture of the real operating results, which were skewed by the company's treatment of general administrative expenses; (ii) eliminate INECCEL accounting errors in consolidation of its own systems; and (iii) include in the plant and service entries amounts corresponding to completed construction that had not yet been transferred in the ledgers. The adjusted consolidated statements of condition appear on the following page:

INECEL  
Comparative Consolidated Statements of Condition  
1978-1970  
(In US\$ thousands) <sup>1/</sup>

	1976		1979		1980	
	\$	%	\$	%	\$	%
<b>ASSETS</b>						
<u>Fixed</u>						
Gross plant in service	183,265	31	182,493	23	331,685	30
Less: cumulative depreciation	8,763	2	13,555	2	19,757	2
Net plant in service	174,502	29	168,938	21	311,928	28
Construction in progress	129,829	22	291,300	36	371,602	32
Total net fixed assets	304,331	51	460,238	57	683,530	60
<u>Investments</u>						
Electric companies	133,417	23	149,747	19	192,671	17
Miscellaneous	1,219	-	22,012	3	28,521	2
Total investments	134,636	23	171,759	22	221,192	19
<u>Current</u>						
Cash	11,510	2	8,655	1	19,931	1
Net receivables	42,390	7	37,110	5	76,992	7
Inventories	22,543	4	42,864	5	55,051	5
Miscellaneous	1,017	-	1,350	-	2,237	-
Total current assets	77,460	13	89,979	11	154,211	13
<u>Other</u>						
Studies	29,262	5	35,121	4	39,134	3
Advance payments	28,900	5	28,832	4	21,178	2
Miscellaneous	17,070	3	17,133	2	28,980	3
Total other assets	75,232	13	81,086	10	89,292	8
Total ASSETS	591,659	100	803,062	100	1,148,225	100
	=====	===	=====	===	=====	===
<b>NET WORTH AND LIABILITIES</b>						
<u>Net worth</u>						
Capital	305,892	52	438,893	55	576,422	51
Cumulative profit	(4,674)	(1)	(12,126)	(2)	(11,370)	(1)
Donations	2,374	-	2,342	-	2,466	-
Total net worth	303,592	51	429,109	53	567,518	50
<u>LIABILITIES</u>						
<u>Long term</u>						
Consolidated debt	238,545	40	305,922	38	462,984	40
Total long-term liabilities	238,545	40	305,922	38	462,984	40
<u>Current</u>						
Current portion of long-term debt	19,924	4	12,230	2	22,344	2
Accounts payable	19,769	3	31,867	4	41,451	4
Miscellaneous	3,600	1	4,449	1	38,713	3
Total current liabilities	43,293	8	48,546	7	102,508	9
<u>Other</u>						
Trust credits	874	-	901	-	651	-
Miscellaneous	5,355	1	18,584	2	14,564	1
Total other liabilities	6,229	1	19,485	2	15,215	1
Total LIABILITIES	288,067	49	373,953	47	580,707	50
Total NET WORTH AND LIABILITIES	591,659	100	803,062	100	1,148,225	100
	=====	===	=====	===	=====	===

<sup>1/</sup> Exchange rate: S\$25 = US\$1.

- 5.37 As is customary for public service electric companies, INECCEL fixed assets represent the bulk of its total assets, accounting for 60% at the close of operations for fiscal year 1980. The most important projects completed during that period were the Extero Salado and Guangopolo thermal plants and the Pisayambo hydroelectric plant, with the supplementary construction of various substations and stringing of transmission and subtransmission lines. The most important works in progress reflect the value of cumulative investments in Paute project "A" and "B" and the Paute transmission system which, together with other projects, are part of the national transmission system.
- 5.38 Although as stated earlier, INECCEL and the other concessions are supposed to reevaluate their plant in service periodically, up to and including fiscal year 1980 this had not been done. However, for purposes of financial strengthening of the sector, orders have been given for the electric companies, starting in fiscal year 1981, to calculate and record in their official accounts the updated monetary value of their fixed investment as a basis for determining annual profitability as required by the Tariff Regulations. This revaluation, however, will be temporary until rate experts complete the inventory and appraisal of the electric service plant for each company. Completion of that task is expected in 1982. To that end, it is recommended in the project report for stage C of the Paute project, that the prospective loan contract include a requirement for INECCEL to conduct an annual revaluation, based on methodology to be agreed upon, of its electric plant for use in calculating the reasonable profitability which is defined contractually. It should be noted that present contracts with the Bank contain rate stipulations that would apply to Paute project "A" and "B" when it goes on stream in 1983, while, starting in 1985, rate requirements will be extended to include the entire SNI. In both cases, profitability of 8.5% has been established on the respective unreevaluated investments. Since the recent World Bank loan 1/ requires this profitability level for the entire SNI reevaluated investment starting in 1984, INECCEL should have no difficulty complying with IDB contract clauses relevant to unreevaluated investment.
- 5.39 On the occasion of the IDB loan for the Pisayambo project, 2/ it was agreed that as of start-up (in 1978), the rates for the sales of energy from this project should generate, both for INECCEL and for the companies distributing that energy, 7% profit on the unreevaluated investment of the project. Thus far, that clause has not been met. In addition, contract 323/OC-EC stipulates that starting December 31, 1981, each regional electric company must obtain an annual profit of no less than 8.5% on the unreevaluated fixed investment for all systems. In principle, this requirement also was not met, since sector profitability over the 1981-1984 period would be 2%, 4%, 8% and 8.5%, respectively, even if those estimates take into account reevaluated investment in electric plant. The corresponding recommendations are made in paragraph 5.75.

---

1/ See paragraph 1.52.

2/ See paragraph 7.02.

- 5.40 The item of investments reflects the value of financial resources placed with the electric companies as well as the cost of construction executed by INECEL for those companies, such as the works scheduled under the rural electrification project discussed in this report. Appendix 15 lists these investments, showing that INECEL provides an average 85% of the capital of the electric companies. Also included are investments made by INECEL in its own decentralized systems. Current assets have posted relatively uniform amounts over the period in consideration.
- 5.41 Receivables have constituted a relatively stable proportion of all assets during this period. On December 31, 1980, the amounts owed to INECEL by the electric companies for supplies of energy amounted to approximately 19% of all Instituto receivables, while the corresponding collection period was 177 days. This is considered relatively high in view of the collection terms stipulated in energy sales contracts.
- 5.42 Decree No. 478 was handed down in 1980, requiring the electric companies starting December 15, to make daily deposits to INECEL's account of revenues from the sale of energy supplied by the SNI. To this end, the ratio of the value of energy delivered by the SNI and the value of total revenue obtained by each company in the first nine months of each year is calculated, and the resulting coefficient is applied to the daily collection schedule. Any differences that may arise are settled at periodic intervals. It is hoped that when this new procedure is put into effect and the overdue balances of certain companies are brought into line, collection terms will not exceed 60 days from 1981 onward.
- 5.43 On June 30, 1981, the situation of payments owed to INECEL by the electric companies was as follows:

INECEL - Breakdown of balances owed by  
electric companies as of June 30, 1981  
US\$

Company	<u>1981</u>	<u>1977/1980</u>	<u>Total</u>
Quito	902,779	909,548	1,812,327
Sistema Latacunga	52,948	538,904	591,852
EMELEC	1,758,448	-	1,758,448
Ambato	372,823	110,341	483,164
Sistema-Guayas-Los Ríos	1,100,166	2,147,247	3,247,413
	<u>4,187,164</u>	<u>3,706,040</u>	<u>7,893,204</u>
	=====	=====	=====
	53%	47%	100%

- 5.44 As may be seen from the table above, only 53% of the amount due was billed in 1981. These figures may also include some 1981 payments now due, which would bring the total balance outstanding to more than the 47% shown. Furthermore, as stated earlier, delays could arise in paying

bills for energy supplied because of differences stemming from application of the rate increase in June 1981. In view of this situation, the project report for Paute Stage C recommends that the eventual loan contract include a clause requiring INECEL to submit each year to the Bank an analysis of outstanding balances by age and evidence that it has collected no less than 85% of the balances due within the year, including any balance pending collection at the start of the fiscal year, for energy sales invoiced by the SNI.

- 5.45 Other assets correspond to outlays for feasibility studies and project designs such as those for the Toachi, Coca, Guayllabamba and other projects. Advance payments are those made to contractors for construction of the Paute Project, Esmeraldas thermal plant and the national transmission system.
- 5.46 INECEL's equity consists basically of capital accounts and cumulative profit. The former consists of the contributions made by the national government in the form of the 47% of oil royalties assigned to INECEL. Cumulative profits reflect the adjustments described in paragraph 5.38, although it has not been possible to make similar adjustments for the fiscal years prior to 1978.
- 5.47 INECEL's consolidated debt almost doubled in current terms although the ratio to net worth and total liabilities remained stable over the three-year period. The breakdown of long-term debt is shown in Appendix 17: it may be seen that 80% of the balances due are for external financing, of which approximately 20% corresponds to the IDB. Current liabilities have also remained relatively stable over this period, the major items being the current portion of consolidated debt and accounts owed to contractors.
- 5.48 INECEL's financial situation is presented in Appendix 16. This is considered of paramount importance for phase C of the Paute project. For purposes of the rural electrification project, a summary is given of the institution's situation, showing that INECEL's economic and financial circumstances have been unfavorable, as indicated by the negative economic results. This is primarily because the rates are too low to cover operating costs and produce enough profits to underwrite the expansion program and amortize indebtedness to credit institutions. To bridge this gap the company sought financial support from the external resources received in the form of royalties and loans. It is hoped, however, that the recent measures issued on rate policies will result in a turnaround within a reasonable length of time --possibly by 1983-- in the adverse economic trends of recent historical experience. Nevertheless, from the financial point of view, throughout the entire forthcoming decade, the company will have to depend on transfers of funds from the national budget or alternative measures, if it is to carry out the investment program in its entirety.

## B. Regional Electric Companies

### 1. Background

- 5.49 Although INECEL would be the borrower and executing agency for the project, the rural electrification works would be transferred when completed to the regional electric companies. In exchange, INECEL would receive stock in those companies equivalent to the cost of the works. Consequently, the electric companies will be responsible for operation and maintenance of the circuits that will result from the project (see paragraph 4.29).
- 5.50 Except for certain regional electric companies that could perform on force account the construction that will probably have to be handled that way, <sup>1/</sup> the electric companies would not take part in building the circuits, so that their finances would not be affected during the project execution period. Even in the case of work on force account, execution would be the responsibility of INECEL.
- 5.51 Taking these factors into account, and based on information supplied by the Ecuadorian authorities, the following paragraphs will examine the capacity of the regional electric companies to operate and maintain the circuits and to estimate the financial effect that acquisition of the circuits to be built by the project will have on those companies.

### 2. Institutional aspects

- 5.52 As indicated in Chapter II, distribution and marketing of electric power in Ecuador is conducted mainly by 15 electric companies, organized as stock corporations, in which the government, through INECEL, is the largest stockholder. INECEL participation in the stock of the electric companies ranges between 54.4% and 98.7%. Most of the other shareholders are the respective provincial councils or the municipalities. Empresa Eléctrica del Ecuador, Inc. (EMELEC) is the only privately-owned electric company in the country: Its concession expires in 1985. Appendix 18 shows the capital composition of the electric companies as of December 31, 1980, in accordance with the regional electric service system.
- 5.53 At present these companies generate, distribute and market their own electricity. Later on, after INECEL has set up the Interconnected National System, they will be responsible for the purchase, distribution and marketing of the energy generated by that system.
- 5.54 The operating characteristics of the electric companies as of December 31, 1980, in terms of subscribers per employee and Kwh are shown below:

---

<sup>1/</sup> See paragraph 4.16.

<u>Companies</u>	<u>Subs- cribers</u>	<u>Staff 31/Dec/80</u>	<u>Subscriber/ Employee</u>	<u>Mwh</u>	<u>Kwh per Employee</u>
E.E. Quito S.A.	144,571	1,283	112	691,347	538.85
Coop.ER Sto.Domingo Lt.	12,528	139	90	27,201	195.69
E.E. Esmeraldas A.A.	13,296	154	86	34,311	222.80
Sistema Elec.Reg.Manabí	48,189	305	157	119,653	392.30
E.E.Regional El Oro SA	24,437	242	100	58,885	243.33
Sistema Latacunga SA	9,775	106	92	27,854	262.77
Sistema Ambato Pastaza SA	40,455	278	145	58,608	210.82
Sistema Riobamba S.A.	21,252	244	87	72,535	297.27
E.E. Bolívar S.A.	7,151	84	85	7,521	89.53
E.E. Norte S.A.	43,266	417	103	49,895	119.65
E.E. Azogues S.A.	6,340	54	117	4,790	88.70
E.E. Centro Sur S.A.	44,436	382	116	103,811	271.75
E.E. Los Rios	11,713	116	100	24,506	211.26
E.E.Península Santa Elena	19,022	172	110	33,695	195.90
INECEL Guayas (Durán- Balzar	29,596	1,041	28	83,274	79.99
E.E. Milagro S.A. (Milagro-Naranjal)	23,324	139	167	57,064	410.53
E.E.Regional del Sur SA	22,661	408	55	29,924	73.34
	<u>522,012</u>	<u>5,564</u>	<u>93</u>	<u>1,484,874</u>	<u>266.87</u>
	=====	=====	=====	=====	=====

5.55 Although the figures in the table above vary sharply from one country to another, thus resulting in a wide range of typical distribution, the averages show that the companies have 93 subscribers for each employee; they sell approximately 267 Kwh per employee; and consumption per subscriber for all of them is around 2,840 Kwh. The information available indicates that the ratio of energy sales per employee of INECEL subsidiary companies is very low in comparison to that of the company serving the Guayaquil area (EMELEC).

5.56 Efficiency of the regional electric companies is not expected to improve in the short term. Nevertheless, the situation should improve gradually in accordance with the Master Electrification Plan goals of consolidating the 16 electric companies into 9 regional electric systems and having INECEL take a more active part in supervising the companies. The recent World Bank loan <sup>1/</sup> included an institutional development sub-project that would benefit the regional electric companies in the financial, administrative and project planning and control areas, which would help improve the present situation.

<sup>1/</sup> See paragraph 2.52.

- 5.57 The staff complement of the regional electric companies and their ratio to the number of subscribers and the Gwh sold per employee (December 1980) are shown below:

	<u>Employees</u>	<u>Subscribers/ employee</u>	<u>Gwh sold/ employee</u>
E.E. Quito	1,283	112	0.538
15 INECEL Subsidiaries	3,240	107	0.219
EMELEC	860	182	1.0

- 5.58 Although the indexes shown in the above table are considered acceptable in comparison to other Latin American countries, <sup>1/</sup> internally they reflect the disparity between the country's electric companies. For example, the Gwh/employee ratio for the electric companies is considerably lower than for the Quito company, which is in turn much lower than Guayaquil's EMELEC.

- 5.59 Considering that 97% of the new subscribers for the rural electrification project will be handled by regional companies, the foregoing statements indicate that the companies will have an opportunity to improve their indicators of energy sales per employee if they make an effort to handle new subscribers exclusively with the present staff or with the minimum number of justified and essential additions to the payroll. The highest percentage increases envisaged in the project in regard to the number of subscribers listed in December 1980 are for the following companies: Latacunga (102.7%), Bolívar (58.6%), Los Ríos (47.3%), Riobamba (38%) and Azogues (36.5%). The total number of subscribers anticipated by the project in the first year represents 2.5% of those of the combined electric companies as of December 31, 1980.

### 3. Financial aspects

- 5.60 INECEL does not prepare consolidated financial statements including its subsidiaries, so that it is impossible to conduct a financial analysis of the group as such. For purposes of analysis, however, the following summary has been prepared of the regional electric companies' statements of condition for fiscal year 1980:

<sup>1/</sup> The respective subscriber/employee and Gwh/employee ratios are: Panama 68 and 0.4; Uruguay 77 and 0.24; Costa Rica 94 and 0.67; and Peru 233 and 1.08.



(In thousands of dollars)

<u>Systems</u>	<u>Companies</u>	<u>Profit (Loss)</u>	<u>Profitability on net capital</u>
Pichincha	E.E. Quito S.A.	4,859.8	5.98 %
"	Coop.ER Sto. Domingo Lt.	53.7	-
Esmeraldas	E.E. Esmeraldas S.A.	(294.5)	-
Manabi	Sistema Elect.Reg.Manabi	59.7	0.33
North Central	Sist. Latacunga S.A.	158.4	5.06
"	Sist. Ambato Pastaza S.A.	221.4	0.94
"	Sist. Riobamba S.A.	217.1	1.9
"	E.E. Bolívar S.A.	(265.8)	-
Northern	E.E. Norte S.A.	(6.7)	-
South Central	E.E. Azogues S.A.	(192.2)	-
"	E.E. Centro Sur S.A.	1,433.0	10.9
Guayas-Los Rios	E.E. Los Rios	(178.2)	-
"	E.E. Peninsula St. Elena	94.2	1.0
"	INECEL Guayas (Durán-Balzar)	769.8	4.0
"	E.E. Milagro S.A. (Milagro-Naranjal)	389.6	0.19
Southern	E.E. Regional del Sur S.A.	(153.2)	-

- 5.61 The above comparative statement shows that of a total of 17 companies, 1/ 7 posted losses for 1980 operations and 10 showed a profit. Five of the latter showed profits of less than 2% and only one exceeded 10% profit on net capital. Analysis of the limited amount of financial information available does not provide a basis that explains the results obtained by the companies as a group, since there are too few correlations.
- 5.62 From the standpoint of sales volume, 6 of the 7 companies that showed a loss on their operations had sales of less than 50,000 Kwh during the year. The exception was Empresa Manabi, which sold 119 Gwh and posted a loss, as stated above. Nevertheless, the limited scale of operations does not appear to be a determinant for negative results, since the companies that showed a profit included Santo Domingo, Latacunga and Santa Elena whose sales were 27,201 Kwh, 27,854 Kwh and 33,695 Kwh, respectively.
- 5.63 Rates: It can be seen that 5 of the 10 companies that posted profits charged rates of more than US\$0.07 equivalent per Kwh and only 2 companies had rates below US\$0.05 per Kwh. This would place the profit subgroup at the highest levels of all the companies examined. Nevertheless, and as in the case of the volume of energy sales, this factor does not appear to be an exclusive determinant for positive results, since the companies that showed a loss included the following, with relatively high rates: Esmeraldas (US\$0.0728); Manabi (US\$0.0772); and Los Rios (US\$0.0792).

1/ Including the system operated by INECEL (Durán-Balzar).

- 5.64 Although we do not yet have complete and updated information on Ecuador's electric sector as a whole, the handling of collections by each company is known to be adversely affected by the long delays of the national, provincial and municipal public sector in payment of the bills submitted by the electric companies. An estimate prepared by INECEL on December 31, 1980 shows the following situation:

Ecuadorian Electric Sector. Accounts Receivable from all  
customers and from the public sector as of December 31, 1980  
(In US\$ thousands)

<u>Companies</u>	<u>Subscribers' Payments Due (1)</u>	<u>Public Sector Payments Due (2)</u>	<u>Percentage of total (3)=(2)/(1)</u>
Regional norte	1,411	418	30
Quito	5,761	4,800	83
Ambato	743	299	40
Riobamba	818	222	27
Bolivar	240	265	69
Centro Sur	3,346	59	2
Azogues	127	100	79
Sur	600	84	14
Esmeraldas	3,857	579	15
Manabí	4,090	739	18
El Oro	1,241	352	28
Milagro	1,466	15	1
Santa Elena	626	107	17
Latacunga	682	156	23
Santo Domingo	653	28	4
Guayas-Los Ríos	2,617	2,052	78
Los Ríos	1,146	327	29
	<u>29,424</u>	<u>10,502</u>	<u>36</u>
	=====	=====	==

- 5.65 The foregoing estimate shows that more than a third of the electric companies accounts receivable are for the public sector. Furthermore, at least half of this amount is for bills that have been due for a number of years. Since this situation has a distinctly adverse effect on company liquidity and ability to provide service, intensive efforts have been made to achieve application of the Basic Electrification Law, which requires public sector agencies to include allocations in their budgets to pay for the consumption of electric power; otherwise, the State Controller's Office will present charges against the treasurers responsible. Despite these provisions and repeated pleas to the Ministry of Finance and Public Credit, electric bills owed by public agencies have mounted steadily and there is no way that the electric companies can cut off this supply.

5.66 During its recent visit to Ecuador, the Analysis Mission told national authorities of the Bank's concern over this situation. The Minister of Finance said that, in reference to autonomous agencies and units of the central government, shortly, a mechanism will be set up to rectify the problem. That mechanism could be in the form of trust contracts between the debtor institutions and the Ministry of Finance, which would proceed to withhold and deposit in the name of the various electric power companies the sums agreed upon for amortization of the consolidated debt of each agency. For other autonomous agencies where the government has no jurisdiction - the provincial councils, municipalities, etc. - forming the autonomous sectional system, INECEL, acting through the regional electric companies, accepts that responsibility. To that end, in the present operation, as in the Phase C Paute operation, a clause will be included in the respective loan contract whereby the guarantor and INECEL undertake to present to the Bank, prior to the first disbursement, an analysis of the balances owed to the electric power companies as of December 31, 1981, by entities of public law, indicating the length of time those balances have been outstanding, and the date by which those balances, plus any interest due by virtue of default, must be paid. In the case of public units of the central government, that date shall be no more than 12 months after the date of the signing of the respective loan contracts, while for units of the autonomous sectional system the limit will be 18 months. Further, such agreements shall specify the mechanism to be employed in the future for punctual payment of the electric power bills (see proposed resolution, paragraph 8(c)(i)(2) and (ii)). In both cases, an additional three-month term will be set for the borrower and the guarantor to submit evidence that the aforementioned balances outstanding and the corresponding interest charges have been collected (see Recommendations, paragraphs 6 and 7).

4. Impact of rural electrification project on regional electric companies

- 5.67 The impact of the project under review here will start to be felt when the companies receive from INECEL the finished circuits, complete with residential connections so that electric service can start immediately.
- 5.68 In addition to the electric power to be supplied by the companies, they will be responsible for operation and maintenance of the circuits built by the project within their respective jurisdictions. These activities <sup>1/</sup> are a routine part of power company operations. Since the technical specifications of the material and equipment scheduled under the project call for items that should last an estimated 30 years, it is reasonable to assume that they will not entail too much work for the electric companies. Among the measures that the borrower should take to ensure adequate maintenance of project works will be the submission of an annual maintenance plan with a detailed report on annual budgets for that purpose, starting when all construction has been completed. <sup>2/</sup> The ex post evaluation of the project also includes operation and maintenance details as part of the information to be compiled for that purpose (see paragraph 4.30 (a)).

---

<sup>1/</sup> Such as repair and installation of meters, replacement of posts, etc.

<sup>2/</sup> See Recommendations, paragraph 4.

- 5.69 The comparative statement of average energy consumption during the first year of project execution and that obtained by the regional electric companies in December 1980 (see Appendix 19) shows that average energy consumption for each user was between 16% and 88% higher than the average anticipated for project subscribers in the first year. This enables us to assume that operation of the 9 circuits would reduce the average amount of energy consumed per subscriber, since the project will add a larger number of subscribers with underaverage consumption. It should be noted that rates are generally lower for subscribers using less than 70 Kwh a month (840 Kwh a year). Most of the new subscribers fall within this category.
- 5.70 The foregoing statements indicate that the electric companies will experience a considerable increase in investment, along with an increase in low-consumption subscribers. As a result, profitability from their operations may drop unless there is a compensating increase in company rates. This is now being scheduled, as indicated in paragraph 5.27.
- 5.71 To determine the necessary rate level for the project to be financially profitable, an estimate has been prepared of the operating cost of the circuits that will probably comprise the rural electrification project, grouped according to the companies that will operate them. The premises used for this calculation are shown in Appendix 20. A comparative table follows of the rates resulting from those calculations, together with average rates in effect in 1981:

<u>Companies</u>	<u>Average Subscriber Rate 1981</u>	<u>Average Rate for all Subscribers 1/</u>	<u>Percentage of Increase</u>
E.E. Quito S.A.	0.0752	0.075	-
Coop. ER Sto. Domingo Lt.	0.040	0.0415	3.8
E.E. Esmeraldas S.A.	0.040	0.0425	6.3
Sist. E. Reg. Manabí	0.077	0.0772	2.6
E.E. Reg. El Oro S.A.	0.0868	0.0868	-
Sist. Latacunga S.A.	0.0520	0.0575	10.6
Sist. Ambato Pastaza S.A.	0.0520	0.0527	1.4
Sist. Riobamba S.A.	0.0416	0.0436	4.8
E.E. Bolívar S.A.	0.0492	0.0588	19.5
E.E. Norte S.A.	0.0656	0.0660	0.6
E.E. Azogues S.A.	0.0588	0.0634	7.8
E.E. Centro Sur S.A.	0.0588	0.0591	0.5
E.E. Los Rios	0.0792	0.0792	-
E.E. Península St. Elena	0.0792	0.0834	5.3
INECEL Guayas (Durán-Balzar)	0.0700	0.0703	0.4
E.E. Milagro SA (Milagro-Naranjal)	0.070	0.0702	2.9
E.E. Regional del Sur S.A.	0.0652	0.0663	1.7

1/ Rate resulting from distributing the cost of the circuits among all users.

- 5.72 The table above shows that if the assumptions adopted for the calculation prove true, the companies should increase their rates to cover their cost and obtain a profit on the investment value of the new circuits, except for the Quito, Manabí, El Oro and Los Ríos companies, which could continue the rates presently in effect.
- 5.73 The companies which should revise their rates include Esmeraldas, Bolívar, Regional Sur, Azogues and Regional Norte, which posted losses for their 1980 operations. The first three should set relatively high rate increases or introduce changes in their operating structure to increase efficiency. Otherwise, they will be unable to finance their operations. It is important to note that the maximum increased rate level would be similar to, or even lower than, those now charged by the El Oro company, the equivalent of US\$0.0868 per Kwh. This would seem to indicate that the rate increases showed as necessary in the above table should prove perfectly feasible for all of the companies.
- 5.74 Since servicing of the IDB loan will be assumed by INECEL with its own resources, this aspect of the project will not directly affect the cash flows of the electric companies that will receive the new facilities in exchange for capital stock. The information also indicates that although the project will help improve living conditions for new subscribers, it may not produce financial benefits for the electric companies. Accordingly, the only way those companies can maintain a sound financial position is by increasing their rates to all consumers in the area served by each company.
- 5.75 To sum up, a combination of adverse factors could produce losses in the operation of project circuits. Those losses would have to be absorbed by the electric companies, using the revenue from their operations. For these reasons, and taking into account the lack of any direct legal connection between the electric companies and the Bank, it is recommended that INECEL be the one to assume a commitment to establish rates that will provide the electric companies with the necessary financial resources for normal operation. Consequently, it is recommended that the loan contract for the rural electrification project include a clause requiring that the rates for energy supplied by the regional electric companies produce sufficient revenue to cover working expenses for the respective systems, including those relevant to the purchase or production of energy, administration, operation, maintenance, depreciation, billing and collection. They should also yield the following levels of profitability on revaluated fixed net investment: a) 4% in 1982; b) 8% in 1983; and c) 8.5% starting in 1984. (See Resolution, paragraph 8(f) and paragraph 6.01 of Appendix 3 to the Loan Proposal).

## VI. PROJECT JUSTIFICATION

### A. Technical Feasibility

- 6.01 Technical analysis of both the executing agency and the project submitted shows the proposed operation to be technically and operationally feasible, on the following grounds:
- (a) 31% of all design work associated with the construction of project works is already completed. Given the capacity for preparing preliminary and final designs demonstrated up to this point, projections are that an additional 40% of design work would be completed by mid-1982 and the final 30% by the end of that year.
  - (b) The standards used in the construction designs, besides being considered appropriate for works of this type, are those originally established by INECCEL and subsequently updated by the executing agency (UNEPER) with advice from an international consulting firm. Experts from NRECA of the U.S. have also reviewed the standards, which, in addition, meet with the approval of all regional electricity enterprises.
  - (c) The following factors, among others, justify the expectation that the project would be executed efficiently: (i) the logistical support available from the UNEPER warehouses would allow full and effective control of the movement of materials and equipment; (ii) the possibilities afforded by dividing acquisition of necessary materials and equipment into three lots covering 30%, 40% and 30% respectively of all circuits --each lot being divided in the same proportion for procurement of civil engineering works and installation of the systems.
  - (d) Project costs have been calculated reasonably on the basis of a representative sample of 31% of the proposed length in kilometers; allowance is also made for possible price escalation during the construction period, while appropriate margins are left for contingencies.
  - (e) No difficulties are anticipated with supplies of necessary materials or manpower availability. There is also an adequate pool of construction firms able to carry out the project works within the time periods scheduled. An exception exists with regard to works which may not be attractive to private contracting firms because of their location in remote areas at considerable distances from other parts of the project. According to the financing plan presented, construction costs in such cases would be covered exclusively from local resources, the figure involved being approximately 10% of the estimated total for installation of lines and 3.3% of the total cost of the project.

- 6.02 The information set out in this report on project execution and the associated investment timetable demonstrates that they are technically feasible and that necessary funding will become available in a manner likely to ensure satisfactory implementation.
- 6.03 The regional electric utility companies that would be responsible for maintenance of the electricity systems included in project execution have the capacity to carry out that activity, and to that end would take part in the proceedings envisaged for the procurement of tools and measuring apparatus, which will become their property once the project works themselves are completed.

B. Institutional Feasibility

- 6.04 From the standpoint of administrative and accounting organization, execution of the project is regarded as feasible, since the executing unit, which is already in existence as an entity answerable to the General Manager of INECEL, would be directly responsible for the actual execution process; besides having the requisite experience and type of organization to fit it for the proper management of the project, it would be able to rely on the services of a specialized consulting firm in supervising and exercising technical control over the proposed works.

C. Financial Feasibility

- 6.05 As indicated, local counterpart resources appropriated for execution of the project come from revenues earmarked in three governmental Decrees, the Regulations which give INECEL the responsibility for supervision and inspection of collection procedures. To that end, the funds allocated for the financing of the National Rural Electrification Program will be centralized upon collection in special accounts opened with the Banco Nacional de Fomento or the Central Bank of Ecuador, as the case may be.
- 6.06 Resources mobilized under Ministerial Order 051 and Decree 306 must be deposited with the Central Bank and the Banco Nacional de Fomento respectively, depending on the sums collected by each regional electric utility company. Under the terms of the Regulations provided for, the Treasurer of each utility company will be expected to inform INECEL monthly as to the deposits made.
- 6.07 Resources channeled under Decree 459-B into the Special Fund for service connections for low-income consumers are placed in a specific account with the Central Bank of Ecuador. This Fund will be utilized exclusively to provide the utility companies with loans which may be employed solely to finance secondary distribution networks and subscriber service connections in rural areas and disadvantaged urban zones. The Regulations governing the Fund are attached as Appendix 21.

- 6.08 Examination of past financial data on Ministerial Order 051 indicates that since its promulgation resources have been generated for the Rural Electrification Fund as follows:

<u>Year</u>	<u>Thousands of US\$</u>
1979	558.8
1980	2,545.4
1981	4,859.8

- 6.09 As that Order came into effect in September 1979, the above figure for that year covers only four months. The steady growth of the funds generated under the Order is due to increments in the energy volume billed and to increases in the average service rate. However, as indicated in paragraph 5.26, in practice the regional electricity companies have used the amounts received to finance improvements and extensions to their facilities.

- 6.10 The following table shows the funds generated since Decree 306 came into effect:

<u>Year</u>	<u>Thousands of US\$</u>	<u>Percentage increase</u>
1976	1,320.7	-
1977	1,706.3	29
1978	2,354.8	38
1979	4,287.2	82

- 6.11 The above figures show that the funds generated under the Decree have been increasing at a growing rate. As indicated in the preceding chapters, these funds come from application of a 10% surcharge on sums billed to subscribers in the commercial and industrial sectors, for the most part enterprises in Quito and Guayaquil. In practice, such funds are retained and invested directly by the utility companies (paragraph 5.32).
- 6.12 Examination of past financial data on Decree 459-B shows that on average a sum equivalent to US\$1,365,000 was generated annually over the period 1975-1979.
- 6.13 The following estimates of the funds likely to be produced by these sources during execution of the proposed project, from 1982 to 1985, have been based on electricity sales by the regional utility companies and the rates for those years projected in the studies forming part of the Master Electrification Plan:



(In thousands of US\$)

	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>Total</u>
Decree 306	11,501	-	-	-	11,501
Ministerial Order 051	1,969	1,458	1,348	1,074	5,849
Decree 459-B	6,533	8,750	10,806	14,123	40,212
<b>Total</b>	<u>20,003</u>	<u>10,208</u>	<u>12,154</u>	<u>15,197</u>	<u>57,562</u>
	=====	=====	=====	=====	=====
Required local contribution to Project	352	717	2,567	2,567	6,203 <sup>1/</sup>

6.14 As estimated above, the resources mobilized from the various sources listed will exceed required local counterpart contributions to the project. However, it must be remembered that the funds collected under Order 051, which should be applied to rural electrification programs, have not reached INECCEL in previous years but have been retained by the regional utility companies. Furthermore, the funds that would be assembled under Decree 306 have been taken into account only until March 1983, the point at which the Decree lapses, although the Government is now considering extending it permanently.

6.15 In view of these factors and in order to ensure that local contributions to the project will be available promptly and in full, any loan contract signed will contain a clause requiring INECCEL to demonstrate to Bank satisfaction prior to launching of each set of bid proceedings for the procurement of materials that: (a) before the issue of invitations to bid on the construction and installation of the particular circuits for which those materials are required, it will dispose of the local counterpart funds that are to finance circuit installation costs; and (b) before the call for bids on the construction and installation of any group of circuits is issued, the resources to finance the local contribution to circuit construction and installation costs are available in cash in the project account (V. Recommendations, paragraph 2c).

#### D. Economic Evaluation

##### 1. Demand

6.16 The consumer demand projections on which UNEPER circuit designs are based took consumption as a function of per capita income among a sampling of population centers. In this present economic evaluation, however, consumption per subscriber has been assessed from statistics made available by the regional utility companies. Monthly consumption per subscriber in project year 1 is thus taken as equal to a percentage (80%

---

<sup>1/</sup> Taking account of the amount of US\$697,000 equivalent corresponding to costs incurred prior to approval of the operation, the total local contribution required would be US\$6,900,000.

and 70% respectively for the Sierra Coast regions) of monthly consumption per rural residential subscriber in the region. Monthly consumption in project year 8 is the same percentage, but of consumption per rural residential subscriber plus commercial consumption; in year 15, it is the same percentage of residential plus commercial plus industrial consumption; and in year 30, it is 100% of consumption per rural subscriber in the region (V. Appendix 23 for details of the estimation procedure). Consumption for the project years between those mentioned specifically is assumed to grow steadily between the figures given. In this manner, account is taken not only of existing knowledge of these markets but also of the fact that the areas where demand is highest have already been electrified, so that unit demand in new areas will be lower, rising to the level of older areas only after a certain time.

- 6.17 The number of subscribers has been estimated to reflect the number of existing dwellings that could be connected to the system, and to allow for growth at the same rate of population increase observed in the region in the past. Of already existing dwellings, only 90% would finally have electric power supply, and then only in project year 10, the increase to the 90% mark taking place gradually over that period.

## 2. Selection and routing of circuits

- 6.18 In 1977, at the request of INECEL, the Escuela Politécnica Nacional in Quito and the Escuela Politécnica del Litoral in Guayaquil began preparing a rural electrification project for the Sierra and Coast regions respectively. The extensive project designed took as its major aim the electrification of relatively large population centers adjacent to already electrified areas, with provision for connection of whatever isolated dwellings and small centers lay in the same path. The original design was subsequently modified and reduced in scale, owing, among other things, to a more in-depth study of the circuits, to financial constraints and to the fact that certain circuits were installed by the regional utility companies. The project was reduced in scale mainly in the sense that limitations were placed on the number of subscribers per kilometer.
- 6.19 At the same time, assessments were made of the economic rate of return to be expected from each component of the project, a selection then being made of those promising the best internal rates of return. That selection was made from a regional and not a national perspective so that the majority of the regions would be included, a factor which explains the diversity seen among project components.

## 3. Energy inputs

- 6.20 Given the structure of Ecuador's installed capacity and the fact that domestic fuel prices are below international levels, approximately 80% of the electricity currently generated in the country depends on the consumption of fuels derived from petroleum. In order to remedy this

situation, meet the very high growth in demand and increase system reliability, large-scale investments are being made in the sector, primarily in the construction of hydroelectric plants and completion of the interconnection of the regional systems. The expected result is that the proportion of electricity generated by using petroleum derivatives will be cut back to 27% beginning in 1983 <sup>1/</sup> when the Paute Project (Phases A and B), also financed by the Bank, comes on line.

- 6.21 It is estimated that the electricity consumed by the project under review here would amount to 20 GWH in year 1 (1984) and to 70 GWH in year 30 (2015) -- in other words, to less than 1% of total demand on the interconnected system. As for the load factor, it would be low, between 30% and 40%, since project-related consumption would be substantial during peak hours, from sunset to 9.30 or 10.30 p.m. The concentration of demand at the major peak time also means that a considerable part of project-related marginal energy consumption would be met, at least in the initial years and especially during the dry season, from thermal power stations.

#### 4. Infrastructure and rural migration

- 6.22 Over 50% of the national population inhabits rural areas, although the agriculture sector accounts for only 25% of GDP. Annual per capita rural income is US\$400, or approximately half the national average. Rural area investment needs are multiple: education, health, water supply, technical assistance, credit and other facilities for producers, farm machinery, research, local roads, etc. One of the most significant aspects of rural life in Ecuador, as in other Latin American countries, is the extent of migration to urban areas. It has been, and still is, a major Government objective to reduce this population movement. It is worth noting that in 1966 the National Planning Board estimated that half the rural population was "surplus", meaning that "without its participation, the same levels of production could still be achieved". Although the available studies on rural electrification come to no definite conclusions regarding the possible impact of electrification on migration from the countryside, the scale of that migration does appear to be closely connected with the existence of jobs and the expectation of a better economic future. Electricity might therefore have a regulating effect on rural migration if it leads to expanded work opportunities -- that is, if it serves as an economic incentive in the region.
- 6.23 One infrastructure investment likely to prove particularly important in rural development is the building of heavy-vehicle all-weather access roads, which are notably lacking in the Ecuador countryside. Such roads

---

<sup>1/</sup> Beginning in 1988, the proportion of thermal energy would fall to 16%, then rising again and finally stabilizing over the next decade between 11% and 12%.

would have a significant supplementary impact on the work of rural electrification. For instance: (a) in a project like the one under review here, they would allow construction work to go on even during the wet season, when the transportation of concrete posts can become impossible without adequate roads; (b) they facilitate system maintenance, which is often hindered by the lack of access routes, especially during the wet seasons; and (c) with or without electricity, the economic potential of a region will remain difficult to tap unless roads exist capable of carrying heavy vehicles in all weathers.

- 6.24 Many demands for energy are observed in rural areas: wood for cooking and heating, gasoline for transportation, farm machinery, machinery used by craftsmen, production of electricity, lighting, water supply, fertilizers, batteries, etc. The comfort of rural dwellings would be improved in a basic sense by the availability of electricity for lighting, and in another sense by its availability to power radios and --depending on income levels-- television sets, refrigerators and other domestic appliances; it could also be used to power craft machinery, water pumps, etc.

#### 5. Cost-benefit analysis

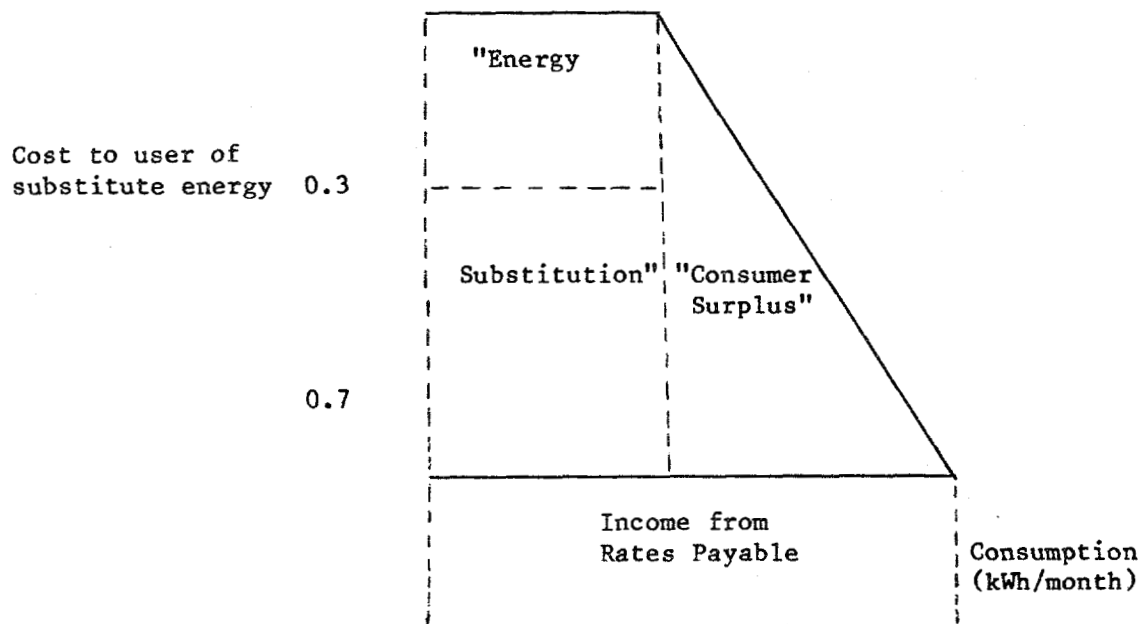
- 6.25 Economic analysis of the project was based on the studies conducted by UNEPER, and to a particular degree on the representative sample referred to in paragraph 3.10. There now follows an explanation of the methods used to determine the benefits, costs and investments associated with the circuits making up that representative sample, and to assess the internal economic rate of return.

#### (a) Benefits

- 6.26 Three types of benefits are distinguished: (a) energy substitution; (b) consumer surplus; and (c) income from rates payable. Explanations of these terms are given below, but they may first be represented graphically as follows:

Economic cost of substitute energy (US\$/kWh)

Sierra 0.53  
Coast 0.42



Energy Substituted  
Sierra 9.3 (kWh/month)  
Coast 10.95 (kWh/month)

(i) Energy substitution

6.27 This is an estimate of the energy which could be replaced by electricity and which, without the project, is now consumed by residents in the areas to be electrified. The estimate is based on two virtually identical surveys, the first conducted in 1977, and the second, consisting of 30 and 33 interviews respectively in the Sierra and the Coast conducted in April 1981 to update the figures obtained initially. The revised findings show that the unit economic cost to Ecuador of the energy that would be replaced by electricity is US\$0.53 per kWh in the Sierra region and US\$0.42 per kWh in the Coast, while the cost to the user in both Sierra and Coast is US\$0.30 per kWh. <sup>1/</sup> The estimated monthly

<sup>1/</sup> The difference between the economic cost to the country and the cost to the user results from the fact that the international and domestic prices of petroleum derivatives are not the same.

consumption per household of energy replaceable by electricity is 9.3 kWh in the Sierra region and 10.95 kWh in the Coast. 1/

(ii) Consumer surplus

- 6.28 This represents the user's ability to pay for electricity less what he actually pays, namely the service rate. The important thing, then, is to plot the demand curve, which is assumed to be a straight line whose extremes coincide on the one hand with the point of intersection between the cost of substitute energy to the user and his consumption, and on the other hand with the point of intersection between the service rate payable for electricity and the consumption of electricity.

(iii) Income from rates payable

- 6.29 This is the expected consumption at the service rate charged to the consumer. If that rate --estimated by INECCEL at US\$0.07 per kWh-- were given different values, the internal rate of return would be virtually the same. Nevertheless, as discussed below, it is an important element in analyzing the group of project beneficiaries. 2/
- 6.30 Assessment of benefits from energy substitution and of consumer surplus was based on average values in the Sierra and Coast regions and, as shown by the survey, no distinction being drawn between residential, commercial and industrial consumers. Although closer approximations could have been obtained by considering each group of consumer separately, this was not done, firstly because the available data does not allow it and secondly because, as indicated already, industrial consumption, at least during the early stage of the project, will make up only a small part of total consumption.

(b) Costs

(i) Electricity input

- 6.31 With the information available, it is very difficult to determine the economic cost of the project energy input. That exercise would require estimation of both the daily project load curve and the volume and cost of the marginal energy it would be necessary to generate; in other words, one would have to assess the extent to which the project would affect the daily load curve of the system, as well as the consequent differences in dispatch and, by extension, in generating costs. All that the available data allows is a conclusion that project-related consumption will be heavily concentrated during the hours of peak demand, and that, given the structure of installed system capacity, the electric

---

1/ That proportion of substitute energy coinciding with what the beneficiary must pay for electricity is accounted for within "income from rates payable".

2/ See paragraphs 6.40-6.47.

power put into the project, at least during the initial stage, will be thermal. The cost of the fuel alone required for thermal generation is estimated at between US\$0.044 and US\$0.087 per kWh. <sup>1/</sup> Allowing also for other marginal generating costs, administrative costs, marginal transmission costs, etc., it is clear that the total cost of power consumed through the project would vary between a minimum of US\$0.05 and a maximum of US\$0.093 per kWh. For purposes of estimating internal rate of return, a cost of US\$0.06 was assumed, and, as demonstrated in the sensitivity analysis, that rate is very sensitive to variations in the cost of the energy channeled into the project.

(ii) Operation and maintenance

- 6.32 Estimated for the Sierra and Coast regions respectively at 3.5% and 3% of total direct investment --that is, the total of all project investments (both initial and subsequent) excluding financial charges and price escalation.

(iii) Administration and sales

- 6.33 Estimated for the Sierra and Coast regions respectively at US\$7 and US\$13 per subscriber.

(iv) Losses

- 6.34 Estimated at 15% of energy consumption.

(c) Investments

(i) Initial

- 6.35 These will cover the direct costs of the project as detailed in Chapter III. Financial charges and price escalation are excluded, however, and divided into two equal parts for the two years preceding project start-up.

(ii) Subsequent

- 6.36 These are the investments that will have to be made to connect new subscribers who come in after the circuits are in operation. Estimated at US\$170 per subscriber.
- 6.37 On the basis of the methodology employed in the cost-benefit calculations, the internal economic rate of return for each of the circuits

---

<sup>1/</sup> These figures correspond respectively to fuel costs at the steam plant under construction at Esmeraldas and average fuel costs at the existing gas plants.

making up the representative sample was computed, with results as follows: 1/

Circuit No.	Name	Province	Internal
			Rate of Return %
82-05	Simón Bolívar	Pichincha	12.7
83-08	Latacunga	Cotopaxi	12.9
83-23	Puebla	Chimborazo	11.5
83-26	Cajabamba	Chimborazo	11.9
86-02	La Lucha	Esmeraldas	11.7
86-09	Muisne	Esmeraldas	11.4
88-01	Daule	Guayas	16.9
88-02	Santa Lucía	Guayas	19.6
88-03	Colorado	Guayas	18.9
88-04	Laurel	Guayas	18.0
88-05	Callejones	Guayas	13.0
88-11	Lomas Sargentillo	Los Ríos	14.2
88-32	Playas	Los Ríos	11.7
89-04	El Recreo	El Oro	15.4
89-12	Piñas	El Oro	17.1
89-14	Balzas	El Oro	12.1

#### 6. Costs and benefits not quantified

##### (a) Benefits

- 6.38 These are indirect benefits not quantified in the course of cost-benefit analysis. They would materialize as improvements in the level of living of rural subscribers, both residential and commercial, and might include the following: (a) substitution of electric lighting for candles and kerosene lamps; (b) it becomes much easier to pump water, which is very often scarce in Ecuador's rural areas, whether in the Sierra or the Coast; (c) power-operated domestic appliances can be used; (d) greater facilities available at health-care centers; (e) education opportunities improve, as it becomes possible to use classrooms and study after natural daylight has failed; (f) greater public safety, as street lighting can be installed; (g) additional artisanal and agro-industrial economic activities become possible. In connection with this last point, good examples would be dairy farms and grain storage facilities; the availability of lower-cost energy helps reduce losses through improper storage, and this in turn adds to the food supply, thereby improving the diet of the rural population.

##### (b) Costs

- 6.39 The economic cost of the project could prove higher than estimated in this evaluation if: (i) the construction of project works ran over

---

1/ See Sensitivity analysis given in Appendix 24.



schedule; (ii) if there were interruptions in supply because of shortcomings in the circuits and/or the system in general; and (iii) the wooden posts to be used had a shorter useful life than the 32 years projected.

E. Analysis of Project Beneficiaries

- 6.40 According to the reference guidelines issued by the Bank, the maximum annual per capita income level which defines low-income groups is S/.13,200 (US\$528). No study is known to have been conducted in Ecuador relating rural incomes to electricity consumption. However, a survey was undertaken in 1980 in the district of Santo Domingo de los Colorados with a sampling group of 634 families, 403 of which had electric power supply. Located in the province of Pichincha, this district consists of the township of the same name, with a population of 50,000, and an area of influence numbering 100,000 inhabitants.
- 6.41 Owing to its agricultural wealth and a high volume of investments over the last ten years, Santo Domingo de los Colorados is one of the areas of Ecuador which has experienced extraordinary population and economic growth <sup>1/</sup>. It can therefore be assumed that its development and income levels are above the average of the areas that would be affected by the rural electrification project under examination here. Furthermore, the data provided by the Santo Domingo survey is partial, so that a number of assumptions had to be made in determining the average figure within each consumer group. It has also been assumed that lower consumption coincides with lower incomes, i.e. that the lowest-income households surveyed are those showing the lowest monthly consumption figures.

Survey/Analysis of Beneficiaries

Number of Households by Income-Level

Monthly Income (In S/.)	Households with Electricity	
	Surveyed	Cumulative
500 or less	2	2
501 - 1000	9	11
1001 - 1500	21	32
1501 - 2000	39	71
2001 - 4000	99	170
4001 - 6000	84	254
6001 - 8000	36	290
8001 - 10000	37	327
10000 or more	76	403

<sup>1/</sup> Various agricultural development projects have been carried out in this zone with financing from international development agencies, including IDB.

Number of Households by Consumption of Electricity

Average Monthly Consumption per subscriber (KWh/month)		Households with Electricity	
		Surveyed	Cumulative
(Residential)	(Commercial + Industrial)		
10	-	5	5
23	-	23	28
43	-	26	54
62	-	31	85
86	70	165 <sup>1/</sup>	250
-	165	121	371
-	250	22	393
-	400	10	403
		<u>403</u>	
		===	

- 6.42 On the basis of this survey, annual per capita income in rural areas can be estimated at approximately S/.10,000 (US\$400) in 1980. The following comparison of average income levels is also obtainable from the survey:

A	B	C	D
Average assumed here	Income as per survey	Households	A x C
250	( 500 or less )	2	500
750	( 500 - 1000 )	9	6,750
1250	( 1001 - 1500 )	21	26,250
1750	( 1501 - 2000 )	39	68,250
3000	( 2001 - 4000 )	99	297,000
5000	( 4001 - 6000 )	84	420,000
7000	( 6001 - 8000 )	36	252,000
9000	( 8001 - 10000 )	37	333,000
17000 <sup>2/</sup>	(10000 or more )	76	1,292,000
		<u>403</u>	<u>2,695,750</u>
		===	=====

- 6.43 Therefore, analysis of the survey shows average monthly household income to be S/.6,690 (US\$268), which corresponds to annual per capita income of S/.14,865 (US\$595), or 1.4865 times the general average for rural areas. That being so, if the survey is to be valid for the Ecuadorian countryside in general and so for the areas where this project is to be implemented, it is necessary to reduce the survey values by 48.65%.

<sup>1/</sup> Assumed here that 50% of dwellings are exclusively residential.

<sup>2/</sup> The figure 17,000 was chosen since the other averages are generally a little higher than the sum of the two preceding figures.

Accordingly, any monthly household income below S/.10,500 <sup>1/</sup> (US\$420) in the survey places that family in the low-income sector.

- 6.44 On that basis, it is estimated that approximately 340 households among the 403 interviewed (i.e. 84.4%) fall in the low-income group. Restated in terms of electricity consumption, this means that of the 121 households consuming a monthly average of 165 kWh, 90 are classifiable as low-income, while the remaining 31, together with those (22) which consume 300 kWh monthly and those (10) which consume 500 kWh, are classifiable as high-income. It is apparent, then, that the low-income households consume 31,339 kWh per month and the others 14,615 kWh, making a total of 45,954 kWh per month. Low-income households therefore consume 68.2% of electric power.

1. Impact of the project on low-income beneficiaries

- 6.45 Among the economic benefits identified as flowing from the project, it is estimated that 27% of the benefits from energy substitution <sup>2/</sup> would go to low-income groups. Low-income subscribers would also receive approximately 85% of the benefits associated with the service rates. <sup>3/</sup>
- 6.46 It is also estimated that 18% of the economic cost of the project investment (total cost less financial charges and price escalation) represents unskilled labor (semi-skilled manpower not included). Based on the representative sample used for purposes of economic analysis of the project, this is equivalent to US\$4,176,237. Unskilled project laborers earn S/.4,500 per month, so that a total of 23,200 man-months is involved. If the opportunity cost of this manpower is taken as the minimum monthly wage of S/.2,500 paid to farm laborers, then the benefit per man per month is S/.2,200; multiplied by the number of workers, this figure gives a total of S/.51,040,000, or US\$2,041,600 equivalent, which has a present value of US\$1,932,229.
- 6.47 On the basis of the reasoning set out above, updated benefits to the low-income sector can be put at US\$22,348,000. Therefore, the distributional impact of the project on its low-income beneficiaries may be expressed in the following manner <sup>4/</sup>

---

<sup>1/</sup> According to Bank estimates, the maximum limit defining low-income sectors is an income of S/.7,000. Since the survey figure is 1.4865 times higher than the rural average, any income below S/.10,400 ( $7,000 \times 1.4865$ ) would be classifiable as a low income.

<sup>2/</sup> Defined as the difference between what is actually paid for this energy and what would be payable at international prices. This also means that the State would benefit as well, since it would be providing a lower subsidy.

<sup>3/</sup> The present net value, after discounting 12% of these benefits, is equivalent to US\$885,054 for low-income users and US\$368,074 for other users.

<sup>4/</sup> The calculations forming part of the distributive analysis are given in Appendix 25.

$$\begin{aligned}\text{Distributional impact} &= \frac{\text{Net benefits to the low-income group}}{\text{Net benefits to the private sector}} \\ &= \frac{\text{US\$22,348,000}}{\text{US\$31,912,000}} \\ &= 70\%\end{aligned}$$

F. Justification for the Use of FSO Resources

- 6.48 Utilization of the resources of the Fund for Special Operations is justified on the following grounds: (a) low-income groups make up 84.4% of the population in the area of influence of the project; (b) 70% of the benefits generated by the project would be received directly by low-income groups; and (c) the area of influence of the project would lie in the rural sectors of the Sierra region and the Coast where indices of electrification are low and electric power supply virtually non-existent.
- 6.49 Finally, it should be noted that according to the provisional guidelines for utilization of the convertible resources of the Fund for Special Operations over the period 1981-1982 (Document GP-82-8 of March 20, 1981), since the proposed project is for rural electrification, 100% of foreign exchange financing may be charged to the Fund.

## VII. EVALUATION OF PREVIOUS LOANS TO INECCEL

### A. Background

- 7.01 The Bank has provided the Republic of Ecuador with a total of nine loans and with technical cooperation, under one project to finance studies and/or the implementation of investment projects in the power sector, for a total equivalent of US\$156.6 million. INECCEL has been the executing agency for all these projects, which are as follows:

<u>Operation No.</u>	<u>Date of Approval</u>	<u>Project</u>	<u>Total in US\$1000</u>	<u>Percentage disbursed by 30/IX/81</u>
314/SF	26/XI/71	Pisayambo Plant	16,200	100
18/CD	26/XI/71	" "	8,860	100
315/SF	26/XI/71	Paute Studies	2,700	100
411/SF	26/IX/74	Paute A and B	16,500	46
271/OC	26/IX/74	" " " "	33,500	95
412/SF	26/IX/74	Coca River Study	1,500	100
323/OC	9/XII/76	Transmission Paute A & B	25,000	40
492/SF	9/XII/76	Guayllabamba River Study	1,600	100
38/IC	9/XI/78	CLC Paute A & B and Transmission	50,000	40
ATC/TF(SP)- 1354-EC	1/IX/75	Jubones River Study <u>1/</u>	<u>760</u>	100
TOTAL			156,620	

- 7.02 Loans 314/SF, 18/CD and 315/SF-EC and technical cooperation ATC/TF(SP)-1354-EC were evaluated when document PR-777, which served as a basis for the approval of loans 323/OC and 492/SF-EC (Paute A and B transmission system and study of the Guayllabamba River basin, respectively), was presented on November 23, 1976. The Pisayambo power plant (loans 314/SF and 18/CD-EC) has been in full operation since the beginning of 1978, and as mentioned above, the studies on the development of the Paute River hydroelectric resources (loan 315/SF-EC) produced the project proposed in this report. The following sections of this chapter cover those projects with loans not previously evaluated, and consider the degree to which the corresponding conditions of contract have been fulfilled.

### B. Loan 412/SF-EC

- 7.03 As indicated in paragraph 7.01, this loan to the Republic of Ecuador was authorized on September 26, 1974, for the equivalent of US\$1.5 million. It financed the preparation of prefeasibility studies on the development

1/ This is a prefeasibility study for a multipurpose project.

of the Coca River for hydroelectricity, and feasibility studies on the project, which was improved by determining the sequence of implementation. The studies were originally planned to be carried out over a three-year period at a cost equivalent to US\$2.7 million. However, due to delays in conducting the corresponding bidding and subsequent negotiations with the company to which the bid was awarded, the project was concluded a year behind schedule, in February 1979. In addition, the final cost of the study was 2.4 times greater than budgeted: US\$6,480,000.

- 7.04 Nevertheless, the prefeasibility studies identified five possible developments and the following sequence of implementation was recommended: Salado, 560 MW; Codo Sinclair, 3,960 MW; El Chaco, 465 MW; Balsas, 375 MW; and Borja, 210 MW. The feasibility studies on the Salado development, carried out as the second part of the project indicated that the resulting project would be too costly because of geological problems.
- 7.05 Considering the above, INECEL intends to continue with the feasibility studies on the Codo Sinclair development for the purposes of maintaining an inventory of projects studied to a comparable level to assist in future investment decisions. The Institute will prepare a prioritization of this project, and it is expected that by mid-1982 a definition of the scope of the necessary feasibility studies can be achieved.

C. Loan 492/SF-EC

- 7.06 On December 9, 1976, the Bank approved this loan for the equivalent of US\$1.6 million to finance a prefeasibility study on the hydroelectric development of the Guayllabamba River and a feasibility study of whatever project might present best prospects for the future. The total cost of the project to be carried out over a three year period was estimated at the equivalent of US\$3.1 million. The corresponding studies were completed within the scheduled period with no additional cost.
- 7.07 These studies showed the feasibility of the Villadora-Chontal project with a capacity of 272 MW. A review of this study indicates that the project is comparable to others that INECEL has studied to the same level. However, it is not included in the Institute's plans for expansion as the studies were completed only after the formulation of the current expansion program.
- 7.08 Nevertheless, given INECEL's undertaking to update its expansion programs, it is likely that this project will be included for the period 1990-1995. INECEL may also request financing from FONAPRE to prepare the final plans, an operation which could be financed by loan 636/SF-EC.

D. Loans 271/OC, 411/SF, 323/OC and 38/IC-EC

- 7.09 As mentioned above, this group of loans to the Republic of Ecuador for the equivalent of US\$125 million, authorized on different occasions between September 26, 1974 and November 9, 1978, is helping to finance

phases A and B of the first stage of the Paute Program and the installation of its transmission network.

- 7.10 When loans 271/OC and 411/SF-EC were approved the project was planned to include only phase A, with an installed capacity of 200 MW. Subsequently, due to modifications in the design of the dam, phase B (300 MW) was included at the request of INECCEL and with the Bank's approval. The total estimated cost for the restructured project in 1976 increased from the equivalent of US\$193 million to US\$473 million. This increase, financed by local contribution, prompted the request for a complementary line of credit 38/IC-EC, which was approved in 1978. With the cost increases which have occurred up to mid-1981, the updated cost of the project is estimated at about US\$600 million.
- 7.11 The project was initially delayed by three years, principally due to changes in the plans for the dam and problems with the bidding, especially in finding contractors who could provide the necessary cement for constructing the dam. These problems were resolved in 1976-77, the bidding took place and construction began in 1978. The construction schedule was modified in 1978, and a three-year extension of the period for disbursement of loans 271/OC and 411/SF-EC, up to October 21, 1982, was approved at the same time as complementary line of credit 38/IC-EC.
- 7.12 Progress on the principal works of the project has been satisfactory since construction began, despite minor delays. The powerhouse, partially financed by loan 271/OC-EC and part of CLC 38/IC-EC, is now 90% completed, and is expected to be finished according to the present schedule. The dam, which loan 411/SF-EC and CLC 38/IC-EC helped to finance, is about four months behind the present schedule, due to problems in obtaining the necessary cement. It is possible that at least part of this delay will be made up by the contractor, but failing this, the dam will be completed by the beginning of 1983, as opposed to the present goal of the end of 1982. As a result, a further four-to-six month extension of the period for disbursement of loan 411/SF-EC may have to be considered. This aspect will soon be studied and probably proposed by INECCEL in 1982.
- 7.13 To sum up, the project is proceeding satisfactorily, and it is reasonable to assume that the 500 MW capacity plant will come into service by the first half of 1983 at the latest. INECCEL has given evidence of its ability to direct an operation of considerable magnitude.

E. Fulfillment of Conditions of Contract

- 7.14 On the whole, the borrower and INECCEL have fulfilled the conditions of the different loan contracts, with the exception of those conditions relating to rates and other financial aspects of the company. There have been delays in submitting the financial statements of INECCEL and the individual projects to the Bank on time. The audited financial statements for INECCEL and all projects financed in the fiscal year ending December 31, 1979, were not received by the Bank until March 1981.

With respect to fiscal year 1980, the auditors of the Contraloría General del Estado are still in the process of auditing, and the Bank is not expected to receive these financial statements until January 1982. To remedy this situation in the future, both for the loan contract for the project proposed in this report and the loan contract for the rural electrification project, INECEL will be required to retain the services of independent auditors, as explained in Chapter V of this report.

- 7.15 As regards establishing the rates and minimum levels of profitability of INECEL, the regional electric companies and the SNI, the respective clauses of contracts 314/SF and 18/CD-EC which financed the Pisayambo Power Plant have not been fulfilled, as explained in paragraph 5.39 of this report. In addition, it is unlikely that the respective conditions in the contracts for Pauta A and B and its transmission system will be met, although these have not yet taken effect.
- 7.16 It should be noted that both the clause pertaining to rates and that which establishes the profitability of INECEL at 7% in the case of the loans financing the Pisayambo project, are only applicable to that specific project. 1/ It is therefore difficult to determine whether or not these conditions will be met in the case of Pisayambo, as this is

---

1/ The texts of the respective clauses are as follows:

1. Section 5.06 of contract 314/SF-EC and Section 5.05 of contract 18/CD-EC:  
"Rates. The Republic undertakes to institute appropriate measures acceptable to the Bank to ensure that:  
(a) The rates for electric power supply from the Pisayambo I system from the time it comes into operation: (i) yield revenues at least sufficient to cover all operating costs of the respective system, including those relating to administration, operation, maintenance and depreciation; (ii) provide a reasonable return on immobilized investment of the system; and (iii) if the flow of funds available from the foregoing is not sufficient to cover the timely service of principal, interest and commissions of this loan and of principal and commission of loan 18/CD-EC, generate such additional revenues as may be necessary for this purpose;  
(b) The rates for electric power supply from the companies which distribute the energy generated by the Pisayambo I system, from the time they use energy generated by the said system; (i) yield revenues at least sufficient to cover all operating costs of the respective systems, including those relating to administration, operation, maintenance and depreciation; (ii) provide a reasonable return on the immobilized investment of the respective systems; and (iii) if the flow funds available from the foregoing is not sufficient to cover the timely amortization of all the financial obligations of the said companies, generate such additional revenues as may be necessary for this purpose."
2. From Appendix B of both contracts, Section VII:  
"Rates. For the purposes stipulated in Section 5.06 of contract No. 314/SF-EC and in Section 5.05 of loan contract No. 18/CD-EC, the rates of the Pisayambo I hydroelectric system must be established so that they yield a return of at least 7% per annum from the time all the energy which can be generated by the said system is substantially sold."



not INECEL's only operation and the financial statements received have not included any specific analysis of the Pisayambo project.

- 7.17 The contractual conditions establishing the required profitability of INECEL in the case of the loans financing the Paute power plant and corresponding transmission lines will take effect after this power plant is in operation. On the one hand, in Annex B of contracts 271/OC and 411/SF-EC (phases "A" and "B"), Section V states that there must be a profitability level of at least 7% from the time of initial operation of the first 400 MW of installed power of the Paute system to 1984 inclusive, and of 8.5% from 1985 onwards. On the other hand, in Annex A of contract 323/OC-EC (transmission), Section V states that a profitability of 8.5% over the immobilized investment of the whole Sistema Nacional Interconectado (Interconnected National System) must be reached by December 31, 1984 at the latest, and that each regional power company must achieve the same return on its own immobilized investments by the same date.
- 7.18 There are obviously conditions in the loan contracts for Pisayambo, Paute and their transmission network which indicate different levels of profitability for the generating projects on the one hand, and the national system on the other. When these loans were approved, the conditions were considered reasonable since in the case of Pisayambo this was the only power plant INECEL would rely upon, and in the case of Paute there had been no final planning or completion of the SNI.
- 7.19 However, the present situation is different due to the existence of the SNI and the fact that the national network will soon be completed. Since energy generated by the Pisayambo and Paute power plants, other INECEL plants and regional companies flows into this national system, it is difficult, if not impossible, to measure the energy consumed by the source power plants. This in turn makes it impossible to determine the profitability of each power plant.
- 7.20 It would be more logical to apply these requirements to the system as a whole, and for this reason the conditions on maintaining adequate rates and on the level of financial profitability of INECEL and the regional companies which are proposed for inclusion in the loan contracts for the Paute C and Rural Electrification projects are aimed at stipulating that these companies should charge rates which guarantee a satisfactory level of profitability over all the operations of each company.
- 7.21 The above is consistent with what was negotiated by INECEL negotiation with the World Bank when the latter approved the loan of US\$100 million for the Transmission System, and it seems likely that both INECEL and the regional companies will be able to meet these conditions. In the interest of uniformity in all the contracts in which these conditions appear, it is believed advisable to modify the respective clauses. To this end, the appropriate amendments will be submitted by short procedure at the time the Paute C and Rural Electrification projects are presented for consideration by the Board of Executive Directors.

Situación del Desarrollo Sectorial y Plan de Desarrollo

I. Desarrollo Sectorial

- 1.01 Datos preliminares señalan que en 1980, el producto agropecuario se expandió en sólo un 2,5 por ciento, aunque superó así el 2 por ciento de crecimiento del año 1979 y el promedio de 0,6 por ciento del período 1976-78. Esta evolución se debió principalmente a la prolongada sequía que empezó en 1976, la que estaría dando paso a un régimen pluviométrico normal con el consiguiente beneficio para las actividades del sector. Durante 1980, se recuperaron los niveles de producción de rubros tales como el trigo, cebada, maíz duro, arroz de invierno y verano, y papas, debido en gran parte a incrementos registrados tanto en la superficie sembrada como en los rendimientos por hectárea. En cambio, la producción de cacao y café fue menor a la obtenida en el año precedente a raíz de las precarias condiciones en que se encuentran las plantaciones por efecto de la irregularidad de las lluvias en años anteriores, por las enfermedades y plagas, y por la disminución en los trabajos de mantención y controles fitosanitarios.
- 1.02 Se anticipa una apreciable recuperación de las actividades agropecuarias para 1981, esperándose un crecimiento del producto cercano al 4,5 por ciento. Favorables condiciones climáticas, junto a una mayor canalización del crédito del Banco Nacional de Fomento hacia el sector y políticas de créditos más ventajosas constituirían los principales factores que inducirían tal expansión.
- 1.03 En 1980, el sector industrial perdió parte del dinamismo observado en el año anterior; deficiencias en la disponibilidad de materias primas afectaron a ciertos grupos fabriles. El producto del sector creció a una tasa de 6,8 por ciento, inferior al 8,9 por ciento del año anterior. La adopción de nuevas escalas de salarios y la vigencia de la jornada de 40 horas semanales de trabajo, puesta en marcha a partir de octubre de 1980, tuvieron efectos sobre los costos de producción e incidieron en forma adversa sobre los niveles de la actividad industrial durante el primer semestre de 1981. A lo anterior se sumó la restricción de créditos por parte de las instituciones financieras privadas, situación que perjudicó principalmente a las pequeñas y medianas empresas que tienen limitado acceso al crédito comercial. No obstante lo anterior, se estima que el sector manufacturero se recuperaría durante el segundo semestre y lograría una tasa de 6,7 por ciento durante 1981, o sea apenas inferior a la del año anterior, estimulado por la expansión de actividades tales como: la elaboración de madera, los productos químicos y de cauchos, las maquinarias y equipos, el material de transporte, la fabricación de textiles y papeles, el procesamiento de cereales y las confecciones.

- 1.04 El valor agregado de la actividad de la construcción tuvo un aumento del orden del 6,5 por ciento en 1980, superior al 4,8 por ciento registrado en 1979. En la evolución de 1980 cabe mencionar, por su importancia, los programas de construcción de vivienda a través del Banco Ecuatoriano de la Vivienda (BEV) y del Instituto Ecuatoriano de Seguridad Social (IESS); y la ejecución del Plan Emergente de Vivienda Popular de Guayaquil, que contempla la construcción de 10.000 viviendas con un costo estimado de 1.400 millones de sucres. En el primer trimestre de 1981 se redujo el ritmo de ejecución de las obras, a raíz de una aguda escasez de cemento, falta de financiamiento de ciertas empresas y la restricción del crédito. A partir del segundo trimestre empezó una reactivación de las actividades del sector al reanudarse los programas del BEV y los trabajos de construcción vial en varias regiones del país. Se anticipa para el segundo semestre un mayor dinamismo con el inicio de obras tales como los nuevos aeropuertos internacionales de Quito y Guayaquil y la construcción de cuatro puertos pesqueros. Sin embargo, continúan afectando al sector la escasez y alto costo de los materiales, los mayores costos de la mano de obra y la disminución de la jornada laboral.
- 1.05 La producción de petróleo, fue de 74,7 millones de barriles en 1980, cantidad inferior en 4,5 por ciento a la lograda en 1979, pero superior a los niveles registrados en el período 1976-78, los cuales no excedieron los 73,6 millones de barriles. A pesar de que el saldo exportado de petróleo disminuyó de 44,8 millones de barriles en 1979 a 40,3 en 1980, los ingresos generados por estas exportaciones se incrementaron 25,2 por ciento con respecto al año anterior, llegando a constituir la suma de \$1.474 millones. Las ventas en el exterior de fuel oil aumentaron de 7,4 millones de barriles en 1979 a aproximadamente 8 millones en 1980. Debe observarse que el precio base del crudo (Arabian Light 34 API) aumentó de \$24 a \$34 por barril entre los meses de diciembre de 1979 y 1980. El consumo interno de productos derivados del petróleo ascendió a 27,1 millones de barriles en 1980, excediendo en 9,8 por ciento el nivel alcanzado el año anterior. A fin de satisfacer la demanda interna, fue preciso importar 4,6 millones de barriles de refinados para los cuales no existe suficiente capacidad de producción en el país. Dicha cantidad significó un aumento de 68,2 por ciento con respecto a las compras en el exterior efectuadas en 1979.
- 1.06 Se estima que el nivel de reservas probadas recuperables de petróleo ascendía a 1.100 millones de barriles al 31 de diciembre de 1980, cantidad suficiente para mantener los actuales niveles de producción durante 12 años. Las reservas probadas de gas natural equivalían a 200.000 millones de pies cúbicos a la fecha indicada. A fin de cumplir con los propósitos del Plan Nacional de Desarrollo, orientados a aumentar el nivel de reservas de hidrocarburos, se intensificaron las actividades de prospección y exploración durante 1980. En efecto, el número de pozos perforados alcanzó a 29, cantidad que se compara favorablemente con los 21 del año 1979 y 16 de 1978. Estos esfuerzos

permitieron descubrir las estructuras de Secoya, Shuara, Tetete y Sansahuari. Además, los estudios hasta ahora efectuados, sugieren que las perspectivas del Golfo de Guayaquil son promisorias no sólo por constituir una importante fuente de reservas de gas, sino por la posibilidad de que exista petróleo.

- 1.07 A fin de racionalizar el consumo interno de derivados y de reducir la exportación ilícita de combustibles, el 17 de febrero de 1981, se efectuó una revisión de los precios de los productos derivados del petróleo. La gasolina "super" se elevó de \$0,73 por galón a \$0,80; la gasolina "extra" se incrementó de \$0,19 a \$0,60 y la "regular" de \$0,16 a \$0,40. Estos significativos aumentos representaron un decidido esfuerzo de las autoridades para acercar los precios internos a los niveles prevalecientes en los mercados internacionales.
- 1.08 Durante el primer semestre de 1981, la producción de petróleo fue de 38,4 millones de barriles, un 4,9 por ciento superior a la de igual período en el año 1980; la exportación disminuyó en 2,3 por ciento debido a dificultades de colocación del producto en los mercados mundiales. Los precios de contratación de CEPE se redujeron llegando a \$32,50 por barril en junio. Además, la Compañía Estatal de Petróleo se vió obligada a almacenar crudo en Bonaire (Antillas Holandesas) y Balao. Se anticipa que la producción de petróleo, en 1981, será inferior en 1,5 por ciento a la del año anterior y que, a pesar de las dificultades experimentadas durante el primer semestre, se incrementarán las colocaciones en el exterior hasta reducir el nivel de petróleo almacenado a un nivel próximo a los 2,5 millones de barriles.

#### B. Plan de Desarrollo y Prioridades

- 1.09 Después de incorporar una serie de ajustes en el presupuesto del Estado durante el primer trimestre del año, en marzo de 1980 se puso en marcha el Plan Nacional de Desarrollo para el período 1980-84, el cual contempla un ambicioso programa de inversiones públicas. Dicho programa tiene por objetivos principales: (a) alcanzar un mayor grado de integración nacional; (b) incorporar nuevos recursos naturales al sistema productivo; (c) estimular el desarrollo social, asignando prioridad a la preservación y calificación de los recursos humanos; y (d) fomentar el crecimiento de los sectores productivos. El total de las inversiones asciende a 145.341 millones de sucres (a precios de 1979); el 87,6 por ciento de esta suma se encuentra distribuido entre 41 proyectos o programas prioritarios calificados como fundamentales. El mejoramiento social absorbería el 32,9 por ciento de los recursos de inversión asignados a los 41 proyectos o programas prioritarios, el 30,9 por ciento correspondería a energía, el 15,8 por ciento a desarrollo rural, el 14,1 por ciento a infraestructura y el 6,3 por ciento restante a manufactura. El avance de estos programas en 1980 debió superar dificultades iniciales derivadas de la falta, insuficiencia o demora en la asignación y entrega de recursos financieros; organización inadecuada

o limitaciones en la capacidad operativa del ente ejecutor; insuficiencia de recursos humanos y materiales; y, complicaciones en los diseños, en la selección de firmas o en los trabajos de campo. El conflicto lmitrofe de principios de 1981 y las dificultades en las colocaciones de petróleo en el exterior han inducido al Gobierno a adoptar un programa de austeridad en el gasto público y a iniciar una revisión del programa de inversiones para el período que resta del Plan Nacional de Desarrollo, a fin de ajustarlo tanto a la capacidad de financiamiento como de ejecución de proyectos del país.

EL SECTOR DE ENERGIA EN EL ECUADOR

1. Aspectos Históricos

- 1.01 Hasta el año 1972, en el cual el país inició la explotación comercial de sus pozos petrolíferos, localizados en la cuenca amazónica, el consumo total de energía crecía a tasas bajas. Por ejemplo, en el período 1969-1972, la tasa media de crecimiento fue del 3,6% anual. A partir de 1973, se inició una época de rápido desarrollo que significó hasta 1978 una tasa de crecimiento para este período del 7,8% anual.
- 1.02 Algunos datos seleccionados del balance simplificado de energía para los años 1969, 1973 y 1978 (que es el último disponible), en miles de toneladas equivalentes de petróleo (TEP), son los siguientes:

<u>R u b r o</u>	<u>1969</u>	<u>1973</u>	<u>1978</u>
<u>Producción de Energía Primaria</u>	<u>1.530</u>	<u>12.522</u>	<u>12.094</u>
Combustible Vegetal	1.136	1.060	969
Petróleo Crudo	230	10.911	10.582
Hidroenergía	39	45	75
Otros	125	506	468
Total Importaciones	<u>979</u>	<u>1.032</u>	<u>327</u>
Total Exportaciones	<u>49</u>	<u>10.296</u>	<u>7.615</u>

- 1.03 Para el mismo período el consumo final energético, expresado en miles de TEP, fue el siguiente:

<u>F u e n t e</u>	<u>1969</u>	<u>%</u>	<u>1973</u>	<u>%</u>	<u>1978</u>	<u>%</u>
Combustible Vegetal	1.136	56	1.060	45	969	28
Productos petrolíferos	829	41	1.224	52	2.378	67
Electricidad	<u>60</u>	<u>3</u>	<u>87</u>	<u>3</u>	<u>188</u>	<u>5</u>
Total	<u>2.025</u>	<u>100</u>	<u>2.371</u>	<u>100</u>	<u>3.535</u>	<u>100</u>

- 1.04 En el período 1973-1978, el incremento porcentual de consumo anual más significativo corresponde a la electricidad, que creció a una tasa anual del 16%, debido especialmente al desarrollo presentado en los principales centros poblados (Quito, Guayaquil y Cuenca) por el establecimiento de industrias y también por la expansión del servicio a áreas no servidas previamente; sin embargo, la participación del sector eléctrico en el consumo total sigue siendo baja. En este mismo período, el incremento de consumo anual de productos petrolíferos fue del 14,2% anual, cifra que es alta si se compara con su crecimiento anterior y con el de la economía en el mismo período.
- 1.05 El consumo porcentual final de energía para el año 1978, por sectores, fue:

<u>S e c t o r</u>	<u>Porcentaje</u>
Residencial, comercial, público	36
Transporte	43
Agropecuario y pesca	4
Industrial	16
Otros	1

## 2. Metas para el Sector Energía

- 2.01 El Plan Nacional de Desarrollo 1980-1984 considera la política energética como prioritaria para el desarrollo del país, tanto para la producción y consumo de energía como para la determinación y control del financiamiento público y externo, y establece las siguientes metas para el sector de hidrocarburos: (i) aumentar el nivel de las reservas; (ii) mejorar la explotación de las instalaciones existentes; y (iii) racionalizar los consumos internos.
- 2.02 En cuanto al sector eléctrico el plan fija las siguientes metas principales: (i) dar prioridad al uso de los recursos hidroeléctricos; (ii) reducir el consumo de combustibles en la generación eléctrica, sustituyendo la energía térmica por energía hidroeléctrica; (iii) aumentar el porcentaje de población servida llegando a un 54,6% en 1985, contra un 40% en 1979; y (iv) preparar un plan maestro de electrificación, que comprenda un período no menor de 20 años, con el fin de orientar la política energética futura y ordenar la realización de estudios y utilización de los recursos energéticos del país.

### 3. Proyecciones de Demanda y Oferta de Energía

- 3.01 Las proyecciones de consumo y producción a corto plazo del sector energético, realizadas en 1981 por INECCEL, la Corporación Estatal Petrolera Ecuatoriana (CEPE) y el Instituto Nacional de Energía (INE), indican las siguientes cifras esperadas para el año 1984:

<u>C o n c e p t o</u>	<u>TEP/mil</u>	<u>%</u>
<u>Consumo Final Energético</u>	<u>5.565</u>	<u>100,0</u>
Leña	560	10,0
Derivados del petróleo y gas	4.420	79,4
Electricidad	374	6,8
Otros	211	3,8
<u>Producción Energía Primaria</u>	<u>13.032</u>	<u>100,0</u>
Leña y combustibles vegetales	560	4,3
Petróleo crudo	11.226	86,2
Gas asociado	644	4,9
Hidroenergía	222	1,7
<u>Superávit</u>	<u>7.467</u>	-----
<u>Exportaciones</u>	<u>5.746</u>	-----

- 3.02 La cantidad relativamente alta para la exportación proviene principalmente de que las proyecciones prevén una producción para este año de 78,1 millones de barriles de petróleo, superior en un 6% a la de 1978, y a un aumento anual del consumo de productos petrolíferos del 10,8% en vez del 14,2% anual registrado en el período 1973-1978. Ambas previsiones dependen del cumplimiento de las metas del Plan Nacional de Desarrollo. Se observa, asimismo, la alta dependencia de los derivados del petróleo, 79,4% para atender el consumo final. Por último, se destaca el aumento importante de la generación de hidroelectricidad, que pasa de 79.000 TEP en 1978.000 a 380 TEP en 1984, debido a la puesta en operación de Pauta "A" y "B".

- 3.03 El consumo porcentual final de energía proyectado para 1984, para los diferentes sectores es:

<u>S e c t o r</u>	<u>%</u>
Residencial, comercial, público	22,7
Transporte	56,9
Agropecuario y pesca	4,0
Industrial	16,3
Otros	<u>0,1</u>
Total	<u>100,0</u>



- 3.04 Con respecto a lo indicado en el párrafo 1.05 anterior, la disminución porcentual de la participación proyectada para el sector denominado residencial, comercial, público, obedece a la sustitución prevista para la leña por otras fuentes más eficientes. Asimismo, el sector transporte aumentaría al 56,9% su participación en el consumo final de energía; para los otros sectores no se tiene previsto que se presenten modificaciones sustanciales en su grado de participación.

4. Situación y Perspectiva de las Fuentes de Energía

(a) Petróleo

- 4.01 El petróleo se extrae en el Ecuador desde el año 1911, pero los grandes yacimientos en la Región Amazónica no fueron descubiertos sino hasta 1967, iniciándose la exportación de cantidades considerables de petróleo a partir de 1972. El cuadro siguiente muestra, en millones de barriles, las cifras de producción, importación, exportación y consumo para el período 1973-1980:

<u>Años</u>	<u>Producción</u>	<u>Importación</u>	<u>Exportación</u>	<u>Consumo</u>
1973	76,2	5,9	71,2	10,1
1974	64,6	9,7	59,5	12,1
1975	58,8	9,0	52,7	14,2
1976	68,4	9,3	61,6	17,8
1977	67,0	9,0	51,4	24,6
1978	73,7	2,1	49,9	31,7
1979	78,8	2,7	53,9	32,4
1980	74,6	4,6	47,6	33,5

- 4.02 El rápido aumento del consumo obedeció principalmente a la utilización de combustibles para la generación de energía y al notable incremento en el parque automotor, destacándose, además, los bajos precios internos de los combustibles, que promovieron su uso e inclusive permitieron fugas a los países vecinos. El 18 de febrero de 1981, el Gobierno aumentó los precios de los combustibles a niveles considerablemente superiores a los vigentes durante los 20 años anteriores, pero que aún son inferiores a los niveles internacionales.
- 4.03 El cumplimiento de estos objetivos es fundamental para el desarrollo económico de Ecuador, los cuales deben ser llevados a cabo principalmente por CEPE. Debido a sus limitaciones de carácter financiero y técnico, el Gobierno ha indicado su intención de modificar la Ley de Hidrocarburos, con el fin de poder atraer el capital de riesgo requerido. El proyecto de ley deberá ser discutido y aprobado por la Cámara Nacional de Representantes, sin que para ello exista un plazo definido.

(b) Gas

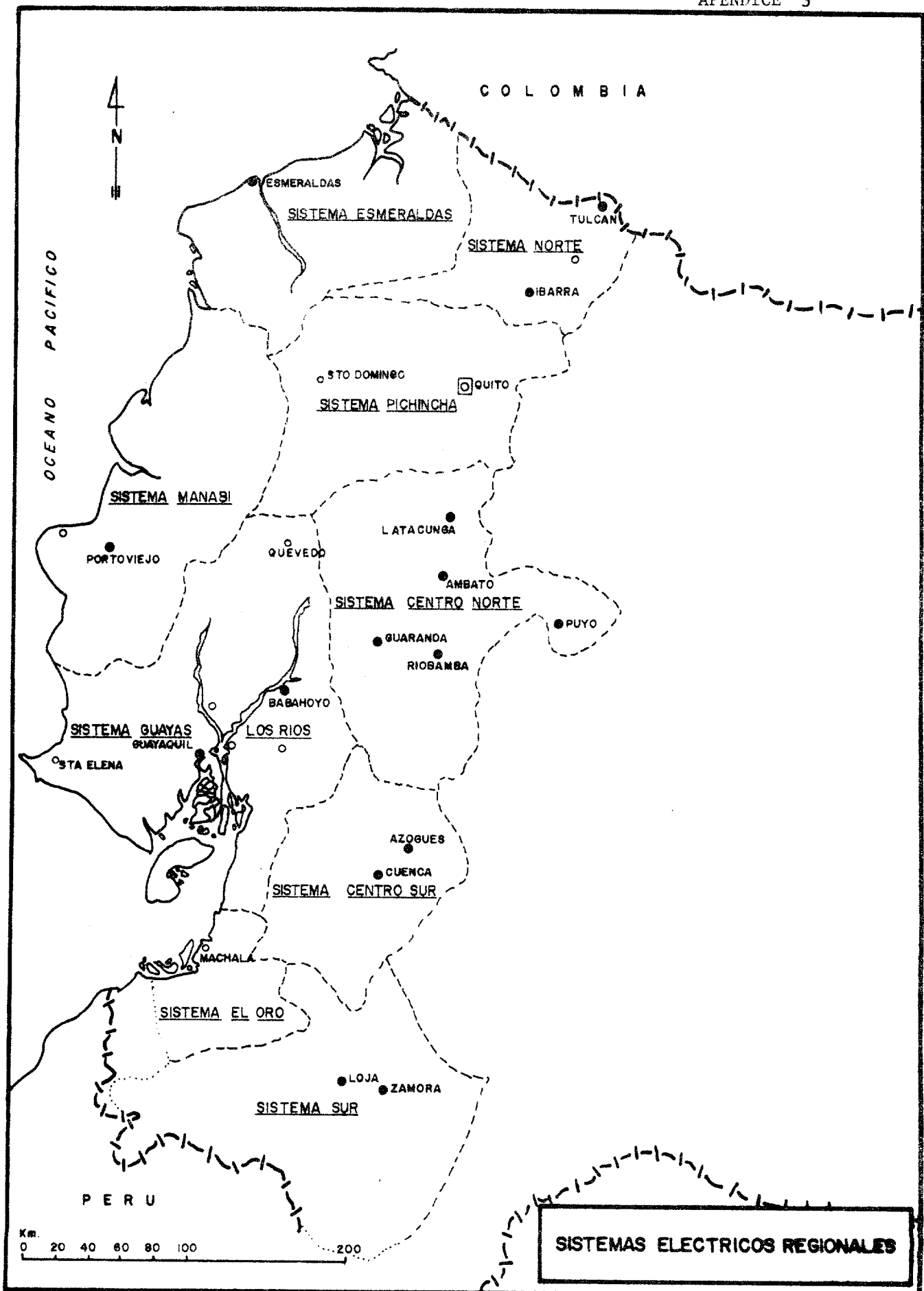
- 4.04 Las reservas probadas de gas natural equivalían, al 31 de diciembre de 1980, a 200.000 millones de pies cúbicos, los cuales se encuentran localizadas principalmente en el campo de Shushufindi, en la región amazónica, y en el Golfo de Guayaquil. La utilización del primer campo se iniciará a principios de 1982, cuando entre en operación una planta de procesamiento y un poliducto que lo transportará a Quito. Con relación al segundo, CEPE tiene prevista su explotación una vez termine en 1984 los estudios exploratorios. Esta explotación permitiría la creación de un importante centro industrial en la zona.

(c) Hidroelectricidad

- 4.05 El potencial eléctrico instalable del país se estima en 22 millones de kilovatios, lo que ha sido identificado en 21 cuencas hidrográficas principales, que cubren el 81% del área total del país. En la actualidad, se aprovecha el 1% de dicho potencial y para 1988 se estima que esta utilización llegaría al 6,2%.
- 4.06 De acuerdo con los estudios para los diferentes proyectos hidroeléctricos, la capacidad instalada ascendería a 8.847 MW, de los cuales 950 MW corresponden a proyectos con diseños definitivos, 1.427 MW a proyectos con estudios de factibilidad y 6.470 MW a proyectos con estudios de prefactibilidad. Para poder cumplir la meta de seguir efectuando las ampliaciones de generación eléctrica con base a proyectos hidroeléctricos, el Instituto deberá efectuar un programa en estudios y diseños de proyectos que le permitan disponer oportunamente de un número adecuado de alternativas para seleccionar su futuro plan de expansión y poder cumplir con el objetivo de atender la expansión de la demanda utilizando primordialmente sus recursos hídricos.

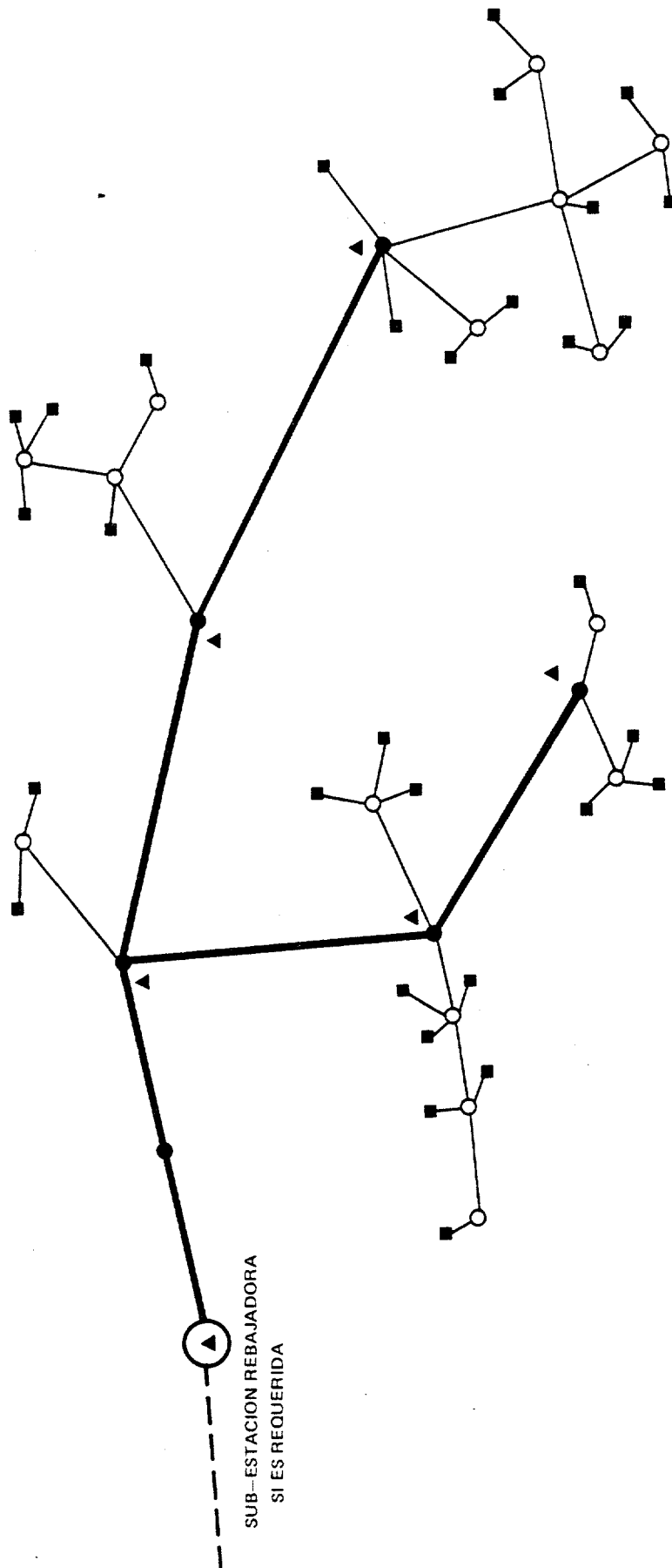
(d) Carbón, Uranio y Fuentes No Convencionales de Energía

- 4.07 No se han detectado en el país yacimientos apreciables de carbón. Se han encontrado en el país algunas manifestaciones radioactivas, lo que hace suponer que de profundizarse los estudios, podrían detectarse reservas de uranio o de otros minerales radioactivos.
- 4.08 Aparentemente, el Ecuador tendría buenos recursos geotérmicos debido a su posición en el arco volcánico del cinturón de fuego del Pacífico y a afloramientos superficiales en varias zonas del país. INECEL, con la colaboración de la Organización Latinoamericana de Energía (OLADE), está efectuando estudios de reconocimiento de dicho potencial, los que estarían terminados en 1983. Con relación a los posibles usos de la energía solar, los vientos y otras fuentes no convencionales de energía, estos están siendo estudiados por el INE.

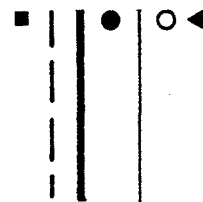


SISTEMAS ELECTRICOS REGIONALES

CIRCUITO TIPO DE ELECTRIFICACION RURAL EN ECUADOR



■ VIVIENDA O CONSUMIDOR  
 --- ALIMENTACION EXISTENTE O PROGRAMADA EN TENSIONES DE 13.2 Kv.; 22.8 Kv.; o 69 Kv.  
 — CIRCUITO PRIMARIO EN TENSIONES DE 7.6 Kv.; 13.2 Kv.; o 22.8 Kv.  
 ● POSTE DE ALTA TENSION O CIRCUITO PRIMARIO  
 ○ CIRCUITO SECUNDARIO EN TENSIONES DE 120 o 240 VOLT.  
 ▲ POSTE DE BAJA TENSION o CIRCUITO SECUNDARIO  
 ▲ TRANSFORMADOR DE DISTRIBUCION



PROYECTO DE ELECTRIFICACION RURALINECELI. TERMINOS DE REFERENCIA DEL CONSULTOR

La firma consultora de ingeniería, llamada en delante como el Consultor, proveerá el personal calificado necesario para la realización de los trabajos descritos a continuación. Estos trabajos se realizarán en las oficinas de UNEPER en Quito y en el campo, en coordinación con el Jefe de UNEPER. El Consultor será el único responsable por todos los aspectos técnicos del programa, desde la etapa de diseño hasta la puesta en operación de todos los circuitos; por lo tanto, las decisiones y recomendaciones del Consultor quedan sujetas solamente a la aprobación del Ingeniero Jefe de UNEPER.

A. Estimativo de materiales y equipos

El consultor deberá introducir un programa de computación de datos, que permita, mediante uso de computador, obtener listas de materiales por grupos homogéneos para licitación considerando el programa de adquisiciones, distribución en bodegas regionales, utilización óptima de materiales, etc.

B. Revisión de costos estimados

El consultor establecerá un programa de computación, que permita fácilmente determinar costos finales, cuando existan variaciones en los elementos unitarios.

C. Programa de trabajo

Se elaborarán programas globales y regionales de trabajo, considerando todas las actividades necesarias tales como preparación de diseños, documentos, contratación, fabricación, y entrega, construcción, etc.

D. Preparación de documentos contractuales

Se elaborarán los documentos para licitaciones y contratación de adquisición de materiales y contratación de firmas constructoras.

E. Programa de Promoción del uso de la energía

Se elaborará un programa promocional del uso productivo de la energía eléctrica en el sector rural. El objeto de este programa es de estimular el consumo y el desarrollo de agro-industrias, utilizando energía eléctrica. Se diseñará un programa que facilite al usuario rural, la adquisición de equipos y aparatos eléctricos.

F. Entrenamiento del personal

El consultor revisará los programas de entrenamiento del personal de UNEPER y de las Empresas Eléctricas y formulará las observaciones que sean necesarias a efectos de lograr un mejor aprovechamiento de los recursos humanos para la ejecución del proyecto.

G. Administración del Proyecto

El consultor elaborará una metodología para la administración del proyecto, relacionada con la emisión de órdenes de trabajo e instrucciones de operación para poder controlar el proyecto en sus diversas etapas: diseño, construcción, fiscalización, contabilidad, adquisiciones y control de materiales, etc.

H. Responsabilidad

El consultor será responsable de asesorar a UNIPER en la supervisión global del proyecto, para lo que contará con la ayuda del personal de UNEPER y responderá únicamente al Jefe de UNEPER.

Asimismo, el consultor preparará, previo a la apertura de las licitaciones, un estimativo y detallado costo de las construcciones; también asistirá a UNEPER en las reuniones periódicas con los contratistas, haciendo las recomendaciones necesarias para el manejo de los contratos y solución de reclamos. Por último, el consultor asesorará a UNEPER en la preparación de los planos "as built" y sus descripciones.

I. Control de materiales

UNEPER espera contar con dos o tres bodegas regionales para la distribución de materiales en todos los proyectos del país. El consultor elaborará, consultando y complementando lo existente en INECCEL; una metodología y codificación de materiales, que permita un control adecuado y contabilización de todos los materiales utilizados en el proyecto. Este método de control será susceptible de introducirse en computador de datos.

J. Otras actividades

El consultor, a solicitud de INECCEL; llevará a cabo otras actividades tales como: asistencia a reuniones, coordinación con el BID, etc.

II. INFORMES A ELABORARSE

El consultor elaborará los informes que fueren necesarios para permitir el normal y eficaz desenvolvimiento del proyecto, entre otros, los siguientes:

- A. Informe sobre programa de control de costos del proyecto.
- B. Informe sobre el programa de adquisiciones y control de materiales.
- C. Informes mensuales sobre avance de los trabajos.
- D. Informe final a la terminación de la misión del consultor.
- E. Otros informes solicitados por UNEPER, o por el BID.

III. RESPONSABILIDAD DEL CONSULTOR

El consultor será el responsable ante UNEPER y el BID, por la ejecución de las tareas asignadas en el alcance de los trabajos mencionados, especialmente en lo relacionado a los cronogramas de ejecución especificados en el Contrato de Consultoría, y a la calidad de los trabajos.

Para el efecto, el Consultor contará con su propio personal, y con la colaboración a tiempo completo del personal asignado por UNEPER.

Como los trabajos asignados requerirán de una estrecha coordinación de los Consultores con UNEPER, con otros consultores del proyecto, y con las Empresas Eléctricas, el Consultor deberá indicar en su propuesta, las condiciones bajo las cuales asumirá la responsabilidad global indicada.

En general, INECCEL espera obtener del Consultor, como resultado final, la ejecución de las tareas asignadas en conjunto con el personal de UNEPER, y el asesoramiento para ejecutar directamente otras actividades que no puedan ser realizadas por el Consultor. El resultado final será la ejecución efectiva, y dentro de los plazos estimados del Proyecto de Electrificación Rural financiado parcialmente con los recursos del préstamo del BID.

IV. PERSONAL ASIGNADO

Todas las actividades arriba mencionadas y las que fuesen necesarias para ejecutar el proyecto, serán llevadas conjuntamente por UNEPER y el Consultor, bajo la dirección del Jefe de la unidad. Cada grupo de trabajo de la Unidad Ejecutora podrá contar con personal de INECCEL y de uno o más expertos del Consultor.

V. PERSONAL REQUERIDO DEL CONSULTOR

Para la ejecución de los trabajos de Consultoría se requerirá del personal nacional y personal extranjero, trabajando a tiempo completo o parcial en las oficinas de UNEPER en Quito, con visitas a los lugares de trabajo.

A continuación se indica únicamente como guía general, el personal de consultores que UNEPER estima necesario para la ejecución de los trabajos de consultoría. El Consultor deberá justificar plenamente el personal requerido, en su propuesta de servicios.

El personal estimado por UNEPER y sus calificaciones mínimas es el siguiente:

A. Director técnico del proyecto - Experto en Electrificación Rural

Deberá tener experiencia mínima de 10 años en el diseño, administración y ejecución de programas de electrificación rural. Será recomendable que parte de esa experiencia sea en países latinoamericanos, y que hable español. Será el jefe del grupo consultor y reportará solamente al Jefe de UNEPER.

B. Especialista en optimización técnico-económica

Experiencia mínima de 10 años en proyectos de distribución y electrificación rural y costos. Idioma español preferible. Contratación parcial.

C. Especialista en preparación y supervisión de cronogramas de obras y su construcción. Adquisición de materiales.

En la adquisición de materiales se debe incluir la licitación, recomendación de adjudicación, contratación, almacenaje y distribución. Experiencia mínima 5 años, preferiblemente en países latinoamericanos. Se recomienda que hable español.

D. Asesor en trabajos de operación y mantenimiento

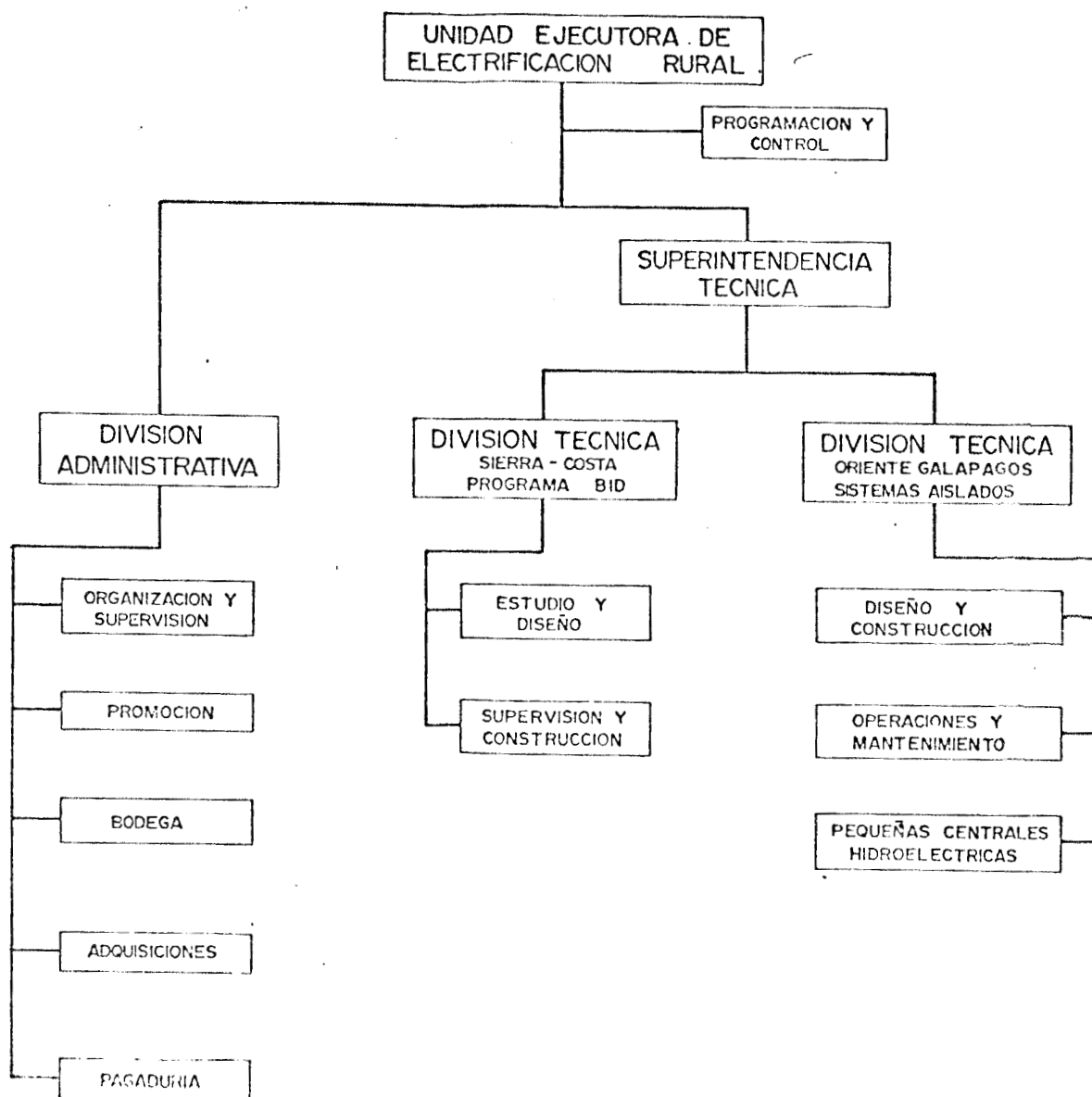
Mínima experiencia de 5 años. Tiempo parcial.

VI. CRONOGRAMA DE UTILIZACION DE PERSONAL

En función del alcance de los trabajos, el Consultor deberá indicar en su oferta técnica el cronograma de utilización de personal.

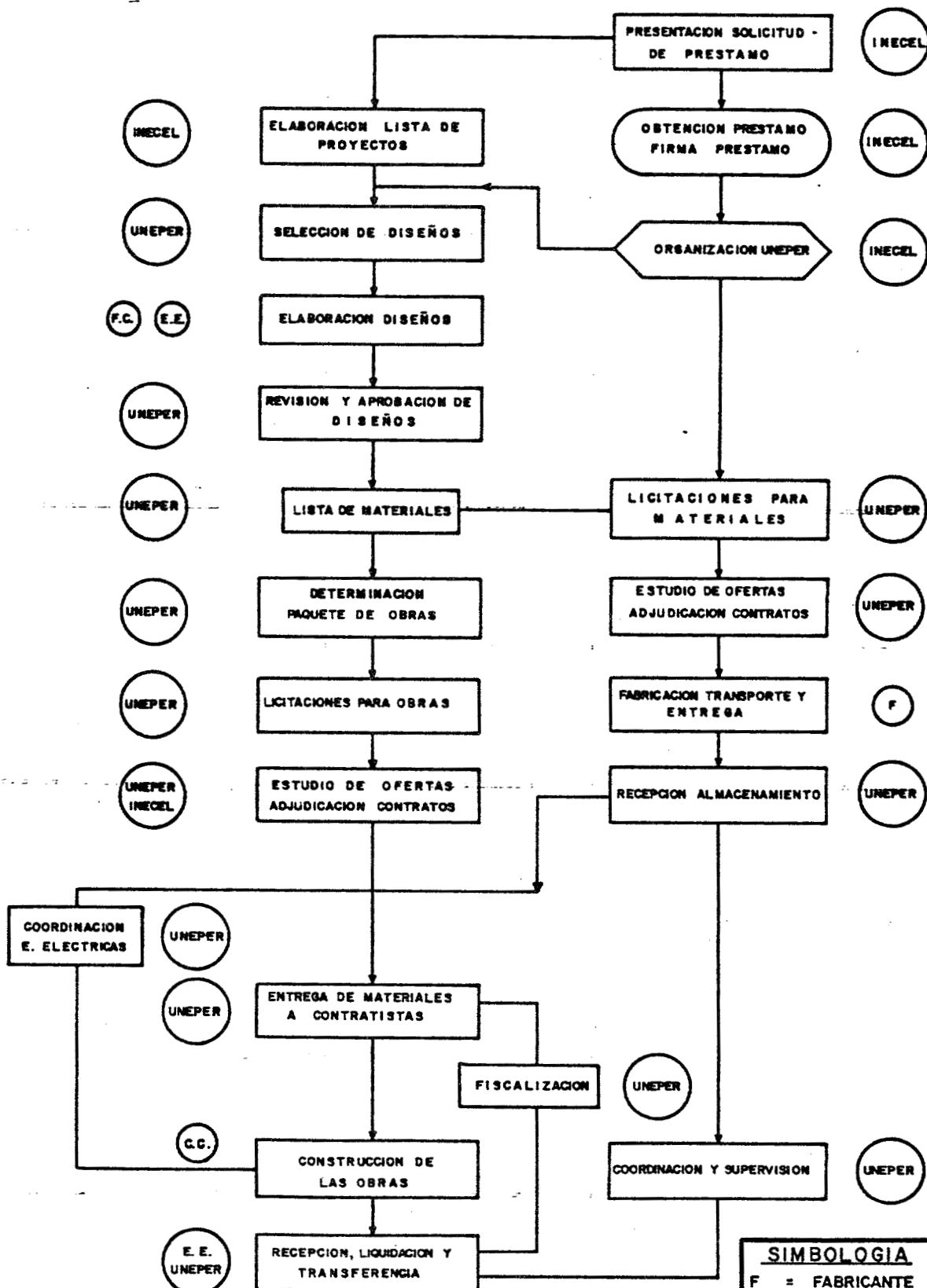


ORGANIGRAMA DE LA UNIDAD EJECUTORA DE ELECTRIFICACION RURAL  
UNEPER



# PLAN NACIONAL DE ELECTRIFICACION RURAL

## SECUENCIA DE ACTIVIDADES POR DESARROLLAR



### SIMBOLOGIA

F = FABRICANTE  
 C.C. = CIA. CONSTRUCTORA  
 E.E. = EMPRES. ELECTRICAS  
 F.C. = FIRMA CONSULTORA

HOJA: DE:  
PREPARO :  
REVISO :  
FECHA :

[illegible]

HOJA :  
PREPARO :  
REVISO :  
FECHA :

[illegible]

HOJA: DE  
PREPARO :  
REVISO :  
FECHA :

SISTEMA	CANTON	LONGI. Km.	Nº ABO	AB/Km		1981	1982	1983	1984	1985	OBSERVACIONES
						E F M A M J J A S O N D	E F M A M J J A S O N D	E F M A M J J A S O N D	E F M A M J J A S O N D	E F M A M J J A S O N D	
Nº 81 NORTE											
CARCHI											
AIRA	ESPEJO	25,2	574	22,78	P E	DISEÑADO					
BABURA											
MAMPIRO	IBARRA	27,10	414	15,28	P E	DISEÑADO					
NUÑOLO	OTAVALO	18,00	681	37,83	P E	DISEÑADO	**				
VACAS GALINDO	COTACACHI	17,90	284	14,78	P E		**				
TOTALCACHI	OTAVALO Y COTACACHI	22,30	682	30,58	P E		***				
TOTAL		110,50	2615	23,67			500 Km - 45%	696 Km - 63,0%	5590 Km - 32,5%		
Nº 82 PICHINCHA											
JITO											
SIMON BOLIVAR	QUITO	23,5	304	12,94	P E	DISEÑADO					
COYAGAL	QUITO	20,6	398	19,22	P E	****					
ALVAROFAMBA	QUITO	9,7	265	27,32	P E	*****					
CHILLO JUJON	QUITO	8,6	168	19,30	P E						
MIRAFLORES ALTO	QUITO Y MEJIA	11,1	206	18,56	P E	*****					
SANTA ROSA DE QUIJOS	QUIJOS	29,7	189	6,38	P E	*****					
SANTO DOMINGO											
EL BELEN	QUINDE Y STO. DOMINGO	11,70	258	22,08	P E	****					
PICHLINQUE	SANTO DOMINGO Y EL CARMI	14,00	146	10,43	P E	****					
SAN VICENTE DEL NILA	STO DOMINGO	22,00	344	15,64	P E	****					
LA MAGDALENA	STO DOMINGO	23,50	314	13,36	P E		****				
TOTAL		174,40	2830	16,08			15,70 Km - 90%	8190 Km - 46,9%	7680 Km - 44,1%		
Nº 83 CENTRO NORTE											
TOPAXI											
PUJILI	PUJILI	56,9	1177	2069	P E	DISEÑADO					
SAQUISLI	SAQUISLI	63,7	2067	32,45	P E	DISEÑADO					
SALCEDO A	SALCEDO	82,8	2570	31,04	P E						
SALCEDO B	SALCEDO	45,3	1712	37,79	P E	DISEÑADO					
LATAKUNGA	LATAKUNGA	76,8	1810	23,57	P E	DISEÑADO					
LATACUNGA	LATACUNGA	37,7	700	18,57	P E	DISEÑADO					
SAN MIGUEL	SAN MIGUEL	67,6	1045	15,46	P E		****				
CHIMBO	CHIMBO Y GUARANDA	24,4	647	26,52	P E		*				
CHILLANES	GUARANDAS	29,55	575	19,45	P E	****					
GUARANDA	GUARANDA	40,7	1087	26,71	P E		****				
LAS NAVES	GUARANDA	41,7	847	20,14	P E		****				
NGURAHUA											
LOS ANDES	PAYATE Y PILLARO	3,8	39	10,26	P E	*					
PILLARO	PILLARO	21,4	481	22,48	P E		*				
HIBULEO	AMBATO	52,6	820	25,15	P E	****					
LAGRAPATA	AMBATO	42,8	942	22,15	P E	****					
BAÑOS	BAÑOS	26,7	427	15,99	P E		****				
PELILEO	PELILEO	4,9	144	29,39	P E	* ****					

# PROGRAMA NACIONAL DE ELECTRIFICACION RURAL

## CRONOGRAMA DE ACTIVIDADES DE DISEÑO Y CONSTRUCCION

HOJA:  
PREPARO:  
REVISO:  
FECHA:

SISTEMA	CANTON	LONGI Km	Nº ABO	AB/Km	1981	1982	1983	1984	1985	OBSERVACION
Nº 89 EL ORO					E F M A M J J A S O N D E	E F M A M J J A S O N D E	E F M A M J J A S O N D E	E F M A M J J A S O N D E	E F M A M J J A S O N D E	
01 VEGA RIVERA	STA ROSA PASAJE	5,1	144	28,24	P E P E P E	*****				
03 USHCURRUM	PASAJE ZARUMA STA ISABEL	18,8	359	19,30	P E P E P E	*****				
04 EL RECREO	MAQUILA	3,4	64	18,82	P E P E P E	DISEÑADO				
05 PLATANILLOS	ARENILLAS	69,4	1008	14,49	P E P E P E	DISEÑADO				
06 RIO CHICO	STA ROSA	14,7	127	8,64	P E P E P E	DISEÑADO				
07 MALVAS	ZARUMA	30,7	1567	51,04	P E P E P E	*****				
08 LOURDES	ZARUMA	5,0	275	55,0	P E P E P E	*****				
12 PINAS	PINAS Y ZARUMA	35,0	2029	57,97	P E P E P E	DISEÑADO				
14 BALZAS	PINAS	53,7	1197	22,29	P E P E P E	DISEÑADO				
TOTAL		235,6	8768	28,54		340 Km - 15%	13940 Km - 59.1%	9280 Km - 39.4%		
AL GENERAL		3036,60	61945	20,40		10820 Km - 36%	171270 Km - 56.4%	121570 Km - 40%		

### LEYENDA

DISEÑO \*\*\*\*\*  
CONCURSO \*\*\*\*\*  
CONSTRUCCION \*\*\*\*\*

INSTITUTO ECUATORIANO DE ELECTRICIDAD  
UNEPER

CRONOGRAMA DE ACTIVIDADES DE DISEÑO

DISEÑO PROGRAMACION Y CONTROL

RECOMENDADO

REVISADO

APROBADO

FECHA: ABRIL / 81

REF.

STV. DE	FECHA	NATURALEZA DE LA REV.	POR	TEMP.	AMOR

METODOLOGIA Y PARAMETROS A UTILIZAR  
EN EL ANALISIS COSTO BENEFICIO DE CADA CIRCUITO

La estimación de la tasa interna de retorno económico (TIR) de cada circuito se realizará de acuerdo a la metodología y a los parámetros que se describen a continuación.

I. DEMANDA

- 1.01 El consumo máximo promedio por abonado se detalla en el Anexo 1. Como se puede ver en dicho anexo el consumo está especificado por subproyecto es decir que es válido para todos los circuitos que componen el subproyecto.
- 1.02 El número de abonados de cada circuito debe ser coincidente con lo especificado por los consultores en el diseño final del mismo. En el Anexo 2 se detalla el número de abonados y los kilómetros de línea primaria previstos originariamente para cada circuito. Por otra parte, el crecimiento del número de las viviendas será como máximo el índice histórico del crecimiento de la población en el área pero nunca mayor del 5% anual. El primer año de funcionamiento del circuito se tomará el 60% de las viviendas que son potencialmente conectables al circuito, que se aumenta regularmente hasta llegar al 90% en el año 10, porcentaje este que es límite máximo.
- 1.03 La demanda anual del circuito prevista está dada entonces por el consumo mensual por abonado para ese año, por los 12 meses, por el número de viviendas que ese año estarán conectadas.

II. COSTOS 1/

A. Inversión Inicial

- 2.01 Incluye todos los costos que implica la construcción del circuito inclusive las conexiones a las viviendas (acometidas) y todo el material que se facilita a los abonados para realizar la instalación interna de la vivienda. Se excluyen los costos financieros, el escalamiento y la mano de obra que los beneficiarios puedan proveer, sin remuneración, en la construcción de las instalaciones interiores.

B. Inversión Posterior

- 2.02 Corresponde al costo total, excluyendo costos financieros y escalamiento, de las conexiones a los abonados que se conectarán una vez que el circuito está en funcionamiento. Se estimó, a título enunciativo, en US\$170 por abonado. Los costos a considerar y el año de atribución de los costos se determinan dentro de los mismos criterios enunciados para la inversión inicial.

C. Operación y Mantenimiento

- 2.03 Se considerará un 3,5% para la Sierra y un 3% para la Costa sobre la inversión total (inicial y posterior ya realizada) excluyendo los gastos financieros y el escalamiento.

D. Administración y Comercialización

- 2.04 Se tomará como mínimo un costo anual de US\$ 7 por abonado ya conectado para la Sierra y de US\$13 para la Costa.

E. Pérdidas

- 2.05 Serán del 15% de la energía comprada para ser consumida en el circuito. En otras palabras, será el 17,65% de la energía vendida (consumo).

F. Costo de la Energía

- 2.06 Se tomará a US\$0,06 el KWh de energía insumida, es decir de la energía comprada. En otras palabras, el costo de la energía es el consumo multiplicado por 1,1765 y por 0,06.

---

1/ Los costos indicados son a septiembre de 1981. Si el análisis se realiza a una fecha posterior deberán escalarse las magnitudes indicadas. De igual manera los beneficios también tienen que escalarse, lo cual debe determinarse de acuerdo al precio internacional vigente del petróleo que aquí se tomó a US\$36 el barril.



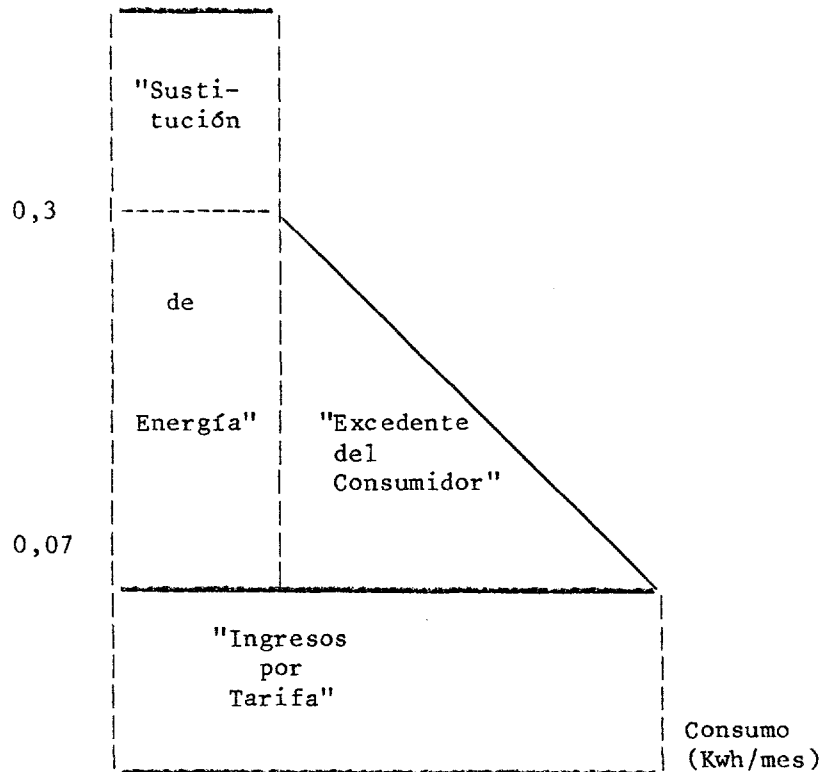
### III. BENEFICIOS

- 3.01 Se distinguen, para efectos de cálculo, tres tipos de beneficios:  
a) "Sustitución de Energía"; b) Excedente del Consumidor; y c) "Ingreso por Tarifa". Estos beneficios deberán calcularse por separado año por año y la suma de los tres corresponde a los beneficios totales de cada circuito. La expresión gráfica de los mismos es la siguiente:

#### Costo económico de la energía de Sustitución (US\$/KWh)

Sierra 0,53  
Costa 0,42

Costo para el  
usuario de la  
energía de sus-  
titución. 0,3



#### Energía Sustituída

Sierra 9,3 (Kwh/mes)  
Costa 10,95 ( " " )

A. Beneficio Anual pagado por el Consumidor (Ingresos por Tarifa)

- 3.02 Corresponde al consumo anual del circuito ponderado por el monto previsto de la tarifa que es de US\$0,07 por KWh. En otras palabras en cada circuito se tiene año por año:

Beneficio de Ingresos por Tarifa = No. Abonados x Consumo Mensual x 12x0,07

B. Sustitución de Energía

- 3.03 El beneficio anual de sustitución de energía es igual al número de abonados, ya conectados, por 12 (meses), por el valor de la energía sustituida, la cual es US\$4,28 para la Sierra y US\$3,83 para la Costa por mes. En otras palabras en cada año y para cada circuito se tiene:

Beneficio sustitución circuito de la Sierra = No. Abonados x 4,28x12

Beneficio sustitución circuito de la Costa = No. Abonados x 3,83x12.

- 3.04 Cabe destacar que US\$4,28 y US\$3,83 es el resultado del valor unitario de la energía de sustitución para el país (Sierra=US\$0,53; Costa=US\$0,42) por el consumo mensual de esa energía de sustitución (Sierra: 9,3 KWh; Costa: 10,95 KWh) menos la parte de ese beneficio incluida en el beneficio de ingreso por tarifa ya explicado que sería el consumo mensual de la energía de sustitución (Sierra: 9,3 KWh; Costa: 10 95 KWh) por la tarifa estimada: US\$0,07.

C. Excedente del consumidor

- 3.05 Es el resultado de multiplicar US\$0,23 por el consumo mensual previsto para ese año menos el consumo mensual de la energía de sustitución (Sierra 9,3 KWh; Costa 10,95 KWh) y dividido por 2. Todo multiplicado por el número de abonados y por 12/meses) para que sea anual. En otras palabras:

Excedente del Consumidor = (CMA-CMES) x 0,23x0,5 x No. Abonados x 12

donde: CMA = Consumo Mensual por Abonado

CMES = Consumo Mensual de Energía de Sustitución

- 3.06 Cabe destacar que US\$0,23 es el costo unitario para el consumidor de la energía de sustitución menos US\$0,07 que es el valor de la tarifa estimada ya que esa parte del beneficio se ha incluido dentro del beneficio del ingreso por tarifa mencionado.

IV. TASA INTERNA DE RETORNO

- 4.01 Una vez que se han determinado los costos y los beneficios del circuito en la forma mencionada se calculará la tasa interna de retorno (TIR) para lo cual se considerará la vida útil del circuito en 30 años.

Anexo 1

PREVISION DEL CONSUMO MENSUAL POR ABONADO (KWh/Abonado/Mes)

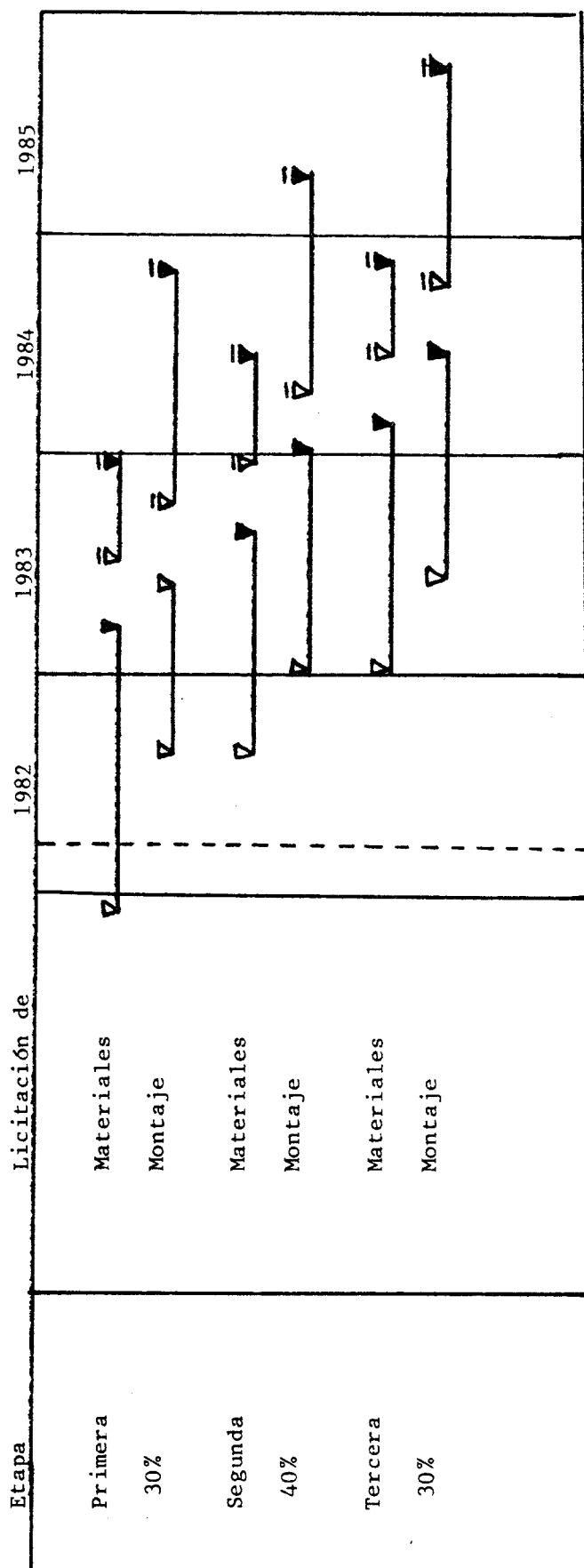
<u>SUBPROYECTO</u> (Empresa Eléctrica)	<u>Año del Circuito</u>			
	<u>1</u>	<u>8</u>	<u>15</u>	<u>30</u>
<u>COSTA</u>				
SANTO DOMINGO	89	111	147	241
ESMERALDAS	61	75	97	138
MANABI	82	105	139	199
GUAYAS-MILAGRO	51	64	145	220
SEGURI	63	79	85	138
SANTA ELENA	63	67	68	98
LOS RIOS	67	80	110	181
EL ORO	66	82	93	133
<u>SIERRA</u>				
CARCHI	30	33	51	64,1
IMBABURA	30	33	51	64,1
QUITO	73	78	88	125,8
COTOPAXI	54	55	112	145,0
TUNGURAHUA	35	39	54	67,7
CHIMBORAZO	35	48	59	73,2
BOLIVAR	28	32	33	42,4
CAÑAR	36	37	60	74,5
AZUAY	36	37	60	74,5
LOJA	35	46	66	80

Anexo 2  
1 de 2

<u>Circuito</u>	<u>Cantidad</u> <u>Abonados</u>	<u>Km. de</u> <u>Líneas</u> <u>Primarias</u>	<u>Circuito</u>	<u>Cantidad</u> <u>Abonados</u>	<u>Km. de</u> <u>Líneas</u> <u>Primarias</u>
81-02	574	25,2	83-14	427	26,7
81-10	414	27,1	83-15	144	4,9
81-11	681	18,0	83-23	498	23,0
81-12	264	17,9	83-24	710	30,7
81-14	682	22,3	83-25	1.795	61,3
82-05	304	23,5	83-26	1.448	56,4
82-07	396	20,6	83-27	1.636	38,5
82-08	265	9,7	83-28	2.005	72,8
82-09	166	8,6	84-01	312	8,4
82-10	206	11,1	84-03	1.417	44,2
82-11	231	29,7	84-04	582	12,2
82-01	258	11,7	84-06	1.192	45,5
82-02	146	14,0	84-07	295	9,5
82-03	344	22,0	84-08	415	16,2
82-04	314	23,5	84-09	120	4,2
83-01	1.177	56,9	84-12	218	8,0
83-02	2.067	63,7	84-13	617	10,3
83-03	2.570	82,8	85-01	904	70,5
83-04	1.712	45,3	85-02	422	43,2
83-06	1.810	76,8	85-03	269	26,4
83-08	700	37,7	85-05	401	69,6
83-30	1.045	67,6	85-07	567	52,4
83-31	647	24,4	85-08	99	7,5
83-32	575	29,6	85-11	373	23,2
83-33	1.087	40,7	86-01	286	27,0
83-35	840	41,7	86-02	585	53,5
83-10	39	3,8	86-03	663	49,0
83-11	481	21,4	86-04	645	64,7
83-12	820	32,6	86-06	448	38,3
83-13	981	42,8	86-08	204	22,5

<u>Circuito</u>	<u>Cantidad</u> <u>Abonados</u>	<u>Km. de</u> <u>Líneas</u> <u>Primarias</u>	<u>Circuito</u>	<u>Cantidad</u> <u>Abonados</u>	<u>Km. de</u> <u>Líneas</u> <u>Primarias</u>
86-09	285	21,0	88-32	356	32,9
87-12	160	13,8	88-33	805	62,7
87-13	62	5,8	88-35	53	3,5
87-14	105	5,8	88-19	331	36,3
87-17	415	28,8	88-21	234	15,0
87-19	15	1,0	88-22	440	56,6
87-24	231	9,5	88-23	506	42,6
87-25	258	5,8	88-24	297	10,9
88-01	336	10,0	88-28	488	25,5
88-02	352	7,2	88-36	299	10,7
88-03	330	6,2	88-37	399	20,3
88-04	98	4,7	88-38	203	15,0
88-05	329	15,2	88-39	819	23,1
88-06	629	28,8	88-40	583	37,1
88-07	91	3,9	88-41	935	63,6
88-10	77	0,6	89-01	144	5,1
88-11	472	22,5	89-03	359	18,6
88-12	204	16,9	89-04	64	3,4
88-15	568	42,5	89-05	1.046	69,4
88-17	151	14,5	89-06	127	14,7
88-26	461	24,5	89-07	1.567	30,7
88-27	657	31,6	89-08	235	5,0
88-29	427	22,2	89-12	2.029	35,0
88-30	191	5,1	89-14	1.197	53,7
88-31	368	32,1			

ELECTRIFICACION RURAL EN EL ECUADOR



Fecha Probable  
Firma Contrato de Préstamo

Construcción de los circuitos:

- ▽ Convocatoria
- ▼ Adjudicación
- ▽ Inicio de las obras
- ▼ Fin de las obras

Materiales:

- ▽ Convocatoria
- ▼ Adjudicación
- ▽ Inicio entrega
- ▼ Fin de entrega

ANEXO B

PROCEDIMIENTO DE LICITACIONES

A. LICITACIONES CON FONDOS DEL FINANCIAMIENTO DEL BANCO

A.1 GENERAL

El presente Procedimiento se aplicará en las licitaciones para construcción de obras y para adquisición de maquinarias, equipos y otros bienes, que se requieran en la ejecución del Proyecto, cuando el valor de dichos contratos o adquisiciones exceda del equivalente de cien mil dólares de los Estados Unidos de América (US\$100.000).

Cuando los bienes y servicios que se adquieran o contraten mediante licitaciones, se costeen total o parcialmente con las divisas del Financiamiento, los procedimientos para las licitaciones y las bases específicas de éstas deberán permitir la libre concurrencia de bienes o servicios originarios de países miembros del Banco. Consecuentemente, en esos procedimientos y bases específicas no se impondrán condiciones que impidan o restrinjan la oferta de bienes o la participación de contratistas originarios de esos países.

A.2 PROCEDIMIENTO DE LICITACION

El procedimiento de licitación será común en cuanto a la adjudicación de contratos para: (i) la ejecución de obras y (ii) la adquisición de bienes. Sin embargo, el procedimiento para la licitación de obras se desdoblará en dos fases y se ajustará a disposiciones especiales, según se especifica a continuación:

I. EJECUCION DE OBRAS

A.2.1. Fase 1: Precalificación para ejecución de obras

- A.2.1.1 El Organismo Ejecutor y el Banco se pondrán de acuerdo sobre el texto de la convocatoria a precalificación de firmas constructoras a objeto de que éstas queden habilitadas para participar en la licitación o licitaciones que vayan a ser convocadas para la ejecución de las obras del Proyecto.

En esa convocatoria deberá establecerse la obligación de los interesados de proporcionar al Organismo Ejecutor, cuando menos la siguiente información:

- (a) Antecedentes jurídicos sobre la empresa o compañía, entre los que deberán incluirse:

- (i) clase de sociedad de que se trata, con indicación de dónde se la constituyó y organizó legalmente, y de la sede o asiento principal de sus negocios y operaciones;
- (ii) estatutos y otros documentos relativos a la constitución de la sociedad, con especificación de si es filial o subsidiaria de alguna otra empresa o compañía;
- (iii) demostración de que la sociedad es parte integrante de la economía de un país miembro del Banco conforme con este Procedimiento, y de que más del 50% de las acciones pertenece a ciudadanos de países miembros del Banco;
- (iv) una declaración en que conste que la sociedad no ha celebrado ningún acuerdo, en virtud del cual una parte sustancial de sus ganancias o beneficios pasa a personas o entidades, que sean nacionales de países no miembros del Banco;
- (v) una declaración de que, por lo menos, el ochenta por ciento (80%) de todas las personas que vayan a prestar servicios en virtud del contrato de construcción para el cual se ha convocado la precalificación en cuestión, deberán ser residentes de buena fe en algún país miembro del Banco. Esta regla abarcará las personas que vayan a ser empleadas por el eventual contratista, o por un subcontratista. Para los efectos de este cómputo, y respecto de una firma proveniente de un país que no sea el de la localidad de la construcción, no se tendrá en cuenta a los ciudadanos o residentes permanentes del país donde se llevará a cabo la construcción. Esta disposición no se aplicará cuando la licitación se restrinja al ámbito nacional del Ecuador.
- (vi) en caso de consorcios: (1) nombre de cada uno de los componentes; (2) copia de los estatutos correspondientes y copia del instrumento constitutivo del consorcio; (3) cuestionario de precalificación, que deberá llenarse separadamente por parte de cada uno de los componentes del consorcio; (4) aceptación de que la responsabilidad de cada uno de los componentes del consorcio será indivisible y solidaria; (5) aceptación de que el requisito de origen en país miembro del Banco, expresado anteriormente, se aplica a todos y cada uno de los componentes del consorcio y de que, en consecuencia, si uno o más miembros del consorcio proviniese de países que no fuesen miembros del Banco, el consorcio como tal quedará descalificado para presentar ofertas en licitaciones de obras financiadas con recursos del Banco; (6) si se trata de un consorcio en constitución, además de lo que se expresa en los incisos (1), (3), (4) y (5) anteriores, deberá presentarse la minuta de la escritura pública de constitución del consorcio si es adjudicatario de la licitación.



Las normas expresadas en los párrafos (i), (ii), (iii), (iv) y (v) anteriores, también regirán para las empresas subcontratistas que sean propuestas.

- (b) Antecedentes técnicos acerca de la empresa o sociedad, con detalle acerca del personal y equipo especializados de que dispone.
- (c) Experiencia en la construcción de obras similares a las del Proyecto.
- (d) Certificado o certificación sobre cumplimiento en la prestación de servicios u obras.
- (e) Nombre de la entidad bancaria o compañía que emitirá la póliza o garantía de cumplimiento del contrato.
- (f) Certificados de solvencia emitidos por una entidad bancaria.
- (g) Certificado de idoneidad emitido por la Cámara de Comercio u otra entidad similar del país de procedencia.

A.2.1.2 El plazo que se señalará para la presentación de los documentos de precalificación no será inferior a cuarenta y cinco (45) días contados desde la fecha de la última de las publicaciones referidas en el párrafo A.2.1.4.

A.2.1.3 Una vez que el Organismo Ejecutor y el Banco hayan aprobado los documentos de la convocatoria a precalificación de firmas, el Comité de Licitaciones del Organismo Ejecutor dispondrá su publicación.

A.2.1.4 La convocatoria a precalificación de firmas se efectuará mediante avisos publicados por lo menos en dos diarios de mayor circulación en el país, uno de Quito y otro de Guayaquil, durante tres días consecutivos. Simultáneamente, se cursará copia de la convocatoria a la embajada de cada país miembro del Banco, acreditada en el Ecuador. El texto del aviso correspondiente deberá contar con la previa aceptación del Banco.

Las bases y otros documentos para la precalificación serán puestos a disposición del interesado para consulta en la Secretaría del Comité de Licitaciones del Organismo Ejecutor desde el día en que se publique por primera vez la convocatoria.

A.2.1.5 Los sobres cerrados que contengan los documentos para precalificación serán recibidos por el Secretario del Comité de Licitaciones del Organismo Ejecutor hasta la hora del día fijado para ello en la convocatoria. La apertura de los sobres la realizará el Comité de Licitaciones en la sesión que para tal efecto convocará el Organismo Ejecutor, que deberá realizarse en el día y hora antes referidos.

- A.2.1.6 El Comité de Licitaciones encargará el análisis de la documentación recibida al Departamento Técnico del Organismo Ejecutor.
- A.2.1.7 El Departamento Técnico del Organismo Ejecutor revisará la documentación recibida y preparará el informe correspondiente con las recomendaciones del caso, basándose en las informaciones a que se refiere el párrafo A.2.1.1, dentro del plazo que en cada caso fijará el Comité de Licitaciones.

Antes de que el Comité de Licitaciones proceda a la calificación definitiva, se enviará el informe al Banco para que exprese oportunamente su conformidad u observaciones. Si el Banco tiene observaciones las dará a conocer por escrito al Organismo Ejecutor y se las analizarán en conjunto hasta llegar a un acuerdo sobre la materia entre el Banco y el Organismo Ejecutor.

- A.2.1.8 La decisión correspondiente se comunicará por escrito a todas las firmas en el domicilio que hayan señalado, dentro de los tres (3) días de la aprobación del acta del Comité.

A.2.2 Fase 2: Presentación de Ofertas

- A.2.2.1. El Organismo Ejecutor enviará a consideración del Banco los documentos de licitación, entendiéndose por tales todas las especificaciones generales, técnicas y administrativas que el Organismo Ejecutor preparará en cada caso y que pondrá a disposición de las firmas precalificadas. Estos documentos contendrán básicamente: instrucciones a los proponentes, planos, especificaciones, que obligatoriamente deben estar redactadas en idioma castellano, pudiendo además, estarlo en idioma inglés, condiciones específicas, formulario de presupuesto, fórmulas de reajuste de precios (los cuales se limitarán a los casos expresamente previstos en la legislación ecuatoriana) y forma de contrato cuya suscripción se requerirá al contratista adjudicado.

Se someterán tales documentos a la aprobación del Comité de Licitaciones del Organismo Ejecutor y posteriormente, a los informes de los organismos oficiales que contempla la Ley de Licitaciones vigente.

Incorporadas las observaciones que pudieran haber efectuado los organismos oficiales y después de que el Banco haya expresado su conformidad, el Organismo Ejecutor solicitará por escrito ofertas a las firmas que hayan sido precalificadas y les comunicará, por ese mismo medio, el plazo de presentación de ofertas y el lugar, fecha y hora en que se realizará la apertura de los sobres que las contenga.

Inmediatamente después de enviada esa notificación, se publicará por tres días consecutivos en dos diarios de amplia circulación en el Ecuador, uno de Quito y otro de Guayaquil, la convocatoria a las firmas precalificadas por medio de la cual se las invitará a presentar ofertas. El texto de la convocatoria deberá ser aprobado, antes de

su publicación, por las autoridades ecuatorianas con jurisdicción sobre la materia y por el Banco, y deberá incluir el lugar, horario y plazo dentro del cual deberán presentarse las ofertas, y el lugar, fecha y hora en que se llevará a cabo el acto de apertura del sobre No.1 referido en el párrafo A.2.2.4.

Las bases, instrucciones a los proponentes, planos, especificaciones, condiciones específicas, formulario de presupuesto y otros documentos de la licitación serán puestos a disposición de las firmas precalificadas para consulta, en la secretaría del Comité de Licitaciones del Organismo Ejecutor desde el día en que se publique por primera vez la convocatoria a las firmas precalificadas.

- A.2.2.2 El plazo de que gozarán los oferentes para la presentación de sus propuestas se especificará en la convocatoria, y en ningún caso será menor de cuarenta y cinco (45) días calendario contados desde la fecha de la última publicación de la convocatoria en diarios ecuatorianos.
- A.2.2.3 Las ofertas y demás documentos exigidos se presentarán en dos sobres cerrados en la forma que se indica en este Procedimiento.
- A.2.2.4 El sobre No. 1 contendrá lo que se especifica a continuación:
  - (a) el certificado de precalificación, y
  - (b) los documentos que les sean exigibles, de acuerdo con lo dispuesto en el Artículo 56 de la Ley de Licitaciones del Ecuador. Si por aplicación del referido Artículo 56, procediese requerir a las firmas precalificadas la actualización de uno o varios documentos que sirvieron para la precalificación, el Organismo Ejecutor antes de que se recabe esa actualización, deberá solicitar el parecer del Banco sobre esa materia.
- A.2.2.5 Dentro del sobre No. 2 presentado por el oferente se incluirá la oferta propiamente dicha y la garantía de seriedad de la propuesta para asegurar la firma del contrato, la que se presentará por un valor no menor del 2% del monto total de la oferta y será bancaria, incondicional, irrevocable y de cobro inmediato, por un plazo no menor de noventa (90) días, con la obligación de renovarla, a pedido del Organismo Ejecutor, hasta un plazo máximo de sesenta (60) días más. Esta garantía también podrá otorgarse mediante póliza de seguro, incondicional e irrevocable y de cobro inmediato, emitida por una compañía de seguros, por un plazo no menor de noventa días, con obligación de renovarla, y debiendo ser otorgada por una entidad legalmente constituida o domiciliada en el Ecuador.
- A.2.2.6 El Comité de Licitaciones se reunirá en la fecha y hora a que se refiere el cuarto subpárrafo del párrafo A.2.2.1 de este Procedimiento, y procederá a la apertura de las ofertas. A esta reunión podrán asistir los representantes de las firmas precalificadas oferentes. Se tomará nota de los datos principales de las ofertas y, entre ellos,

del valor total y plazo de entrega, y se levantará acta de todas esas actuaciones que podrá ser firmada por cualquier participante que así lo desee.

- A.2.2.7 Concluida la apertura y conocimiento de las ofertas, se encargará el análisis de las mismas a la Comisión Técnica designada para el efecto. La Comisión procederá a determinar si existen errores de cálculo en las ofertas, si éstas se ajustan a los términos de los documentos de licitación, si se ofrecen las garantías solicitadas y si, en general, las ofertas cumplen con las condiciones requeridas. Toda oferta que no se ajuste a las bases, o esté incompleta, será eliminada. A continuación, se efectuará un análisis técnico-económico con el objeto de evaluar las ofertas que reúnan las condiciones solicitadas y hacer una comparación de las mismas. Para facilitar este análisis se tabularán cuadros comparativos que deberán constar en el informe que la Comisión preparará para presentar sus conclusiones y recomendaciones sobre la adjudicación. Copia de este informe deberá ser proporcionado por el prestatario al Banco.
- A.2.2.8 Una vez que el Banco haya manifestado su conformidad con el informe enviado por el Organismo Ejecutor, el resultado del análisis de ofertas será puesto a consideración del Comité de Licitaciones para la aprobación final.
- A.2.2.9 Si el Comité de Licitaciones decidiere: (1) adjudicar la licitación a un postor diferente al recomendado en el informe que hubiera aprobado el Banco; o (2) introducir otros cambios sustanciales en el informe, se enviarán al Banco los documentos pertinentes a la adjudicación para que el Banco exprese su parecer o haga las observaciones del caso. Ello se hará previamente a la notificación de los resultados de la licitación.
- A.2.2.10 Una vez que el Organismo Ejecutor, y el Banco hayan concordado sobre la adjudicación, el Organismo Ejecutor la notificará oficialmente a la firma o firmas ganadoras.
- A.2.2.11 En el caso de que la forma de contrato referida en el párrafo A.2.2.1 de este Procedimiento, se hubiese modificado por hechos, acuerdos o disposiciones sobrevinientes, se enviará al Banco, para su aprobación previa, el proyecto o proyectos de contratos definitivos que el Organismo Ejecutor se propone firmar con el contratista adjudicado.
- A.2.2.12 Los contratos así aprobados se suscribirán con la firma o firmas adjudicatarias, una vez cumplidos los requisitos legales pertinentes.
- A.2.2.13 Cuando hayan subcontratos, los cuales deberán ser autorizados en cada caso por el Organismo Ejecutor, las empresas subcontratistas deberán cumplir con las normas de elegibilidad por razones de nacionalidad establecidas en este Procedimiento.

## II. ADQUISICION DE BIENES

A.2.3 En los casos de licitación convocada para adquirir bienes, el Organismo Ejecutor podrá prescindir del requisito de precalificación. En consecuencia, se estará a lo dispuesto en el párrafo A.2.2, "Fase 2: Presentación de Ofertas" de este Procedimiento, salvo las siguientes disposiciones especiales:

A.2.3.1 La convocatoria, una vez aprobada por el Organismo Ejecutor, se publicará por lo menos en un diario de amplia circulación en Quito y en uno de Guayaquil, por tres veces consecutivas.

A.2.3.2 Simultáneamente con la publicación de la convocatoria en la prensa, el Organismo Ejecutor deberá remitir copia de esa convocatoria a las representaciones diplomáticas de los países miembros del Banco, acreditadas en el Ecuador.

### B. LICITACIONES FINANCIADAS CON CONTRAPARTIDA NACIONAL O SUCRES PROVENIENTES DEL FINANCIAMIENTO DEL BANCO

#### B.1 GENERAL

Para la adquisición de maquinaria, equipos y otros bienes y en la adjudicación de los contratos para la ejecución de obras financiadas con recursos de contrapartida nacional o con sucres provenientes del Financiamiento del Banco, si los hubiese, se aplicará lo estipulado en el presente capítulo.

#### B.2 PROCEDENCIA DE BIENES Y SERVICIOS

B.2.1 La licitación podrá limitarse al ámbito nacional en los casos indicados en el párrafo inmediato precedente.

B.2.2 El Organismo Ejecutor podrá permitir la concurrencia de postores originarios o provenientes de cualquier país cuando la fuente del financiamiento sea el aporte nacional adicional al Préstamo.

### C. REQUISITOS PARA LICITACIONES DEL PROYECTO

C.2.1 Las ofertas deberán presentarse con indicación de los bienes que se importarán, con señalamiento del origen y el costo estimado de esos bienes. Asimismo, deberán indicarse en esas ofertas el origen y costo de los servicios técnicos provenientes del exterior.

C.2.2 Toda modificación o ampliación de las bases y especificaciones de la licitación o de variación de la fecha de presentación de las ofertas, deberá ser previamente aceptada por el Banco y comunicada por escrito a todas las firmas precalificadas, o en caso de que no haya habido precalificación, a las empresas que hubieren retirado los documentos de licitación. En estos casos, el plazo entre la última notificación de modificación y la fecha de presentación de ofertas, no podrá ser inferior a treinta (30) días.

- C.2.3 Cualquier consulta dirigida al Organismo Ejecutor por parte de los interesados en presentar ofertas o por los eventuales oferentes, acerca de la interpretación de las bases y especificaciones de la licitación que no comportase ninguna modificación o ampliación de las mismas, deberá ser hecha hasta 15 días antes de la fecha prevista para la presentación de las ofertas y será absuelta, por escrito, por el Organismo Ejecutor y llevada a conocimiento, también por escrito, de todos los demás proponentes así como del Banco, por lo menos 10 días antes de la fecha de presentación de las ofertas.

La consulta y su respuesta no producirán efecto suspensivo en el plazo para la presentación de ofertas.

- C.2.4 El Organismo Ejecutor podrá declarar desierta cualquier licitación, previo envío al Banco de un informe razonado y después de recibida la aceptación por parte del Banco de la medida que aquel se propone adoptar al respecto. En tal caso, el Organismo Ejecutor deberá convocar de nuevo a licitación o concurso de ofertas, ajustándose a lo dispuesto en este Procedimiento. El derecho que se reserva el Organismo Ejecutor de declarar desierta la licitación deberá constar en las bases y documentos respectivos. Asimismo, el Organismo Ejecutor podrá rechazar una o varias ofertas, cuando ellas no se ciñan a las bases de la licitación y/o al presente Procedimiento. Si por segunda vez se declarara desierta una licitación, el Organismo Ejecutor y el Banco acordarán el procedimiento a seguir, el cual se sujetará a las normas legales pertinentes.

- C.2.5 Con respecto a maquinaria, equipos, materiales y otros bienes, el "origen" de éstos es el país en el cual el material o equipo ha sido extraído, cultivado o producido, ya sea por manufactura, elaboración o montaje. El origen de un artículo "producido" necesariamente tiene que ser del país en el cual, como resultado de dicha manufactura, procesamiento o montaje, resulta en otro artículo, comercialmente reconocido, que difiere sustancialmente en sus características básicas, en su propósito o finalidad, de cualquiera de sus componentes importados.

#### D. MARGEN DE PREFERENCIA

- D.1 Podrá aplicarse un margen de preferencia en favor de ofertas de bienes originarios del Ecuador o, según corresponda, de países miembros de la Asociación Latinoamericana de Integración (ALADI) y/o del Grupo Andino, conforme con las siguientes normas:

(a) Margen de preferencia nacional

- (i) Se considerará que un bien es originario del Ecuador cuando el costo de los materiales, mano de obra y servicios del Ecuador empleados en su fabricación represente por lo menos el 40% del costo total del bien.

- (ii) A los efectos de comparación de ofertas, se tendrá como precio de los productos originarios del Ecuador, el precio de éstos, puestos en obra, una vez deducidos los siguientes importes: (1) los derechos de importación pagados sobre materias primas principales o sobre componentes manufacturados; y (2) los impuestos nacionales sobre ventas al consumo y al valor agregado, incorporados al costo del artículo ofrecido. El oferente deberá proporcionar la prueba documentada de las cantidades que, de conformidad con los incisos (1) y (2) anteriores, deben deducirse con el solo objeto de facilitar el cotejo de propuestas.
  - (iii) También a los efectos de comparar las ofertas, se tendrá como precio de los productos de origen extranjero, el precio CIF del producto (excluidos derechos de importación, consulares y portuarios), al cual deberá sumarse el importe de los gastos siguientes: (1) los de manipulación en puerto, y (2) los de transporte local, desde el puerto o lugar fronterizo de entrada hasta el pie de la obra.
  - (iv) Para comparar ofertas de productos de origen ecuatoriano y extranjero se observará lo siguiente:
    - (1) los costos expresados en moneda extranjera se expresarán en su equivalente en sucres, utilizando el tipo de cambio pactado entre el Organismo Ejecutor y el Banco en el Contrato de Préstamo; y
    - (2) al precio de los productos extranjeros, calculado conforme se estipula en el inciso (iii) anterior, se sumará un margen del 15% o el derecho aduanero real, según cual sea menor.
  - (v) Cuando aplicando las normas anteriores resulte que la oferta del producto nacional es más conveniente que la del producto extranjero, podrá hacerse uso para su adquisición de las divisas que formen parte del Préstamo.
- (b) Margen de preferencia regional
- (i) Se considerará que un bien es de origen regional cuando: (1) se lo produzca en un país miembro de la ALADI y/o del Grupo Andino y cumpla con los requisitos establecidos en los instrumentos jurídicos que gobiernan la ALADI y/o el Grupo Andino, en cuanto a origen y otras materias vinculadas con los programas de liberalización del comercio regional; y (2) el costo de los materiales, mano de obra y servicios, empleados en su fabricación en el país originario sea por lo menos el 40% del costo total del producto.
  - (ii) Se sumarán al costo CIF del producto ofertado los costos locales referidos en (iii)(1) y (2) del acápite (a) (Margen de Preferencia Nacional) de este párrafo.

- (iii) Para efectuar los cotejos de precios entre ofertas de bienes originarios de países de la ALADI y/o del Grupo Andino y las de bienes originarios de otros países extranjeros elegibles, se observará lo siguiente:
- (1) también se convertirán a su equivalente en sucres los precios expresados en moneda extranjera, sobre la misma base de cálculo establecida en el inciso (a)(iv)(1) anterior; y
  - (2) se sumará a las ofertas de bienes originarios de países que no sean parte de la ALADI y/o del Grupo Andino, expresadas en el equivalente en sucres, un margen del 15%, o bien la diferencia entre los derechos de importación, aplicables a bienes originarios de países que integran esa Asociación, y los derechos aplicables a bienes extranjeros elegibles que no sean parte de la ALADI y/o del Grupo Andino, según cual sea menor.
- (iv) Cuando, por aplicación de las normas anteriores resulte que el precio de la oferta del producto originario del país miembro de la ALADI y/o del Grupo Andino, es más conveniente que el del producto originario de otro país extranjero elegible, podrá hacerse uso para su adquisición de las divisas que formen parte del Préstamo.



**PLAN DE ACTIVIDADES  
FORMULARIO PMS 4-2**

Descripción de la Actividad (b)	Duración (días) (c)	Costo Estimado (d)	Actividad Predecesora (e)	Entidad Responsable (f)	Código de Entidades Responsables (g)
Asociación y firma Contrato Crédito					<div> <div> PE Poder Ejecutivo PL Poder Legislativo PR Gobierno del Ecuador AS dor EC Entidad Componente EE INECEL UE UNEPER </div> <div> JE Junta Expertos FC Firma Consultora CO Contratista PB Proveedor de Bienes </div> </div>
Presentación de solicitud al	30	-		PR-EE	
Asociación crédito con el	60	1000	1000	PR-EE-BID	BID-Fuente Crediticia
Aprobación por Directorio - BID	15	1010	1010	BID	
Obtención de aprobaciones de Entidades Competentes en Ecua	30	1020	1020	EE	
Comunicar al BID	8	1030	1030	EE	
Firma del Contrato de Crédito	15	1040	1040	PR-BID	
Verificación de condiciones legales previas al primer desembolso					
Elaborar el Informe Legal	15	1050	1050	EE	
Designar representantes legales	8	1050	1050	PR - BID	
Preparar procedimientos	15	1110	1110	EE	
Obtener aprobación del BID	8	1100-1120 3010	1100-1120 3010	BID-UE	
Pagos de derechos de paso					
Limitar obtención de derechos	100	1050	1050	UE-EE	

Proyecto: Electrificación Rural

Prestatario: INECEL

Ejecutor: UNEPER

Preliminar ☒

Inicial ☐

Revisión ☒ No. 1

Presentado

Fecha

Abril-81

PLAN DE EJECUCION  
DEL PROYECTO

PLAN DE ACTIVIDADES

Leg ☒ Fin ☐ Ins ☐ Tec

Hoja 1 De 10

PLAN DE ACTIVIDADES  
FORMULARIO PMS 4-2

No. de Actividad (a)	Descripción de la Actividad (b)	Duración (días) (c)	Costo Estimado (d)	Actividad Predecesora (e)	Entidad Responsable (f)	Código de Entidades Responsables (g)
1210	Presentar evidencia de derecho de paso al BID.	15		1200	UE	<div> <div> PE Poder Ejecutivo PL Poder Legislativo PR Gobierno de Ecuador AS EC Entidad Componente EE INECEL UE UNEPER BID-Fuente Crediticia </div> <div> JE Junta Esmarinas FC Firma Consultora CO Contratista PB Proveedor de Bienes </div> </div>

Proyecto: Electrificación Rural  
Prestatario: INECEL  
Ejecutor: UNEPER

Preliminar ☒  
Inicial ☐  
Revisión ☒ No. 1

Fecha

Leg ☒ Fin ☐ Im ☐ Tcc ☐

Presentado Abril 1 - 81 Hora 2 De 10

PLAN DE EJECUCION DEL PROYECTO  
PLAN DE ACTIVIDADES

PLAN DE ACTIVIDADES  
FORMULARIO PMS 4-2

No. de la Actividad (a)	Descripción de la Actividad (b)	Duración (días) (c)	Costo Estimado (d)	Actividad Predecesora (e)	Entidad Responsable (f)	Código de Entidades Responsables (g)
2000	<p>Demstrar disponibilidad de Fondos locales</p> <p><u>Contratar auditoría externa</u></p>	15		1130	UE-EE	<p>PE Poder Ejecutivo PL Poder Legislativo PR Gobierno Ecuador AS Entidad Componente EC Entidad Componente EE INECEL UE UNEPER</p> <p>BID-Fuente Crediticia</p>
2010	Elaboración de requisitos de precalificación	15		1130	UE	
2020	Aprobación de requisitos por el BID	8		2010	BID	
2030	Invitación a precalificación	45		2020	EE-UE	
2040	Selección de Firmas	8		2030	UE	
2050	Aprobación del BID	8		2040	BID	
2060	Elección de Firma	8		2050	UE-EE	
2070	Negociar y subscribir contrato	20		2060	UE-FC	
2100	Formular el código de cuentas	8		2070	UE-FC	
2110	Aprobación del BID	8		2100	BID	
2120	Aprobación del BID de convenios con Empresas Eléctricas	15		2000 - 2110	BID	
2130	Firma de convenios con Empresas Eléctricas	30		2120	EE-UE-EC	

Proyecto: Electrificación Rural

Prestatario: INECEL

Ejecutor: UNEPER

Preliminar ☒

Inicial ☐

Revisión ☒ No. 1

Presentado ☒ Abril - 81

PLAN DE EJECUCION DEL PROYECTO

PLAN DE ACTIVIDADES

Leg ☐ Fin ☒ Inc ☐ Tec ☐

Hoja 3 De 10

# PLAN DE ACTIVIDADES

## RM. ... RIC ... S.4. ...

No. de la Actividad (a)	Descripción de la Actividad (b)	Duración (días) (c)	Costo Estimado (d)	Actividad Predecesora (e)	Entidad Responsable (f)	Código de Entidades Responsables (g)	
3000	Condiciones previas al primer desembolso Formular Plan de Ejecución "Inicial" del Proyecto	15		1050	UE	PE Poder Ejecutivo PL Poder Legislativo PR Gobierno de Ecuador AS EC Entidad Componente EE INECEL UE UNEPER	JE Junta Expertos FC Firma Consultora CO Contratista PB Proveedor de Bienes
3010	Aprobación del BID del PEP "Inicial"	8		3000	BID	BID - Fuente Crediticia	
3100	Administración de contratos de consultores locales	365		5025	UE - FC		
3105	Administración de contratos de consultores extranjeros	942		5035	UE - FC		
3110	Administración de contratos provisión de materiales I	260		5034	UE - PB		
3115	Administración de contratos provisión de materiales II	260		5023	UE - PB		
3120	Administración de contratos de constructores	920		5017	UE - CO		
3160	Entrega de obras a las empresas	700		2130 - 5033	EE - UE		
3170	Informe final	30		3160 - 4160 4570 - 4380	UE - EE		
3180	Ultimo desembolso	15		4060 3170	BID		

Proyecto: Electrificación Rural	
Prestatario: INECEL	
Ejecutor: UNEPER	
Preliminares <input checked="" type="checkbox"/>	PLAN DE EJECUCION DEL PROYECTO PLAN DE ACTIVIDADES
Inicial <input type="checkbox"/>	
Revisión <input checked="" type="checkbox"/> No. 1	
<div></div> Fecha	Leg <input type="checkbox"/> Fin <input type="checkbox"/> Ins <input checked="" type="checkbox"/> Loc <input type="checkbox"/>
Presentado Abril - 81	Hora 4 De 10

Proyecto: Electrificación Rural	
Prestatario: INECEL	
Ejecutor: UNEPER	
Preliminar <input checked="" type="checkbox"/>	PLAN DE EJECUCION DEL PROYECTO
Inicial <input type="checkbox"/>	PLAN DE ACTIVIDADES
Revisión <input checked="" type="checkbox"/> No. 1	Leg <input type="checkbox"/> Fin <input type="checkbox"/> Ins <input checked="" type="checkbox"/> Tec <input type="checkbox"/>
Presentado	Fecha
Abril - 81	Hora 4 De 10

**PLAN DE ACTIVIDADES  
FORMULARIO PMS 4-2**

Descripción de la Actividad (b)	Duración (días) (c)	Costo Estimado (d)	Actividad Predecesora (e)	Entidad Responsable (f)	Código de Entidades Responsables (g)
<u>Consultoría local. Diseño</u>					PE Poder Ejecutivo PL Poder Legislativo PR Gobierno de Ecuador AS Entidad Componente EE INECEL UE UNEPER
<u>Consultoría</u>					JE Junta Expertos FC Firma Consultora CO Contratista PB Proveedor de Bienes
Elaboración términos de referencia	15		1000	UE	
Elaboración BID	8		4000	BID	BID - Fuente Crediticia
Obtención de firmas	200		4010	EE - UE	
Elaborar y suscribir contrato	200		5026	EE - UE - FC	
Elaboración de trabajos	390		5027	FC	
Elaboración de trabajos	365		5028	UE - FC	
Informe técnico final de la consultoría local	30		3100 - 4050	EE - UE	
<u>Consultoría Extranjera</u>					
Elaboración términos de referencia	15		1000	UE	
Elaboración BID	8		4100	BID	
Presentación a presentación de ofertas	45		4110	EE - UE	
Envío de ofertas e informe	15		4120	EE - UE	
Elaborar y suscribir contrato	15		4130	EE-UE-FC	
Elaboración de trabajos	912		4140	FC	
Informe final consultoría extranjera	30		4150 - 3105	EE - UE	

Proyecto: Electrificación Rural	
Prestatario: INECEL	
Ejecutor: UNEPER	
Preliminar <input checked="" type="checkbox"/>	PLAN DE EJECUCION DEL PROYECTO  PLAN DE ACTIVIDADES
Inicial <input type="checkbox"/>	
Revisión <input checked="" type="checkbox"/> No. 1	
Presentado	Fecha: Abril - 81 Leg <input type="checkbox"/> Fin <input type="checkbox"/> Ins <input type="checkbox"/> Tec <input type="checkbox"/> Hoja 5 De 10

PLAN DE ACTIVIDADES  
FORMULARIO PMS 4-2

No. de la Actividad (a)	Descripción de la Actividad (b)	Duración (c/a)	Costo Estimado (d)	Actividad Predecesora (e)	Entidad Responsable (f)	Código de Entidades Responsables (g)
4200	<u>Adquisición</u> Preparación de documentos Licitación	30		1000	UE - EE	PE Poder Ejecutivo PL Poder Legislativo PR Gobierno de Ecuador AS Entidad Componente EC INECEL EE UNEPER UE BID- Fuente Crediticia
4205	Aprobación BID	15		4200	BID	JE Junta Expertos FC Firma Consultora CO Contratista PB Proveedor de Bienes
4210	Aprobación Directorio INECEL	15		4205	EE	
4215	Informes de Ley	60		4210	PR	
4220	Preparar convocatoria	8		4215	UE - EE	
4225	Recepción ofertas	45		4220	UE - EE	
4230	Informe de calificación	15		4225	UE - EE	
4235	Informe de propuestas	30		4230	UE	
4240	Adjudicación contratos	15		4235	EE - UE	
4245	Aprobación BID	15		4240	BID	
4250	Discusión contratos	15		4245	UE - EE - BID	
4255	Informes Legales	45		4250	PR	
4260	Legalización contratos	30		4253	UE - PB	
4265	Apertura cartas crédito	30		4260	PB - EE	
4270	Garantía cartas crédito	15		4265	PB	
4275	Recepción y bodegaje	200		5020 - 5021	UE	
4300	<u>Adquisición</u> Aprobación Directorio INECEL documentos Licitación	15		5022	EE	
4310	Informes de Ley	60		4300	PR	

Proyecto: Electrificación Rural	PLAN DE EJECUCION DEL PROYECTO
Prestatario: INECEL	PLAN DE ACTIVIDADES
Ejecutor: UNEPER	Leg <input type="checkbox"/> Fin <input type="checkbox"/> Ins <input type="checkbox"/> Rec <input checked="" type="checkbox"/>
Preliminar <input checked="" type="checkbox"/>	No. 1
Inicial <input type="checkbox"/>	Fecha
Revisión <input checked="" type="checkbox"/>	Presentado
Presentado	Abril - 81
	Hoja 6 De 10

PLAN DE ACTIVIDADES  
FORMULARIO PMS 4-2

No. de la Actividad (a)	Descripción de la Actividad (b)	Duración (días) (c)	Costo Estimado (d)	Actividad Predecesora (e)	Entidad Responsable (f)	Código de Entidades Responsables (g)
4320	Preparación convocatoria	8		4310	UE - EE	PE Poder Ejecutivo PL Poder Legislativo PR Gobierno de Ecuador AS Entidad Componente EC INECEL EE UNEPER UE BID - Fuente Crediticia
4325	Recepción de ofertas	45		4320	UE - EE	JE Junta Externos FC Firma Consultora CO Contratos PB Proveedor de Bienes
4330	Informe de calificación	15		4325	UE - EE	
4335	Informe de propuestas	30		4330	UE	
4340	Adjudicación de contratos	15		4335	EE - UE	
4345	Aprobación BID	15		4340	BID	
4350	Discusión de contratos	15		4345	UE - EE - BID	
4355	Informes Legales	45		4350	PR	
4360	Legalización de contratos	30		4355	UE - PB	
4365	Apertura cartas crédito	30		4360	PB - EE	
4370	Garantía cartas crédito	15		4365	PB	
4375	Recepción y bodegaje	200		4370	UE	
4380	Informe bodega final	30		4375 - 4530 3110 - 4275	EE - UE	
	<u>Ejecución de obras</u>					
4400	Preparación de documentos de Precalificación	30		1000	EE - UE	Proyecto: Electrificación Rural Presentador: INECEL
4410	Aprobación del BID	8		4400	BID	Ejecutor: UNEPER
4420	Invitación a calificación de firmas	45		4410	EE - UE	Preliminar <input checked="" type="checkbox"/> Inicial <input type="checkbox"/> Revisión <input checked="" type="checkbox"/> No. 1 Fecha
4430	Informe calificación de firmas	30		4420	EE - UE	PLAN DE EJECUCION DEL PROYECTO
4440	Aprobación del BID	8		4430	BID	PLAN DE ACTIVIDADES Leg <input type="checkbox"/> Fin <input type="checkbox"/> Ins <input type="checkbox"/> Rec <input checked="" type="checkbox"/> Hojas 7 De 10

PLAN DE ACTIVIDADES  
FORMULARIO PMS 4-2

No. de la Actividad (a)	Descripción de la Actividad (b)	Duración (días) (c)	Costo Estimado (d)	Actividad Predecesora (e)	Entidad Responsable (f)	Código de Entidades Responsables (g)
4450	Comunicar resultados a interesados	8		4440	UE	PE Poder Ejecutivo PL Poder Legislativo PJ Gobierno de Ecuador AS Entidad Componente EC INECEL EE UNEPER
4460	Preparación de documentos - ofertas de construcción	30		4450	UE - FC	JE Junta Expertos FC Firma Consultora CO Contratista PB Proveedor de bienes
4470	Aprobación del BID	8		4460	BID	
4480	Invitación a presentación de ofertas	630		4470	EE - UE	BID-Fuente Crediticia
4490	Recepción de ofertas	630		5000	EE - UE	
4500	Evaluación y selección de ofertas	630		5001	EE - UE	
4510	Aprobación del BID	630		5003	BID	
4520	Adjudicación y suscripción de contratos	630		5004 - 1210	EE - UE - CO	
4530	Entrega-recepción de materiales	630		5005 - 5018	UE - CO	
4540	Ejecución de trabajos	810		5006	UE - CO	
4550	Pruebas y aceptación de trabajos	660		5007	UE - CO	
4560	Recepción y liquidación de contratos	660		5008	EE - UE - CO	
4570	Informe técnico final	60		3120 - 4560	UE - CO	


Proyecto:	Electrificación Rural	
Prestatario:	INECEL	
Ejecutor:	UNEPER	
Preliminar <input checked="" type="checkbox"/>	PLAN DE EJECUCION DEL PROYECTO	
Inicial <input type="checkbox"/>		
Revisión <input checked="" type="checkbox"/> No. 1		
Presentado	Fecha	Leg <input type="checkbox"/> Fin <input type="checkbox"/> Ins <input checked="" type="checkbox"/> X



**PLAN DE ACTIVIDADES  
FORMULARIO PMS 4-2**

Descripción de la Actividad (b)	Duración (días) (c)	Costo Estimado (d)	Actividad Predecesora (e)	Entidad Responsable (f)	Código de Entidades Responsables (g)
CC 4490	45		4470		PE Poder Ejecutivo PL Poder Legislativo PR Gobierno de Ecuador AS EC Entidad Componente EE INECEL UE UNEPER
CC 4500	45		5000		JE Junta Expertos FC Firma Consultora CO Contratista PB Proveedor de Bienes
CC 4510	8		5001		
CC 4520	45		5003		
CC 4530	42		5004 - 1210		
CC 4540	8		5005 - 5018		BID - Fuente Crediticia
CC 4550	150		5006		
CC 4560	30		5007		
FF 4490	30		4480		
FF 4500	30		4490		
FF 4510	30		4500		
FF 4520	30		4510		
FF 4530	30		4520		
FF 4540	30		4530		
FF 4550	30		4540		
FF 4560	30		4550		
CC 3120	15		5004 - 1210		
CC 4530	30		5021 - 5020		
FC 4275	60		4240		
FC 4275	15		4270		
FC 4300	30		4040		
CC 3115	15		4335		
FF 4530	30		4375		

Proyecto: Electrificación Rural		
Prestatario: INECEL		
Ejecutor: UNEPER		
Preliminar <input checked="" type="checkbox"/>	<b>PLAN DE EJECUCION DEL PROYECTO</b>  <b>PLAN DE ACTIVIDADES</b>	
Inicial <input type="checkbox"/>		
Revisión <input checked="" type="checkbox"/> No. 1		
	Fecha	Leg <input type="checkbox"/> Fin <input type="checkbox"/> Ins <input type="checkbox"/> Rec
Presentado	Abril - 81	Hoja 9 De 10

PLAN DE ACTIVIDADES  
FORMU. RIO PMS 4-2

No. de la Actividad (a)	Descripción de la Actividad (b)	Duración (en días) (c)	Costo Estimado (d)	Actividad Predecesora (e)	Entidad Responsable (f)	Código de Entidades Responsables (g)
5025	4030 CC 3100	15		5026		PE Poder Ejecutivo PL Poder Legislativo PR Gobierno de Ecuador AS EC Entidad Componente EE INECEL UE UNEPER
5026	4020 CC 4030	60		4010		JE Junta Expertos FC Firma Consultora CO Contralista PB Proveedor de Bienes
5027	4030 CC 4040	60		5026		
5028	4040 CC 4050	60		5027		
5029	4020 FF 4030	45		4020		
5030	4030 FF 4040	45		4030		
5031	4040 FF 4050	45		4040		
5032	4340 CC 4375	30		4335		
5033	4540 CC 3160	150		5006		
5034	4240 CC 3110	15		4235		
5035	4140 CC 3105	15		4130		

**Observación:** Esta hoja contiene actividades especiales, de relación, utilizadas con el propósito de obedecer a las condiciones específicas del proyecto.

**BID - Fuente Crediticia**

**Proyecto:** Electrificación Rural

**Prestatario:** INECEL

**Ejecutor:** UNEPER

**Preliminar** ☒ **Inicial** ☐ **Revisión** ☒ No. 1

**PLAN DE EJECUCION DEL PROYECTO** ☐ **PLAN DE ACTIVIDADES** ☒

**Presentado** Abril - 81 **Leg** ☐ **Fin** ☐ **Ins** ☐ **Rec** ☐

**Hoja** 10 **De** 10

PMS-4-251 2548 (Rev. 7, 79)



INECEL

11 de 16

LISTA DE PRECEDENCIA DE ACTIVIDADES

ACTIVIDAD	DURACION	ACTIVIDAD PRECEDENTE
1010	60	1000
1020	15	1010
1030	30	1020
1040	8	1030
1050	15	1040
1100	15	1050
1110	8	1050
1120	15	1110
1130	8	1100 - 1120 - 3010
1200	100	1050
1210	15	1200
2000	15	1130
2010	15	1130
2020	8	2010
2030	45	2020
2040	8	2030
2050	8	2040
2060	8	2050
2070	20	2060
2100	8	2070
2110	8	2100
2120	15	2000 - 2110
2130	30	2120



INECEL

12 de 16

LISTA DE PROCEDENCIA DE ACTIVIDADES

ACTIVIDAD	DURACION	ACTIVIDAD PRECEDENTE
-----------	----------	-------------------------

3000	15	1050
3010	8	3000
3100	365	5025
3110	260	5034
3115	260	5023
3120	920	5017
3160	700	2130 - 5033
3170	30	3160 - 4160 - 4570 -
		4380 - 4060
3180	15	3170
4000	15	1000
4010	8	4000
4020	200	4010
4030	200	5026
4040	390	5027
4050	365	5028
4060	30	3100
4100	15	1000
4110	8	4100
4120	45	4110
4130	15	4120
4140	15	4130
4150	912	4140
4160	30	4150 - 3105

./.



INECEL

13 de 16

LISTA DE PRECEDENCIA DE ACTIVIDADES

ACTIVIDAD	DURACION	ACTIVIDAD PRECEDENTE
4200	30	1000
4205	15	4200
4210	15	4205
4215	60	4210
4220	8	4215
4225	45	4240
4230	15	4225
4235	30	4230
4240	15	4235
4245	15	4240
4250	15	4245
4255	45	4250
4260	30	4253
4265	30	4260
4270	15	4265
4275	200	5020 - 5021
4300	15	5022
4310	60	4300
4320	8	4310
4325	45	4320
4330	15	4325
4330	30	4325
4340	15	4335
4345	15	4340
4350	15	4345
4355	45	4350
4360	30	4355
4365	30	4360

./.



INECEL

14 de 16

LISTA DE PRECEDENCIA DE ACTIVIDADES

ACTIVIDAD	DURACION	ACTIVIDAD PRECEDENTE
4370	15	4365
4375	200	4370
4380	30	4375 - 4530 - 3110
		4275
4400	30	1000
4410	8	4400
4420	45	4410
4430	30	4420
4440	8	4430
4450	8	4440
4460	30	4450
4470	8	4460
4480	630	4470
4490	630	5000
4500	630	5001
4510	630	5003
4520	630	5004 - 1210
4530	630	5005 - 5018
4540	810	5006
4550	660	5007
4560	660	5008
4570	60	3120 - 4560
5000	45	4470
5001	45	5000
5003	8	5001

./.



INECEL

15 de 16

LISTA DE PRECEDENCIA DE ACTIVIDADES

ACTIVIDAD	DURACION	ACTIVIDAD PRECEDENTE
-----------	----------	-------------------------

5004	45	5003
5005	42	5004 - 1210
5006	8	5005 - 5018
5007	150	5006
5008	30	5007
5009	30	4480
5010	30	4490
5011	30	4500
5012	30	4510
5013	30	4520
5014	30	4530
5015	30	4540
5016	30	4550
5017	15	5004 - 1210
5018	30	5021 - 5020
5020	60	4240
5021	15	4270
5022	30	4040
5023	15	4335
5024	30	4375
5025	15	5026
5026	60	4010
5027	60	5026
5028	60	5027
5029	45	4020

./.



INECEL

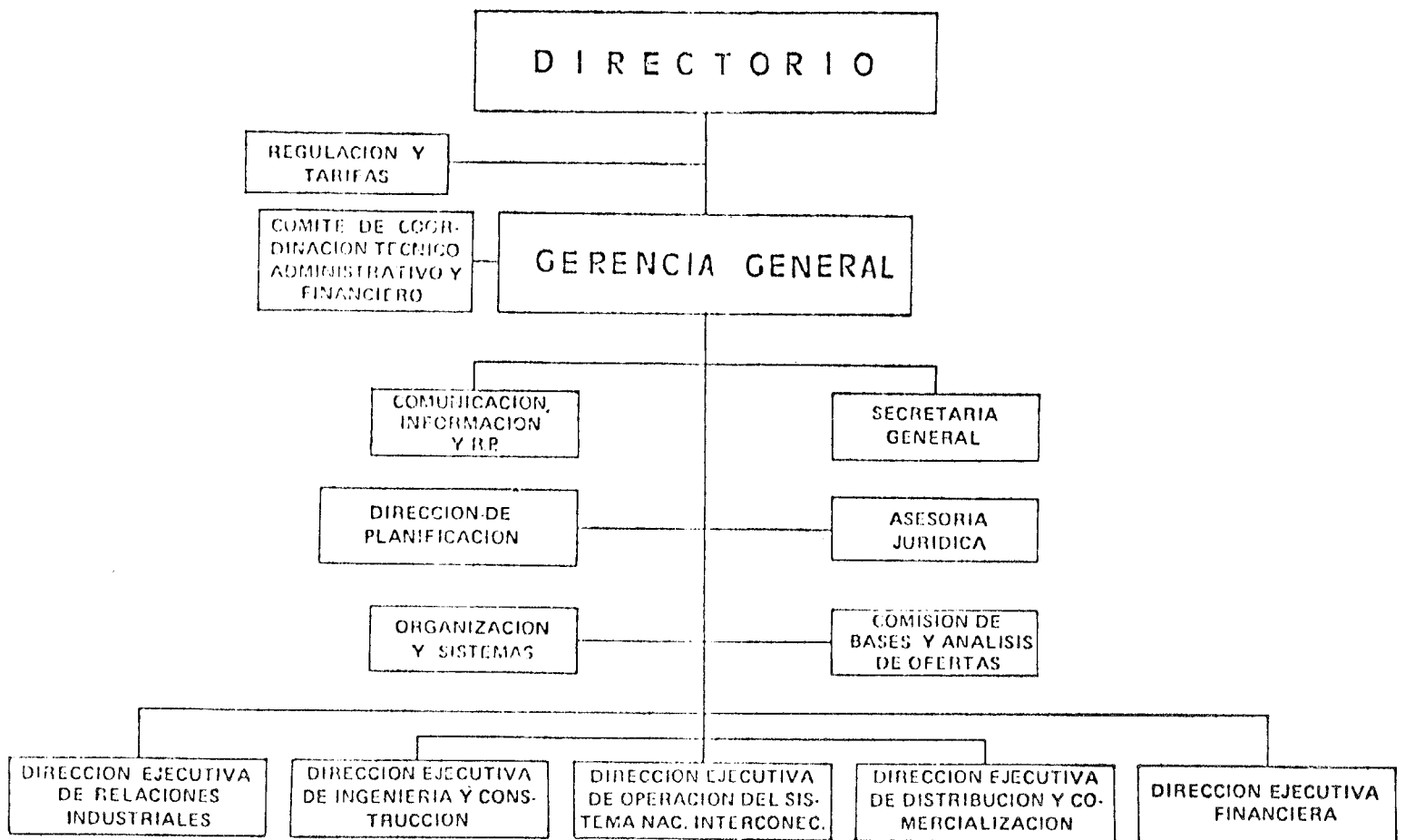
16 de 16

LISTA DE PRECEDENCIA DE ACTIVIDADES

ACTIVIDAD	DURACION	ACTIVIDAD PRECEDENTE
-----------	----------	-------------------------

5030	45	4030
5031	45	4040
5032	30	4335
5033	150	5006
5034	15	4235
5035	15	4130





Elaborado por: O. y S.  
Aprobado por: Directorio  
Fecha: 12 de Julio de 1978

APENDICE 14

Reajustes mensuales de tarifas en las empresas electricas  
a partir de mayo de 1981

<u>EMPRESA</u>	<u>REAJUSTE</u> <u>MENSUAL</u>
Riobamba	2%
Norte	2%
Quito	2%
Latacunga	2%
Ambato	3%
Santa Elena	4%
Sur	4%
Milagro	4%
El oro	4%
Centro Sur	4%
Manabí	4%
Esmeraldas	5%
Bolívar	5%
Santo Domingo	5%
Los ríos	5%
Serguri	5%
Promedio	2,95%

Para la Empresa Eléctrica del Ecuador (EMELEC) se autorizaron cuatro ajustes a saber:

Mayo 1981	\$ 0,12
Junio 1981	\$ 0,10
Julio 1981	\$ 0,10
Agosto 1981	\$ 0,10

Fuente: División de tarifas.

APENDICE 15

INECEL - Inversiones en compañías asociadas y sistemas propios  
al 31 de diciembre de 1980  
(en miles de US\$)

---

	<u>Monto inversión</u>	<u>% s/capital social</u>
E.E. Ambato	7.729	71.4
E.E. Riobamba	10.532	67.3
E.E. Esmeraldas	9.183	92.7
E.E. Regional Centro Sur	18.741	93.2
E.E. Bolívar	5.238	93.1
E.E. El Oro	11.372	92.2
E.E. Santa Elena	9.825	98.4
E.E. Los Rios	10.043	98.7
E.E. Milagro	13.209	94.1
E.E. Quito	23.598	54.5
E.E. Azogues	2.281	76.2
E.E. Regional del Norte	12.433	90.1
E.E. Regional del Sur	11.564	93.2
E.E. Manabí	22.574	86.8
Sistemas propios	<u>18.337</u>	100.0
Total	186.659	8.5
	=====	=====

INECEL. SITUACION FINANCIERA

1. Estados de Resultados

- 1.01 Los estados ajustados de resultados para el período 1978-1980 se muestran en la página siguiente.

(a) Ingresos de explotación

- 1.02 Como puede observarse, las ventas de energía del SNI en unidades de producto han aumentado a una tasa acumulativa del 50% anual, lo cual es explicable dado que INECEL es una empresa relativamente nueva y en pleno crecimiento, siendo el proyecto Pisayambo, que fuera parcialmente financiado por el Banco y que entrara plenamente en operación en 1978, una de sus primeras obras. En valores monetarios corrientes las ventas, con una tasa de expansión del 60% anual, reflejan asimismo la misma situación. La composición de las ventas de energía por empresa suplida y con el precio medio resultante, se indica en el cuadro de la página subsiguiente. Conforme con lo allí mostrado, las empresas EMELEC y Quito, con un 88% del suministro total, son los principales consumidores del SNI, correspondiéndoles el 50% y 38%, en promedio, respectivamente. A su vez, se observa que en el período analizado las ventas en unidades de energía crecieron en un 131% y en valores corrientes un 181% mientras que la tarifa media, que sólo creció un 19%, no alcanzó a recuperar plenamente la desvalorización de la moneda local. En este respecto corresponde mencionar que las tarifas indicadas para cada empresa corresponden a valores medios que han sido influidos, además de por cambios en los precios, por la diferente proporción en que las empresas adquirieron energía firme, a la que corresponden volúmenes y precios prefijados, o energía de sustitución cuyo precio es diferente. Los otros ingresos de explotación tienen su origen en el arriendo de transformadores, postes y líneas efectuado por INECEL y en las recaudaciones de conexiones, reconexiones, multas y similares provenientes de la explotación de sus sistemas propios.

INECEL

Estados de Resultados Consolidados Comparativos  
1978 - 1980  
(en miles de US\$) 1/

	<u>1978</u>		<u>1979</u>		<u>1980</u>		<u>Total 1978</u>
	<u>\$</u>	<u>%</u>	<u>\$</u>	<u>%</u>	<u>\$</u>	<u>%</u>	<u>\$</u>
<u>Estados de Operación</u>							
Ingresos de energía (Gwh)	496.6		806.8		1.114.8		
Tarifa media (S/. Kwh)	0.59		0.60		0.67		
<u>Ingresos de explotación</u>							
Ingresos de energía	11.633	98	19.318	99	29.975	99	60.926
Otros ingresos de explotación	242	2	160	1	162	1	564
Total de ingresos de explotación	<u>11.875</u>	<u>100</u>	<u>19.478</u>	<u>100</u>	<u>30.137</u>	<u>100</u>	<u>61.490</u>
<u>Gastos de explotación</u>							
Combustibles	996	8	2.500	13	3.227	11	6.723
Operación y mantenimiento	5.805	49	10.221	52	15.340	50	31.366
Depreciación	3.399	29	5.480	28	5.746	19	14.625
Gastos generales de administración	2.502	21	3.929	20	5.054	17	11.485
Otros gastos de explotación	1.166	10	811	5	-	-	1.977
Total de gastos de explotación	<u>13.868</u>	<u>117</u>	<u>22.941</u>	<u>118</u>	<u>29.367</u>	<u>97</u>	<u>66.176</u>
Resultado neto de explotación	(1.993)	(17)	(3.463)	(18)	770	3	(4.686)
<u>Ingresos operacionales</u>	148	1	37	-	761	3	946
<u>Gastos no operacionales</u>	30	-	71	-	713	3	814
Utilidad (pérdida) antes de gastos financieros	(1.875)	(16)	(3.497)	(18)	818	3	(4.554)
Gastos financieros	2.188	18	7.709	40	6.149	20	16.046
Utilidad (pérdida) neta	<u>(4.063)</u>	<u>(34)</u>	<u>(11.206)</u>	<u>(58)</u>	<u>(5.331)</u>	<u>(17)</u>	<u>(20.600)</u>
	=====	===	=====	===	=====	===	=====

1/ Tipo de cambio: \$ 25.00 = US\$ 1.00

INECEL - Energía e ingresos facturados  
1978-1980  
(en miles US\$)

Empresa Eléctrica	1978		1979		1980	
	MWH	Precio medio \$/KWh	MWH	Precio medio \$/KWh	MWH	Precio medio \$/KWh
E.E. Quito	273.116.4	6.096.9	246.347.0	6.256.2	344.064.2	9.946.8
E.E. EMELEC	127.570.1	1.989.9	431.256.0	9.219.4	574.096.8	13.504.3
E.E. Ambato	27.909.1	555.8	41.399.0	823.0	43.279.0	1.056.2
E.E. Riobamba	-	-	1.981.0	67.2	3.979.9	168.4
S.E. Latacunga	16.730.6	559.1	5.706.0	141.0	8.941.7	257.0
S.E. INECEL- Guayas	10.271.0	210.7	45.588.0	902.6	76.568.8	1.428.2
E.E. Regional del Norte	-	-	-	-	2.791.1	93.8

Totales 455.597.2 9.412.4 0.021 772.227.0 17.409.4 0.023 1.053.721.5 26.454.7 0.025

Indice base 1978 = 100 100 100 169 185 110 231 281 119

Indice general de precios

base 1978 = 100 100 110 124

(b) Egresos de explotación

- 1.03 Tal como resulta del cuadro ajustado consolidado de resultados que se ha preparado para el período 1978-1980, los costos de las etapas funcionales de operación y mantenimiento, incluyendo el combustible, representaron en promedio el 62% de los gastos de explotación, correspondiendo aproximadamente el 65% de ese total a la operación y el 35% al mantenimiento. Estos gastos incluyen el 15% del total de los gastos generales de administración, como se indica en párrafo 1.05 siguiente. El costo del combustible responde a su utilización en las centrales de generación termoeléctrica, las cuales producen alrededor del 75% de la energía generada por el SNI. Los precios de los combustibles, que permanecieron sin variaciones durante la década de los setenta, fueron ajustados por acuerdo ministerial el 18 de febrero de 1981, con base en los siguientes precios:

	<u>US\$/galón</u>		<u>% Incremento</u>
	<u>Anterior</u>	<u>Nuevo</u>	
Diesel	0.144	0.440	206
Bunker C	0.104	0.280	169

- 1.04 La incidencia de estos aumentos y los correspondientes a la mano de obra así como la decisión de alcanzar el nivel de rentabilidad legal, motivaron la puesta en marcha de la política tarifaria que comenzó a aplicarse recientemente (ver párrafo 5.27).
- 1.05 Como se indicó en el párrafo 5.36, los gastos generales de administración, que no son mostrados por INECCEL en sus cuadros de resultados, han sido incorporados a los mismos en el proceso de análisis como lo requieren los principios contables de aceptación general. Para la distribución contable se utilizó el siguiente esquema:

Gastos de operación y mantenimiento	15%
Gastos generales de administración	30%
Obras en ejecución	55%
Total	<u>100%</u>

- 1.06 Como consecuencia de esa asignación, el rubro específico de gastos de administración mostrado en el cuadro de resultados ha representado en el periodo analizado el 19% de los gastos de explotación totales.
- 1.07 El costo unitario de KWh vendido por el SNI por su parte, ha evolucionado como sigue:

<u>Año</u>	<u>Ventas de ener- gía (Gwh)</u>	<u>Indice</u>	<u>Gastos de Explotac.</u>			<u>Indice</u>	<u>Nivel</u>
			<u>\$/Kwh</u>	<u>US\$ 1/</u>	<u>Kwh</u>		<u>general</u> <u>precios</u>
1978	496.6	100	0.279	0.011	100	100	
1979	806.8	162	0.283	0.011	101	110	
1980	1.114.8	224	0.263	0.010	94	124	

- 1.08 Como puede apreciarse, los costos medios de explotación del SNI han mantenido una tendencia satisfactoria, especialmente cuando se los compara con la del índice general de precios, que creció en un 24% en igual periodo.

## 2. Estados de Origen y Aplicación de Recursos

- 1.09 Estos estados, que se incluyen en la página siguiente, han sido preparados para el periodo 1978-1980. De su análisis surge que la generación interna de recursos ha sido extremadamente baja y no ha cubierto siquiera el servicio de la deuda, razón que asimismo impidiera la utilización de recursos internos para el programa de expansión. La causa fundamental ha sido un nivel tarifario muy deprimido, que ha obligado a la empresa a depender para su desenvolvimiento financiero de las regalías petroleras y los impuestos sobre la producción de petróleo (de cuya recaudación INECEL percibe el 2.83%) que, conjuntamente, han representado el 47% del total de recursos correspondiente al periodo cubierto por el análisis. La principal fuente de financiamiento han sido los préstamos, cuya magnitud relativa ha alcanzado al 48% de ese mismo total.
- 1.10 La utilización de fondos ha sido fundamentalmente hecha en el programa de construcción, en la capitalización de las empresas eléctricas y en la atención del servicio de la deuda, usos que absorbieron, en promedio, el 70%, 14% y 8% respectivamente del

---

1/ Tipo de cambio: \$25.00 = US\$1.00.



## INECCL

Estados de Origen y Aplicación de Fondos Consolidados Comparativos  
1978 - 1980  
(en miles de US\$) 1/

	1978		1979		1980		Total 197
	\$	%	\$	%	\$	%	\$
<b>ORIGEN DE FONDOS</b>							
<b>Fuentes Internas</b>							
Utilidad (Pérdida) antes de gastos financieros	(1.875)	(1)	(3.497)	(1)	818	-	(4.554)
Depreciación	3.399	2	5.480	2	5.746	2	14.625
Cargos que no constituyen desembolsos	1.166	-	811	-	-	-	1.977
Generación interna de fondos	<u>2.690</u>	<u>1</u>	<u>2.794</u>	<u>1</u>	<u>6.564</u>	<u>2</u>	<u>12.048</u>
<b>Fuentes externas</b>							
Regalías	78.685	37	133.821	53	126.669	41	339.175
Impuestos varios	7.763	4	7.518	3	8.511	3	23.792
Donaciones	2.374	1	-	-	125	-	2.499
Préstamos	116.125	55	87.933	35	169.319	54	373.377
Otras Fuentes externas	3.689	2	19.098	8	-	-	22.787
Total Fuentes Externas	<u>208.636</u>	<u>99</u>	<u>248.370</u>	<u>99</u>	<u>304.624</u>	<u>98</u>	<u>761.630</u>
Total Origen de Fondos	<u>211.326</u>	<u>100</u>	<u>251.164</u>	<u>100</u>	<u>311.188</u>	<u>100</u>	<u>773.678</u>
	=====	===	=====	===	=====	===	=====
<b>APLICACION DE FONDOS</b>							
Inversiones en obras	151.803	72	167.283	67	225.973	73	545.059
Servicio de la deuda							
Amortizaciones	8.086	4	20.557	8	12.258	4	40.901
Gastos financieros	2.188	1	7.709	3	6.149	2	16.046
Total servicio de la deuda	<u>10.274</u>	<u>5</u>	<u>28.266</u>	<u>11</u>	<u>18.407</u>	<u>6</u>	<u>56.947</u>
Inversiones en compañías eléctricas	20.811	10	37.123	15	49.433	16	107.367
Estudios	7.857	4	5.870	2	4.012	1	17.739
Aplicaciones diversas	15.847	7	5.356	2	3.093	1	24.296
Total, Aplicación de Fondos	<u>206.592</u>	<u>98</u>	<u>243.898</u>	<u>97</u>	<u>300.918</u>	<u>97</u>	<u>751.408</u>
	=====	===	=====	===	=====	===	=====
<b>Variación en capital de trabajo</b>							
Anual	4.734	2	7.266	3	10.270	3	22.270
Acumulado	4.734		12.000		22.270		

1/ Tipo de cambio \$ 25.00 = US\$ 1.00

total de recursos captados. Como resultado de los flujos financieros del período, se verificó un incremento en el capital de trabajo por el equivalente de aproximadamente US\$22 millones.

### 3. Indices Económico-financieros

1.11 Para concluir el análisis financiero histórico de INECEL, se presentan seguidamente los principales indicadores de gestión económico-financiera para el período 1978-1980.

	<u>1978</u>	<u>1979</u>	<u>1980</u>
1. Liquidez	1.79	1.85	1.50
2. Cobertura del servicio de la deuda (veces)	Neg.	Neg.	Neg.
3. Indice de cobranzas (días)	184	172	-177
4. Endeudamiento	0.78	0.71	0.82
5. Rentabilidad sobre la inversión neta inmovilizada	Neg.	Neg.	Neg.
6. Rentabilidad sobre el patrimonio	Neg.	Neg.	Neg.

1.12 Si bien la liquidez medida por la relación de activos con pasivos corrientes muestra un nivel aceptable, la posición financiera general de la empresa examinada conjuntamente con los índices de cobertura del servicio de la deuda y período medio de cobranzas resulta menos favorable. Efectivamente, la generación interna de recursos ha resultado insuficiente para cubrir el servicio de la deuda a largo plazo, aún cuando INECEL ha podido cumplir con sus obligaciones financieras en el período analizado, principalmente mediante la utilización de los recursos provenientes de su participación en el producido de las regalías petroleras. Adicionalmente, y no obstante la relativa estabilización del plazo medio de cobros de las cuentas a cobrar por ventas de energía que se observa en los tres últimos años, los valores registrados por el índice respectivo resultan elevados tomando en consideración las condiciones de facturación y pago del suministro eléctrico acordadas con las empresas del sector. Por último, y conforme lo mencionado en el párrafo 5.28 del Informe de Proyecto, pudiera eventualmente producirse un deterioro en la cobranza como consecuencia de la distinta modalidad de aplicación de los aumentos tarifarios adoptada por INECEL y las empresas eléctricas.

1.13 El índice de endeudamiento registra valores satisfactorios, indicativos de una utilización relativamente reducida del crédito, no obstante el incremento en la utilización de recursos de terceros verificado durante el curso del año 1980.

1.14 Los indicadores de rentabilidad de las operaciones del Instituto calculados con referencia a la inversión inmovilizada y al patrimonio neto, muestran un comportamiento insatisfactorio, producto básicamente de la insuficiencia de las tarifas aplicadas hasta mediados del año 1981, lo cual ha limitado severamente la capacidad de la empresa para producir utilidades y generar recursos propios.

INECEL - Deuda consolidada  
al 31 de diciembre de 1980  
(en miles de US\$) 1/

	<u>Monto</u>
<u>I. Acreedores en moneda extranjera</u>	
Banco Interamericano de Desarrollo	79.859
Gobierno Británico	20.289
Eximbank	32.431
AID	4.765
Gobierno Alemán	10.419
City Bank	13.333
Mitsubishi	28.283
Banco de América	36.156
OECF	37.747
Interunion Bank	20.000
Impregilo	16.700
GIE	43.326
Lloyds Bank	20.000
Swiss Bank	10.654
Diversos	2.752
Subtotal	<u>376.714</u>
<u>II. Acreedores en moneda nacional</u>	
IESS	23.823
Gobierno del Ecuador	60.928
Diversos	<u>1.519</u>
Subtotal	<u>86.270</u>
Total general	<u>462.984</u> =====

1/ Tipo de cambio \$25.00 = US\$1.00

## COMPOSICION DEL CAPITAL DE LAS EMPRESAS ELECTRICAS DEL

ECUADOR A DICIEMBRE - 1980

(Millones de sucres)

TEMA Y EMPRESA	AÑO CONSTITUCION	CAPITAL SUSCRITO TOTAL	CAPITAL PAGADO TOTAL	ACTIVOS TOTALES EMPRESA	COMPOSICION DEL :		NUMERO DE ABONADOS
					CAPITAL %		
					INECEL	MUNICIPIOS Y OTROS	
<hr/>							
EMA NORTE							
Regional del Norte S.A.	1.975	394.1	310.8	506.6	90.1	9.2	43.500
EMA PICHINCHA							
Quito S.A	1.955	788.0	589.9	2.568.4	54.5	44.8	173.429
R. Santo Domingo	1.963	103.6	131.9	157.7	81.0	9.0	12.527
EMA CENTRO NORTE							
Latacunga	1.975	-	-	40.6	54.4	-	9.776
Ambato S.A.	1.959	166.4	193	289.7	-	34.9	41.786
Riobamba S.A.	1.963	49.0	263	259.1	67.3	10.2	21.222
Bolívar S.A.	1.966	128.1	130.2	101.5	93.1	8.0	7.281
EMA CENTRO SUR							
Cuenca S.A.	1.965	67.9	468.5	785.0	88.3	12.3	44.437
Azogues S.A.	1.972	32.8	57.0	37.3	76.2	16.9	6.559
EMA SUR							
Regional del Sur	1.973	262.1	289.1	289.7	93.2	6.9	22.645

EMPRESA	AÑO CONSTITUCION	CAPITAL SUSCRITO TOTAL	CAPITAL PAGADO TOTAL (1)	ACTIVOS TOTALES EMPRESA	COMPOSICION DEL CAPITAL % INECEL MUNICIPIOS Y OTROS		NUMERO DE ABONADOS
TEMA ESMERALDAS							
Esmeraldas S.A.	1.963	112.2	229.5	256.3	92.7	5.9	13.329
TEMA MANABI							
Regional de Manabí	1.976	491.5	564.3	771.7	86.8	12.4	48.190
TEMA GUAYAS LOS RIOS							
LEC (2)	-	-	-	1.735.7	-	-	178.924
Milagro S.A.	1.970	274.8	330.2	266.7	94.1	10.7	17.996
Los Ríos S.A.	1.970	295.9	251.0	224.6	98.7	8.1	11.691
Santa Elena	1.966	305.0	-	377.7	98.4	1.6	19.619
GURI	1.980	-	245.6	-	-	-	29.596
TEMA EL ORO							
El Oro S.A.	1.964	267.2	284.3	499.1	92.2	10.0	27.229
S	-	3.738.6	4.338.3		84.0		729.736

ye capital pagado como aportes para futuras capitalizaciones

ec es una Empresa con el 100% del Capital Extranjero. Datos del Balance VI-78

ocluye a Emelec

Balances de E. Eléctricas

Informe de Directorio de INECCEL

Constitución Empresas Eléctricas

Valores tomados del Balance de INECCEL 1980

COMPARACION CONSUMO MEDIO DE ENERGIA

as	Empresas	Subproyecto	No. de Circuitos	Kwh por Abonado		% consumo abonado a proyecto respecto promedio 1980
				Consumo promedio anual abonado proyecto	Consumo promedio abonado 1980	
cha	E.E. Quito S.A.	Quito	6	876	4.782	18.3
	Coop. ER Sto. Domingo Lt.	Sto. Domingo	4	1.068	2.171	49.2
ldas	E.E. Esmeraldas S.A.	Esmeraldas	7	732	2.881	28.4
	Sist. E. Reg. Manabí	Manabí	7	984	2.483	39.6
	E.E. Reg. El Oro S.A.	El Oro	9	792	2.410	32.9
Norte	Sist. Latacunga S.A.	Cotopaxi	6	648	2.850	22.7
"	Sist. Ambato Pastaza S.A.	Tungurahda	6	420	1.449	29.0
"	Sist. Riobamba S.A.	Chimborazo	6	420	3.413	12.3
"	E.E. Bolívar S.A.	Bolívar	5	888	1.052	84.4
	E.E. Norte S.A.	Carchi	1			
		Imbabura	4	828	1.153	71.8
Sur	E.E. Azogues S.A.	Cañar	3	432	756	57.1
"	E.E. Centro Sur S.A.	Azuay	6	432	2.936	14.7
Los Ríos	E.E. Los Ríos	Los Ríos	12	804	2.092	38.4
"	E.E. Península St. Elena	Guayas	3	852	1.771	48.1
"	INECEL Guayas (Durán-Balzar)	Guayas	12	756	2.814	30.4
"	E.E. Milagro S.A. (Milagro-Naranjal)	Guayas	5	756	2.447	30.9
	E.E. Regional del Sur S.A.	Loja	7	756	1.321	57.0
			109		2.638	
			===		=====	

Bases para la elaboración de proyecciones  
financieras de los circuitos

Las proyecciones financieras de los circuitos y empresas eléctricas fueron elaborados sobre la base de las siguientes premisas:

1. Costo de la electricidad

El costo de la electricidad es el factor que tiene mayor ponderación en el costo de la operación de las empresas eléctricas. La información existente permite estimar que el costo de la energía utilizada en el proyecto variará entre un mínimo del equivalente de US\$0,050/Kwh y un máximo del equivalente de US\$0,093/Kwh. Las pérdidas de transmisión de energía de las empresas han sido estimadas en 15%.

Para el cálculo de la tarifa estimada para los circuitos del proyecto se ha tomado un costo de US\$0.07 Kwh.

2. Operación y mantención

Se ha estimado en un 3% del valor de la inversión incluyendo escalamiento y gastos financieros.

3. Administración y comercialización

Se ha considerado un costo del equivalente de US\$7 por abonado.

4. Depreciación

Se ha considerado una vida útil de 30 años para las instalaciones.

5. Utilidad

Se ha considerado una rentabilidad de 9.5% anual sobre el valor de las instalaciones.

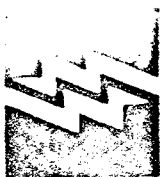
6. Número de abonados

Se ha considerado que el número de abonados crecerá a razón de 3% por año.

7. Consumo promedio de energía

Se ha considerado que el consumo promedio de electricidad por abonado crecerá sobre la base de distintos porcentajes en cada zona que oscilan alrededor de 3% por año.





**INECEL**

PROGRAMA NACIONAL DE ELECTRIFICACION RURAL  
REGLAMENTO OPERATIVO DEL FONDO ESPECIAL PARA CONEXIONES  
DE SERVICIO A CONSUMIDORES DE BAJOS INGRESOS

El Directorio del Instituto Ecuatoriano de Electrificación,  
INECEL.

CONSIDERANDO:

Que, mediante Decreto Supremo N° 459-B de Junio 3 de 1.975 pu-  
blicado en el Registro Oficial N° 831 del 24 del mismo -  
mes y año, se crea el Fondo Especial para Conexiones de  
Servicio a Consumidores de Bajos Ingresos;

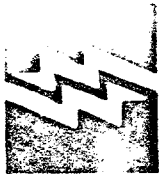
Que, el Art.11 del antes mencionado Decreto faculta al Directo-  
rio de INECEL, la expedición del Reglamento Especial pa-  
ra la administración y operación del Fondo; y en uso de  
sus atribuciones.

RESUELVE:

Expedir el siguiente Reglamento Operativo del Fondo Especial  
para Conexiones de Servicio a Consumidores de Bajos Ingresos.

1º Serán considerados como "Consumidores de Bajos Ingresos"  
aquellos cuya renta bruta anual no supere los quince sala-  
rios mínimos vitales. (Nota 1).

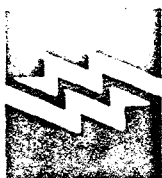
2º El Fondo Especial para conexiones de servicio a Consumido



**INECEL**

res de Bajos Ingresos será destinado al financiamiento de redes de distribución secundaria y acometidas de servicio eléctrico en zonas rurales y urbanas marginales; inclusive las instalaciones de alumbrado público en esas mismas zonas.

- 3º El Fondo será utilizado exclusivamente para otorgar préstamos a las Empresas Eléctricas, los mismos que serán destinados exclusivamente a financiar las obras señaladas en el artículo anterior.
- 4º Todos los recursos que maneje el Fondo se Depositarán en el Banco Central del Ecuador en una cuenta específica que se denominará "Fondo Especial para Conexiones de Servicio a Consumidores de Bajos Ingresos".
- 5º De conformidad con lo dispuesto en el Art. 11 del Decreto Supremo N° 459-B, la administración de este fondo estará a cargo de INECEL a través de su Gerente General, quien podrá resolver operaciones que no exceden de S/. 1'000.000. En los demás casos la resolución competirá al Directorio, por intermedio de una Comisión Ejecutiva conformada por miembros Directores que representan al Consejo Nacional de Desarrollo CONADE, a las Empresas Eléctricas ante el Directorio de INECEL, a los Colegios de Ingenieros Eléctricos del país; y, por el Gerente General de este Instituto o su Delegado.
- 6º Los recursos del Fondo que no se encuentran utilizados en Préstamos a las Empresas Eléctricas, podrán ser invertidos en títulos de crédito o valores fácilmente converti -

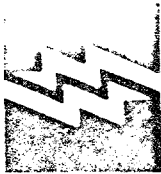


**INECEL**

bles, en depósitos a plazo o en cualquier otra inversión recuperable a la par, plenamente garantizada, hasta la fe cha de su utilización.

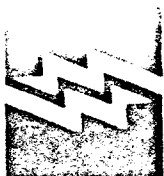
- 7º El monto del crédito a concederse a una misma Empresa se fijará de acuerdo a las necesidades de cada una de ellas, y en ningún caso podrá considerarse como aportado por el Instituto en calidad de acciones.
- 8º Los criterios y prioridades para el uso de estos Fondos, serán señaladas por el Gerente de INECEL, considerando - las recomendaciones de los Directores Ejecutivos de UNE - PER y Finanzas.
- 9º Los préstamos serán concedidos a las Empresas Eléctricas bajo las siguientes condiciones:
  - Plazo: Hasta 10 años
  - Interés: 6% anual
  - Pagos semestrales, siendo el primero pagadero a seis me ses luego de que el proyecto financiado con estos fon - dos haya sido puesto en servicio.

Para garantizar la operación, la Empresa Eléctrica beneficiaria firmará pagarés a nombre de INECEL. Caso de que la Empresa no cumpla con el pago de estos pagarés, INECEL podrá demandar su pago por la vía coactiva, o descontar esos valores de los aportes que INECEL tenga que realizar en la Empresa.



**INECEL**

- 10º El contrato de préstamo deberá contener principalmente lo siguiente:
- a) Nombre del prestatario, dirección y autorización legal para contratar.
  - b) Forma de pago de la amortización.
  - c) Tasa de intereses y forma en que se calcularán los mismos.
  - d) Lugar en que se efectuarán los pagos.
  - e) Forma en que se harán los desembolsos.
  - f) Procedimientos a seguir a caso de incumplimiento de alguna de las cláusulas del contrato.
  - g) Garantías que se consideren necesarias.
- 11º Los recursos del Fondo podrán ser utilizados únicamente en la ejecución de los proyectos prioritarios considerados en este Reglamento, no pudiendo destinarse estos re cursos a gastos administrativos, pago de deudas, ni cual quier otro fin que desvirtúe la naturaleza del Fondo.
- 12º La Empresa interesada en obtener el préstamo del Fondo Especial para Conexiones de servicio a Consumidores de Bajos Ingresos, deberá presentar a INECEL una solicitud de préstamo, a la que adjuntará toda la información refe rente al proyecto que se propone realizar.
- 13º La Empresa Eléctrica, con cargo a los Recursos provenientes de este fondo, podrá conceder préstamos a los consu midores de Bajos Ingresos, de las zonas rurales y margi-



**INECEL**

nales de las ciudades, con el fin de ayudarlos a financiar el costo de las acometidas, que excedan los 30 mts. y sus instalaciones interiores.

- 14° El financiamiento por parte de las Empresas Eléctricas a los consumidores de Bajos Ingresos se hará en las condiciones siguientes:
- Plazo: Hasta 36 meses
  - Interés 6 %
  - Pagos mensuales, facturados junto al importe por consumo de energía eléctrica.
- 15° La Unidad Ejecutora del Programa de Electrificación Rural UNEPER, supervisará el avance y la calidad de los proyectos financiados en este fondo, de acuerdo con las condiciones estipuladas en el contrato de préstamo, informando con la misma periodicidad al Directorio de INECCEL, por intermedio del Gerente General.
- 16° El diferencial de interés del préstamo del Kreditanstalt-Bank así como cualquier otro fondo que se adquiriera en el futuro para esta finalidad, serán parte integrante del Fondo Especial para Conexiones de Servicio a Consumidores de Bajos Ingresos.
- 17° El Directorio de INECCEL podrá modificar o ampliar el presente Reglamento de conformidad con las necesidades de operación del Fondo.



**INECEL**

APENDICE 21  
6 de 6

APROBADO en sesión de Directorio del 7 de Abril de 1980,  
Resolución N° 092.

NOTA 1: El salario mínimo vital a que se refiere este -  
artículo, es el vigente para los trabajadores a  
grícolas.

MODIFICADO en Sesión de Directorio del 22 de Julio de 1980,  
Resolución N° 0184

I. PROYECCION DE LA GENERACION DE FONDOS PARA EL PROYECTO

1.01 A continuación se incluye un resumen de las fuentes del financiamiento estimadas de la contrapartida local para el proyecto de electrificación rural durante el período de ejecución.

<u>Fuentes y Recursos</u> (en miles de US\$)					
<u>Aportes</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>Total</u>
Decreto No.306	11.501	-	-	-	11.501
Decreto No.459-B	1.969	1.458	1.348	1.074	5.849
Acuerdo Ministerial No.051	<u>6.533</u>	<u>8.750</u>	<u>10.806</u>	<u>14.152</u>	<u>40.212</u>
Total	<u>20.003</u>	<u>10.208</u>	<u>12.154</u>	<u>15.226</u>	<u>57.562</u>

1.02 Las estimaciones anteriores fueron elaboradas sobre la base de las tarifas medias a nivel nacional, previstas en el Plan Maestro de Electrificación, elaborado por INECEL y que se detallan a continuación:

<u>Año</u>	<u>Tarifa Nacional Media (S/kwh)</u>
1980	1.09
1981	1.86
1982	2.24
1983	2.74
1984	3.24
1985	3.64

1. Decreto No 306

1.03 A continuación se incluye el detalle por empresa eléctrica de los valores estimados correspondientes al Decreto No. 306, durante 1982:

(en S/ x 1000)					
<u>Año</u>	<u>E.E. Quito</u>	<u>Emelec Inc.</u>	<u>Resto del País</u>	<u>Total</u>	<u>US\$</u>
1982	58.647	135.240	95.659	289.546	11.501

2. Decreto No. 459-B

1.04 A continuación se incluye la generación de fondos estimada de la aplicación de este decreto en los créditos que se detallan en el período de ejecución del proyecto.

(en S/ x 1000)					
<u>Año</u>	<u>BID-411/SF-EC</u>	<u>Kreditanstalt</u>	<u>Reino Unido</u>	<u>Total</u>	<u>US\$</u>
1982	23.925	15.028	10.287	49.240	1.969
1983	21.725	5.009	9.739	36.473	1.458
1984	19.525	5.009	9.190	33.724	1.348
1985	13.209	5.009	8.641	26.859	<u>1.074</u>
					<u>5.849</u>

3. Acuerdo Ministerial No.051

- 1.05 A continuación se incluye el detalle del cálculo de la generación estimada de recursos derivada de la aplicación de este decreto durante el período de ejecución del proyecto:

(en S/ x 1000)						
<u>Año</u>	<u>Facturada</u> <u>MWh</u>	<u>Media</u>	<u>Totales</u>	<u>10%</u>	<u>20% elect.</u> <u>rural</u>	<u>US\$</u>
1982	3.646.000	2.24	8.167.000	816.700	163.340	6.533
1983	3.992.000	2.74	10.938.080	1.093.808	218.762	8.750
1984	4.169.000	3.24	13.507.560	1.350.756	270.151	10.806
1985	4.860.000	3.64	17.690.400	1.769.040	353.080	<u>14.123</u>
						<u>40.212</u>



CONSUMO MENSUAL POR ABONADO (Kwh/Abonado/Mes)

Estadísticas de las Empresas					Análisis Económico			
SUBPROYECTO	Residencial				1	8	15	30
	Residencial	+Comercial	+Industrial	+Otros				
Año								
Residencial	+Comercial	+Industrial	+Otros	1	8	15	30	
COSTA								
ANTO DOMINGO	127,8	158,0	209,5	241,2	89	111	147	241
SMERALDAS	86,9	107,6	-	138,0	61	75	97	138
ANABI	117,0	149,8	-	198,6	82	105	139	199
JAYAS-MILAGRO	72,4	91,9	207,8	220,0	51	64	145	220
ERGURI	90,5	113,0	121,0	138,1	63	79	85	138
ANTA ELENA	90,2	95,5	97,2	97,8	63	67	68	98
OS RIOS	95,3	114,1	157,9	181,5	67	80	110	181
L ORO	94,2	116,7	133,4	-	66	82	93	133
SIERRA								
ARCHI	37,7	42,3	63,4	64,1	30	33	51	64,1
BABURA	37,7	42,3	63,4	64,1	30	33	51	64,1
ITO	104,7	111,8	-	125,8	73	78	88	125,8
OTOPAXI	67,4	68,5	-	186,2	54	55	112	145,0
NGURAHUA	44,0	49,0	-	67,7	35	39	54	67,7
IMBORAZO	44,0	60,4	-	73,2	35	48	59	73,2
OLIVAR	35,0	40,2	41,2	42,4	28	32	33	42,4
NAR	44,4	46,7	-	74,5	36	37	60	74,5
UAY	44,4	46,7	-	74,5	36	37	60	74,5
JA	43,8	56,9	82,4	99,8	35	46	66	80

Análisis de Sensibilidad

Para analizar la sensibilidad de la tasa interna de retorno económico (TIR) a cambios en las variables utilizadas en el análisis costo-beneficio se seleccionaron algunos circuitos procurando aquellos que tuvieran una tasa interna diferente y abarcarán zonas de la Sierra y de la Costa. Los resultados logrados son los siguientes:

CIRCUITO	TIR	Costo Energía Insumida (US\$/KWh)		Inversión		Valor Energía de Sustitución (para el país)		Disponibilidad a pagar (costo energía para el usuario)	
								-20%	+20%
	%	0,05	0,07	-20%	+20%	-20%	+20%	-20%	+20%
S 8308 Latacunga	12,9	13,6	12,1	17,5	11,6	12,1	13,8	11,4	14,3
S 8327 Cebadas	11,7	12,4	10,9	14,2	9,8	10,5	12,8	10,4	12,9
C 8804 Laurel	18,0	19,1	16,8	21,4	15,5	17,0	18,9	15,7	20,1
C 8905 Platanillos	10,1	11,0	9,2	12,5	8,4	9,5	10,8	8,5	11,6
S 8302 Saquisilí	16,1	17,0	15,1						
C 8602 La Lucha	11,7	12,6	10,8						
C 8832 Playas	11,7	12,5	10,8						
C 8912 Piñas	17,1	18,3	15,9						

S: Sierra

C: Costa

DISTRIBUCION DE LOS BENEFICIOS DEL PROGRAMA  
(Valor presente US\$ x 103)

	Flujo Económico	Bajos Ingresos	Altos Ingresos	No Determinados	Trabajadores No calificados	Sector Público (1)
<u>OS</u>						
ción de Energía	13.124	6.534	3.047	-	-	3.543
e del Consumidor	21.652	14.767	6.885	-	-	-
al Consumidor Final <sup>2/</sup>	15.346	-	-	-	-	15.346
/						
nes	(21.269)	(885)	(368)	-	1.932	(21.948)
n y Mantenimiento	(6.342)	-	-	-	-	(6.342)
lización y Admi-						
ón	(1.949)	-	-	-	-	(1.949)
L	<u>20.562</u>	<u>20.416</u>	<u>9.564</u>	-	<u>1.932</u>	<u>(11.350)</u>

los Sectores de Bajos Ingresos =  $\frac{20\,416 + 1\,932}{20\,416 + 9\,564 + 1\,932} = 70\%$

esas eléctricas son propiedad del gobierno y por lo tanto se las considera "Sector Público".  
 icio para el consumidor de la electricidad correspondiente al monto de la tarifa por él pagada no  
 ues se anula el beneficio con el costo.  
 de la energía insumida por el programa (US\$15 126 923) no figura ya que la cobra y paga el sector