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DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
Washington, D.C. 20523

CAPITAL ASSISTANCE PAPER

**Proposal and Recommendations
For the Review of the
Development Loan Committee**

BOLIVIA - RURAL ELECTRIFICATION

AID-DLC/P-1070

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PART ONE: SUMMARY AND RECOMMENDATIONS

1. Borrower

The Government of Bolivia (GOB) will be the borrower. The executing agency will be the Empresa Nacional de Electricidad S.A. (ENDE), an autonomous public corporation created for the purpose of developing and implementing a national plan to electrify Bolivia.

2. Amount and Terms of the Loan

Up to $10.8 million, repayable over 40 years including a grace period of ten years on principal and with interest at 2% per annum during the grace period and 3% per annum thereafter. An extimated 20% to 40% of the A.I.D. loan will be converted to Bolivian pesos to meet projected local currency requirements.

3. Purpose

The purpose of the loan is to improve the economic and social conditions of the inhabitants of the rural areas adjacent to two major population centers of Bolivia by providing them with electrical transmission, distribution and connection services on a self supporting basis.

4. Project Description

The project to be supported by A.I.D. loan financing consists of the construction of electricial transmission, distribution and connection facilities in rural areas adjacent to Cochabamba and Santa Cruz.

Also included in the project are the construction of related facilities and the purchase of auxiliary equipment, as well as the provision of necessary consulting engineering services and technical assistance.

Total project cost is $12.0 million, with $10.8 million to be provided by the proposed loan. The project will be administered by ENDE, who will contract for necessary consulting engineering and technical assistance services.

Loan funds will be passed on at the same concessional terms as the A.I.D. loan to the respective sub-borrowing entities for foreign exchange and local currency costs of the individual sub-projects listed below. (See Section II, p. 33 for a discussion of sub-loan terms.)

Exchange rate: US$1.00 = $b 20.00 unless otherwise indicated.

a. Santa Cruz Area. The sub-borrower will be the Cooperativa Rural de Electrificación (CRE), a cooperative with exclusive responsibility for electrical distribution in the Santa Cruz area. The $7.5 million sub-project with $6.7 million provided by the proposed loan calls for the extension of a 69 KV transmission line, expansion of CRE's existing distribution lines into previously unserved areas and for providing corresponding improvements to the distribution system as a whole. The new distribution facilities will have a capacity to serve an expected 14,000 residential, 11,000 farm, 900 small commercial and 1,700 large commercial - industrial consumers within ten years.

1,188 kilometers of distribution lines, 2,250 street light installations and 14,000 house connections as well as 50 kilometers of 69 KV transmission line and 4 related step down substations are included. The sub-project will also finance headquarters and warehouse buildings for CRE, several vehicles, shop and office equipment and assorted lineman's tools.

b. Cochabamba Area. The sub-borrower will be Empresa de Luz y Fuerza Eléctrica Cochabamba, S.A. (ELFEC), a mixed coporation which is responsible for electrical distribution in the Cochabamba area. The $4.5 million sub-project with $4.1 million provided by the proposed loan, calls for the expansion and improvement of ELFEC's current rural distribution system. This will provide ELFEC with the capacity to serve an expected 20,000 residential, 13,400 farm and 400 small commercial consumers, as well as 215 large commercial-industrial consumers, 50 irrigation systems and 25 street lighting systems of the rural area type. 815 kilometers of distribution lines, 740 street light installations, 4,000 house connections and 2 step down sub-stations are included. The sub-project will also finance 4 vehicles, shop and office equipment, and assorted linemen tools.

The two sub-borrowers have their own qualified engineering and administrative staffs. These staffs will participate in project implementation. No loan funds will be used for their salaries or related expenses. It is proposed, however, that loan funding be provided for necessary consulting engineering services. In addition, loan financed technical assistance in engineering, management, administration and accounting will be required. Provision for such services has been included within the respective sub-loans.

5. Proposed use of Loan Funds and Financial Plan

a. It is estimated that 80% of the loan will be used for foreign exchange expenditures for materials, equipment and engineering services. Such procurement will be from A.I.D. Code 941 sources.

U.S. suppliers are competitive in the type of equipment needed for the project. It is probable that most imports financed by the loan will be from U.S. suppliers with some smaller purchases from Argentine and Brazilian suppliers. It is anticipated that technical assistance will be procured from abroad.

b. It is estimated that 20% of the loan will be converted to Bolivian pesos to finance the local currency portion of the project. This will include purchases of locally produced materials (primarily poles), construction services, local expenditures for consultants and off-the-shelf purchases in accordance with A.I.D. procurement practices.

It should be noted, however, that a plant for the manufacture of electric cable has recently been opened in Cochabamba. Should its cable prove to meet specifications at a competitive price, the local currency expenditures of the loan could increase to 40% of the total.

The following tables show the project cost breakdown by components and area (Table I); by foreign exchange and local cost (Table II); and by source of financing (Table III).

TABLE I

PROJECT COST BREAKDOWN BY COMPONENT AND AREA
US$

Component	Cochabamba ELFEC	Santa Cruz CRE	T o t a l
A.I.D. LOAN			
1. Transmission		533,900	533,900
2. Substations	250,000	442,700	692,700
3. Distribution	2,842,670	4,073,190	6,915,860
4. Facilities and Equipment	215,500	406,000	621,500
5. Engineering	309,267	529,950	839,217
6. Contingency *	351,333	595,490	946,823
7. Technical Assistance	100,000	150,000	250,000
Sub-Total	4,068,770	6,731,230	10,800,000
LOCAL CONTRIBUTIONS*	453,367	769,161	1,222,528
T O T A L	4,522,137	7,500,391	12,022,528

* See Table II

TABLE II

PROJECT COST BREAKDOWN BY FOREIGN EXCHANGE AND LOCAL COSTS
US$

Component	Dollar Costs	Local Costs	Local Contribution	Total
Materials	6,352,083	648,144	267,500	7,267,727
Construction		1,142,233	200,000	1,342,233
Vehicles and Equipment	421,500	-	-	421,500
Buildings, Furniture and Land	50,000	150,000	-	200,000
Engineering	335,687	503,530	148,533	987,750
Contingency *	641,912	304,911	-	946,823
Technical Assistance	250,000	-	-	250,000
Project Administ. (ENDE Project Coordin. Expenses)	-	-	350,000	350,000
Interest during Construction	-	-	256,495	256,495
T O T A L	8,051,182	2,748,818	1,222,528	12,022,528

*a 10% contingency has been allowed for foreign exchange costs while 6% has been established for local currency expenditures.

TABLE III

PROJECT COST BREAKDOWN BY SOURCE OF FINANCING
US$

	A. I. D. L O A N				
	Foreign Exchange	Local Currency	AID Loan	Local Contribution	TOTAL
ELFEC	2,992,860	1,075,910	4,068,770	453,367	4,522,137
CRE	5,058,322	1,672,908	6,731,230	769,161	7,500,391
	8,051,182	2,748,818	10,800,000	1,222,528	12,022,528
Percent of Project Cost	67	23	90	10	100

6. Basis for the Amount of the Loan

The proposed $10.8 million amount of the loan is based upon the study published in October 1972 by NRECA engineer Gilbert Moon, entitled "Outline for Rural Electric Development in Bolivia". Moon's recommendations were subsequently modified or adopted in consultation with the GOB and the sub-borrower during intensive review in November and December, 1972.

7. Background

Although Bolivia has a great potential for hydroelectric generating capacity, the country has suffered from a chronic shortage of delivered energy and has the lowest per capita consumption of electricity in South America. The GOB, through ENDE, has developed short range (1971-1980), medium range (1981-1990) and long range (1991-2000) plans for national electrical energy development 1/. The international lending agencies, primarily the World Bank Group (IDA), the Interamerican Development Bank (IDB) and the Agency for International Development (A.I.D.) have coordinated their programs. IDA and IDB have emphasized the construction of large electrical generating facilities, primarily hydroelectric projects, with related transmission lines. A.I.D. has concentrated on assistance to cooperatives and rural areas, as well as on feasibility studies for projects which have subsequently been financed by other lenders.

The first A.I.D. loan for electrification (511-L-031, $4.75 million, authorized in June 1966) was made to ENDE with the participation of CRE, for the construction of electrical generating and related transmission and distribution facilities in the Santa Cruz area. This loan was well executed, and efficiencies resulted which allowed the purchase and installation of an additional generating unit within authorized loan funding. The benefits to the Santa Cruz area from the A.I.D. loan have been demonstrated by the rapid increase in new industries within the service area and by the rapid rise in electrical consumption. On the basis of the outstanding success of the Santa Cruz Loan and in view of the increasing demand for electrical services, the Mission has been working with the GOB since 1970 to develop this project. Contact with the GOB has been maintained through the Mission engineering staff and by A.I.D. financed NRECA specialists. The project originally contemplated the inclusion of other rural areas in addition to Cochabamba and Santa Cruz. The sub-projects in these other areas, however, were delayed for various reasons and have been postponed for future consideration.

1/ ENDE, Departamento de Planificación, Informe No. 12

The Santa Cruz area sub-project has been developed in coordination with a proposed IDA loan for generation and transmission facilities. The A.I.D. sub-project depends on the IDA project for power, while the IDA financed generating capacity relies on consumption provided by the A.I.D. financed distribution system.

The project as proposed conforms to GOB priorities expressed in the National Development Plan and at recent CIAP meetings.

As a matter of interest, the project will serve areas which are illustrative of the great geographic, ethnic and economic variety in Bolivia. The Santa Cruz area is in fertile, humid lowlands, where the population is largely Spanish speaking of mixed descent, and the economy is rapidly expanding with impetus from petroleum, large scale farming and light industry. The Cochabamba area is in a temperate valley, the population in the rural areas is composed largely of quechua speaking campesinos, and the economy is making steady progress, but at a slower rate.

8. Loan Implementation Plan

Representatives of the GOB and sub-borrower are anxious to proceed with this rural electrification project as soon as possible. GOB officials have stressed the high priority assigned this project during discussions at CIAP meetings and with A.I.D. officials in Washington. The project was specifically mentioned in President Banzer's recent statement of GOB economic policy.

In view of the GOB priority given this project, the excellent collaboration shown during intensive review, and considering that the project is well advanced, there is no reason to anticipate any unusual delay in implementation. An estimated implementation schedule from time of authorization would be as follows:

Negotiate and sign loan agreement	45 days
Meet conditions precedent to disbursement	3 months
Design phase	12 months
Receipt of bids and award of construction contracts	3 months
Construction	18 months

It should be noted that timely approval of the IDA loan for generating capacity in Santa Cruz will be required to meet the conditions precedent within this schedule. (See Section V).

Standard A.I.D. procurement and disbursement procedures will be followed. ENDE, the executing agency for the GOB, is familiar with A.I.D. requirements and has demonstrated capacity to rapidly and effectively implement A.I.D. financed projects. The present Bolivian government has also demonstrated its capacity to rapidly negotiate and implement A.I.D. loans. Therefore, no delays in disbursement or project implementation are anticipated.

The loan will be reviewed annually to: a) compare actual progress against the projected implementation plan; b) evaluate the socio-economic impact of the program in the areas to be affected using base line data established prior to implementation, and; c) establish that the IDA financed generating capacity in the Santa Cruz area is being constructed in a timely manner.

9. Other Sources of Funds

The Export-Import Bank, the World Bank Group (IDA) and the Interamerican Development Bank (IDB) have stated that they are not interested in financing this project.

10. Statutory Criteria

All statutory criteria have been met (See Annex I).

11. Priority of Project and Views of Country Team

The present Government of Bolivia has clearly demonstrated its interest in supporting and assisting the integration of the rural agricultural areas into the economic, political, and social life of the nation. They give high priority to this project, which will enable them to continue recent accomplishments in expansion of electrical services to rural agricultural areas.

As indicated in the FY 1973 country program submission which was approved at the AID/W review in August 1972, assistance to the agricultural and rural development sector has the highest priority within the proposed U.S. assistance program.

In addition to its significant economic and social impact, the proposed loan program will also complement other A.I.D. activities in the agricultural and rural development sector. This includes the 8.0 million dollar Agricultural Production and Marketing loan signed in November 1971, the 3.0 million dollar Rural Community Development loan signed in September 1972 and the continuing program of A.I.D. financed agricultural technical assistance by Utah State University.

12. Issue (See Section V for further discussion).

Project Reliance Upon Proposed IDA Loan

The World Bank Group (IDA) is in the final stages of processing two electrification loans to Bolivia; one for ENDE power generation in Santa Cruz and transmission in Cochabamba, and the other for expansion of services by Bolivian Power Corporation (BPC) in La Paz.

The CRE sub-project in Santa Cruz and the proposed IDA loan for generating capacity in Santa Cruz are mutually interdependent. The new generators provide the power to make the CRE sub-project viable, while the new CRE distribution system will provide much of the demand for the increased generating capacity.

No major problems are foreseen in IDA approval of their ENDE project for Santa Cruz and Cochabamba. However, the La Paz project requires a rate increase which has not been forthcoming and it may be delayed. IDA prefers to approve the ENDE and BPC projects simultaneously. This could delay the ENDE project. Therefore, authorization of the ENDE loan by IDA will be established as a condition precedent to disbursement of the AID Loan. A further condition precedent to disbursement for construction costs of the CRE sub-project will require satisfactory evidence that the IDA loan is being implemented in a timely manner with respect to power generation in Santa Cruz. Progress on this condition will be reviewed annually.

The ELFEC sub-project will not be directly affected by the IDA program.

13. Recommendations

On the basis of the conclusions of the Capital Assistance Committee that the project is technically, economically and financially justified, it is recommended that a loan to the Government of Bolivia for an amount not to exceed $10.8 million be authorized subject to the following terms and conditions:

a. Interest and Terms of Repayment. Borrower shall repay the Loan to A.I.D in United States dollars within forty (40) years from the date of the first disbursement under the Loan, including a grace period not to exceed ten (10) years. Borrower shall pay to A.I.D. in United States dollars on the outstanding balance of the loan interest at the rate of two percent (2%) per annum during the grace period and three percent (3%) per annum thereafter.

b. Other Terms and Conditions

(i) Goods, services (except for ocean shipping) and marine insurance financed under the loan shall have their source and origin in Bolivia and countries included in Code 941 of the A.I.D. Geographic Code Book. Marine insurance may be financed under the loan only if it is obtained on a competitive basis and any claims thereunder are payable in freely convertible currencies. Ocean shipping financed under the loan shall be procured in any country included in A.I.D. Geographic Code 941.

(ii) United States dollars utilized under the loan to finance local currency costs shall be made available pursuant to procedures satisfactory to A.I.D.

(iii) Prior to any disbursement or the issuance in any commitment documents under the loan, AID shall have received and reviewed, in form and substance satisfactory to AID, evidence that the rates in effect in the ELFEC system are adequate to provide a return sufficient to cover operating costs, maintenance, administration, taxes, assessments, depreciation and a positive rate of return on the rate base.

(iv) Prior to any disbursement for construction costs under the loan, AID shall have established the information base and methodology necessary for adequately assessing physical progress and related socio-economic benefits or the respective sub-projects.

(v) The loan shall be subject to such other terms and conditions as AID may deem advisable.

COMPOSITION OF THE CAPITAL ASSISTANCE COMMITTEE:

Ronald G. Russell	- Capital Resources Development Officer, USAID/B
Fred Alvarez	- General Engineering Officer, USAID/B
Hasan A. Hasan	- Deputy General Engineering Officer, USAID/B
Gilbert Moon	- NRECA Rural Electrification Specialist
Randolph Mye	- Program Economist, USAID/B
Bruce L. Eckersley	- Financial Analyst, USAID/B
Juan Cariaga	- Loan Officer, USAID/B
Luis Montero	- Accountant, USAID/B
Fernando Torres	- Local Chief Accountant, USAID/B
Chris Schultz	- Electrical Engineer, AID/W
Michael Demetre	- Economist, AID/W
Norman Williams	- Legal Advisor, AID/W

Drafted by: All of the above contributed to the drafting of the CAP.
Coordinator; Ronald G. Russell

PART TWO: PROJECT

SECTION I. Nature of the Project

A. Project Description

1. Purpose: The purpose of the project is:

(a) to improve the economic and social conditions of the rural population in the areas to be served by providing them with electrical transmission, distribution and connection services on a self-supporting basis; and by so doing

(b) to encourage the increased participation of the rural population in the development process.

2. Strategy and Focus of the Project

This project continues the recent accomplishments in electrifying rural areas of Bolivia through the construction of electrical distribution facilities to expand electric service to rural areas adjacent to the two of the three largest population centers of Bolivia. This electrical service will be provided by transmission lines and substations needed to connect existing sources of power to new load centers, improvements to existing distribution systems, related technical assistance and consulting engineering services.

The GOB, through ENDE, has developed short range (1971-1980), medium range (1981-1990) and long range (1991-2000) plans for national electrical energy development. 1/ The international lending agencies, primarily the World Bank Group (IDA), the Interamerican Development Bank (IDB) and the Agency for International Development (AID) have coordinated their programs to be mutually complementary within the overall development framework. AID has tended to support projects such as rural electrification, where the economic rate of return is lower, but where the social benefits may be equal or greater than in more conventional projects. This project is the logical next step in the GOB/ENDE electrification plan. It complements existing or soon to be constructed generating capacity.

With the planned expansion of electric service it is expected that 63,000 additional rural residential and small commercial users will be receiving electric service by 1985, the 10th year of operation of the new facilities. These 63,000 rural consumers plus an additional 77,000 urban consumers will be located in areas totalling approximately 20,000 square kilometers. The systems will also be designed to have capacity to serve industrial and large commercial loads which can be expected to develop and have combined loads of 165,000 MWH/yr. Irrigation loads totalling 25,000 MWH/yr. have also been provided for.

1/ ENDE, Departamento de Planificación, Informe No. 12.

The project is located in two separate areas in which the electric facilities are operated independently of each other.

A map showing the location of each sub-project and their respective service areas is included in Annex III.

3. Major Components of the Project

The project will electrify the rural areas in the vicinities of the cities of Cochabamba and Santa Cruz. The major components of the project and their implementation are the following:

a. Cochabamba (ELFEC)

The Cochabamba sub-project consists of expanding the ELFEC system that now serves the city of Cochabamba to serve the rural area in the vicinity of that city. The sub-project consists primarily of the construction of sub-stations, a distribution system and consumer connections.

b. Santa Cruz (CRE)

In Santa Cruz, CRE proposes to expand its system to serve the rural area in the vicinity of that city. Major components of the sub-project consist of the construction of a transmission line, substations, distribution system, consumer connections and the construction of office and warehouse buildings.

Both sub-projects will be provided with necessary tools and equipment purchased with loan funds.

c. Empresa Nacional de Electrificación (ENDE)

ENDE will be the executing agency for this project and will be responsible to the Government of Bolivia for its implementation. Included will be the processing of sub-loans, contracting engineering and construction services, procurement of materials, approval of disbursements, coordination of all project documentation and reports, and the maintenance of liaison with USAID.

d. Technical Assistance and Consulting Services

Technical assistance and consulting engineering services will be required in the administration and implementation of this project. The consulting engineering services will be in connection with the design of the individual systems, preparation of documents for procurement of materials and equipment and construction services, awarding of contracts and supervision of construction. The technical assistance will be in the nature of assistance to the borrower in the coordination and monitoring of sub-projects implementation and in the improvement of the management, administration and accounting of ELFEC and CRE.

4. Basis for the Size of the Loan

The project is based on the feasibility report prepared by NRECA Rural Electrification Specialist Gilbert Moon in October, 1972. Moon's report, Outline for Rural Electric Development Bolivia, was developed from information furnished by the participating organizations.

An initial intensive review request (IRR) in the amount of $2.0 million was approved by AID/W in August, 1970. The project as proposed at that time included the Sucre, Potosi, Tarija and La Paz areas as well as Cochabamba and Santa Cruz. Progress was slow until the present GOB took office in August, 1971. AID funded NRECA technicians and AID/W engineers, as well as Mission staff, continued to work with the GOB on project preparation. By the time Moon's report was issued, the project had increased in amount and was concentrated on the areas of La Paz, Cochabamba and Santa Cruz. This reflected increased demand for electrical service in the areas to be served, growth in generating capacity in Bolivia, and the relative state of development of the proposed sub-projects. Moon's report recommended an ambitious project costing $16.8 million. The proposal was reduced to what the GOB believed were more manageable proportions and an IRR for a $12.0 million loan was approved by AID/W in November 1972. The decision was made during the intensive review to postpone the La Paz area sub-project for a possible subsequent electrification project, and to concentrate on Cochabamba and Santa Cruz. The result is a project costing $12,022,528, with AID financing $10,300,000 of that amount.

B. Project Background

1. History of Rural Electrification in Bolivia

Rural electrification first took root in Bolivia as an extension of municipal electrification systems in the major population centers. Cochabamba started a municipal system in 1908 and the city of La Paz followed in 1909, but both were essentially urban oriented systems and the only rural beneficiaries were those located at the fringes of these cities.

Another activity that brought a rural electrification system of sorts into the country was the intensive mining operations that flourished during the following decades. Companies requiring energy for their mining operations installed and operated isolated power plants in their areas, and extended service from these plants to their employees and other villagers living nearby. This was especially true in the Altiplano area and in Potosí.

This was essentially the state of rural electrification in the country for a half centry, although the aforementioned elements of rural electrification were supplemented with small diesel operated generators in places. Rural electrification, however, remained the province of the private sector with little or no Government interest or support. Early in the 1960's, the GOB took note of rural electrification in its ten year development plan, and began to channel limited encouragement and support to fledging cooperatives all over the country. The first and largest cooperative was established in the city of Santa Cruz in 1962, and combined several small operations in the area. As a result of the GOB's interest, the Bolivian Power Company in La Paz expanded its services into the outlying areas only in 1966. ELFEC, in Cochabamba, followed in 1967 by establishing four pilot cooperatives.

In 1970, the National Institute for Rural Electrification (INER) was created by the GOB to coordinate and provide Government interest and support in rural electrification. It was charged with providing electrical services to small communities countrywide through small self-contained power plants and distribution systems. Fifty-one such systems are now under construction funded by a $2.45 million loan from the Spanish Government.

It was only during the past ten years that the GOB began to take active part in the electrification of the country, including the rural areas. During this decade, however, the GOB's involvement and interest have been intense. The intensity of this interest is demonstrated in the following table showing previous and projected international loans for electrification:

Date	Lending Agency	Borrowing or Executing GOB Entity	Project	Amount US$ Million
1964	IDA	ENDE	Corani Plant	10.0
1964	IDB	ENDE	Corani Plant	3.5
1965	IDA	Bolivian Power Co.	Chururaqui Plant	5.0
1966	AID	ENDE/CRE	Santa Cruz Power	6.32 1/
1968	Export Dev. Corp. Canada	BPC	La Paz Transm. & Distribution	0.50 2/
1968	French Gov't	CESSA 3/	Central Plant Ruffo & high tension line Ruffo-Sucre	0.50
1969	IDA	ENDE	Sta. Isabel Hydroelectric Plant	7.34
1969	IDB	ENDE	Sucre Plant & Sucre Potosí Transmission	5.65
1969	Spanish Gov't	INER	Electrification of 51 Rural Communities	2.45
			Total 5 years	41.26

1/ Includes $1.57 Million in Pesos
2/ Canadian Dollars
3/ Electric Services Cooperative - Sucre

The following are projected activities over the next few years:

Lending Agency	Borrowing or Executing GOB Entity	Project
IDA	ENDE	Expansion of the Santa Cruz Generation Plant
AID	ENDE	Rural Electrification, La Paz-Cochabamba-Santa Cruz
Not decided	ENDE	Sucre-Potosí & La Paz (Altiplano)
Not decided	ENDE	Expansion of Corani Plant, New Generation plant, interconnection of La Paz-Cochabamba-Oruro-Cochabamba Santa Cruz.
Not decided	ENDE	Interconnection of southern grid system (Potosí-Sucre) to the central grid system (Cochabamba-Oruro). Other sources of generation

2. Evaluation of Previous A.I.D. Support for Electrification

During the past decade, Bolivia has been the recipient of varied A.I.D. support for electrification and electrification related studies and projects. Following in chronological order, is a brief description of each, and an evaluation of its implementation and achievements:

a. 1962, a $289,000 Grant - In response to the growing demand for electricity in the Santa Cruz area, three 500 KW generators were grant-funded utilizing the Corporación Boliviana de Fomento (CBF) as the implementing agency. The Empresa Nacional de Electricidad (ENDE) undertook the installation, operation and maintenance of these diesel operated units.

CBF, the implementing agency, met its responsibilities as defined in the grant agreement and the procurement and installation of the three generators was accomplished on schedule. The project

achieved its intended objective which was to provide a temporary and rapid solution to the power shortage then existing. ENDE operated and maintained these units to a professional standard.

b. 1966, the Santa Cruz Electric Power loan was signed authorizing $4.7 million in U.S. dollar (511-L-031) and 18.81 million in Bolivian Pesos (511-LCL-1001+. These funds were used for the expansion of ENDE's generating facilities by 13,200 KW and for the transmission and distribution necessary for this generated power, in the Department of Santa Cruz. Also included were 65 kilometers of a 69 KV line between Santa Cruz and the town of Montero, thus providing service to several small towns and settlements in between.

ENDE, the borrower of record, and CRE, the primary beneficiary of project met all terms and conditions agreed upon with dispatch, and the work was accomplished on schedule and with no difficulties. In fact, efficiencies in project execution allowed the purchase of an additional 3,300 KW generating unit within project funding. The resulting benefits to the region far exceeded those anticipated. CRE's membership expanded from 5,566 consumers in 1965 to 18,000 at present. In general, the power generated and distributed has made it possible to satisfy the major portion of household needs, to make more efficient use of existing industrial capital, to induce agriculture related industries, and to increase agricultural activity by powering irrigation systems and facilitating the refrigeration and processing of agriculture produce.

c. 1967, A.I.D. financed a feasibility studies loan (511-L-010) which included, among others, a feasibility study of electric power requirements for the southern part of Bolivia. The work was undertaken by the Harza Engineering Company in collaboration with Consultora Galindo, a local firm. Total payments to these consultants consisted of US$ 97,790 and $b 268,000 1/.

1/ Rate of exchange $b 12.- per US$ 1.-

Upon completion, the feasibility study was used by the GOB as a basis for inviting international lending agency interest in the region. As a result, a loan for $5.65 million was made by IDB in 1969 to ENDE for the financing of a generation plant at Sucre and the installation of the Sucre-Potosí transmission line.

In summary, all of these A.I.D. financed activities have been efficiently implemented, and have met or exceeded their goals.

SECTION II - PROJECT ANALYSIS

A. BORROWER AND SUB-BORROWERS

1. Executing Agency

Although the Bolivian Government will be the borrower of record, its Empresa Nacional de Electricidad (ENDE) will be the executing agency for this loan with full responsibility and authority for its implementation. Following is a brief discussion of ENDE's history, organizational structure, experience in loan administration and role in the project:

a. Origin and Legislative History

ENDE was created as a sub-division of the Corporación Boliviana de Fomento (CBF) on February 9, 1962 by Supreme Decree No. 05999. As a result of suggestions by IDA and IDB, ENDE became a self-governing branch of CBF on May 1, 1963, and on June 11, 1964, adopted its own charter and by-laws, drafted with the assistance of these international agencies. It was formally recognized as a legal entity through Ministerial Resolution No. 127462, dated February 4, 1965.

The functions of ENDE, as defined by these decrees and resolutions is to develop and control the primary systems of generation and transmission countrywide, with the exception of the Department of La Paz and a part of the Department of Oruro, where private industry, i.e. the Bolivian Power Company, is operating.

b. Organization

ENDE is a Public Corporation with ownership of shares open to both the private and public sectors. To date, however, 100% of its shares have been owned by three public entities, the Corporación Boliviana de Fomento, Yacimientos Petrolíferos Fiscales Bolivianos and the Corporación Minera de Bolivia. On the other hand, ENDE is a shareholder in the Empresa Luz y Fuerza Eléctrica de Cochabamba (ELFEC), Servicios Eléctricos de Tarija and Servicios Eléctricos de Potosí, S.A. Also, ENDE has a representative on the Board of Directors of the Instituto Nacional de Electrificación Rural (INER).

ENDE's management is responsible to a board of directors, the powers of which are set forth in detail in its by-laws. Organizationally, it consists of two divisions, a general management division and a special projects division. The special projects division oversees individual complicated projects such as the Corani and Santa Isabel

generating facilities. The corporate offices are headquartered in Cochabamba, with about 50% of employees assigned to this central office. Presently, its engineering staff consists of 50 engineers; 34 in Cochabamba, 5 in Corani, and in Santa Isabel, 4 in Santa Cruz, 6 in Sucre and 1 in La Paz. In addition, it employs 200 executive and administrative personnel, technicians, secretaries and laborers. A detailed organizational chart is shown in Annex II.

ENDE derives its operating revenue solely from the sale of electrical energy. Its primary clients are ELFEC in Cochabamba, CRE in Santa Cruz, Corporación Minera de Bolivia and the Grace Corporation mine "ESTALSA".

c. Experience in External Financing

ENDE has had extensive experience in external loan administration and implementation since its inception as a sub-division of CBF in 1962. It has been the executing agency on one previous AID loan for the aforementioned Santa Cruz project. It has also administered two loans from the Inter-American Development Bank for the Corani hydroelectric plant in 1964 (3.5 million) and the Sucre-Potosí system in 1969 ($4.65 million). The IDA group has also made two loans which ENDE has had executing responsibility. The Corani hydroelectric plant in 1964 ($10.0 million), and Santa Isabel hydroelectric plant in 1969 ($7.34 million). In total, ENDE has administered five loans for a total of $32.91 million in the past ten years.

ENDE has administered these loans with competence and dispatch, and it is considered quite capable of acting as the executing agency for this loan.

d. Role in Project

ENDE will assume full executive responsibility for all phases of loan implementation. It will set criteria and process all sub-loans. It will contract engineering and construction services, as well as the procurement of all electrical equipment. It will process and approve all disbursements, and will coordinate all project documentation and reports. It will maintain liaison with USAID, and will coordinate all sub-loans and sub-projects to ascertain that the objectives of this loan are met.

2. Sub-Borrowers

ENDE will process two sub-loans to the two entities providing electric service to two of the three largest population centers in Bolivia. Following is a brief evaluation of each sub-borrower in terms of legislative history, organization and experience.

a. Cooperativa Rural de Electrificación (CRE)

CRE, with headquarters in Santa Cruz, was organized as a local cooperative to provide electric service to the City of Santa Cruz and its environs and rural areas nearby on November 14, 1962. It was recognized as a legal entity on February 12, 1965, and was given the concession, essentially a monopoly, of distributing power in the Santa Cruz area. In 1966, CRE entered into an agreement with ENDE to purchase all generated power and assume the operation and maintenance of the distribution system financed under AID Loan 511-L-031. The project was completed in 1970, and CRE assumed full responsibility for the operation and maintenance of these systems. CRE also became the sole customer of ENDE's 13.2 MW new generating plant, purchasing and distributing all generated energy.

CRE's growth since its organization has been phenomenal. This is probably due to two factors. First is the rapid development of the region and the resulting electrical services demand for industry, commerce, municipal and domestic consumption. The second factor is CRE's responsiveness to this increasing demand, and its concerted effort to meet it, which in turn accelerated development by encouraging industrial, agricultural and commercial growth. CRE's dynamic leadership shares in the credit for this rapid growth, and the Cooperative enjoys the esteem and confidence of its members. In June of 1965, CRE's membership consisted of 5,566 subscribers. As of December 31, 1971, one year after the completion of the construction of the generating system under Loan 511-L-031, membership was at the 15,217. CRE is now serving approximately 18,000 members, 13,500 consumers in the city of Santa Cruz and 4,500 consumers in the rural areas. Membership is projected to increase to 37,500 consumers at the completion of this project in 1976, and to 51,000 consumers by 1985.

CRE operates within a cooperative framework, with a salaried general manager and staff responsible to a board of directors elected from among the membership for a two year term. Members of the board of directors receive no compensation for their services, and they are in turn monitored by a membership vigilence committee. The general manager's staff consists of an administrative services division, (38 employees) an engineering and planning division (6 employees) and an operations division (26 employees). The Cooperative is self supporting with operational funds and debt service requirements derived from the sale of electrical energy.

CRE's experience in external financing is limited to its association with ENDE in implementing loan 511-L-031. Its engineering personnel, however, have completed preliminary plans for their sub-project. With a staff of four graduate engineers, an office manager who is a certified public accountant with a degree in economics and finance, and a general manager with extensive management experience, it is not anticipated that CRE will have any problems implementing its sub-loan.

b. Empresa de Luz y Fuerza Eléctrica Cochabamba, S.A. (ELFEC)

ELFEC was created as a "sociedad anónima" by decree on June 6, 1908, and was wholly owned by one shareholder at its inception. It was charged with the electrification of the Cochabamba area with responsibility for generation, transmission and distribution of power. It continued to operate as a privately owned company with ownership changing hands from the original owner to other shareholders and the municipality of Cochabamba until 1962. The creation of ENDE in 1962 relieved ELFEC of its generating responsibility, which were taken over by the new agency.

ELFEC decided to expand its activities into the rural areas of the Cochabamba valley in the latter part of 1967. Studies into this potential market led to the decision of adopting a cooperative framework for its rural activities and four cooperatives were formed in 1968. It became evident after a period of time that the operation of the four cooperatives as separate entities would not be economically feasible or practical. Consequently the four service areas were integrated into, and became parts of, the ELFEC system. The present ELFEC system serves 1,000 rural consumers and 39,000 additional consumers are projected to receive service at the completion of this project in 1976.

ELFEC's objectives were officially revised in 1969 by Government Decree (No. 149414, May 27, 1969) charging it with power distribution, mostly purchased from ENDE, to all jurisdictions, communities and rural areas in the Department of Cochabamba. As a result, ELFEC's ownership now is shared by private owners (18%), Municipality of Cochabamba (36%) and ENDE (46%). Its installed capacity grew from 2,000 KW in 1909 to 12,050 KW in 1972.

ELFEC continues to operate as corporate entity with a board of directors responsible to its shareholders. Executive responsibility is vested in a general manager with four operating divisions: administration, technical, commercial and industrial relations. ELFEC's staff currently consists of 178 people, all stationed in the City of Cochabamba and the surrounding area. A detailed organizational chart is shown in Annex II.

ELFEC's association with ENDE and ENDE's experience with the international lending agencies has contributed to the familiarization of ELFEC with the implementation process. ELFEC, as a sub-borrower under ENDE, should have no difficulty implementing its sub-loan.

B. POWER REGULATORY AGENCY - DIRECCION NACIONAL DE ELECTRICIDAD (DINE)

1. Legal Status

The National Directorate of Electricity (DINE) was created by Supreme Decree No. 05997 dated February 9, 1962. Subsequently, various other decrees were issued defining its authority, responsibility and legal functions. Finally, the Electrical Code was approved by Supreme Decree No. 08438 dated July 31, 1968. The code clearly defined the legal status of DINE.

DINE is a public agency which became a subordinate part of the Ministerio de Energía e Hidrocarburos, upon the creation of this Ministry in 1970. It is charged with the regulation, enforcement and promotion of all activities of the electric power industry in the country.

For its operational expenditures, DINE is empowered by the electric code to collect a surcharge of 3.5 Bolivian pesos for each megawatt-hour generated by all electrical enterprises, public and private, in Bolivia.

2. Duties and Responsibilities

DINE is charged with the establishment of standards of service for the electric power industry and to guarantee national compliance with projected development needs for the country in terms of quantity, quality and price. Within these general areas, its duties and responsibilities could be listed thus:

a. To insure compliance with current laws and regulations and render opinions and issue guidelines.

b. To grant or renew electric service concessions.

c. To act as an arbitrator in electricity related disbutes.

d. To program and control distribution, sales and rationing of electric power consumption.

e. To establish norms of service and uniform technical construction and operation of electrical systems.

f. To continuously prepare and update technical, economical and financial studies of the electric power sub-sector, and based upon these studies, establish appropriate tariffs.

g. To regulate operational budgets and investments programs of the private and public electric entities.

h. In general, to monitor the electrical sub-sector by acting as its coordinator, maintaining statistical records on its activities and preparing an annual report defining its state.

3. Organization

DINE is headed by a director responsible to the Minister of Energy and Hydrocarbons, with a staff of three operating divisions: an administrative department, a division of norms, regulations and concessions, and a division on rates. Currently, its staff consists of 16 employees: 7 engineers, 3 economists, one attorney, and 5 subprofessional, secretarial and service personnel. A detailed organization chart is shown in Annex II.

4. Rate Determination Procedure

Rate determination procedures were established by the electric code. An electric utility entity desiring an adjustment or establishment of a new rate, submits an application to DINE with the following documentation: listing of all tangible and intangible assets, its program for investments, drawdowns and depreciations, operation and maintenance cost breakdown, projections of power sales, calculations of the required rates of return on investment to meet expenditures and calculations showing the rate structure compatible with rate of return.

The application is then studied and analyzed by DINE based upon guidelines established in the electric code, and a provisional rate is fixed for a minimum of three years and a maximum of five years. Such provisional rate is subject to annual adjustments by DINE when actual data is at variance with that submitted by the electric enterprise at the time of its request for the rate determination. In this manner, DINE can effect adjustments of rates upon the request of electric utility companies when an extraordinary revision is required because of factors normally not anticipated.

C. Engineering Analysis

1. General Description

The project as conceived encompasses the planning, design and construction of electrical transmission and distribution systems in rural and semi rural areas in Santa Cruz and Cochabamba.

The proposed Santa Cruz sub-project with the Corporación Rural de Electrificación (CRE) includes both transmission and distribution components as well as related supporting facilities. The distribution component includes the extension of existing lines into presently unserved areas, converting and/or adjusting other lines to standard voltages, grounding presently ungrounded circuits and, in general, expanding, improving and modernizing the existing distribution system.

The transmission and substation component in the Santa Cruz sub-project consisting of 50 Km of 69 KV transmission and four step down substations is an undertaking that would complement the distribution system.

The Cochabamba sub-project with the Empresa de Luz y Fuerza Eléctrica Cochabamba S.A. (ELFEC) envisions the expansion and improvement of existing rural systems, with related supporting vehicles, equipment and tools.

The two sub-projects are described in technical detail in Annex III.

2. Studies

The two sub-projects and sub-project areas have been the subject of several studies of various degree and depth over the past four years. The rural electric cooperative (CRE) at Santa Cruz maintains, as a part of its normal operations, projections of load growth in its service areas. In the Cochabamba area, ELFEC has been preparing this project for four years and has financial projections for the expansion of its rural system. In order to verify and authenticate locally prepared analyses, the AID Mission undertook the funding of NRECA technical services for the preparation of a feasibility study. Under PIO/T 511-3643-3-20061 and Task Order No. 12 to the AID/NRECA contract AID/csd No. 1504 Mr. Gilbert Moon, NRECA Rural Electrification Specialist (Registered Professional Electrical Engineer) and Dr. James Ross, Agriculture Economist, University of Florida, were assigned to prepare a feasibility study in collaboration with INER, ENDE and the prospective sub-borrowers. This study

was begun in July, 1972, and Moon's report titled, "Outline for Rural Electric Development Bolivia", was submitted to USAID/Bolivia in November of 1972.

The report covers the scope of the proposed project in detail, analysis the administrative and financial structure of sub-borrowers and GOB executing entity, estimates, cost reports on availability of materials, equipment and labor, competency and availability of engineering and construction firms, the availability of generated electric power in the sub-projects areas and analysis wholesale and retail rates. The report concludes that the sub-projects are technically and economically sound.

3. Engineering Plan for Project Execution

a. Planning. Preliminary plans for all sub-projects have been completed in collaboration with the GOB entities involved. These plans are complete to the extent that the sub-projects are defined and a reasonable estimate of cost is obtained. They will be further developed and refined by the two sub-borrowers under the coordination of ENDE and will be used as a basis for securing engineering services and the preparation of construction contract documents.

b. Design and Preparation of Contract Documents. The two sub-borrowers (CRE and ELFEC) and ENDE have at present in house engineering staffs. These staffs will be utilized to the fullest extent in monitoring the design of the project components, and the preparation of construction plans, technical specifications and other contract documents. No loan funds will be utilized to pay staff salaries or related expenses.

Consulting engineering services will be required. The Consultant's services will include the preparation or approval of final plans and specifications and contract documents; the compilation of material and equipment lists and the preparation of bidding documents for their procurement; analyses of bids received and recommendation of award of contract; field engineering, and the inspection of construction.

An engineering consulting firm will be selected to provide these services for CRE, ELFEC. Consulting services will also be required to provide engineering inspection during the construction phases of the project. The consultant will be selected from among interested and qualified firms. The source of these services will be AID Code 941 countries and Bolivia. The selected firm will be evaluated by AID and will be subject to its approval.

It is anticipated that there will be only one engineering services contract, and that ENDE will be the contracting entity of the GOB. The exact scope of services to be provided each of the sub-borrowers will be defined in the contract.

The design standards of the Rural Electrification Administration (REA), U.S. Department of Agriculture, will govern all electrical components and civil works under the loan, to the extent practicable.

c. Public Bidding. Upon completion of the design phase, invitations for bids for materials and construction will be issued to international bidders. Advertising for bids will be published in the Small Business Circular and in the Commerce Business Daily in the United States and in the local press.

d. Construction. The number of construction contracts to be awarded through competitive bidding will be determined by the requirements of the project during the design phase. No loan financed construction work will be done under force account by the sub-borrowers.

Although it is doubtful that the nature, magnitude, and dispersion of the work would attract U.S. contractors, the different contracts will be advertised in the United States. Local contractors, experienced in this type of construction are available.

No special construction problems are anticipated because of the nature of the work, terrain or climatic conditions, although the prudent scheduling of the different construction activities will be required to take maximum advantage of the dry season.

The consulting engineer will supervise all construction inspection, will be responsible for all related approvals of workmanship and materials, will approve all change orders, additional work orders, monthly progress payments, and inspect and recommend final acceptance of completed components of the work. In this work, the project participants will be governed by the construction standards of the Rural Electrification Administration (REA), to the extent practicable.

All construction contracts will be approved by AID in writing prior to execution.

An engineering and construction schedule is included in Annex II.

e. Procurement. In order to obtain the benefits of reduced prices through volume procurement, it is anticipated that most materials and electrical components will be procured through IFB's

(Invitation for Bids) which combine sub-borrowers' requirements with the necessary contract stipulations defining CIF, (Cost, Insurance, Freight) insurance and guarantee requirements for the determinations of vendor-sub borrower relationship. Sub borrowers will prepare lists of all off-shore procurement in the early design stages and steps will be taken to ascertain that all delivery schedules are compatible with the time frame of the construction portion of the work.

All materials contracts will be approved by AID in writing prior to execution.

f. Time Provisions. The project is scheduled for completion in three years, allowing for all phases of planning, design, advertising for and receipt of bids and construction. Procurement and prequalification of construction contractors will be done concurrently with other project activities. Following is an estimated time schedule for the work from the time that the loan is signed:

Select Contract Consultants	3 months
Design Phase: Preliminary Approvals	3 months
Bidding documents	9 months
Receipt of bids, evaluation and award of construction contract(s)	3 months
Construction	18 months
Total	36 months

g. Operation and Maintenance. Upon acceptance, each entity will assume the operation and maintenance of the different components its sub-project. Each entity is now operating similar facilities and no problems are foreseen in the operation and maintenance of the expanded systems. In anticipation of this added workload, each of these entities is reviewing its staffing requirements. Financial projections and other overhead and organizational support have been budgeted for the years of project operation.

During the construction period, each entity will have the opportunity to develop its projected staffing needs, through collaboration of their staffs with the consulting engineering firms and other firms to be retained for technical assistance.

h. Technical Assistance. In addition to the engineering consultant for design and construction, the project will require considerable technical assistance during the course of its

implementation. ENDE will be required to coordinate the activities of the engineering consultant and the sub-borrowers, and to carry out the implementation of the entire project in compliance with AID procedures. In addition, ENDE, CRE and ELFEC will need assistance in establishing and developing their staff to a degree compatible with the functions intended for them by the GOB. NRECA has had ample experience in the development and management of rural electric systems and in providing management advice to AID financed rural electric systems in Latin America. It is anticipated that NRECA will be asked to provide technical assistance to ENDE, CRE and ELFEC.

Both CRE and ELFEC have indicated a desire for advice in management practices to improve their overall operational efficiency. Management assistance will be financed by loan funds through separate contract(s) with competent management consultants.

4. Technical Feasibility

a. General Considerations. It is considered that all facets of the projects are technically feasible. Physical characteristics of the terrain, climatic conditions and technical construction problems pose no special problem for this type of undertaking as indicated by the previous experience of the sub-borrowers.

It is expected that all electrical components required for the projects such as wire, transformers, insulators, etc. will be imported from the United States where these items are available in adequate supply. No specially manufactured or custom-made equipment pieces will be required. All civil works such as pole manufacture and installation, clearing of the right of way, buildings, etc. will be accomplished utilizing native materials and labor, both of which are readily available. Supporting facilities such as vehicles, tools and communication equipment are readily available in the U.S. or 941 Code countries.

The two sub-projects have been conceived and planned as modern transmission and distribution systems in accordance with the current standard practice of designing for the projected number of consumers in each area ten years hence.

Utility experience in the U. S. has demonstrated that additional initial investment required in such systems is more economical than expanding or replacing these facilities after a short period of time.

An electrification transmission and distribution system is by its nature an ever growing network. In that sense, the existing

systems in both sub-project areas lend themselves to the proposed expansion under this loan, and also could be easily expanded in the future.

. The distribution voltage of 14.4/24.9 KV is the voltage standard now existing in the rural systems of CRE and ELFEC. Secondary voltages of 220/380 are standard in Bolivia. The transmission voltage of 69 KV is that now in use in sub-project areas and is considered adequate for the expected loads. Standard system frequency is 50 Hz in Bolivia. All of the proposed work contemplates these voltages and frequencies.

b. Power Supply. Power for the ELFEC project will be available from the central system complex. A one line diagram of this complex is shown in Annex III.

In the Cochabamba area, generating capacity will increase to 63 MW upon the completion of the Santa Isabel plant in 1973. ELFEC projected demand for the year 1975 is only 24 MW, again well within the anticipated generating capacity.

In the Santa Cruz area, the current source of power for the CRE system is the AID financed gas/diesel generating plant of ENDE with a total generating capacity of 13.2 MW. This generating capacity is to be increased by 16 MW by the installation of 2-8 MW gas turbines to be financed by IDA. It is expected that this additional capacity will be in operation by 1974, and the total projected capacity of 29.2 MW will be sufficient to meet CRE's service area demand through 1975. Beyond 1975, additional power will be transmitted to the CRE service area by ENDE from grids now scheduled for operation in 1977.

When generating plants, now under construction are completed in 1973, there will be an excess of 200 MW of generating capacity introduced countrywide. There exists no system at this time, however, to transfer excess energy from one area to another. 115 KV and 230 KV transmission lines are proposed for the transfer of surplus energy to needy areas. With the introduction of such transmission facilities into the Santa Cruz area, no problem is foreseen in meeting the power requirements of CRE in the next ten years.

c. Disposition of Existing Facilities in Project Area. Existing electrification facilities in sub-project areas not receiving central station electricity consist mostly of privately owned and operated self-serving systems with unreliable generating units. Such systems allow limited electric service to these communities, normally from 6:00 p.m. to 10:00 p.m. Upon the availability of reliable central station sources from which power could be transmitted to and distributed into these areas, the self contained and

inefficient systems will be either abandoned or when feasible integrated into the overall system. Details of the acquisition of these properties will be negotiated during the life of the project.

In summary, from an engineering standpoint, the project is technically feasible. The borrowers have had the experience and expertise to implement and maintain such systems and no construction of other technical problems are anticipated during implementation. The planned expansions are compatible with the existing systems, and the resulting expanded systems lend themselves to further expansion. Power is or will be available for all systems for the next ten years. No problems are anticipated in the disposition of existing facilities.

5. Estimate of Cost:

The estimated cost of all sub-projects was developed using recent prices of materials and equipment for similar size projects in Bolivia and the surrounding Latin American countries. The labor component is based upon current wages and social benefits now prevalent in the different sub-project areas. Force account records of the sub-borrowing entities were used to the extent possible in verifying the assumed costs.

The estimated costs include an escalation allowance of approximately 7% per year for the next one and one half years, and also a contingency item to cover unforeseen problems and delays.

It must be noted that this estimate of cost was developed for construction to commence September of 1974 and to continue for 18 months. A drastic change of this schedule would most likely render this estimate unrealistic and additional funds could be required.

The estimate of cost is shown in detail Annex III.

Shown below is a summary of the estimate of cost of the project, including local contribution:

AID LOAN

	Foreign Exchange	Local Currency	Total AID Loan	Local Contribution	Total
ELFEC	2,992,860	1,075,910	4,068,770	453,367	4,522,137
CRE	5,058,322	1,672,908	6,731,230	769,161	7,500,391
	8,051,182	2,748,818	10,800,000	1,222,528	12,022,528
Percent of Project cost	67%	23%	90%	10%	100%

6. Engineering Conclusions.

The engineering reports, feasibility studies, preliminary plans and other data indicate that this is a feasible and sound project. The estimated cost has been realistically developed based upon reliable data and are considered reasonably firm. It is felt, therefore, that the requirements set forth in Section 611 (a)(1) of the Foreign Assistance Act of 1961, as amended, have been met.

D. Economic Analysis

Introduction

The project consists of the improvement and expansion of existing electric distribution systems in two rural areas in Bolivia located in the Departments of Santa Cruz and Cochabamba.

Within the Department of Santa Cruz, CRE proposed the expansion of its distribution system to include the outlying Provinces of Andres Ibanez, Warnes, Santisteban, Sara and Ichilo. This area is bounded by the rivers Chane, Piran, Grande and Yapacani. In addition to improvements to the existing distribution system, 16,000 new consumers would be connected during the initial 10-year growth period for energy demand.

ELFEC in Cochabamba proposes establishing rural electrification distribution lines in the Upper, Central and Lower Valleys. The Upper Valley consists of the Provinces of Esteban Acre, Jordan, Punata and Arani. The Central Valley includes that part of the Province of Chapare encompassing Sacaba, Corani and Tiraque. The Lower Valley includes the Provinces of Capinota and Arce. ELFEC estimates that 17,000 new consumers will be served.

The economic evaluation of this project was based on studies made by James E. Ross,1/ Gilbert E. Moon,2/ and the Harza Engineering Co.3/ The analytical tool used to assess the impact of the project was based on the benefit/cost and the rate of return methodology. The measurable information used in the analysis was the incremental savings resulting from the shifting from one source of power, viz., motor generators to the proposed system, and the value of retail sales to new consumers. The results of the analysis indicates that the Santa Cruz sub-project has a benefit/cost ratio of 1.21 and a rate of return of 14.6% and the Cochabamba sub-project has a benefit/cost ratio of 1.12 and a rate of return of 13.6%. The main beneficiary being the lesser privileged rural occupants. The project implementation at the rural level entails the installation of a wire harness at the cost of the power company which will initially provide a switch, light socket and service outlet. The wiring harness is so designed to accept future expansion for farm and cottage industry implements. As outlined in Annex IV(A), the estimated consumer demand is compatable with the physical size of the project as well as meeting the needs of the lesser privileged. Initially it is presumed that the power will supply two 60-watt light bulbs drawing 18 kwh per month.

1/ Draft economic report, James Ross, based on 1972 studies
2/ Outline For Rural Electric Development Bolivia, Gilbert Moon, Oct. 1972
3/ Harza Electric Power Feasibility Study for Santa Cruz, July 1972

The immediate results of the project will realize a decline in the purchase of kerosene for lighting. This offers a substantial import substitution effect, and a foreign exchange savings advantage of 31% over the long run (see Annex IV(A), Exhibit III).

D. Devaluation

Basically, this loan is comprised of 80% foreign exchange components with the remainder being divided between technical assistance and in-country costs. Approximately 16% of total cost is labor costs for installation of the project. A recent government decree allowed labor costs to increase about 20%, and local costs have risen to reflect certain improved shelf items. As a result, the dollar conversions will be made at an exchange rate of 20 pesos rather than 12 pesos per dollar implying an increase of local purchasing power of about 67 percent. However, with only 25% of the loan earmarked for conversion into local currency the overall effect would be to reduce the size of the total project by 7%. Due to the relatively small impact on this project of the devaluation and the uncertainties connected with the GOB's salary/wage policies over the near term, the magnitude of the loan will remain unchanged.

The effect of the devaluation on the cost structure of operating entities under this project depends on their import and debt service components of their total cost - most operating entities have adjusted their rate structures to reflect the impact of the devaluation of their costs. The principle foreign costs connected with their operations are spare parts, replacement equipment and external debt service. It is estimated that these components represent about 40% to 60% of total cost which implies an increase in costs of between 27% and 41%. The entities have recognized this issue and have received permission from DINER (the official utility regulatory agency) to increase rates between 40 and 45% to cover increased costs.

Agricultural Development Prospects

Agriculture accounted for 17.6 percent of Bolivia's GNP in 1971 and employed 67% of the work force. The rate of increase in GNP attributed to agriculture for 1960 - 68 was about 3 percent; in 1970, 5 percent; and in 1971, 5.2 percent.

The success of the increase in agricultural production* has been principally in the Santa Cruz area where efforts have been concentrated in rice, cattle and cotton on small and medium holdings. The only notable successes where small farms are concerned are in wheat and milk production in the Valleys, such as those in the Cochabamba project area. In each case where success has been achieved it has been a result of sub-sectorial concentration with integrated programs including industry. Success also has been related to roads and transport. Approximately 70 percent of the country's increased agricultural production during the past 10 years has originated in the Santa Cruz area.

Resources in Santa Cruz

The Department of Santa Cruz, with 370,621 square kilometers, had an estimated population in 1971 of 548,939. Density of population is 1.48 persons per square kilometer. The Department represents about one-third of the country's total area and less than 10 percent of its total population. Rural people account for 57 percent of the Department's total population.

Per capita income in 1968 was $312. Agricultural and industrial production in Santa Cruz account for 17 percent of the gross national product. The rate of growth between 1965 and 1970 was 8 percent.*

The principal crops in the Santa Cruz area are cotton, rice, sugar cane, wheat and forages. (See Annex IV (A) Exhibit 1.)

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* Data are taken from "Estadisticas Economicas y Sociales del Departamento de Santa Cruz," 1972, pp. 8 and 9. Original data were provided by the ministerio de Planificacion.

Resources in Cochabamba

The Department of Cochabamba includes 55,631 square kilometers and in 1971 had an estimated population of 801,000. Density of population was 14.4 persons per square kilometer. Approximately 75 percent of the population in the Department are classified as rural, according to data from the Ministry of Planning.

The Department contributes 17 percent of the gross national product and has a growth rate of 4.85 percent. Per capita income in 1968 was $176 and is rising slowly.

Potatoes, corn, wheat and vegetables are the principal crops grown in the project area in the Department of Cochabamba. Potatoes, although occupying only 20 percent of the cultivated area, account for roughly 80 percent of the agricultural income. Corn occupies 41 percent of the area and is next to potatoes as an income earner. About 106,235 hectares are cultivated, 10,600 hectares are in pasture and 5,300 hectares have various uses. It is estimated by the Ministry of Agriculture that the rural electrification project area contributes 90 percent of the Departments agricultural production.

The average size family farm unit is approximately two hectares. A large number os sheep are raised, however, cattle numbers are small and poultry production is limited to individual households.

*Data are taken from "Estadisticas Economicas y Sociales del Departamento de Santa Cruz," 1972, pp. 8 and 9. Original data were provided by the Ministerio de Planificacion.)

Socio Economic

The GOB has clearly stated that a principal objective of its policies is to integrate the rural population into the mainstream of Bolivian life. To this end, the GOB has spent on the average 33% of its education budget to improve the quantity and quality of education. The existing facilities for adult education have been limited due to the lack of electricity. This project would provide the necessary distribution to use more intensively existing facilities for night classes, etc.

Health facilities for the rural population are inadequate for treatment purposes particularly due to the inability to use the existing medical facilities during the night hours. The lack of simple equipment impedes diagnostic procedures. This equipment could in many cases be introduced if electric power existed. The high mortality and morbidity rates in Bolivia attest to low nutritional levels as well as inadequate medical facilities. One ongoing A.I.D. program, the $3 million community development loan is aimed at upgrading rural life. Of course, the main objective is to enhance the rural area to curb the migration flow to the urban areas, and the compatability of these two projects tends to buttress that desire. For while the community development loan will enhance infrastructure improvements the rural electrification loan will provide the basic foundation necessary for development.

Moreover, as the transmitted power replaces small gas and diesel generators now servicing the project area, INER plans to service, repair and move these generators to those rural areas without electric power service. This program should complement future full-scale rural electrification projects by providing a period of social conditioning and technicial familiarization to the uses of electric power. Together these projects will instill greater community pride and stimulate a more active participation in the political life of the community.

E. FINANCIAL ASPECTS

1. Funding requirements:

a. The total cost of the overall project by dollar procurements and local costs is presented by the following table:

(In U. S. Dollars)

Sub-Borrower	Dollar Procurement	Local Costs	Total
Cooperativa Rural de Electrificación	5,058,322	2,442,069	7,500,391
Empresa Luz y Fuerza de Electricidad de Cochabamba	2,992,860	1,529,277	4,522,137
TOTALS	8,051,182	3,971,346	12,022,528

The dollar procurement portion includes materials and consultants services; the local costs protion includes labor, materials, interest during construction, and administrative costs.

b. The components breakdown of the project is as follows:

Description	Cochabamba ELFEC	Santa Cruz CRE	Total
A.I.D. Loan Funds:			
1. Transmission		533,900	533,900
2. Substations	250,000	442,700	692,700
3. Distribution	2,842,670	4,073,190	6,915,860
4. Engineering	309,267	529,950	839,217
5. Facilities and Equipment	215,500	406,000	621,500
6. Contingency	351,333	595,490	946,823
7. Technical Assistance	100,000	150,000	250,000
Sub-Total	4,068,770	6,731,230	10,800,000
Local Contributions:			
1. Local Contribution	453,367	769,161	1,222,528
TOTAL:	4,522,137	7,500,391	12,022,528

Local contributions are shown in total for each company involved, however the following table lists these funds by project items.

Description	A.I.D. Dollar Costs	A.I.D. Local Costs	Local Contrib.	Total
Materials	6,352,083	648,144	267,500	7,267,727
Construction	-	1,142,233	200,000	1,342,233
Vehicles and Equipment	421,500	-	-	421,500
Buildings, Furniture and Land	50,000	150,000	-	200,000
Engineering	335,687	503,530	148,533	987,750
Contingency	641,912	304,911	-	946,823
Technical Assist.	250,000	-	-	250,000
Project Administration (ENDE Project coordination Expenses)	-	-	350,000	350,000
Interest during construction	-	-	256,495	256,495
Totals:	8,051,182	2,748,818	1,222,528	12,022,528

Local contributions are provided for all cost items except for technical assistance which will be loan funded for services in advisory capacity.

Contingency cost has been calculated at approximately 10% of materials and engineering and 8% of construction.

c. The timing of disbursements of loan fund project costs are as follows:

Loan Fund Disbursements Table, CRE and ELFEC

	1st Year F/C US$	1st Year L/C US$	2nd Year F/C US$	2nd Year L/C US$	3rd Year F/C US$	3rd Year L/C US$	TOTAL
Engineering	307,713		307,713		281,301		896,727
Materials			4,584,857	324,122	2,292,435	324,122	7,525,536
Construction				500,411		1,000,826	1,501,237
Vehicles and Equipment	36,000		385,500				421,500
Buildings, Furniture & Land		4,000	56,000	140,000			200,000
Tech.Assist.	84,666		85,668		84,666		255,000
	428,379	4,000	5,419,738	964,533	2,658,402	1,324,948	10,800,000

Interest during construction will be contributed by the participants therefore is not included in the above table.

2. Sources of Financing:

a. The following two tables respectively show the proposed sources of financing and the cost components by sources of funding:

Source	C O S T Foreign	Local	Total	%
A.I.D.	8,051,182	2,748,818	10,800,000	89.8
Participants		1,222,528	1,222,528	10.2
Total	8,051,182	3,971,346	12,022,528	100.0

Description	C O S T A.I.D.	Participants	Total
Materials	$ 7,000,227	$ 267,500	$ 7,267,727
Construction	1,142,233	200,000	1,342,233
Vehicles and Equipment	421,500		421,500
Buildings, Furniture and Land	200,000		200,000
Engineering	839,217	148,533	987,750
Contingency	946,823		946,823
Technical Assistance	250,000		250,000
Project Administration (ENDE Project Coordination Expenses)		350,000	350,000
Interest during Construction		256,495	256,495
Totals:	$10,800,000	$1,222,528	$12,022,528

The source and timing of the projected funds disbursements is presented in the next table:

Source	C O S T Year 1	Year 2	Year 3	Total
A.I.D.	432,379	6,384,271	3,983,350	10,800,000
Participants	A s	r e q u i r e d		1,222,528
Total				$12,022,528

The total cost of project is estimated at $12,022,528. A.I.D. will fund not to exceed $10,800,000 through the subject loan; the balance of $1,222,528 which amounts to 10.2% of the estimated total cost will be financed by the participating companies.

3. Financial Analysis

CRE

The financial position of CRE (the largest sub-borrower under the loan) has been reviewed for the years 1970 and 1971. The balance sheets and profit and loss statements for each year are included in Annex V. This review indicated a slight worsening in their short term position in 1971 compared to 1970 due to the addition of short term debt used to improve services during the period. The acid test ratio[1] shows a movement from 2.7:1 to 1.1:1 from 1970 to 1971, while the current ratio[2] moved from 5.4:1 to 1.7:1 respectively. However, in 1971 there was a substantial increase in their net worth which brought the ratio of long term debt to capital[3] from 36.8:1 in 1970 to 17.5:1 in 1971. This increase in capital reflected an expansion in the share subscriptions issued to new customers. The large increases in short term debt and capital reflected the needs to finance the increased service requirements of the zone. The projected balance sheet, profit and loss statement demonstrate a dramatic improvement in the financial position of CRE (See Table No. 1). The projections are based on the old rate structure which is being revised in light of the recent devaluation. We expect rates to be increased on the average by 40+% which will markedly improve the cash flow related to the project. It appears that, although CRE's present financial position is somewhat weak in the short term, there is substantial room to absorb medium and long term debt on relatively mild terms as demonstrated by the relatively stronger long term position. The demand for services in the area are growing substantially and offer a bright future.

1/ Reflects liquidity position of business entity in short term, i.e., the ability to generate immediate cash to meet possible immediate liabilities.

2/ Reflects ability to liquidate normal liabilities within the operating cycle of the business entity.

3/ Reflects overall solvency of business entity with the assumption that current liabilities will be offset by short term future income; this ratio is used to demonstrate ability to absorb additional long term debt.

TABLE I 1/

ANALYSIS RATIOS

CRE and ELFEC

		CRE			ELFEC		
		1980	1971	1970	1980	1971	1970
a.	Acid Test Ratio Quick assets / Current Liabilities	1,543,400 / 283,600 = 5.4:1	275,489 / 252,696 = 1.1:1	137,684 / 50,364 = 2.7:1	2,724,900 / 150,000 = 18.2:1	782,624 / 503,635 = 1.6:1	1,002,605 / 875,233 = 1.1:1
b.	Current Ratio: Current Assets / Current Liabilities	2,039,940 / 283,600 = 7:2	426,627 / 252,696 = 1.7:1	271,214 / 50,364 = 5.4:1	3,345,200 / 150,000 = 22.3:1	1,413,134 / 503,635 = 2.8:1	1,639,164 / 875,233 = 1.9:1
c.	Total Debt / Total Assets	8,890,590 / 10,871,590 = .82:1	3,462,449 / 3,644,419 = .95:1	3,295,433 / 3,383,475 = .97:1	5,411,600 / 8,724,600 = .62:1	2,102,024 / 3,120,730 = .67:1	2,253,154 / 3,240,354 = .70:1
d.	Total Liabilities / Net Worth	8,890,590 / 1,981,000 = 4.5:1	3,462,449 / 181,970 = 19.0:1	3,295,433 / 88,042 = 37.4:1	5,411,600 / 3,313,000 = 1.6:1	2,102,024 / 1,018,706 = 2.1:1	2,253,154 / 987,200 = 2.3:1
e.	Long-term Debt / Net Worth	8,890,590 / 1,981,000 = 4.5:1	3,190,424 / 181,970 = 17.5:1	3,242,023 / 88,042 = 36.8:1	5,261,600 / 3,313,000 = 1.6:1	1,008,408 / 1,018,706 = .99:1	922,065 / 987,200 = .93:1

1/ Balance sheets for 1970 and 1971 and profit and loss statements for 1970-1971 See Annex V

Source: C.R.E. and E.L.F.E.C. Financial Data.

ELFEC

The short and long term financial position of ELFEC appears to be relatively good as demonstrated in its balance sheets and profit and loss statements for 1970 and 1971. The acid test ratio shows an improvement from 1970 of 1.1:1 to 1971 of 1.6:1 reflecting primarily heavy repayments of short term loans during 1971. While the current ratio indicates an improvement from 1.9:1 in 1970 to 2.8:1 in 1971 reflecting a substantial reduction in short liabilities during 1971 - probably repayments to ENDE. The ratios used to measure solvency indicate a very favorable position implying that ELFEC could easily absorb more longer term debts. The profit and loss projections indicate a continually improving cash flow.

4. Sub Loan Terms

Analysis of the financial return accruing to the individual sub-borrowers has indicated that the GOB could best achieve the purposes of the loan program by passing the concessionary terms of the AID loan on to the sub-borrowers. Although rural electrification in Bolivia has a strong social justification, there is no intention to develop projects which are not financially viable. All projects must generate adequate cash revenues to cover operating and fixed charges, amortize their debts and establish reasonable reserves.

Sub-borrowers will bear the maintenance of value responsibility for repayment of the dollar loan to AID. In view of the relatively low profit margin typical of rural electrification projects and bearing in mind that public entities or non-profit cooperatives are involved, the use of concessionary loan terms is considered justified. Adequate cash revenues will be generated to meet the project requirements mentioned above, and the sub-borrowers will minimize the risk of decapitalization through maintenance of value requirements. In addition, the sub-borrowers will be less likely to jeopardize the overall rate of return required to maintain eligibility for support from other international lenders.

5. Financial Conclusions

The balance sheets and profit and loss statements appear to be fair measures of the financial positions of the participating agencies. This financial data reflects some weakness in CRE but based on the projected cash flow we believe that CRE will represent no repayment problem. ELFEC's long term position appears to be very strong assuring repayment of this loan. Thus it appears that the sub-borrowers and the GOB (see Annex IV on GOB debt service) who guarantee this loan are in positions to meet the financial obligations imposed by the loan.

A. Target Dates

1. Execution of the Loan Agreement

The GOB is in a position to proceed expeditiously with final negotiations, drafting and execution of the loan agreement as soon as the Loan is authorized. The officials concerned have prior experience and a record of accomplishment in similar activities. The nature and scope of the program are well defined. The GOB has proceeded expeditiously with other recent A.I.D. loan agreements. It is reasonably anticipated, therefore, that the loan agreement should be signed within forty-five days following loan authorization.

2. Conditions Precedent

a) It is anticipated that ENDE should be able to select a consulting engineering firm within three months following execution of the loan agreement. No delay is anticipated in arranging satisfactory technical assistance arrangements between ENDE and NRECA.

b) Both CRE and ENDE have recently revised their rate structure to ensure an adequate rate of return. It is anticipated that a financial review can be done rapidly and that no major problems should be encountered.

c) Necessary baseline data for socio-economic review should be established before initiation of construction.

3. Schedule for Subsequent Action

Please refer to Section II (page 18) for further discussion of project timing.

B. Disbursement Procedures

No deviation from A.I.D. established disbursement procedures is anticipated. Materials and equipment procured in the U.S. and other A.I.D. Code 941 countries and foreign exchange costs of engineering and construction contracts will be paid through the letter of commitment procedure. Requests for letters of commitment will contain appropriate certification that the items listed are required for the project and are eligible for financing under the loan. Disbursement for approved local currency costs will be made from a U.S. government owned RDO account in the Central Bank.

C. Procurement Procedures

All of A.I.D.'s procurement policies will be followed. Appropriate reports will be required from ENDE concerning compliance with procurement requirements including source and origin, 50/50 shipping, etc.

Specifications for procurement will be prepared by the consulting engineers and ENDE and reviewed by USAID engineers. When appropriate, AID/W assistance with specifications and procurement will be requested.

D. USAID Monitoring Responsibilities

Monitoring will be exercised by the Mission through review and approval of procurement lists and selected specifications, construction plans and specifications, contracts, reports and periodic site inspections.

The USAID/Bolivia Engineering and Transportation Division will have primary monitoring responsibility within the Mission. The Office of Capital Development, the Controllers Office and the Regional Legal Advisor will also assist with monitoring as appropriate.

Annual review meetings will be held between Mission personnel and representatives of ENDE, DINE, ELFEC, CRE, and GOB ministries. These meetings will review the current status of rate structure, and return on rate base, construction of IDA financed generating capaicty in Santa Cruz, and physical progress of the project. The nature of the social and economic evaluation process to a great extent establishes the periods for subsequent evaluations. While more or less annual evaluations could be made, it is felt that more meaningful evaluation can be made at the end of the construction period and two years after the completion of the project.

E. Reports

1. Audited annual financial statements will be submitted yearly to USAID/Bolivia for ENDE, CRE and ELFEC.

2. Quarterly shipping and financial reports will be required from ENDE.

3. Monthly progress reports will be required from the consulting engineering firms and from the technical assistance advisors.

4. Other reports which may be required as appropriate will be specified in implementation letters.

F. Evaluation

1. Although it is generally accepted that rural electrification does provide many benefits in the social and economic development of a country there has never been a definitive evaluation of those benefits. Consequently, early in 1972, AID initiated a long range study to develop a methodology for determining the social and economic impact of rural electrification in a developing country. AID has contracted with the University of Florida to carry out the first phase of this study. Studies have been completed in Costa Rica and studies are now under way in Colombia. At the conclusion of these two studies, it is expected that a methodology for establishing base line information will be developed and ready for application in other developing countries.

2. The University of Florida team is under the direction of Dr. James Ross who prepared, as an NRECA consultant, the economic report in support of the sub-projects in the Santa Cruz and Cochabamba areas. Because of the inter-relationship of the AID sponsored University of Florida evaluation study with the study in Bolivia, Dr. Ross, to the extent possible, included information in the Bolivia study to allow a base line to be established. However, the conclusions to be reached in the first phase of the overall AID study may make revision in the Bolivia data desirable. If such revisions are needed the cost should be minimal, possibly not more than two man months of service by a U.S. consultant who would enlist and utilize local sources of expertise such as university personnel interested in such research.

G. Conditions and Covenants

In addition to the standard conditions and covenants of A.I.D. lending, the conditions below will be included in the Loan Agreement.

1. Prior to any disbursement or the issuance in any commitment documents under the loan, AID shall have received and reviewed, in form and substance satisfactory to AID, evidence that the rates in effect in the CRE and ELFEC systems are adequate to provide a return sufficient to cover operating costs, maintenance, administration, taxes, assessments, depreciation and a positive rate of return on the rate base.

2. Prior to any disbursement for construction costs under the loan, AID shall have established the information base and methodology necessary for adequately assessing physical progress and related socio-economic benefits of the respective sub-projects.

3. The loan shall be subject to such other terms and conditions as AID may deem advisable.

SECTION IV. ENVIRONMENT

Environmental Determination

The USAID Capital Assistance Committee has determined that this proposed project does not have significant adverse environmental impact for the following reasons:

a. The electrical service provided will be largely to private homes for domestic use with negligible impact on the environment.

b. To the extent that the service stimulates the growth of industry, it will be in industries small by the standards of more developed countries, with relatively limited potential for pollution, and it will be dispersed in less densely populated areas such that the environment can better absorb the impact without notable damage.

c. To the extent that the service stimulates the growth of agriculture it will be primarily by facilitating irrigation with beneficial environment impact. By promoting the cultivation of land more appropriate for agriculture it should tend to attract campesinos away from the erosion producing dry farming of the marginal highland slopes.

d. To the extent that the electric transmission and distribution lines themselves may be viewed as unsightly this must be considered a relatively low price for the quantum of economic and social progress involved.

SECTION V - ISSUE

1. Project Reliance upon Proposed World Bank Group (IDA) Loan

A $6.0 million IDA loan to ENDE has been proposed by the GOB for power generation and transmission in Santa Cruz, transmission and substation extensions in the Cochabamba area, and provision of consulting services. Scheduled for completion by November 1974, the IDA project will provide 16 MW of electrical generating capacity in Santa Cruz and a 69 KV transmission line from Santa Cruz to Montero. The CRE sub-project in the Santa Cruz area has been developed in close coordination with IDA officials during their field trips to Bolivia as well as in Washington. The IDA financed facilities will be used to provide required electrical power for the planned CRE distribution lines. At the same time, the IDA project depends upon the CRE sub-project for much of its power consumption. The two projects are therefore complementary and to a large degree mutually dependent.

The IDA project as contemplated for the Cochabamba area should have no significant effect upon the ELFEC sub-project, since adequate generating capacity now exists.

The IDA project has proceeded on schedule. Both CRE and ELFEC have recently instituted rate increases which had been urged by IDA. The project is in the final stages of preparation. No major problems are foreseen to delay authorization of the project by the IDA Board of Directors by May 1, 1973.

IDA is simultaneously preparing a $4.5 million loan to expand Bolivian Power Corporation services to the La Paz area. Rate increases which IDA feels are necessary have not yet been instituted for La Paz. IDA would prefer to approve all their electrification projects simultaneously, and it is possible that delay in approval of the La Paz project could affect the Santa Cruz/Cochabamba project. Prudence dictates, therefore, that conditions precedent to disbursement be established which require authorization and subsequent progress in construction of the IDA financed generating capacity in Santa Cruz. Those conditions will state that "Prior to any disbursement or the issuance of any commitment documents under the loan, A.I.D. shall have received, in form and substance satisfactory to A.I.D., evidence that the International Development Association (IDA) has duly authorized a loan to Bolivia for constructing additional ENDE generating capacity in the Santa Cruz area adequate to meet the requirements of the CRE sub-project."

CERTIFICATION PURSUANT TO SECTION 611 (e) OF THE

FOREIGN ASSISTANCE ACT OF 1961, AS AMENDED

I, Edward W. Coy, the principal officer of the Agency for International Development in Bolivia, having taken into account among other factors the maintenance and utilization of projects in Bolivia previously financed or assisted by the United States, do hereby certify that in my judgement Bolivia has both the financial capability and human resources capability to effectively maintain and utilize the capital assistance project: RURAL ELECTRIFICATION.

This certification is based, inter alia, on the Government of Bolivia's and the Empresa Nacional de Electricidad's performance in the execution of an electrical generation, transmission and distribution project financed by A.I.D. Loan 511-L-031.

Edward W Coy

Edward W. Coy
Director USAID/Bolivia

PRESIDENCY OF THE REPUBLIC

BOLIVIA

4272

La Paz, December 27, 1972

Mr. Edward W. Coy
Director
USAID/Bolivia
La Paz

Mr. Director:

By means of the present letter, we are pleased to reiterate, on behalf of the Republic of Bolivia, our credit request for TEN MILLION EIGHT HUNDRED THOUSAND 00/100 UNITED STATES DOLLARS (US$ 10,800,000.00), which was initially submitted to USAID by the Ministry of Energy and Hydrocarbons for the Rural Electrification Program.

The Government of Bolivia would be the Borrower and the sub-borrowers the enterprises: Cooperativa Rural de Electrificación,(CRE) of Santa Cruz and Empresa de Luz y Fuerza (ELFEC) of Cochabamba.

The sub-loans, referred to above, will be granted by our Government, on the same conditions as those set forth by USAID, except for a small interest differential to be used exclusively to cover the administration costs of the project. In this connection we must point out that the administration, supervision and control of the loan would be entrusted to Empresa Nacional de Electrificación (ENDE), an institution with broad experience in this type of operations.

We would greatly appreciate your giving prompt consideration to the study of the second stage for the Rural Electrification Program, which in principle would cover the departments of Oruro, La Paz, Sucre, Potosí and Tarija.

Please transmit the present request to the corresponding officers in AID/Washington.

Sincerely yours,

(signed) Lic. Luis Rodrigal Rodo
Minister of Finance
Vice-President of the
National Economic and
Planning Council

(signed) Ing. Julio Prado Salmón
Minister Secretary of
National Economic and
Planning Council

CHECKLIST OF STATUTORY CRITERIA

(Alliance for Progress)

The following abbreviations are used:

FAA - Foreign Assistance Act of 1961, as amended.

App.- Foreign Assistance and Related Agencies Appropriations Act,1972.

MMA - Merchant Marine Act of 1936 as amended.

COUNTRY PERFORMANCE

Progress Toward Country Goals

1. FAA 208; 251 (b)

A. Describe extent to which country is:

(1) Making appropriate efforts to increase food production and improve means for food storage and distribution.	Bolivia is making appropriate efforts with respect to food production, storage, and distribution. AID Loan 511-L-042 will contribute to these efforts.
(2) Creating a favorable climate for foreign and domestic private enterprise and investment.	The GOB program emphasizes creation of a favorable climate for selected foreign and domestic private enterprise and investment. They are seeking special exemptions within the Andean Common Market for certain investments.
(3) Increasing the public's role in the developmental process.	The Government continues to take an active role in the developmental process, and is no doing to increase popular participation.
(4)(a) Allocating available budgetary resources to development.	The Government appears to be allocating as much as it is able to development.

(b) Diverting such resources for unnecessary military expenditure (See also Item No. 16) and intervention in affairs of other free and independent nations. (See also Item No. 14).	The government does not make unnecessary military expenditures and does not intervene in the affairs of other nations.
(5) Willing to contribute funds to the project or program.	GOB contribution consists of support for ENDE and other participating agencies. GOB is unable to provide substantial funding for the project per se.
(6) Making economic, social and political reforms such as tax collection improvements and changes in land tenure arrangements and making progress toward respect for the rule of law, freedom of expression and of the press and recognizing the importance of individual freedom, initiative, and private enterprise.	The government is making these efforts.
(7) Adhering to the principles of the Act of Bogotá and Charter of Punta del Este.	The government adheres to these principles.
(8) Attempting to repatriate capital invested in other countries by its own citizens.	Bolivia has urged repatriation of capital invested in other countries by its own citizens, and is considering active measures to accomplish such repatriation.
(9) Otherwise responding to the vital economic, political, and social concerns of its people and demonstrating a clear determination to take effective self-help measures.	The government appears to be doing this in an increasingly effective manner.

B. Are above factors taken into account in the furnishing of the subject assistance?	Yes.
Treatment of U.S. Citizens	
2. FAA. 620(c). If assistance is to government, is the government liable as debtor or unconditional guarantor on any debt to a U.S. citizen for goods or services furnished or ordered where (a) such citizen has exhausted available legal remedies and (b) debt is not denied or contested by such government?	The government is not known to be indebted under these circumstances to any U.S. citizen for goods or services furnished or ordered.
3. FAA. 620(e)(1). If assistance is to a government, has it (including government agencies or subdivisions) taken any action which has the effect of nationalizing, expropriating, or otherwise seizing ownership or control of property of U.S. citizens or entities beneficially owned by them without taking steps to discharge its obligations toward such citizens or entities?	The previous government of Bolivia nationalized two United States mining firms. However, steps have been or are being taken to realize prompt, adequate and effective compensation to the former owners.
4. FAA. 620(o); Fishermen's Protective Act. a. If country has seized, or imposed any penalty or sanction against, any U.S. fishing vessel on account of its fishing activities in international waters.	Not applicable.
a. has any deduction required by Fishermen's Protective Act been made?	
b. has complete denial of assistance been considered by AID Administrator?	

Relations with U.S. Government and Other Nations

5.	FAA. 620(d). If assistance is for any productive enterprise which will compete in the U.S. with U.S. enterprise, is there an agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan?	Not applicable.
6.	FAA. 620(j). Has the country permitted, or failed to take adequate measures to prevent, the damage or destruction by mob action, of U.S. property?	The government of Bolivia has taken adequate measures to prevent the damage or destruction by mob action or U.S. property whenever possible.
7.	FAA. 620(l). If the country has failed to institute the investment guaranty program for the specific risks of expropriation, in convertibility or confiscation, has the AID administration within the past year considered denying assistance to such government for this reason?	The government has instituted the investment guarantee program.
8.	FAA. 620(q). Is the government of the recipient country in default on interest or principal of any AID loan to the country?	Bolivia is not in default in payment of principal and interest on any AID loan within the meaning of FAA 620(q).
9.	FAA. 620(t). Has the country severed diplomatic relations with U.S.? If so, have they been resumed and have new bilateral assistance agreements been negotiated and entered into since such resumption?	Bolivia has not severed diplomatic relations with U.S.
10.	FAA. 620(u). What is the payment status of the country's U.N. obligations?	Bolivia paid $47,671 in September 1972; therefore it is not delinquent within the meaning of 620(u). However, it remains approximately two years in arrears on its assessed contributions.

If the country if in arrears, were such arrearage taken into account by the AID Administrator in determining the current AID Operating Year Budget?	
11. FAA. 620(a). Does recipient country furnish assistance to Cuba, or fail to take appropriate steps to prevent ships or aircraft under its flag from carrying cargoes to or from Cuba?	No, the recipient country does not furnish assistance, nor fail to take appropriate steps to prevent ships or aircraft under its flag from carrying cargoes to or from Cuba.
12. FAA. 620(b). If assistance is to a government, has Secretary of State determined that it is not controlled by the international Communist movement.	Bolivia is not controlled by the international Communist movement according to the Secretary of State.
13. FAA. 620(f). Is recipient country a communist country?	No. Bolivia does not have a Communist government.
14. FAA. 620(i). Is recipient country in any way involved in (a) subversion of, or military aggression against, the U.S. or any country receiving U.S. assistance, or (b) the planning of such subversion or aggression?	No. Bolivia is not engaged in these activities.
15. FAA. 620(n). Does recipient country furnish goods to North Viet-Nam or permit ships or aircraft under its flag to carry cargoes to or from North Viet-Nam?	No, the recipient country does not furnish goods to North Viet-Nam nor permit ships or aircraft under its flag to carry cargoes to or from North Viet-Nam.
16. FAA. 481. Has the government of recipient country failed to take adequate steps to prevent narcotic drugs and other controlled substances (as defined by the Comprehensive Drug Abuse Prevention and Control Act of 1970) produced or processed, in whole or in part, in such country, or transported through such country, from being sold illegally within the jurisdiction of such country to U.S. Government personnel or their dependents, or from entering the U.S. unlawfully?	The GOB is actively cooperating with USAID public safety advisors, BNDD representatives and other international agencies to take such steps as may be necessary to control drug traffic in Bolivia.

Military Expenditures

17. FAA. 620(s). What percentage of country budget is for military expenditures? How much of foreign exchange resources is spent on military equipment? How much is spent for the purchase of sophisticated weapons system?

(Consideration of these points is to be coordinated with the Bureau for Regional Coordinators and Military Assistance Staff (PPC/RC).

17.2% of FY 72 (Calendar year 1972) GOB budget is designated for military expenditure. An estimated $900,000 was targeted for equipment expenditure, but we have no figures on how much of that represented foreign exchange expenditure. There were no purchases of sophisticated weapons systems.

CONDITIONS OF THE LOAN

General Soundness

18. FAA. 201(d). Information and conclusion on reasonableness and legality (under laws of country and U.S.) of lending and relending terms of the loan.

The loan terms are reasonable and consistent with United States and Bolivian laws.

19. FAA. 251(b)(2), 251(e) Information and conclusion on activity's economic and technical soundness. If loan is not made pursuant to a multilateral plan, and the amount of the loan exceeds $100,000, has country submitted to AID an application for such funds together with assurances to indicate that funds will be used in an economically and technically sound manner?

The borrower has made an application for loan funded assistance in this activity and there have been assurances that the funds will be used in an economically and technically sound manner.

20. FAA. 251(b). Information and conclusion on capacity of the country to repay the loan including reasonableness of repayment prospects.

There are reasonable prospects of repayments.
for further discussion.

21. FAA 611(a)(1). Prior to signing of loan will there be (a) engineering, financial, and other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?	The basic engineering, financial and other plans necessary to carry out the assistance have been prepared. Some detailed engineering, to be financed in the past by the loan, remaining to be done. Reasonably firm cost estimates have been established.
22. FAA. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purposes of loan?	No further legislative action in Bolivia is required for implementation of this project.
23. FAA. 611(e). If loan is for capital assistance and all U.S. assistance to project now exceeds $1 million has Mission Director certified the country's capability effectively to maintain and utilize the project?	See Annex I.
24. FAA. 251(b). Information and conclusion on availability of financing from other free-world sources, including private sources within the United States.	Financing for this activity is not available from other free-world sources, including private sources within the United States, on feasible terms.
Loan's Relationship to Achievement of Country and Regional Goals	
25. FAA. 207; 251(a). Extent to which assistance reflects appropriate emphasis on: (a) encouraging development of democratic economic, political and social institutions; (b) self-help in meeting the country's food needs; (c) improving availability of trained manpower in the country; (d) programs designed to meet the other important areas of economic, political, and social development, including industry; free labor unions, cooperatives, and voluntary agencies; transportation and communication; planning and public administration; urban development; and modernization of existing laws.	This loan will contribute directly to the objectives reflected in items (a), (b), (c) and (e).

26. FAA. 209. Is project susceptible of execution as part of regional project? If so why is project not so executed?	This project could not be carried out as part of a regional project since it is designed specifically to promote Bolivian local electrical distribution systems.
27. FAA. 251(b)(3). Information and conclusion on activity's relationship to, and consistency with, other development activities, and its contribution to realizable long-range objectives.	This activity has broad significance with regard to the long-range objectives of integrating the rural areas into the national economic, social and political life, and strengthening the economy.
28. FAA. 251(b)(7). Information and conclusion on whether or not the activity to be financed will contribute to the achievement of self-sustaining growth.	This project should contribute to the achievement of self-sustaining growth since it will provide impulse to the rural areas to be served.
29. FAA. 281(a). Describe extent to which the loan will contribute to the objective of assuring maximum participation in the task of economic development on the part of the people of the country, through the encouragement of democratic, private, and local governmental institutions.	This loan is aimed at the stated objective through the provision of electricity to rural user groups.
30. FAA. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civic education and training in skills required for effective participation in governmental and political processes essential to self-government.	The program directly recognizes and utilizes the needs, desires and capacity of the rural population as its motivating force.

31.	FAA. 601(a). Information and conclusions whether loan will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture, and commerce; and (f) strengthen free labor unions.	This loan should do all of these things with the exception of items (a) and (f).
32.	FAA. 619. If assistance is for newly independent country, is it furnished through multilateral organizations or plans to the maximum extent appropriate?	Not applicable.
33.	FAA. 251(h). Information and conclusion on whether the activity is consistent with the findings and recommendations of the Inter-American Committee for the Alliance for Progress in its annual review of national development activities.	Activity is consistent with such findings and recommendations.
34.	FAA. 251(g). Information and conclusion on use of loan to assist in promoting the cooperative movement in Latin America.	This loan will directly benefit the cooperative movement in Bolivia through the participation of the Rural Electric Cooperative (CRE) in Santa Cruz.
35.	FAA. 209; 251(b)(8). Information and conclusion whether assistance will encourage regional development programs, and contribute to the economic and political integration of Latin America.	By strengthening the economic base of the rural population in the areas to be served the capacity of Bolivia to participate in regional activities should be enhanced.

Loan's Effect on U.S. and AID Program

36.	FAA. 251(b)(4); 102. Information and conclusion on possible effects of loan on U.S. economy, with special reference to areas of substantial labor surplus, and extent to which U.S. commodities and assistance are furnished in a manner consistent with improving the U.S. balance of payments position.	The loan will have no foreseeable unfavorable effect on the United States economy. Some U.S. products will be imported.
37.	FAA. 601(b). Information and conclusion on how the loan will encourage U.S. private trade and investment abroad and how it will encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).	There will be U.S. private sector participation in this project to the extent that some of the loan proceeds will be used to buy materials from U.S. sources.
38.	FAA. 601(d). If a capital project, are engineering and professional services of U.S. firms and their affiliates used to the maximum extent consistent with the national interest?	Professional advisory services of U.S. firms will be utilized to the maximum extent consistent with the needs of the project.
39.	FAA. 602. Information and conclusion whether U.S. small business will participate equitably in the furnishing of goods and services financed by the loan.	U.S. small businesses will be invited to participate when appropriate.
40.	FAA. 620(h). Will the loan promote or assist the foreign aid projects or activities of the Communist-Bloc countries?	No, the loan will not promote or assist the foreign aid projects or activities of the Communist-Bloc countries.

41. FAA. 621. If technical assistance is financed by the loan, information and conclusion whether such assistance will be furnished to the fullest extent practicable as goods and professional and other services from private enterprise on a contract basis. If the facilities of other Federal agencies will be utilized, information and conclusion on whether they are particularly suitable, are not competitive with private enterprise, and can be made available without undue interference with domestic programs.

Technical assistance and consulting services will be provided by private sector groups.

42. FAA. 252(a). Total amount of money under loan which is going directly to private enterprise, is going to intermediate credit institutions or other borrowers for use by private enterprise, is being used to finance imports from private sources, or is otherwise being used to finance procurement from private sources.

Loan's Compliance with Specific Requirements

43. FAA. 201(d). Is interest rate of loan at least 2% per annum during grace period and at least 3% per annum thereafter?

Yes.

44. FAA. 608(a). Information on measures to be taken to utilize U.S. government excess personal property in lieu of the procurement of new items.

The Mission will ensure that the Borrower is apprised of the availability of excess U.S. Government property and that the Borrower purchases that property which fits its needs.

45. FAA. 604(a). Will all commodity procurement financed under the loan be from U.S. except as otherwise determined by the President?	Yes. Code 941, U.S. and Bolivian sources will be used for procurement.
46. FAA. 604(b). What provision is made to prevent financing commodity procurement in bulk at prices higher than adjusted U.S. market price?	Any bulk commodities which may be procured will be subject to the bid procedure.
47. FAA. 604(d). If the host country discriminates against U.S. marine insurance companies, will loan agreement require that marine insurance be placed in the U.S. on commodities financed by the loan?	In the unlikely event that Bolivia discriminates against any U.S. marine insurance company, commodities purchased with loan funds will be insured against risks with a U.S. company as required by this section.
48. FAA. 604(e). If off-shore procurement of agricultural commodity or product is to be financed is there provision against such procurement when the domestic price of such commodity is less than parity?	Not applicable.
49. FAA. 611(b); App. 101. If loan finances water or water-related land resource construction project or program, is there a benefit-cost computation made, insofar as practicable, in accordance with the procedures set forth in the Memorandum of the President dated May 15, 1962.	Not applicable.
50. FAA. 611(c). If contracts for construction are to be financed, what provision will be made that they be let on a competitive basis to maximum extent practicable?	This requirement will be met by adherence to AID and Bolivian regulations concerning procurement of contractor services.

51. FAA. 620(g). What provision is there against use of subject assistance to compensate owners for expropriated or nationalized property?	Assistance will not be used to compensate owners for expropriated or nationalized property.
52. FAA. 612(b); s 636(h). Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services and foreign currencies owned by the U.S. are utilized to meet the cost of contractual and other services.	No Bolivian pesos owned by the U.S. are available for financing this project. An effort was made during intensive review to ensure that Bolivian sources contributed local currency to the maximum extent possible.
53. App. 104. Will any loan funds be used to pay pensions, etc., for military personnel?	No loan funds will be used to pay pensions for military personnel.
54. App. 106. If loan is for capital project, is there provision for AID approval of all contractors and contract terms?	Yes.
55. App. 107. Will any loan funds be used to pay U.N. assessments?	No.
56. App. 109. Compliance with regulations on employment of U.S. and local personnel for funds obligated after April 30, 1964 (Regulation 7).	Will comply.
57. FAA. 636(i). Will any loan funds be used to finance purchase, long-term lease, or exchange of motor vehicle manufactured outside the United States, or any guaranty of such a transaction?	No. Any motor vehicles needed, if any, will be imported from the United States, unless other procurement is authorized.
58. App. 401. Will any loan funds be used for publicity or propaganda purposes within U.S. not authorized by the Congress?	No funds will be used for publicity purposes within the U.S.

59.	FAA. 620(k). If construction of production enterprise, will aggregate value of assistance to be furnished by U.S. exceed $100 million?	No.
60.	FAA. 612(d). Does the U.S. own excess foreign currency and, if so, what arrangements have been made for its release?	U.S. does not own excess foreign currency in Bolivia.
61.	MMA. 901.b. Compliance with requirement that at least 50 per centum of the gross tonnage of commodities (computed separately for dry bulk carriers, dry cargo liners, and tankers) financed with funds made available under this loan shall be transported on privately owned U.S. flag commercial vessels to the extent that such vessels are available at fair and reasonable rates.	Regulation will be complied with.

LOAN AUTHORIZATION

Provided from: Alliance for Progress Funds
BOLIVIA: Rural Electrification

Pursuant to the authority vested in the Deputy U. S. Coordinator, Alliance for Progress, by the Foreign Assistance Act of 1961, as amended, and the delegations of authority issued thereunder, I hereby authorize the establishment of a loan ("Loan"), pursuant to Part I, Chapter 2, Title VI, Alliance for Progress, to the Government of Bolivia ("Borrower") of not to exceed four million one hundred thousand United States Dollars ($ 4,100,000) to assist in financing the United States dollar and local currency costs of the Rural Electrification Program administered by the Empresa Nacional de Electricidad S. A. (ENDE). The Loan shall be subject to the following terms and conditions:

1. Interest and Terms of Repayment

Borrower shall repay the Loan to A.I.D. in United States dollars within forty (40) years from the date of the first disbursement under the Loan, including a grace period not to exceed ten (10) years. Borrower shall pay to A.I.D. in United States dollars on the outstanding balance of the Loan interest at the rate of two percent (2%) per annum during the grace period and three percent (3%) per annum thereafter.

2. Other Terms and Conditions

(a) Goods, services (except for ocean shipping) and marine insurance financed under the Loan shall have their source and origin in Bolivia and countries included in Code 941 of the A.I.D. Georgraphic Code Book. Marine insurance may be financed under the Loan only if it is obtained on a competitive basis and any claims thereunder are payable in freely convertible currencies. Ocean shipping financed under the loan shall be procured in any country included in A.I.D. Geographic Code 941.

(b) United States dollars utilized under the Loan to finance local currency costs shall be made available pursuant to procedures satisfactory to A.I.D.

(c) Prior to any disbursement or the issuance in any commitment documents under the loan, AID shall have received and reviewed, in form and substance satisfactory to AID, evidence that the rates if effect in the ELFEC system are adequate to provide a return efficient to cover operating costs, maintenance, administration, taxes, assessments, depreciation and a positive rate of return on the rate base.

(d) Prior to any disbursement for construction costs under the loan, AID shall have established the information base and methodology necessary for adequately assessing physical progress and related socio-economic benefits of the respective sub-projects.

(e) The loan shall be subject to such other terms and conditions as AID may deem advisable.

Deputy U. S. Coordinator

Date

ORGANIZATION OF PARTICIPATING ENTITIES

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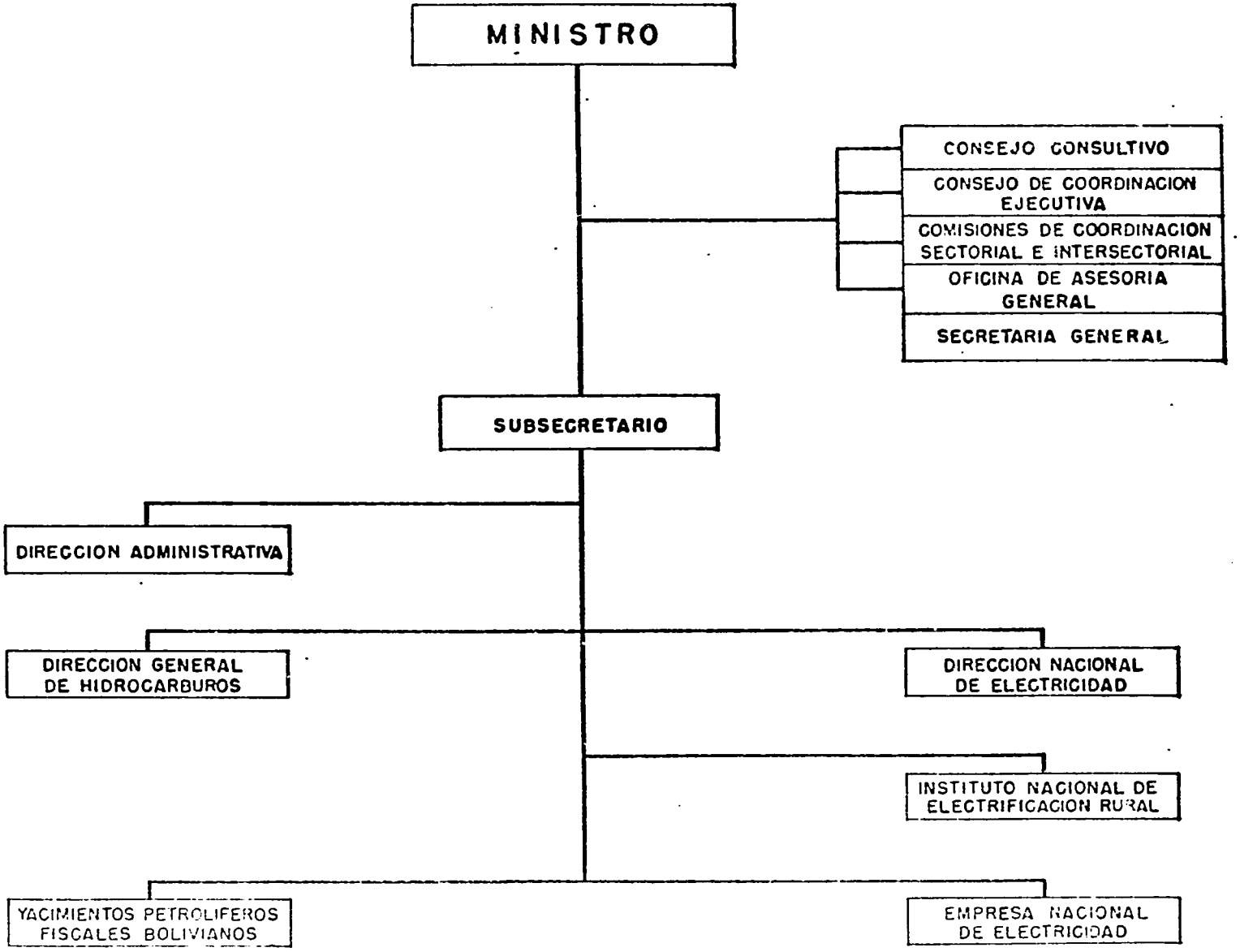
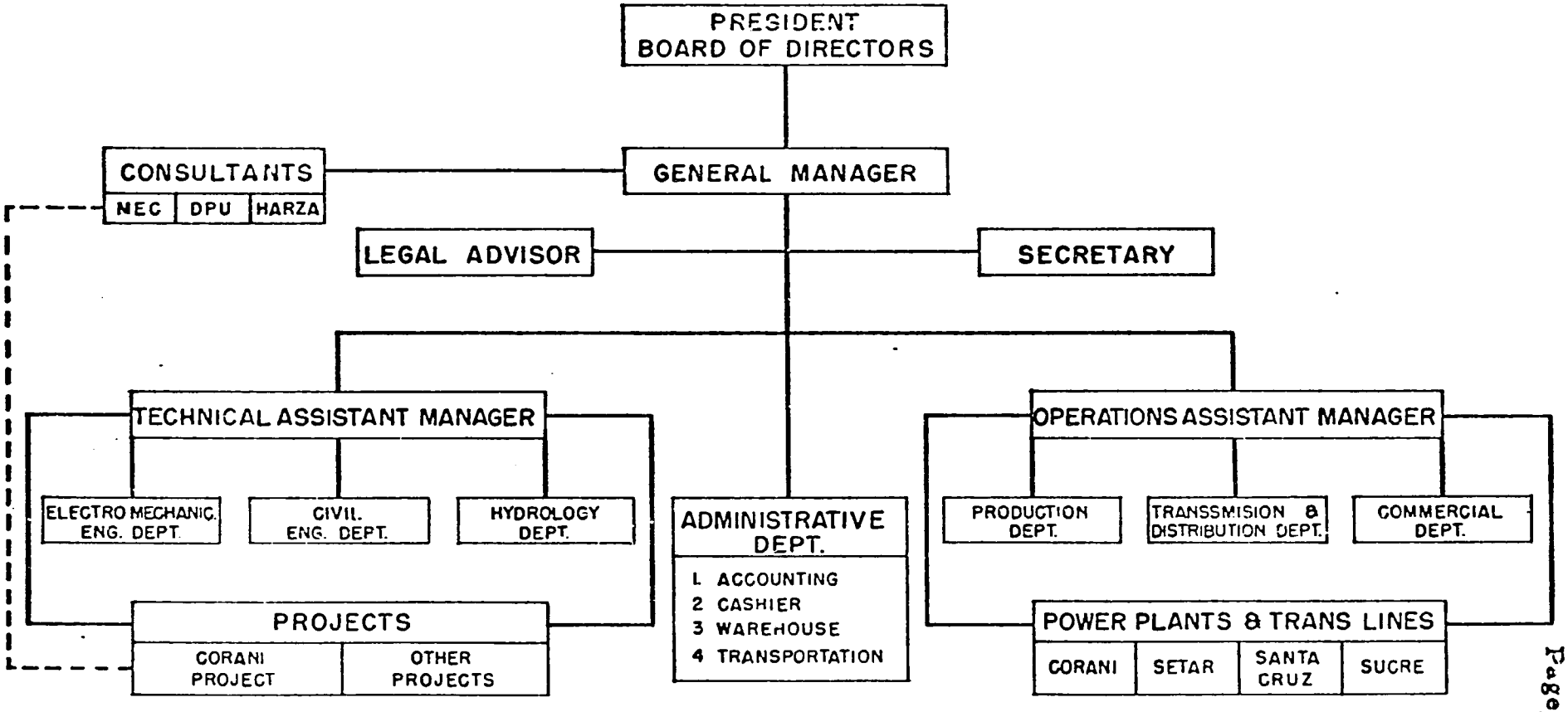
MINISTERIO DE ENERGIA E HIDROCARBUROS



EMPRESA NACIONAL DE ELECTRICIDAD

ORGANIZATION CHART



3. ENDE - PERSONNEL CURRICULUM VITAE

a. Oscar A. Morales M.

Education: Mechanic Engineer and Electrician

Professional Experience:

-ENDE Genera' Manager, July 1971 up-to-date
-ENDE Operations Under-Manager, 1969/1971
-ENDE Coordinator and Directorate Secretary, 1965/1968
-Corporación Boliviana de Fomento, La Paz, Bolivia. Engineer from Engineering Division, 1960/1964
-Sociedad Boliviana de Cemento, La Paz, Bolivia. Chief, Electrical Shop in Viacha, Jan/July 1960
-Compañía Introductora de Buenos Aires. Jefe Técnico de la Fábrica Beneficiadora de Sal, San Luis, Argentina, 1956/1959

b. Bernardo Abela Ruiz

Education:-Electro-Mechanic Engineer, Universidad Nacional de La Plata, Argentina

Professional Experience:

-Simultaneously General Manager from ELFEC S. A. and Chief, Studies and Projects Division from ENDE, 1962 up-to-date
-Corporación Boliviana de Fomento, Chief, Energy Division, 1960/1962
-Metropolitan Vickers Co. Ltd. (Now Associated Electrical Industries), 1958/1960
-Scolarship awarded by Instituto Cultura Hispánica for working in "Union Eléctrica Madrileña", Madrid, 1957/1958
-Corporación Comercial Boliviana S.A. (COBANA), (Electrical Division), 1956/1957
Corporación Minera de Bolivia (COMIBOL), 1953/1956
Private electrical works, 1951/1953

c. Claude Bessé Arze

Education: -Electro-Mechanic Engineer. Universidad Nacional de Córdoba, Argentina

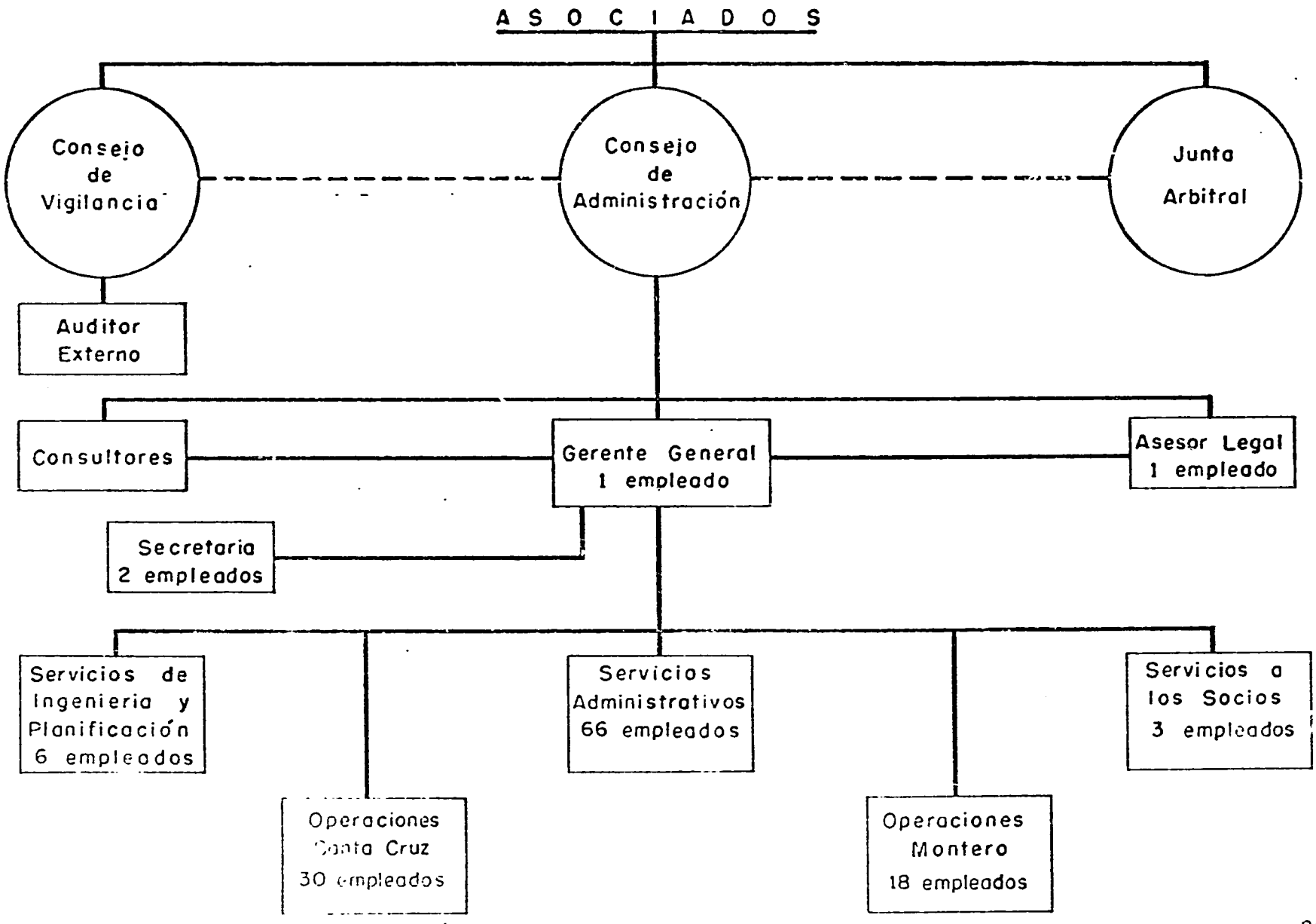
Professional Experience:
-ENDE from 1963 up-to-date
-DINE, as Engineer for the Studies and Projects Department

d. Eduardo Rodriguez Arauco

Education: -Electro-Mechanic Engineer. Facultad de Ingeniería de La Plata, Argentina

Professional Experience:
-ENDE, 1963 up-to-date
-YPFB, Instruments Engineer, 1962/1963.

COOPERATIVA RURAL DE ELECTRIFICACION LTDA. CRE
SANTA CRUZ - BOLIVIA
ORGANIGRAMA PARA 1975*



* Incluye 127 empleados. Se estima que habrán 30,000 usuarios.

26 8.72

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ANNEX II
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5. CRE - PERSONNEL CURRICULUM VITAE

a. Dante Pavisich Ribera

Education: CIVIL ENGINEER

Professional Experience:

-Cooperativa Rural de Electrificación Ltda. CRE General Manager - 3 years
-Ministerio de Planificación - Minister - 10 Months
-Comité de Obras Públicas - President - 2 years
-Ministerio de Economía - Advisor - 1 year
-Fábrica Abrasivos (Brasil), Manager - 4 years

b. Guido Entrambasaguas Garrón

Education: AUDITOR

Professional Experience:

-Administrative Chief - Cooperativa Rural de Electrificación Ltda. "CRE"
-Economic Advisor - Ingenio Azucarero "San Aurelio" S.A.
-Chief of Accountants - Cia. Industrial Azucarera San Aurelio S.A.
-Auditor Area No. 1 - Banco Agrícola de Bolivia
-Deputy Manager and First Accountant - Cia. de Teléfonos Automáticos Sucre S.A.

c. Guillermo Aguilera Ramirez

Education: ELECTRIC-MECHANIC TECHNICIAN

Professional Experience:

-Operations Chief - Cooperativa Rural de Electrificación Ltda. "CRE" - 20 months
-Assistant Operations Chief - Servicios Eléctricos Santa Cruz "SELSAC" - 2 years
-Superintendent Power Generation Plant Maintenance - Bolivian Power

d. Ronald Mariano Paz Dittmar

Education: ELECTRIC ENGINEER

Professional Experience:

-Cooperativa Rural de Electrificación Ltda. CRE - Electric Engineer - From January 6, 1971 up todate
-Empresa Nacional de Electricidad - Departamento de Transmisión de la Sub-Gerencia de Operaciones

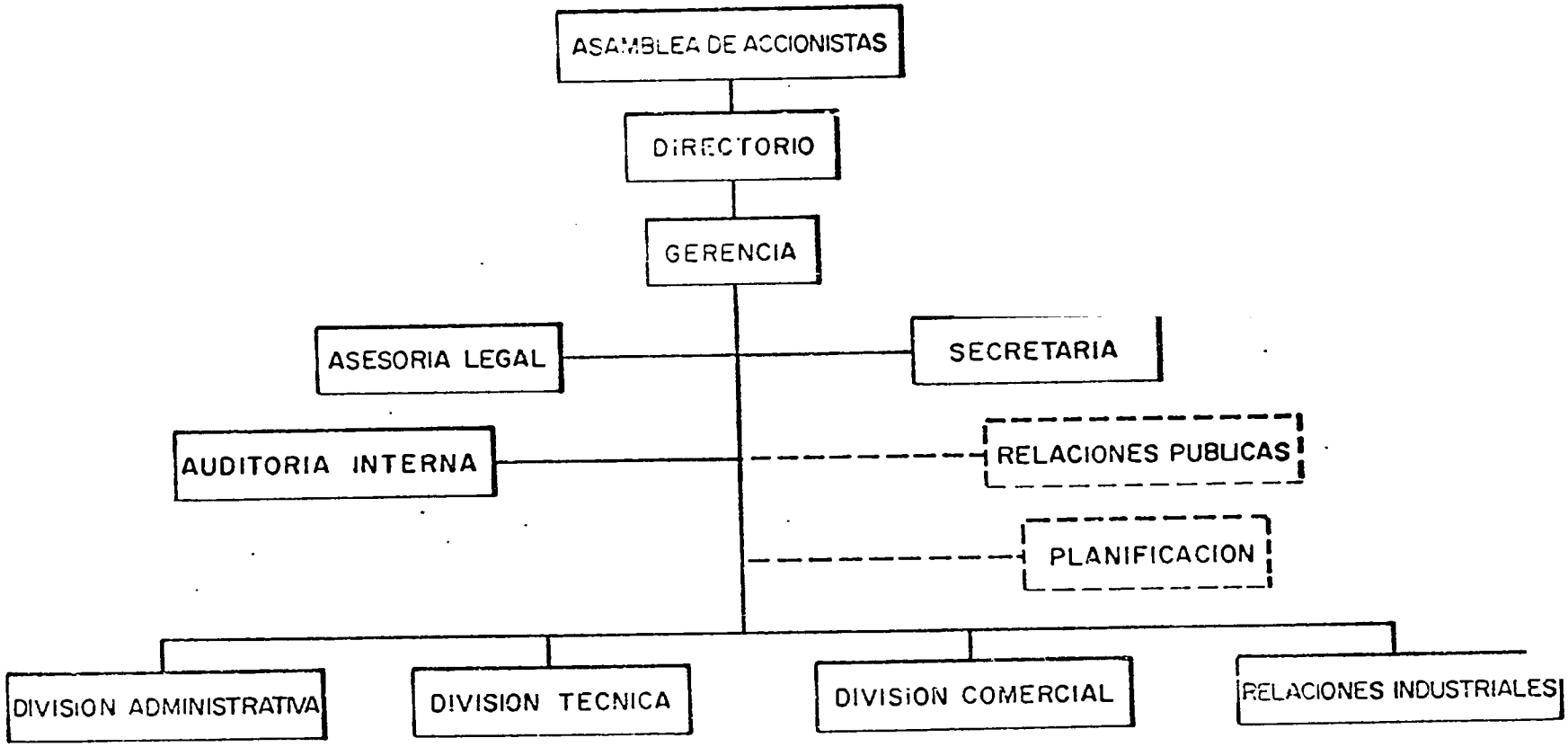
e. Calixto Orlando Galarza G.

Education: MECHANIC ENGINEER - ELECTRIC

Professional Experience:

-Cooperativa Rural de Electrificación Ltda. CRE - Departamento de Ingeniería from March 1972 todate
-Empresa Nacional de Electricidad - Depto. Electromecánico.

ORGANIGRAMA BASE DE ELFECSA



E.L.F.E.C. COCHABAMBA —, BOLIVIA		ORGANIGRAMA Designed / Drawing C.Q.S. / Checked / Date 11-IX-72	ANNEX

7. ELFEC - PERSONNEL CURRICULUM VITAE

a. Orlando Joffre D.

Education:-ELECTRICAL ENGINEERING degree from Córdoba University, Argentina, 1954
-Master of Science in Electrical Engineering from Purdue University, U.S.A. 1956

Professional Experience:
-General Manager of ELFEC since 1964
-Superintendent, Technical Division of ELFEC: 1963/1964
-Head of Electrical Dept. Empresa Minera San José, COMIBOL, 1960/1963
-Head of Electrical Dept. Siglo XX, Empresa Minera Catavi COMIBOL, 1957/1960
-Engineer, Transmission Dept. of Cleveland Electric Illuminating Co., Cleveland, Ohio, U.S.A. 1956/1957

b. Federico Lucero B.

Education: -Degree in ELECTRO-MECHANICAL Engineering from Córdoba, University of Argentina

Professional Experience:
-Chief of the Technical Division - ELFEC, since 1971
-Supervisor, Transmission & Distribution - Santa Cruz Project 1969/1970
-Maintenance Engineer in Santa Cruz - 1968/1969
-Engineer in charge of construction, ELFEC, 1967

c. Augusto Quiroga Hurtado

Education:-National Certificate of Accountant from Buchon Institute of Commerce - Cochabamba
-Special Studies in Administration and Management in the "Centro Boliviano de Productividad Industrial", "Instituto de Administración Pública" and "Centro de Estudios Empresariales".

Professional Experience:
-Chief of the Administration Division - ELFEC
-Chief of Accountants - ELFEC

d. Carlos Ulloa N.

Education: -Degree in Electrical Engineering from San Andrés University, La Paz-Bolivia, 1969
-Specialist on Electronic Data Processing Systems, South American School, IBM - Argentina, 1966.

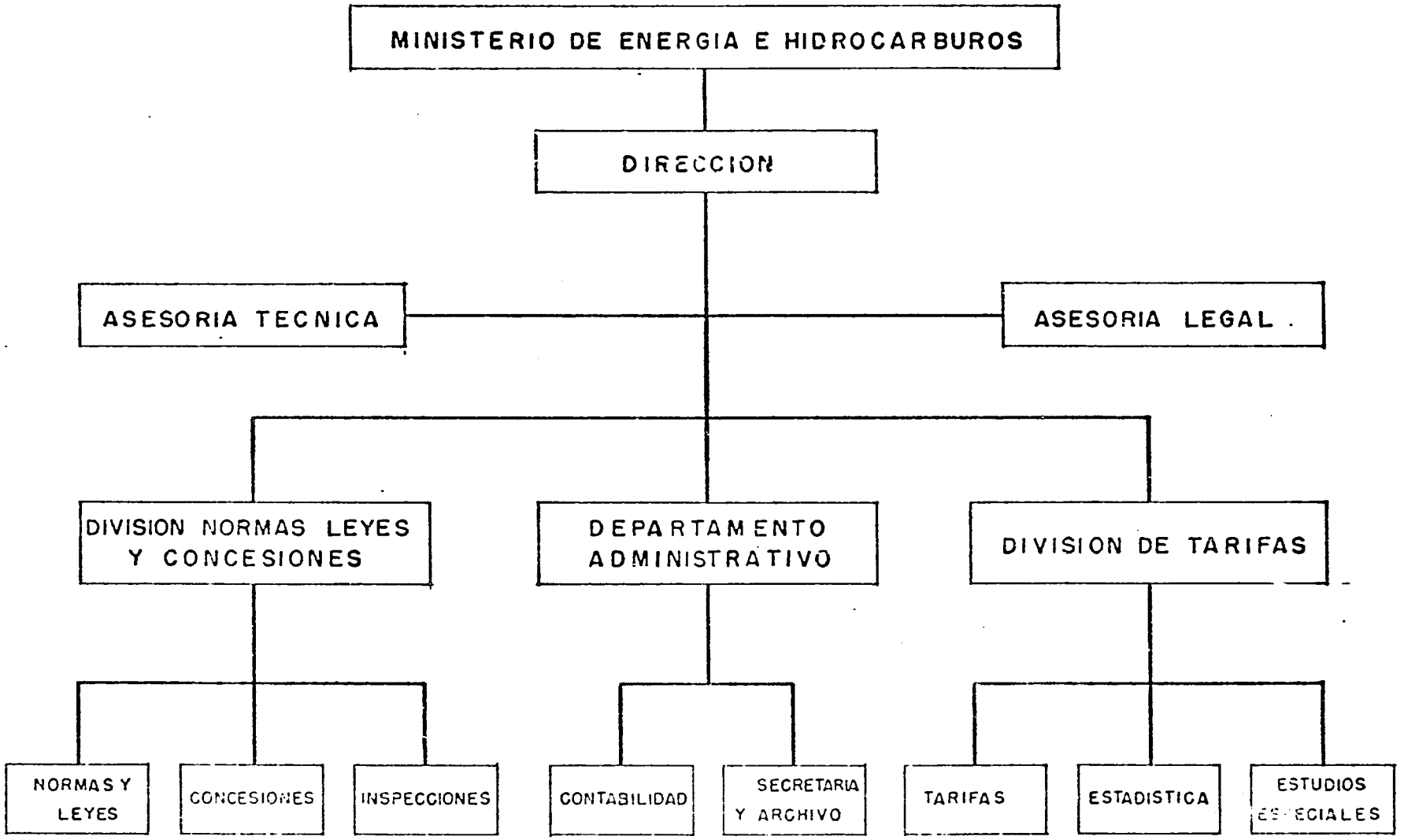
Professional Experience:
-Chief of Rural Electrification, ELFEC/ENDE, since 1972
-Electrical Engineer, Rural Electrification, ELFEC/ENDE 1970/1971

e. Oscar Salinas

Education: -Degree in Electrical Engineering from the Technical School of Engineering, University of Barcelona, Spain

Professional Experience:
-Electrical Engineer, Rural Electrification ELFEC, since 1972.

DIRECCION NACIONAL DE ELECTRICIDAD



9. DINE - PERSONNEL CURRICULUM VITAE

a. Roger Levy Sanjines

Education: -Electro-Mechanical Engineering - Universidad Mayor de San Andrés
-Economic Development Course by CEPAL
-Training in a Factory - Belgium. ACEC Factory
-Training in Ecuador - Preparation and Evaluation of Projects

Professional Experience:
-Dirección Nacional de Electricidad - Chief Division of Standards Regulations and Concessions - 1969 to present
-Banco Industrial - Deputy Chief Technical Division 1966-1969
-Dirección Nacional de Electricidad - Project Engineer, 1963-1966
-Junta Nacional de Planificación: Projects Evaluation, 1962

b. Renán Arce M.

Education: Ecole-Plytechnique Federale - Suiza -Electric Engineer

Professional Experience:
-Dirección Nacional de Electricidad - Chief Division and Director - Fare Division
-Motor Columbus S. A. - Design Engineer, 1970-1971
-Prudencio Claros y Asociados - Ingenieros Consultores - Project Engineer - 1969

c. Jorge Zamora Mujía

Education: -Civil Engineering - Universidad Técnica de Oruro

Professional Experience:
-Acting Under-Secretary - Ministerio de Energía e Hidrocarburos on loan from the Dirección Nacional de Electricidad
-Director - Dirección Nacional de Electricidad, 1967/1971
-Chief of Energetic - Secretaría de Planificación, 1962-1967
-Director-Engineer - Fábrica de Cemento - Sucre, 1953-1959.

ENGINEERING AND CONSTRUCTION ANALYSIS

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1. TECHNICAL DESCRIPTION OF THE PROJECT.

The physical aspects of this project are the construction of transmission, substation, distribution and service facilities to provide electricity to the rural and sub-urban areas in the vicinity of the cities of Cochabamba and Santa Cruz, two of the most populated areas of Bolivia that are much lacking and desirous of electric service. Supporting facilities and equipment will be provided such as vehicles and work equipment and tools. Included also are office and warehouse buildings for the Santa Cruz sub-project.

Each project description is as follows:

a. Santa Cruz

In Santa Cruz, CRE operates a system that provides electric distribution to the city of Santa Cruz and to the rural areas of Warnes, Montero, Portachuelo, General Saavedra and Mineros to the North of Santa Cruz. The primary system operates at 10 KV delta while the rural distribution is a 14.4/24.9 KV ungrounded wye. The proposed sub-project consists of the extension of the 14.4/24.9 KV rural system into presently unserved areas, correction of low voltage conditions existing in the 10 KV delta urban system by converting the sub-urban 10 KV circuits to 14.4/24.9 KV wye, installation of neutral conductor on the presently ungrounded 14.4/24.9 KV circuits and replacing of 30 three-phase distribution transformers in the rural communities to increase the present 204/353 secondary voltage to the standard 220/380 volts.

In addition to the extensions and improvements to the physical plant, funds are provided for headquarters and warehouse buildings, additional vehicles, communications equipment, lineman's tools and office equipment.

The new distribution facilities will have a capacity to serve an expected 14,000 residential, 11,000 farm, 900 small commercial and 1,700 large commercial-industrial consumers ten years hence. In addition it can serve an expected 1,000 irrigation systems and 30 street lighting systems, totalling 2,250 street lights.

The system is designed according to U. S. utility practice which provides circuit capacities for loads expected during the first 10 years of operation. Voltage regulation studies show that the system design will provide voltage regulation at ends of circuits well within the 6% allowable by good utility operating standards. With the use of voltage regulations the circuit capacity can be increased to meet load requirements after 6% regulation has been reached.

The three-phase primary conductors will be standardized at #1/0 ACSR phase wire and #4 ACSR neutral wire. For tap lines #4 ACSR for both primary and neutral wires will be used unless specific loads require larger size wire. Secondary circuits will be either #1/0 ACSR or #4 ACSR depending on the projected loads to be served by the particular secondary circuit. Service drops will be ACSR duplex and quadruplex conductors.

Transformers will be of U. S. standard design to provide 220/380 volts secondary utilization voltage.

The CRE system will be sectionalized by use of automatic oil circuit reclosers to reduce circuit outages to a minimum.

The electric distribution facilities included in the loan consist of the following:

640 Km	14.4/24.9 KV three-phase line
252 Km	14.4 KV single-phase line
210 Km	220/380 volt secondary line
86 Km	220/380 volt secondary underbuilt
2,250	Street light installations (30 systems)
14,000	Interior house wiring installations

ENDE is presently providing power to CRE from the 13.2 MW gas/diesel generating plant. The CRE 10 KV urban system connects to the plant while its 14.4/24.9 KV rural system is served from an ENDE 69 KV transmission line to to Warnes where an ENDE 69 KV - 14.4/24.9 KV 5000 KVA substation is located.

ENDE is extending its 69 KV line 25 Km from Warnes to Montero with other financing and CRE is extending this same 69 KV line 50 Km further, from Montero to Buena Vista with funds provided by this loan.

The 69 KV transmission line will be built on steel and concrete poles. Conductor will be ACSR with static wire.

Substations will be of standard design built in a fenced area and following REA standards for grounding. The structures will be either wood or steel, with gang operated disconnect switches on the high-voltage side, oil circuit reclosers on the low-voltage side, lightning arresters on both high and low-voltage sides and KVAR metering on the outgoing lines. Transformers will be either three-phase automatic tap changing under load or single-phase with single-phase regulators to provide regulated bus-voltage.

The CRE 69 KV transmission and substations will consist of the following:

50 KM	69	KV	line
1	10,000	KVA	10 KV - 69 KV substation
1	15,000	KVA	10 KV - 14.4/24.9 KV substation
2	5,000	KVA	69 KV - 14.4/24.9 KV substation

CRE needs facilities to accommodate its present and future staff. Preliminary plans for the development of office and warehouse facilities for CRE have been prepared. Office building layout was conceived assuring its being functional as general offices of a large and busy cooperative and also be responsive to public needs. Offices dealing with the general public on a daily basis are easily accessible. A demonstration room, centrally located within this public area, will permit the display of a model kitchen, will provide space for other promotional activities, and may be utilized for meetings, lectures and other purposes. Offices for staff departments, such as member services, engineering, operations, and administration, as well as a combination General Manager's office - board room are also provided within easy access, but removed from the public area to insure some degree of privacy. General plan sheets for both office and warehouse buildings are shown in this Annex.

b. Cochabamba

The proposed sub-project consists of extending the existing 14.4/24.9 KV distribution system with a capacity to serve an expected 20,000 residential, 13,400 farm, 400 small commercial consumers, 215 large commercial-industrial consumers and 50 irrigation and 25 street systems of the rural area type. Also a neutral conductor will be installed and the existing ungrounded 14.4/24.9 KV wye circuits will be grounded. To assist ELFEC in its operations and maintenance, funds are included for additional vehicles, communication equipment and lineman's tools.

Primary 14.4/24.9 KV three-phase lines will use #1/0 ACSR phase wires and #4 ACSR neutral wire. Tap lines will use #4 ACSR for both phase and neutral wires, unless specific loads will required larger size conductors. Secondary conductors will be #1/0 ACSR with #4 ACSR neutral. Service drops will be ACSR duplex and quadruplex.

The voltage regulation study shows that the system design will provide voltage regulation at ends of circuits well within the 6% allowed by good utility operating standards. With the use of voltage regulators the circuit capacity can be increased to meet load requirements after the 6% regulation has been reached.

Transformers will be of standard design to provide 220/380 volt secondary utilization voltages. The ELFEC circuits will be sectionalized by oil circuit reclosers to improve operation through reduction of circuit outage time.

The ELFEC distribution facilities to be constructed with funds in this loan are as follows:

132	Km	14.4/24.9 KV three-phase line
362	Km	14.4 KV single-phase line
107	Km	220/380 volt secondary line
214	Km	220/380 volt secondary underbuild line
740		Street light installation (25 systems)
4000		Interior house wiring installations
1 5000	KVA	115 KV - 14.4/24.9 KV substation
1 10000	KVA	115 KV - 14.4/24.9 substation

2. ANALYSIS OF PROJECT COSTS.

a. SUMMARY

AID Loan

	Foreign Exchange	Local Currency	Total AID Loan	Local Contribution	TOTAL
ELFEC	2,992,860	1,075,910	4,068,770	453,367	4,522,137
CRE	5,058,322	1,672,908	6,731,230	769,161	7,500,391
	8,051,182	2,748,818	10,800,000	1,222,528	12,022,528
Percent of Project Cost	67%	23%	90%	10%	100%

b. MAJOR COMPONENT OF PROJECT COSTS

Item	Cochabamba ELFEC	Santa Cruz CRE	TOTAL
AID Loan			
1. Transmission		533,900	533,900
2. Substations	250,000	442,700	692,700
3. Distribution	2,842,670	4,073,190	6,915,860
4. Facilities and Equipment	215,500	406,000	621,500
5. Engineering	309,267	529,950	839,217
6. Contingency	351,333	595,490	946,823
7. Technical Assistance	100,000	150,000	250,000

c. LOCAL CURRENCY AND DOLLAR COST BREAKDOWN.

AID Loan

Item	Dollar Costs	Local Costs	Local Contributions	Total
Materials	6,352,083	648,144	267,500	7,267,727
Construction		1,142,233	200,000	1,342,233
Vehicles and Equipment	421,500	-	-	421,500
Buildings, Furniture and Land	50,000	150,000	-	200,000
Engineering	335,687	503,530	148,533	987,750
Contingency	641,912	304,911	-	946,823
Technical Assistance	250,000	-	-	250,000
Project Administ. (ENDE Project Coordin Expenses)	-	-	350,000	350,000
Interest during Construction	-	-	256,495	256,495
TOTAL	8,051,182	2,748,818	1,222,528	12,022,528

3. DETAILED PROJECT COSTS.

C. R. E.

ITEM	F/C (US$)	L/C(US$)	TOTAL (US$)
	A.I.D. Loan Funds		
TRANSMISSION			
a. Right of way clearing		11,725	11,725
b. Poles, towers and fixtures	45,500	P. 165,000 L. 11,375	221,875
c. Overhead Conductors	200,200	100,100	300,300
Sub-Total	245,700	288,200	533,900
SUBSTATIONS			
a. R/W Clearing and Preparation		30,000	30,000
b. Structures	50,000	20,000	70,000
c. Conduit, wiring & busses	10,000	10,000	20,000
d. Protective & Auxiliary Equipment	32,700	5,000	37,700
e. Switchgear	15,000	5,000	20,000
f. Transformers	215,000	15,000	230,000
g. Regulators	30,000	5,000	35,000
Sub-Total	352,700	90,000	442,700
DISTRIBUTION			
a. Right of way clearing		5,326	5,326
b. Poles, towers & Fixtures	955,449	P. 190,182 L. 239,000	1,384,631
c. Overhead Conductors	566,250	141,548	707,798
d. Line Transformers	731,638	22,106	753,744
e. Services	135,302	34,171	169,473
f. Meters	286,960	18,564	305,524
g. Inside house wiring	270,507	19,608	290,115
h. Sectionalizing Devices	128,800	1,680	130,480
i. Street lighting	45,500	13,650	59,150
Sub-Total	3,120,406	685,835	3,806,241

P. = Poles
L. = Labor

ITEM	F/C (US$)	L/C (US$)	TOTAL (US$)
GENERAL			
a. Office Buildings & Warehouses		140,000	140,000
b. Office Furniture & Equipment	50,000	6,000	56,000
c. Transportation Equipment	130,000		130,000
d. Tools and Work Equipment	10,000		10,000
e. Shop Equipment	35,000		35,000
f. Communications Equipment	35,000		35,000
Sub-Total	260,000	146,000	406,000
IMPROVEMENTS AND REPLACEMENTS			
a. Install Neutral Conductor	11,680	8,320	20,000
b. Install Grounds	1,000	1,000	2,000
c. Replace 204/353 Volt Transformers with 220/380 Volt Transformers	34,419	4,950	39,369
d. Replace 10 KV transformers with 14.4 KV transformers	200,000	5,580	205,580
Sub-Total	247,099	19,850	266,949
ENGINEERING	211,980	317,970	529,950
CONTINGENCY	470,437	125,053	595,490
TECHNICAL ASSISTANCE	150,000		150,000
Sub-Total AID Loan	5,058,322	1,672,908	6,731,230
LOCAL CONTRIBUTION			
INTEREST DURING CONSTRUCTION		156,175	156,175
ENDE PROJECT ADMINISTRATION		225,000	225,000
ENGINEERING		95,986	95,986
MATERIAL HANDLING		172,000	172,000
RIGHT OF WAY PROCUREMENT & LAND RIGHTS		120,000	120,000
Sub-Total Local Contribution		769,161	769,161
TOTAL PROJECT COST	5,058,322	2,442,069	7,500,391

E. L. F. E. C.

ITEM	F/C(US$)	L/C(US$)	TOTAL(US$)
A.I.D. LOAN FUNDS			
SUBSTATIONS			
a. Land and Land rights	25,000	5,000	30,000
b. Structures	5,000	3,000	8,000
c. Conduit, wiring and busses	40,500	5,000	45,500
d. Protective and Auxiliary Equipment	13,000	5,000	18,000
e. Switchgear	141,000	7,500	148,500
f. Transformers			
Sub-Total	224,500	25,500	250,000
DISTRIBUTION			
a. Right of Way Clearing		5,165	5,165
b. Poles, towers and fixtures	486,934	L. 121,734 P. 293,062	901,730
c. Overhead conductors	231,496	57,874	289,370
d. Line Transformers	643,011	71,445	714,456
e. Services	122,890	61,445	184,335
f. Meters	237,247	40,867	278,114
g. Inside house wiring	81,600	14,400	96,000
h. Sectionalizing Devices	13,500	1,500	15,000
i. Street Lighting	45,000	13,500	58,500
Sub-Total	1,861,678	680,992	2,542,670
GENERAL			
a. Transportation equipment	129,000		129,000
b. Tools and work Equipment	15,000		15,000
c. Communications equipment	31,500		31,500
Sub-Total	175,500		175,500

P. = Poles
L. = Labor

ITEM	F/C(US$)	L/C(US$)	TOTAL(US$)
IMPROVEMENTS AND REPLACEMENTS			
Add neutral conductor, Install ground wires and driven grounds to suburban area	200,000	100,000	300,000
Sub-Total	200,000	100,000	300,000
ENGINEERING	123,707	185,560	309,267
CONTINGENCY	271,475	79,858	351,333
TECHNICAL ASSISTANCE	100,000		100,000
POLE TREATING PLANT	36,000	4,000	40,000
Sub-Total AID Loan	2,992,860	1,075,910	4,068,770
	LOCAL CONTRIBUTION		
INTEREST DURING CONSTRUCTION		100,320	100,320
ENDE PROJECT ADMINISTRATION		125,000	125,000
ENGINEERING		52,547	52,547
MATERIAL HANDLING		95,500	95,500
RIGHT OF WAY PROCUREMENT LAND RIGHTS		80,000	80,000
Sub-Total Local Contributions		453,367	453,367
TOTAL PROJECT COST	2,992,860	1,529,277	4,522,137

4. UNIT COST ANALYSIS

a. BASE COST PER KILOMETER ---- Main 3Ø Feeders
14.4/24.9 KV 3#1/0 ACSR - 1# 4 ACSR

Quantity	Description	US$/Unit Material Cost	Extended Material Cost	US$ Labor Cost
10	10 m. Pole	18.50	185.00	46.25
5	12 m. Pole	23.00	115.00	28.75
9	VC-1	31.66	284.94	71.24
3	VC-2	66.47	199.41	49.85
1	VC-3	48.13	48.13	12.03
1	VC4-1	94.47	94.47	23.62
1	VC-8	115.28	115.28	28.82
3000 m.	D-1/0 ACSR	0.20	600.00	150.00
1000 m.	D-4 ACSR	0.10	100.00	25.00
5	VEI-2	7.68	38.40	9.60
1	E2-2	12.51	12.51	3.13
3	VE6-2	15.90	47.70	11.93
11	F2-2	5.03	55.33	13.83
15	VM2-11	4.83	72.45	18.11
15	VM-10-15	1.23	18.45	4.61
		TOTAL	1,987.07	496.77
		Combined		2,483.84

Note: All driven grounds are included with equipment installations and secondary dead-ends.

b. BASE COST PER KILOMETER ---- 3Ø Taps
14.4/24.9 KV. 4 # 4 ACSR

8	10 m. Pole	18.50	148.00	37.00
8	12 m. Pole	23.00	184.00	46.00
4	VC-1	31.66	126.64	31.66
4	VC-2	66.47	265.88	66.47
2	VC-3	48.13	96.26	24.07
2	VC4-1	94.47	188.94	47.24
4	VC-7	68.41	273.64	68.41
2	VC-8	115.28	230.56	57.64
4000 m.	D-4ACSR	0.10	400.00	100.00
8	VEI-2	7.68	61.44	15.36
1	E-2-2	12.51	12.51	3.13
6	VE6-2	15.90	95.40	23.85
20	F2-2	5.03	100.00	25.15

Quantity	Description	US$/Unit Material Cost	Extended Material Cost	US$ Labor Cost
12	VM2-11	4.83	57.96	14.49
16	VM10-15	1.23	19.68	4.92
		TOTAL	2,261.51	565.36
		Combined		2,826.87

Note: All driven grounds are included with equipment installations and secondary dead-ends
Quantities are based on 2 Taps/Kilometer

c. BASE COST PER KILOMETER ---- 1ø Taps
14.4/KV 2# 4 ACSR

17	10 m. Poles	18.50	314.50	78.63
3	12 m. Poles	23.00	69.00	17.25
7	VA-1	7.98	55.86	13.97
3	VA-2	16.38	49.14	12.29
2	VA-3	16.78	33.56	8.39
1	VA-4	32.47	32.47	8.12
6	VA-5	15.69	94.14	23.54
1	VA-6	31.58	31.58	7.90
2000 m.	D-4 ACSR	0.10	200.00	50.00
15	VE1-2	7.68	115.20	28.80
1	E-2-2	12.51	12.51	3.13
15	P2-2	5.03	75.45	18.86
17	VM2-11	4.83	82.11	20.53
20	VM10-14	0.69	13.80	3.45
		TOTAL	1,179.32	294.86
		Combined		1,474.18

Note: All driven grounds are included with equipment installations and secondary dead-ends
Quantities are based on 3 Taps/Kilometer

d. BASE COST OF PSP TRANSFORMERS ---- 14.4 KV
1 ø INSTALLATIONS

Quantity	Description	US$/Unit Material Cost	US$ Labor Cost	US$ Total Cost
1-5 KVA	VE105-VE106	200.81	20.00	220.80
1-10 KVA	VE105-VE106	222.33	25.00	247.33
1-15 KVA	VE105-VE106	275.65	30.00	305.65
1-25 KVA	VE105-VE106	344.91	35.00	379.91

e. BASE COST OF CONVENTIONAL TRANSFORMERS -- 14.4 KV/24.9
3 ∅ Installations

Quantity	Descriptions	US$/Unit Material Cost	US$ Labor Cost	US$ Total Cost
3-5 KVA	VG312-15KVA	601.41	90.00	691.41
3-10 KVA	VG312-30KVA	685.49	105.00	790.49
3-15 KVA	VG312-45KVA	822.77	125.00	947.77
3-25 KVA	VG312-75KVA	1042.88	150.00	1,192.88
3-37.1/2KVA	VG312-112.5KVA	1371.99	180.00	1,551.99
3-50 KVA	VG-312-150KVA	1489.63	225.00	1,714.63
	Platform	250.00		
3-100 KVA	Platform Mount	2600.65	525.00	3,125.65
3-167 KVA	Platform Mount	3456.97	655.00	4,111.97
3-250 KVA	Platform Mount	4578.40	855.00	5,433.40

Note: CSP Transformer unit costs include driven grounds and primary and secondary jumpers and connectors
Conventional transformer unit costs also include the installation of lighting arresters and fuse cutouts.

f. BASE COST PER KILOMETER ---- 3 ∅ - 220/380 Volts
SECONDARY UNDERBUILD # 1/0 ACSR

Quantity	Description	US$/Unit Material Cost	Extended Material Cost	US$ Labor Cost
36	J - 5	1.17	42.12	10.53
12	J - 6	2.07	24.84	6.21
12	J - 7	2.07	24.84	6.21
3000 m.	D-1/0 ACSR	0.20	600.00	150.00
4	VEI-2	7.68	30.72	7.68
4	F2-2	5.03	20.12	5.03
4	VM2-12	6.01	24.04	6.01
		TOTAL	766.68	191.67
		Combined		583.35

g. BASE COST PER KILOMETER ---- 3 ∅ - 220/380 Volts
SECONDARY UNDERBUILD # 4 ACSR

36	J - 5	1.17	42.12	10.53
12	J - 6	2.07	24.84	6.21
12	J - 7	2.07	24.84	6.21
3000 m.	D-4 ACSR	0.10	300.00	75.00
4	VEI-2	7.68	30.72	7.68

Quantity	Description	US$/Unit Material Cost	Extended Material Cost	US$ Labor Cost
4	F2-2	5.03	20.12	5.03
4	VM2-12	6.01	24.04	6.01
		TOTAL	466.68	116.67
		Combined		583.35

h. BASE COST PER KILOMETER SECONDARY UNDERBUILD ---- 1 Ø - 220 Volts # 1/0 ACSR

12	J - 5	1.17	14.04	3.51
4	J - 6	2.07	8.28	2.07
4	J - 7	2.07	8.28	2.07
1000 m.	D-1/0 ACSR	0.20	200.00	50.00
4	VEI-2	7.68	30.72	7.68
4	F2-2	5.03	20.12	5.03
4	VM2-12	6.01	24.04	6.01
		TOTAL	305.48	76.37
		Combined		381.85

i. BASE COST PER KILOMETER SECONDARY UNDERBUILD ---- 1 Ø - 220 Volts # 4 ACSR

12	J - 5	1.17	14.04	3.51
4	J - 6	2.07	8.28	2.07
4	J - 7	2.07	8.28	2.07
1000 m.	D-4ACSR	0.10	100.00	25.00
4	VEI-2	7.68	30.72	7.68
4	F2-2	5.03	20.12	5.03
4	VM2-12	6.01	24.04	6.01
		TOTAL	205.48	51.37
		Combined		256.85

j. BASE COST PER KILOMETER SECONDARY ---- 3Ø-220/380 Volts # 1/0 ACSR

30	10 m. Poles	18.50	555.00	138.75
96	J - 5	1.17	112.32	28.08
24	J - 6	2.07	49.68	12.42
4000 m.	D-1/0 ACSR	0.20	800.00	200.00
6	VEI-2	7.68	46.08	11.52

Quantity	Description	US$/Unit Material Cost	Extended Material Cost	US$ Labor Cost
6	F2-2	5.03	30.18	7.55
6	VM2-12	6.01	36.06	9.02
		TOTAL	1,629.32	407.34
		Combined	2,036.66	
k. BASE COST PER KILOMETER SECONDARY		----	3Ø - 220/380 Volts #4 ACSR	
30	10 m. Poles	18.50	555.00	138.75
96	J-5	1.17	112.32	28.08
24	J-6	2.07	49.68	12.42
4000 m.	D-4 ACSR	0.10	400.00	100.00
6	VEI-2	7.68	46.08	11.52
6	F2-2	5.03	30.18	7.55
6	VM2-12	6.01	36.06	9.02
		TOTAL	1,229.32	307.34
		Combined	1,536.66	
l. BASE COST PER KILOMETER SECONDARY		----	1 Ø - 220 Volts # 1/0 ACSR	
30	10 m. Poles	18.50	555.00	138.75
48	J-5	1.17	56.16	14.04
12	J-6	2.07	24.84	6.21
2000 m.	D-1/0 ACSR	0.20	400.00	100.00
6	VEI-2	7.68	46.08	11.52
6	F2-2	5.03	30.18	7.55
6	VM2-12	6.01	36.06	9.02
		TOTAL	1,148.32	287.09
		Combined	1,435.41	
m. BASE COST PER KILOMETER SECONDARY		----	1 Ø - 220 Volts # 4 ACSR	
30	10 m. Poles	18.50	555.00	138.75
48	J-5	1.17	56.16	14.04
12	J-6	2.07	24.84	6.21
2000 m.	D-4 ACSR	0.10	200.00	50.00
6	VEI-2	7.68	46.08	11.52

Quantity	Description	US$/Unit Material Cost	Extended Material Cost	US$ Labor Cost
6	F2-2	5.03	30.18	7.55
6	VM2-12	6.01	36.06	9.02
		TOTAL	948.32	237.09
		Combined		1,185.41

n. BASE COST OF SERVICE INSTALLATION

Quantity	Description	US$/Unit Material Cost	US$ Labor Cost	US$ Total Cost
100'	2 # 6 Duplex	9.53	5.24	14.77
100'	2 # 4 Duplex	14.50	7.98	22.48
100'	2 # 1/0 Duplex	22.05	12.13	34.18
100'	4 # 6 Quadruplex	17.95	9.87	27.82
100'	4 # 4 Quadruplex	27.90	15.35	43.25
100'	4 # 1/0 Quadruplex	41.90	23.05	64.95
100'	4 #3/0 Quadruplex	63.50	34.93	98.43

Note: Materials common to all 2 Wire Service Installations

2- Split bolt connectors	$ 1.47
1- Swinging Clevis	$ 1.33
1- Wire holder	$ 0.41
2- Dead End Grips	$ 0.76
	$ 3.97

Materials common to all 4-Wire Service Installations

4- Split bolt connectors	$ 3.43
1- Swinging Clevis	$ 1.33
1- Wire Holder	$ 0.45
2- Dead-End grips	$ 0.96
	$ 6.17

o. BASE UNIT COST OF METERS

Description	US$/Unit Material Cost	US$ Labor Cost	US$ Total Cost
Watthour Meter-Class 100 Socket, Type R-2 2 W-220 Volt - 50 Hz	20.00 (Includes Socket)	3.00	23.00

Description	US$/Unit Material Cost	US$ Labor Cost	US$ Total Cost
Watthour Meter-Class 200 Socket, Type R-2 2 W - 220 Volt - 50 Hz	20.00 (Includes Socket)	3.00	23.00
Watthour Meter-Class 200 Socket, Type SV-60 3 Element - 220 Volt 50 Hz	100.00	5.00	25.00
Current Transformers 200/5 - 600/5	35.00	3.00	38.00
800/5	40.00	3.00	43.00
Watthour Meter-Class 10 Socket, Type SV-60 3 Element - 220 Volt 50 Hz	100.00 (Includes Socket)	5.00	25.00

p. BASE UNIT COST OF INTERIOR HOUSE WIRING

Quantity	Description	US$/Unit Material Cost	Extended Material Cost	US$ Labor Cost
1	Panel Box 2-10A Breakers	7.29	7.29	
60'	#14 TW (nonmetallic flat)	0.05	3.00	
60'	#12 TW (nonmetallic flat)	0.06	3.60	
60'	Staples	0.01	.60	
3	Wall Receptacles	0.54	1.62	
3	Light Sockets with pull chains	0.90	2.70	
			18.81	3.00
				21.81

q. BASE COST FOR PUBLIC STREET LIGHTS

Description	US$/Unit Material Cost	US$ Labor Cost	US$ Total Cost
BPCo. standard Suburban street light fixture 50/100 W Incandescent Cast Base Acrylic Reflector Support Arm	10.00	5.00	15.00
Photo-electric cell	5.00		5.00

5. DESIGN CRITERIA.

a. Transmission and Distribution:

The distribution system design and construction will generally follow REA (Rural Electrification Administration, U.S. Department of Agriculture) standards. Where not practical, the project will utilize the highest possible standards complementary to the existing systems.

b. Substation and Switching:

Areas, will be fenced, cleared of brush, graded for proper drainage and gravel surface and adequately grounded in accordance with REA standards. High voltage structures of either wood or steel will be used with gang operated disconnect switches and either fuses or adequate backup protection and lightning arresters. Steel or wood low voltage structures with provisions for oil circuit reclosers; station demand, KWH and KVAR metering; and lightning arresters for each outgoing line.

Three-phase automatic tap changing under load substation transformers or single-phase substation transformers with single-phase voltage regulators to provide a regulated bus bar voltage will be used.

c. Poles:

Availability of poles is a problem in Bolivia. A study conducted by NRECA is explored the possible use of local materials. This study's recommendations for the use of treated eucalyptus poles has been proposed for the project. A treatment plant will have to be provided and is considered in the project analysis. Concrete or imported timber poles are alternative solutions and will be studied during the design stage.

d. Conductor:

For main three-phase feeders - 1/0 - 6/1 ACSR with 4 - 7/1 ACSR as the neutral a second 1/0 ACSR feeder will be considered.

For all taps, except where loads necessitate a larger conductor, 4 ACSR for both the primary and neutral conductor will be used.

For secondaries match 1/0 ACSR and 4 ACSR with transformer capacities supplying the secondary systems are proposed.

For service drops - ACSR duplex and quadruplex will be utilized.

e. Connectors, Splices and Dead-Ends:

It is proposed to use compression connectors for all connections to ground and for all tap connections, recloser by-pass switches etc. where conductors are subject to large current carryin capacities. Hot line clamps will only be used for transformer jumper connections to the primary lines.

Split bolt connectors will only be used for service wire connections to the secondary system.

f. Transformers:

Standard U. S. manufactured single-phase with 220/440 volt secondary rating are recommended. However, DINE requirements and adaptability to the existing systems have to be considered during design.

g. Meter:

Outdoor socket type of U. S. standard are recommended.

h. Materials:

REA specifications will apply throughout the project and those materials listed in the latest edition of the "REA Approved List of Materials for Use by REA Electric Borrowers" are recommended as minimum specifications.

6. ENGINEERING AND CONSTRUCTION PLAN.

The project calls for private engineering consulting services for the design of the project and supervision of its construction. Each sub-project or components thereof, will be designed separately. However, it is proposed that materials for the two sub-projects be purchased jointly in order to reduce costs. Construction may be by several different contracts or by one contract for the total project.

It is proposed that one Engineering Consulting firm be retained for the design and construction supervision of the two sub-projects. The firm will be contracted by the GOB through ENDE to do all engineering work required.

Construction of all transmission and distribution facilities will be done by contract awarded on the basis of competitive bids. ELFEC and CRE have been using contractor services and find that it is not only less costly but more satisfying then construction performed under force

account procedures. The quality of work performed by local contractors appears satisfactory and there is no scarcity of either skilled or unskilled line construction labor. As an example, ICE, a Peruvian-Bolivian contractor was the prime contractor on the CRE original system financed by AID. Also ICE was subcontractor in Nicaragua on the 138 KV transmission line portion of the recently completed rural electrification project partially financed by AID.

The Mission feels that the responsible entities may experience some difficulties in implementing the project in conformance with AID requirements. It is likely that the engineering consultant selected may also not be well acquainted with AID methods. In order to complete the project in a reasonable period of time, it is proposed that technical assistance be secured through NRECA for the purpose of assisting the implementing entities in the selection and contracting of engineering consulting services, in the monitoring of the design work and in the supervision of construction. Included will be the review of plans and specifications, contract documents and bid analysis. NRECA is suggested because of their familiarity and contribution to this project. Management, administration, accounting and other types of technical assistance are also proposed.

7. OPERATION AND MAINTENANCE.

The operation and maintenance of the distribution and transmission systems will be the responsibility of each sub-borrowing entity which should pose no problems since each, at present, is an operating utility.

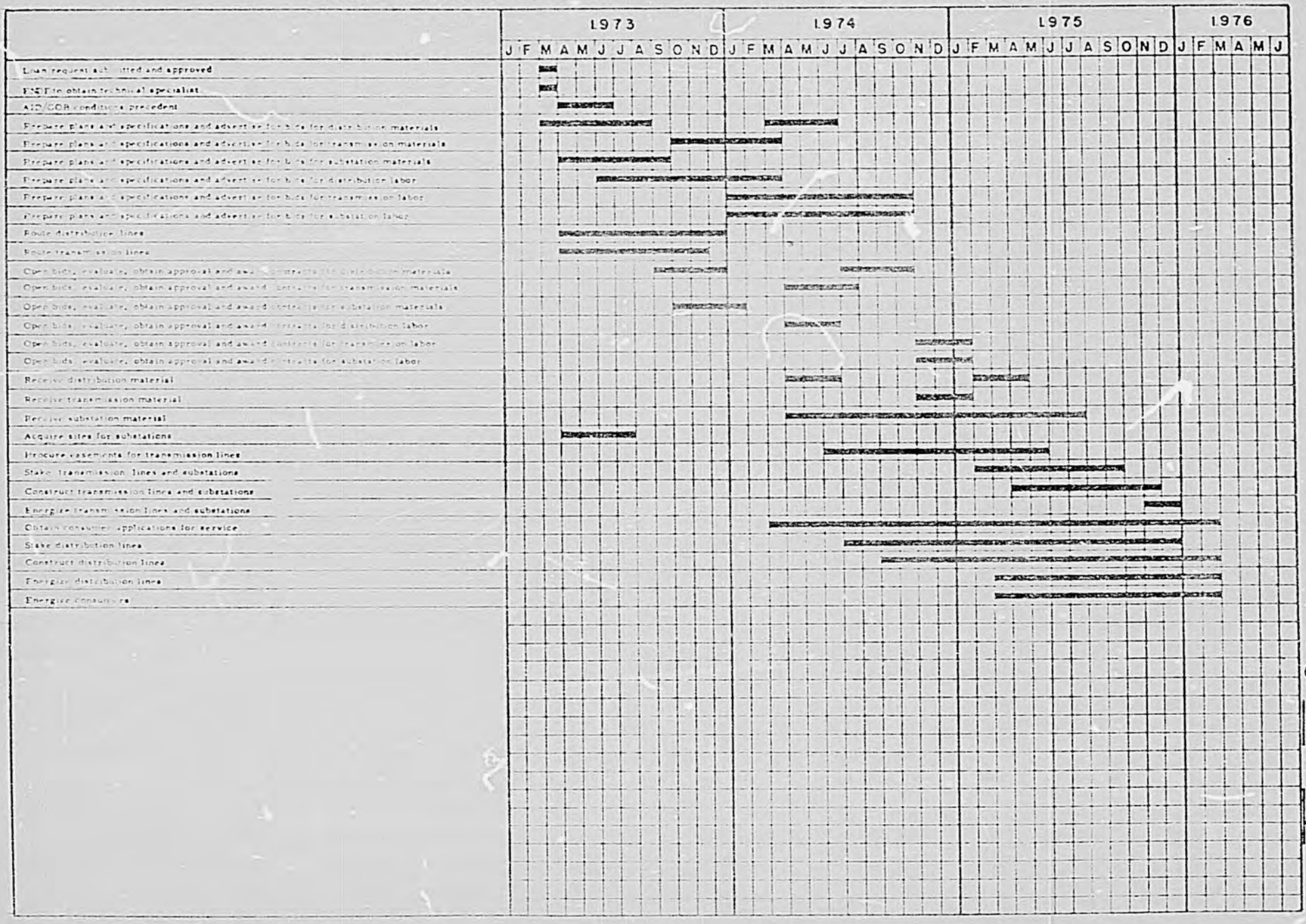
Organization charts for CRE and ELFEC show that each is well prepared to adequately operate and maintain their existing systems and can easily expand to accommodate the proposed project.

During the 1974-1975 period, the service areas of each entity will be growing at a fairly rapid rate. However, energization will not occur on a large scale before 1975 which will give each entity sufficient time to plan, employ and train personnel for the job ahead.

CRE has prepared detailed plans for the operation and maintenance of their system as expanded by this project. ELFEC, in recognition of its increasing responsibilities, has expressed its need for technical assistance to improve its management techniques and make more effective use of its present and additional personnel.

Technical specialists retained for this project will be qualified professionals, well versed in the relatively unsophisticated needs of rural electrification. These will assist each entity in developing the rural portion of its program under the loan.

ENGINEERING AND CONSTRUCTION SCHEDULE



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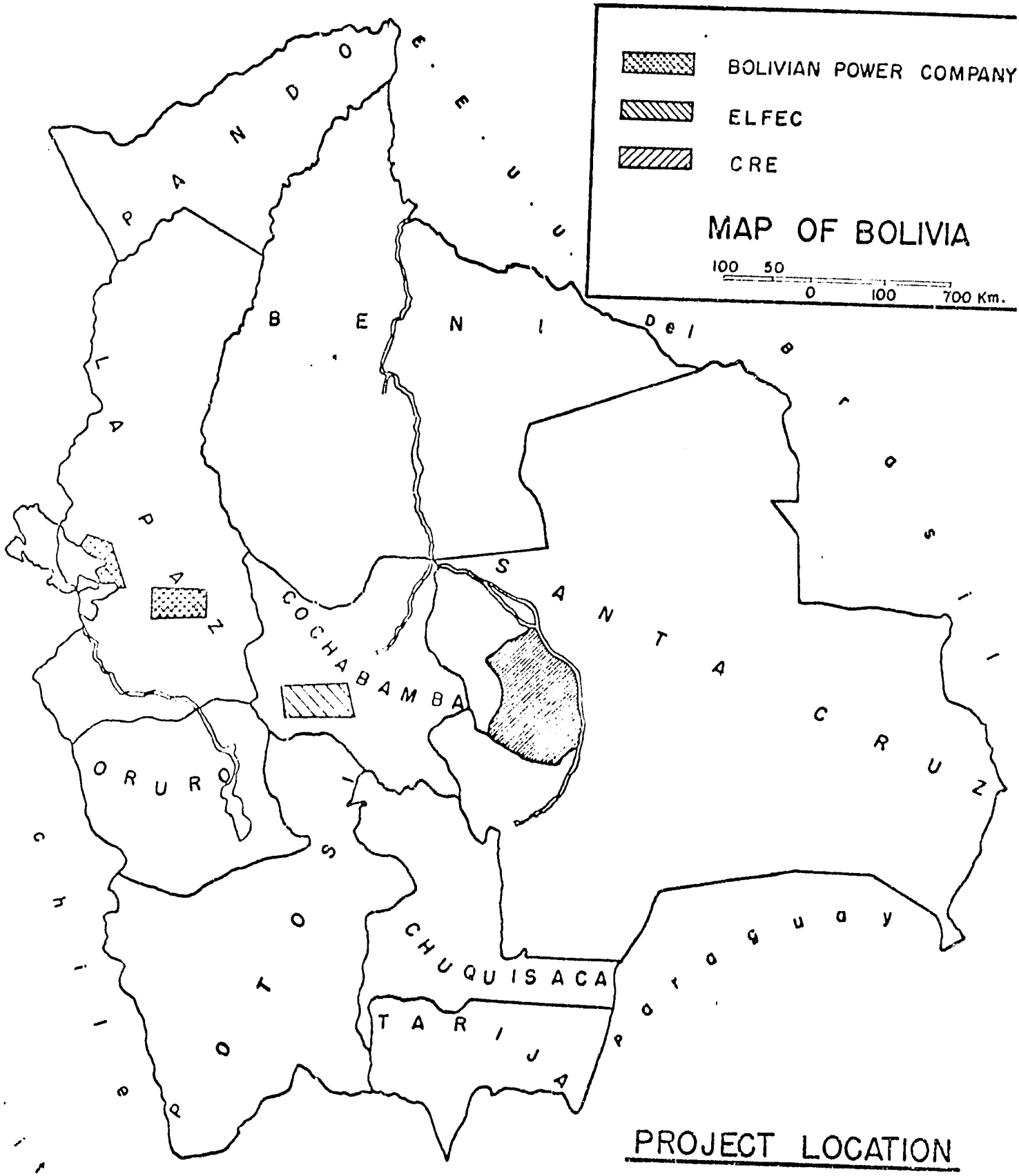
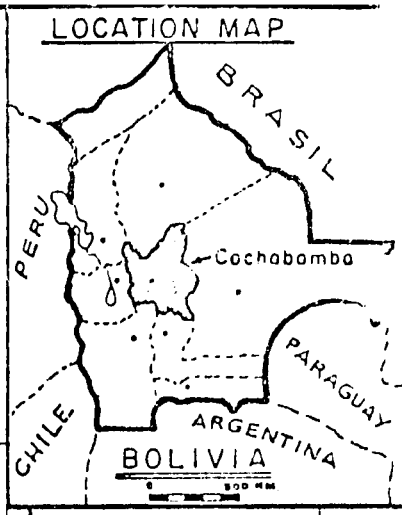


PROJECT LOCATION

LOCATION
COCHABAMBA SUB-PROJECT

SCALE
0 50 K.M.



BENI

N.

LA PAZ

COCHABAMBA

SANTA CRUZ

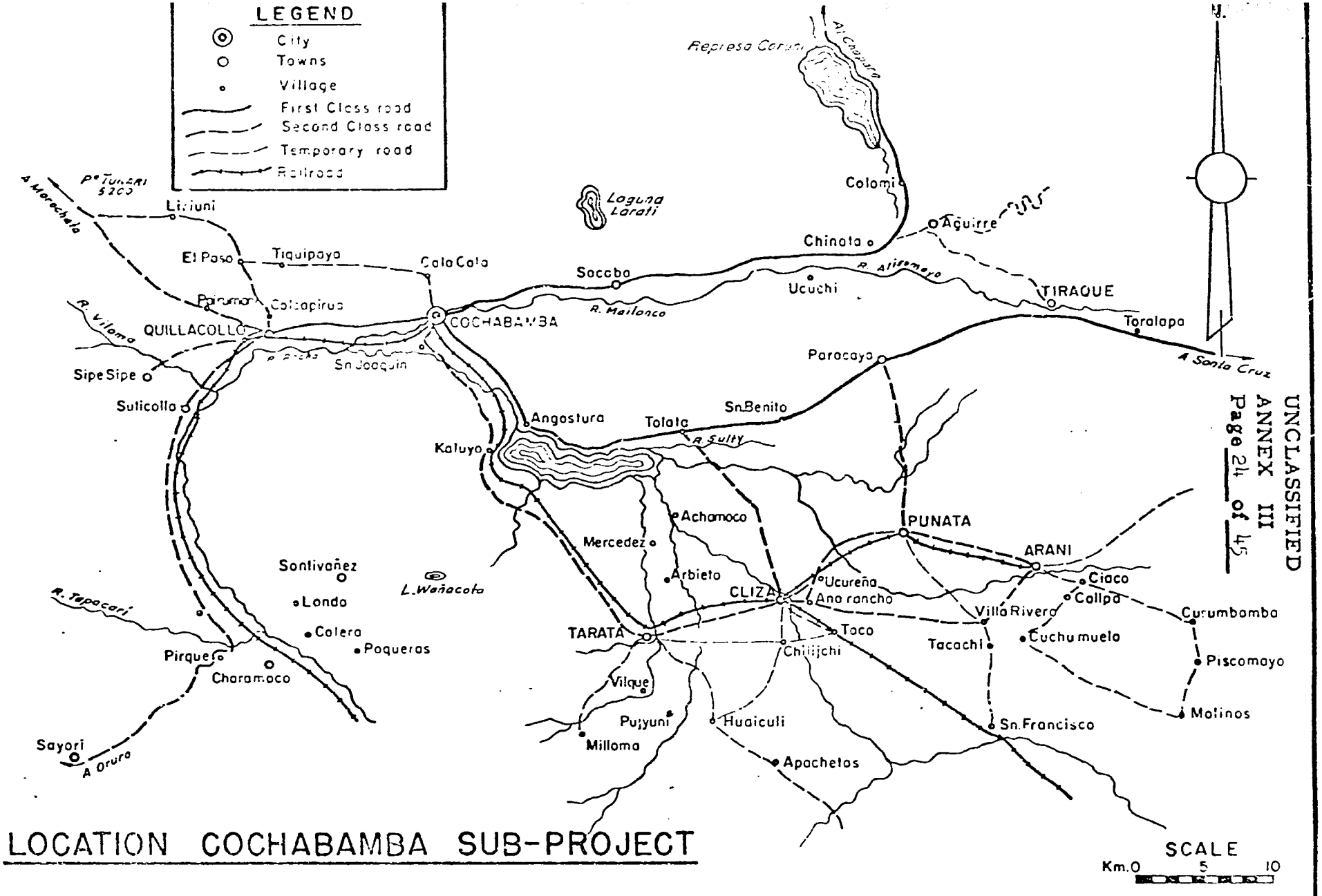
ORURO

POTOSI

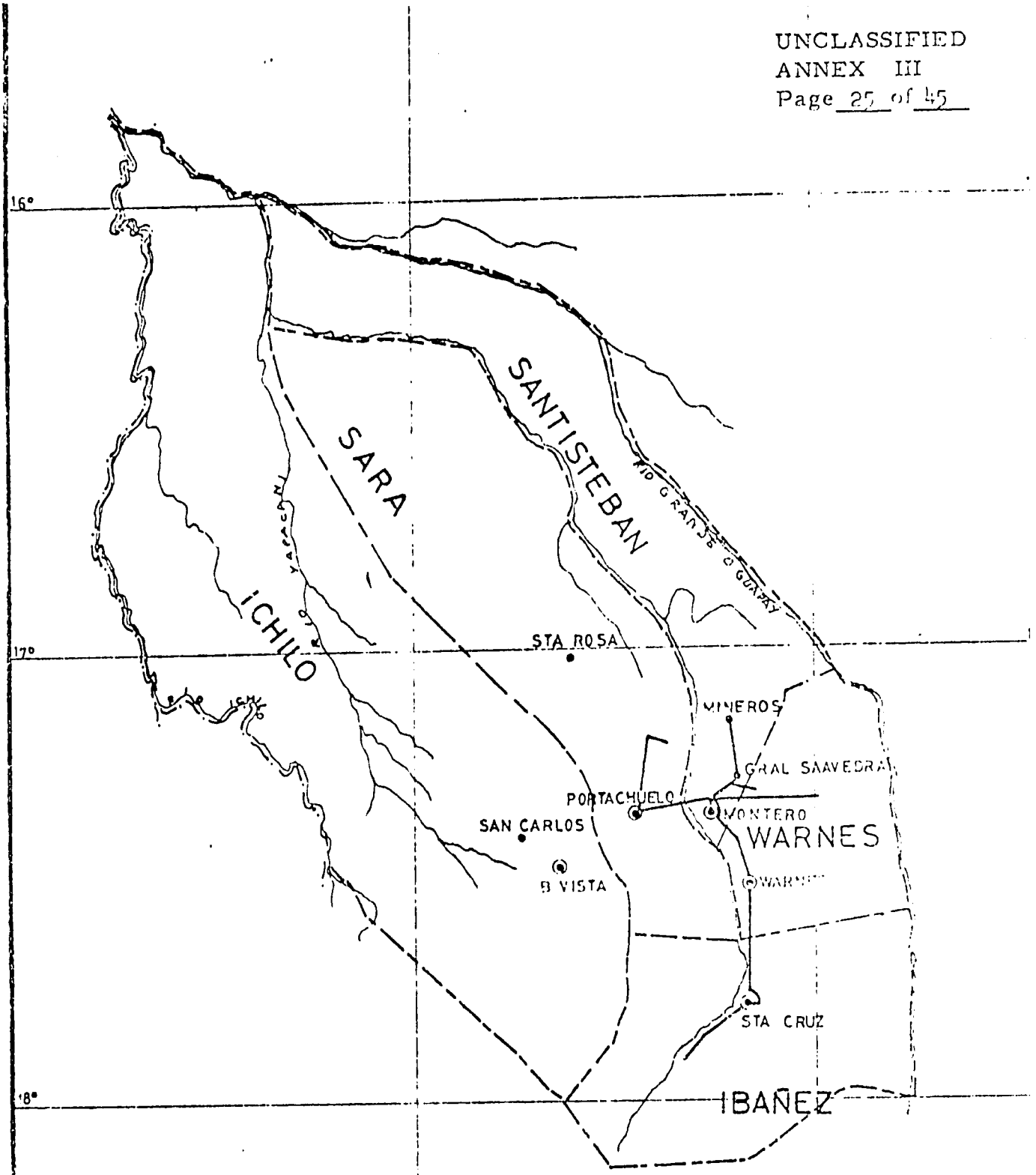
CHUQUISACA

LEGEND

- Capital
- Towns and Villages
- Road
- Railroad
- River
- Covered area



E.L.F.E.C.		SERVICE AREA				ANNEX
COCHABAMBA — BOLIVIA		Designed	Drawing C.O.S.	Cheked	Date. 7-IX-72	



LOCATION SANTA CRUZ SUB-PROJECT

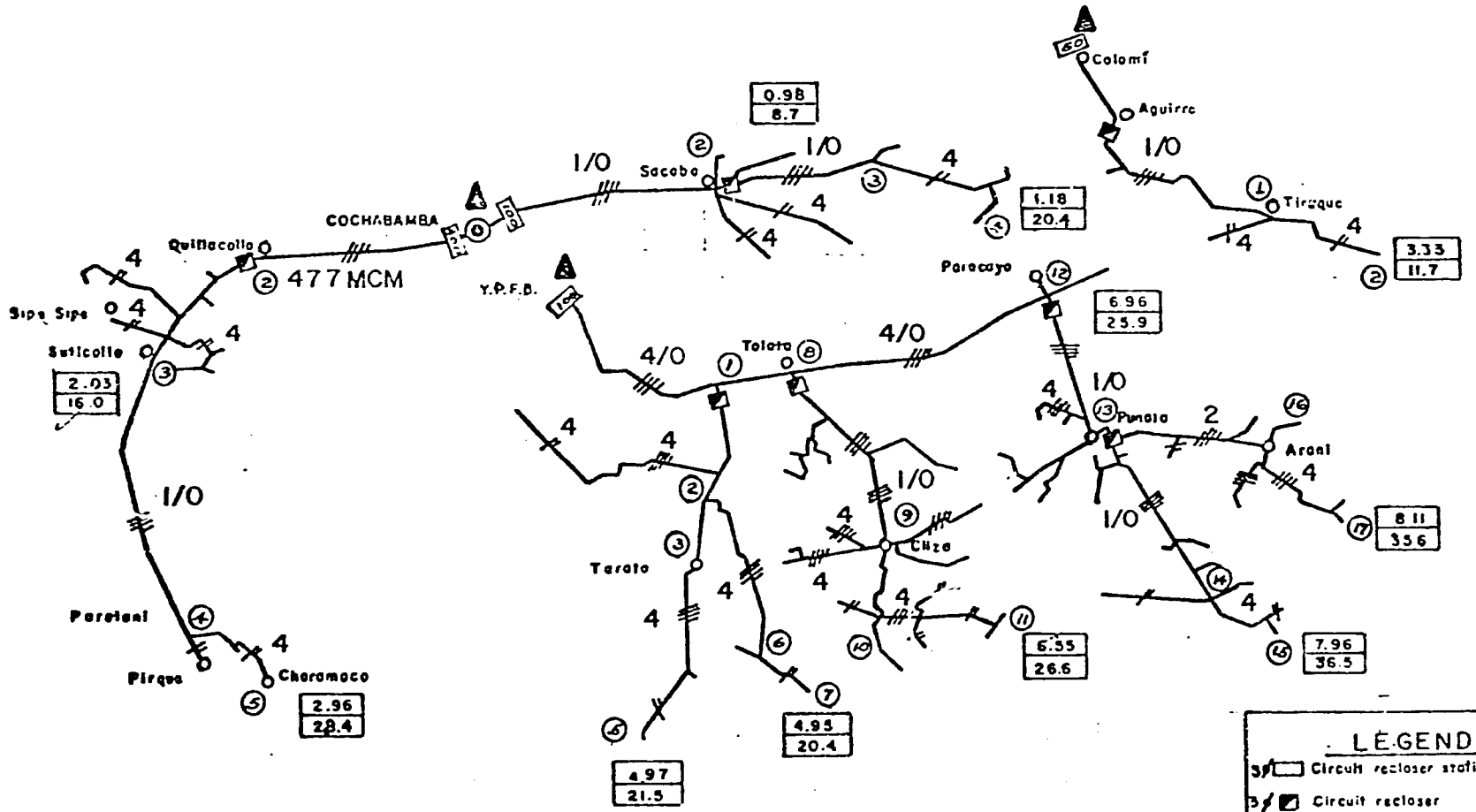
FECHA	REVISION Y PROPOSITO

PROYECTO RURAL DE ELECTRIFICACION

COOP RURAL DE ELECTRIFICACION LTD

PLANO LLAVE

DIBUJO F.A.	APROBADO I.G.R.P.	ESCALA SIN ESCALA	PLANO E-1	HOJA 1 DE 1



LINE DIAGRAM
COCHABAMBA SUB-PROJECT

MIL. 0 SCALE 5

LEGEND

- 3 ϕ Circuit recloser station type
- 3 ϕ Circuit recloser
- Substation
- Volts drop to point / MIL from point to source
- 3 ϕ ACSR
- 1 ϕ ACSR

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E.L.F.E.C.		PRIMARY DISTRIBUTION SYSTEM AND SUBSTATIONS	ANNEX
COCHABAMBA — BOLIVIA		Designed / Drawing G.A.R. / Checked / Date 7-IX-72	

U. S. DEPARTMENT OF AGRICULTURE
RURAL ELECTRIFICATION ADMINISTRATION

VOLTAGE DROP SHEET

SYSTEM DESIGNATION: ELEEC
SUBSTATION: YPEB/14.4
SYSTEM DESIGN: 50 KWh/mo./cons.
SYSTEM ENGINEER:
CIRCUITS: ABC
DATE: October 1972

SECTION		LOAD									LINE								
		CONSUMERS					CONCENTRATED										VOLTAGE DROP		
SOURCE END	LOAD END	WITHIN THIS SECTION	BEYOND THIS SECTION	EQUIV. THIS SECTION	KWH PER MONTH	PEAK KW	WITHIN THIS SECTION	BEYOND THIS SECTION	EQUIV. THIS SECTION	TOTAL KW	CONDUCTOR SIZE CU. EQUIV.	φ	KV	VOLTAGE DROP FACTOR	LENGTH OF SECTION IN MI.	KW MILES	THIS SECTION	TOTAL	AT POINT
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1ABC4	105	50	100	[illegible]	50	27.0				27.0	6	1	14.4	1.32	3.2	86.4	.14	6.97	105
1ABC3	1ABC4	–	650	650	50	125.0				125.0	4	3	14.4	.345	2.5	312.5	.11	6.81	1ABC4
1ABC6	187	–	200	200	50	41.2				41.2	6	1	14.4	1.32	1.2	49.4	.09	6.93	187
1ABC3	1ABC5	450	200	425	50	82.0				82.0	6	3	14.4	.507	3.4	278.8	.14	6.84	1ABC6
1ABC2	1ABC3	–	1300	1300	50	246.0				246.0	4	3	14.4	.345	1.0	246.0	.08	6.70	1ABC3
1ABC1	1ABC2	185	1710	1605	50	340.0				340.0	4	3	14.4	.345	2.1	714.0	.25	6.62	1ABC2
1ABC10	1811	270	110	215	50	49.5				49.5	6	1	14.4	1.32	3.2	158.4	.29	6.55	1811
1ABC9	1ABC10	330	690	815	50	163.0				163.0	6	3	14.4	.507	2.3	456.4	.23	6.26	1ABC10
1ABC8	1ABC9	1000	2960	3460	50	662.0				662.0	2	3	14.4	.241	4.3	3177.6	.77	6.03	1ABC9
1ABC14	1ABC15	210	190	295	50	59.6				59.6	6	3	14.4	.507	2.8	164.1	.08	7.58	1ABC15
1ABC13	1ABC14	520	640	1160	50	209.0				209.0	2	3	14.4	.241	5.1	1065.8	.25	7.33	1ABC14
1ABC16	1ABC17	210	150	500	50	97.5				97.5	6	3	14.4	.507	4.1	399.8	.20	8.11	1ABC17
1ABC15	1ABC16	460	1310	1540	50	293.0				293.0	4	3	14.4	.345	3.8	1113.4	.38	7.91	1ABC16
1ABC12	1ABC13	195	5113	5351	50	1021.0				1021.0	2	3	14.4	.241	2.7	2756.7	.66	7.45	1ABC13
1ABC9	1ABC12	460	5709	5933	50	1115.0				1115.0	2/0	3	14.4	.161	10.1	11261	1.70	5.58	1ABC12
1ABC1	1ABC8	100	10103	10159	50	1910.0				1910.0	2/0	3	14.4	.161	3.1	5921	.95	5.28	1ABC8
1ABC0	1ABC1	150	12104	12193	50	2280.0				22[illegible]	2/0	3	14.4	.161	12.7	28956	4.67	4.33	1ABC1
To Sub			12254		50	2330.0				2330.0									

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U. S. DEPARTMENT OF AGRICULTURE
RURAL ELECTRIFICATION ADMINISTRATION

VOLTAGE DROP SHEET

SYSTEM DESIGNATION	SUBSTATION	SYSTEM DESIGN
ELEEC	COLOMI	50 KWh/mo./cons.
SYSTEM ENGINEER	**CIRCUITS**	**DATE**
	ABC	October 1972

SECTION		LOAD									LINE								
		CONSUMERS					CONCENTRATED										VOLTAGE DROP		
SOURCE END	LOAD END	WITHIN THIS SECTION	BEYOND THIS SECTION	EQUIV. THIS SECTION	KWH PER MONTH	PEAK KW	WITHIN THIS SECTION	BEYOND THIS SECTION	EQUIV. THIS SECTION	TOTAL KW	CONDUCTOR SIZE CU. EQUIV.	ϕ	KV	VOLTAGE DROP FACTOR	LENGTH OF SECTION IN MI.	KW MILES	THIS SECTION	TOTAL	AT POINT
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
[illegible]	ABC3	154	–	22	50	12.2				12.2	2	3	10.0	1.48	2.5	44.3	.02	3.33	ABC3
[illegible]	ABC2	1,660	154	284	80	182.0				182.0	2	3	10.0	1.48	11.7	2,182.9	3.26	3.26	ABC2
[illegible]			2,050			382.0				382.0									

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U. S. DEPARTMENT OF AGRICULTURE
RURAL ELECTRIFICATION ADMINISTRATION

VOLTAGE DROP SHEET

SYSTEM DESIGNATION: ELFEC
SYSTEM ENGINEER:
SUBSTATION: Cochabamba
CIRCUITS: ABC and 2 ABC
SYSTEM DESIGN: 50 Kwh/mo/cons
DATE: October 1972

SECTION		LOAD									LINE						VOLTAGE DROP		
		CONSUMERS					CONCENTRATED												
SOURCE END	LOAD END	WITHIN THIS SECTION	BEYOND THIS SECTION	EQUIV. THIS SECTION	KWH PER MONTH	PEAK KW	WITHIN THIS SECTION	BEYOND THIS SECTION	EQUIV. THIS SECTION	TOTAL KW	CONDUCTOR SIZE CU. EQUIV.	ϕ	KV	VOLTAGE DROP FACTOR	LENGTH OF SECTION IN MI.	KW MILES	THIS SECTION	TOTAL	AT POINT
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
ABC 3	B 4	198	-	94	50	21.0				21	6	1	14.4	1.84	5.1	107.1	.20	1.18	B 4
ABC 2	ABC 3	1224	189	800	50	153.0				153	2	3	14.4	.241	6.6	1009.8	.24	.98	ABC 3
ABC 1	ABC 2	938	1412	1831	50	355.0				355	2	3	14.4	.241	8.7	3088.5	.74	.74	ABC 2
AC Subs			2350		50	444.0				444									
2 ABC 4	2 B 5	600		300	50	59.5				59.5	6	1	14.4	1.84	4.8	286	.53	2.96	2 B 5
2 ABC 2	2 ABC 4	1155	600	1178	50	219.0				219.0	2	3	14.4	.241	7.6	1664	.40	2.43	2 ABC 4
2 ABC 2	2 ABC 3	1850	1755	2680	50	510.0				510.0	2	3	14.4	.241	8.5	4335	1.04	2.03	2 ABC 3
2 ABC 1	2 ABC 2	9000	3605	8105	75	*2200.0				2200.0	250 MCM	3	14.4	.060	7.5	16500	.99	.99	2 ABC 2
AC Subs			12605		75	3405.0				3405.0									

* Quillacollo Sub-urban

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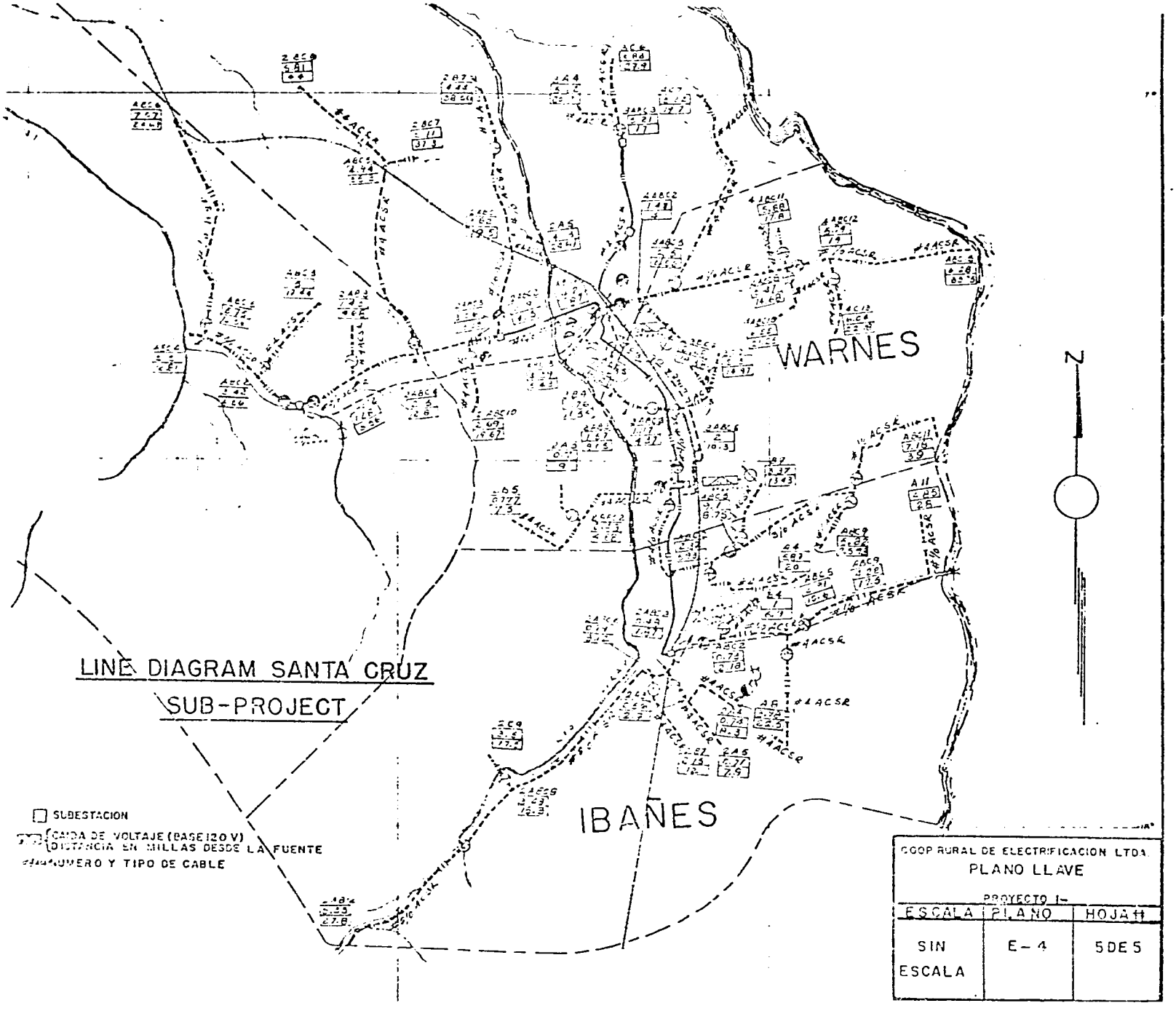
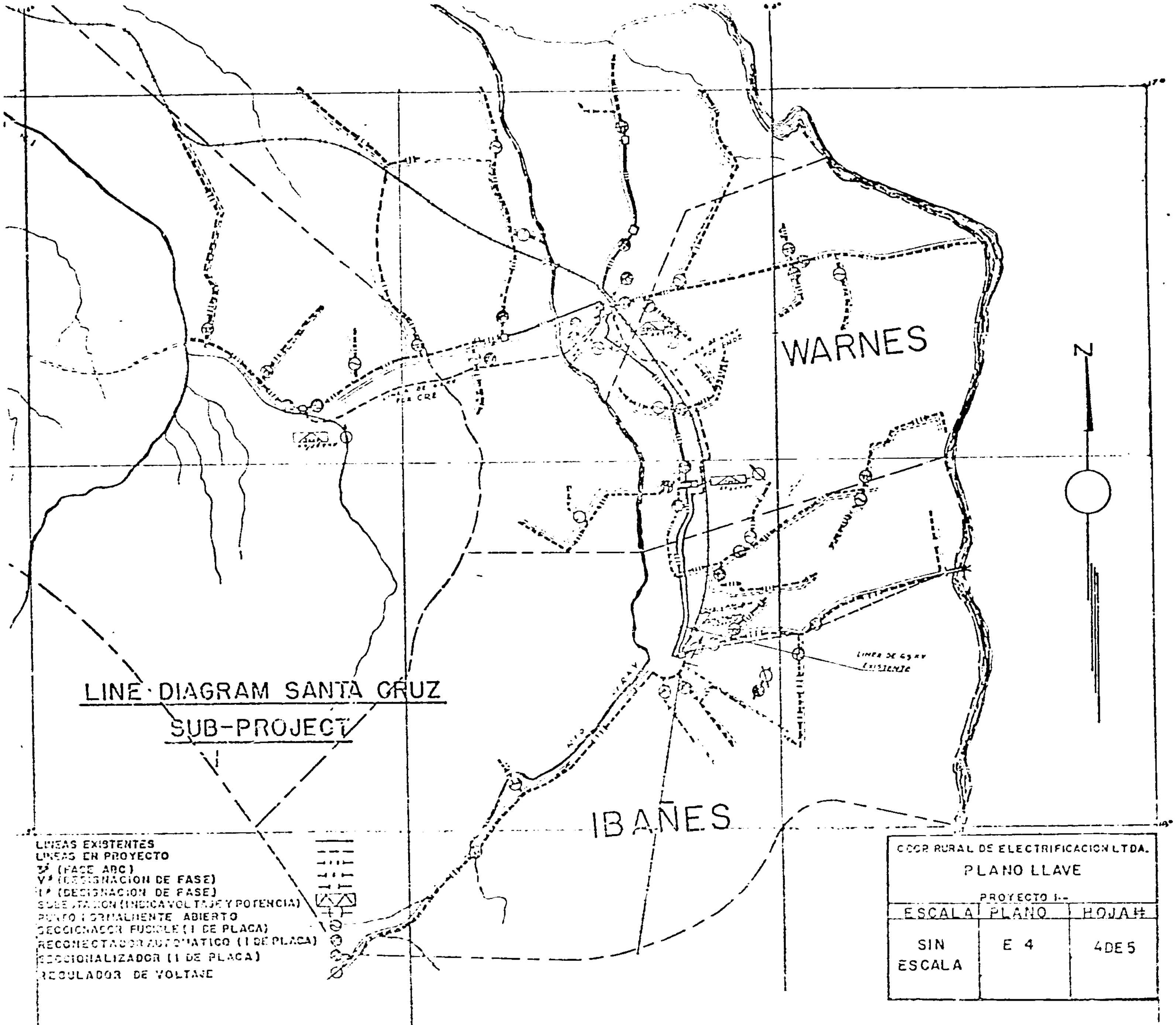

WARNES
IBAÑES
N
LINE DIAGRAM SANTA CRUZ
SUB-PROJECT
SUBESTACION
CAIDA DE VOLTAJE (BASE 120 V)
DISTANCIA EN MILLAS DESDE LA FUENTE
NUMERO Y TIPO DE CABLE
COOP RURAL DE ELECTRIFICACION LTDA.
PLANO LLAVE
PROYECTO I-
ESCALA
PLANO
HOJA #
SIN ESCALA
E-4
5DE5


LINE DIAGRAM SANTA CRUZ
SUB-PROJECT
WARNES
IBAÑES
N
LINEAS EXISTENTES
LINEAS EN PROYECTO
(FACE ABC)
(DESIGNACION DE FASE)
(DESIGNACION DE FASE)
SUBESTACION (INDICA VOLTAJE Y POTENCIA)
PUNTO NORMALMENTE ABIERTO
SECCIONADOR FUSIBLE (1 DE PLACA)
RECONECTADOR AUTOMATICO (1 DE PLACA)
SECCIONALIZADOR (1 DE PLACA)
REGULADOR DE VOLTAJE
COOP RURAL DE ELECTRIFICACION LTDA.
PLANO LLAVE
PROYECTO I-
ESCALA
PLANO
HOJA
SIN ESCALA
E 4
4 DE 5

U. S. DEPARTMENT OF AGRICULTURE
RURAL ELECTRIFICATION ADMINISTRATION

VOLTAGE DROP SHEET

SYSTEM DESIGNATION: Santa Cruz
SUBSTATION: Guaracachi
SYSTEM DESIGN: 75 Kwh/mo/cons.
SYSTEM ENGINEER: C R E
CIRCUITS: ABC
DATE: 5/8/72.

SECTION		LOAD									LINE						VOLTAGE DROP		
		CONSUMERS					CONCENTRATED												
SOURCE END	LOAD END	WITHIN THIS SECTION	BEYOND THIS SECTION	EQUIV. THIS SECTION	KWH PER MONTH	PEAK KW	WITHIN THIS SECTION	BEYOND THIS SECTION	EQUIV. THIS SECTION	TOTAL KW	CONDUCTOR SIZE CU. EQUIV.	Φ	KV	VOLTAGE DROP FACTOR	LENGTH OF SECTION IN MI.	KW MILES	THIS SECTION	TOTAL	AT POINT
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
[illegible]	A11	-	63	63	75	22.5	10.9	-	5.4	28	2	1	14.4	1.05	3	84	0.088	4.85	A11
[illegible]	ABC10	-	286	286	75	82	267	10.9	292	300.5	2	3	14.4	0.241	7.5	225.3	0.54	4.76	ABC10
[illegible]	ABC 9	4.4	286	508	75	87	-	640	640	727	2	3	14.4	0.241	7.5	5452.5	1.31	4.22	ABC 9
[illegible]	A8	-	105	105	75	32.9	-	-	-	32	6	1	14.4	1.84	2.5	82.25	0.15	3.98	A8
[illegible]	AB7	-	185	185	75	54.8	50	-	25	79.8	6	2	14.4	0.92	4.7	375	0.34	3.83	AB7
[illegible]	ABC6	-	185	185	75	54.8	50	165	190	244.8	6	3	14.4	0.507	4.7	1150	0.58	3.49	ABC6
[illegible]	ABC5	-	795	795	75	219	67	826	359	1078	2	3	14.4	0.241	8.42	9076	2.18	2.91	ABC5
[illegible]	B4	-	-	-	-	-	-	8.1	8.1	8.1	6	1	14.4	1.84	1.9	15.3	0.028	1.008	B4
[illegible]	ABC3	-	-	-	-	-	-	274	274	274	6	3	14.4	0.507	1.82	498	0.25	[illegible]	ABC3
[illegible]	ABC2	-	819	819	75	224	-	1167	1167	1591	2	3	14.4	0.241	2.18	3032	0.75	0.75	ABC2

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U. S. DEPARTMENT OF AGRICULTURE
RURAL ELECTRIFICATION ADMINISTRATION

VOLTAGE DROP SHEET

SYSTEM DESIGNATION: Santa Cruz
SYSTEM ENGINEER: C B E
SUBSTATION: Guaracachi
CIRCUITS: 2ABC
SYSTEM DESIGN: 75 Kwh/mo/cons.
DATE: 5/8/72.

SECTION		LOAD									LINE						VOLTAGE DROP		
		CONSUMERS					CONCENTRATED			TOTAL KW	CONDUCTOR SIZE CU. EQUIV.	ϕ	KV	VOLTAGE DROP FACTOR	LENGTH OF SECTION IN MI.	KW MILES	THIS SECTION	TOTAL	AT POINT
SOURCE END	LOAD END	WITHIN THIS SECTION	BEYOND THIS SECTION	EQUIV. THIS SECTION	KWH PER MONTH	PEAK KW	WITHIN THIS SECTION	BEYOND THIS SECTION	EQUIV. THIS SECTION										
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2.511	2ABC12	40	48	68	75	22.5	152	25.8	99.6	122.1	1	2	14.4	0.455	7.2	879	0.40	5.53	2ABC12
2ABC10	2ABC11	172	88	174	75	52	50	187	227	279	1	3	14.4	0.205	7.8	2176	0.44	4.93	2ABC11
2ABC8	2ABC10	320	260	420	75	117	455	319.7	576	693	1	3	14.4	0.205	7.5	5197	1.06	4.49	2ABC10
2.508	209	-	56	56	75	19	-	-	-	19	6	1	14.4	1.84	2.2	41.8	0.077	3.5	2C9
2ABC6	2ABC8	40	656	656	75	179	154	802	879	1059	1	3	14.4	0.205	12.18	12886	2.64	3.429	2ABC8
2.506	207	52	36	52	75	17.7	-	44	44	61.7	6	1	14.4	1.84	12	740.4	1.362	2.151	207
2ABC2	2ABC6	-	744	744	75	205	-	1000	1000	1205	1	3	14.4	0.205	1.25	1506	0.308	0.789	2ABC6
2.5	2.5	-	14	14	75	3.78	-	9.8	9.8	155	6	1	14.4	1.84	5.1	79.45	0.116	0.714	2A5
2.5	2A4	24	24	36	75	12.9	7.14	-	3.57	16.47	6	1	14.4	1.84	5.6	92	0.17	0.756	2A4
2ABC2	2A5	-	142	142	75	42	-	14.73	14.73	56.7	6	1	14.4	1.84	0.83	47	0.087	0.566	2A5
2.501	2ABC2	-	886	886	75	245	-	1014	1014	1257	1	3	14.4	0.205	1.87	2350	0.481	0.481	2ABC2

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U.S. DEPARTMENT OF AGRICULTURE
RURAL ELECTRIFICATION ADMINISTRATION

VOLTAGE DROP SHEET

SYSTEM DESIGNATION: Norte
SUBSTATION: Varnes
SYSTEM DESIGN: 75 Kwh/mo/cons.
SYSTEM ENGINEER: C [illegible]
CIRCUITS: ABC
DATE: 5/8/72.

SECTION		LOAD									LINE						VOLTAGE DROP		
		CONSUMERS					CONCENTRATED												
SOURCE END	LOAD END	WITHIN THIS SECTION	BEYOND THIS SECTION	EQUIV. THIS SECTION	KWH PER MONTH	PEAK KW	WITHIN THIS SECTION	BEYOND THIS SECTION	EQUIV. THIS SECTION	TOTAL KW	CONDUCTOR SIZE CU. EQUIV.	ϕ	KV	VOLTAGE DROP FACTOR	LENGTH OF SECTION IN MI.	KW MILES	THIS SECTION	TOTAL	AT POINT
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
ABC10	ABC11	-	-	-	-	-	130	105	170	170	2	3	14.4	0.241	11.82	2009	0.48	7.18	ABC11
ABC8	ABC10	-	62	62	75	11.3	91	694	741	735.5	2	3	14.4	0.241	7.48	5653	1.36	6.7	ABC10
ABC8	ABC9	-	51	51	75	8.58	-	168	168	176	6	3	14.4	0.507	5.45	955	0.48	5.82	ABC9
ABC5	ABC8	96	96	144	75	25.5	331	956	1121	1164	1/0	3	14.4	0.176	10.9	12734	2.241	5.34	ABC8
ABC	B7	=	=	=	=	=	26.6	13.6	26	26	6	1	14.4	1.84	2.85	73	0.13	3.57	B7
ABC5	AB6	-	-	-	-	-	53.1	55	84	84	6	2	14.4	0.92	1.85	155	0.14	3.24	AB6
ABC2	ABC5	16	192	200	75	53.9	26.6	1400	1413	1472	1/0	3	14.4	0.176	2.82	4152	0.73	3.1	ABC5
ABC5	A4	20	12	22	75	8.58	-	-	-	8.58	6	1	14.4	1.84	3.75	32	0.058	5.87	A4
ABC2	ABC3	84	52	71	75	24.2	745	261	634	658	6	3	14.4	0.507	10.32	6790	3.44	5.81	ABC3
ABC1	ABC2	-	116	116	75	31.8	361	2432	2512	2647	2/0	3	14.4	0.151	5.95	15.696	2.37	2.37	ABC2

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U. S. DEPARTMENT OF AGRICULTURE
RURAL ELECTRIFICATION ADMINISTRATION

VOLTAGE DROP SHEET

SYSTEM DESIGNATION: Norte
SUBSTATION: Varnes
SYSTEM DESIGN: 75 Kwh/no/cons.
SYSTEM ENGINEER: C R E
CIRCUITS: 23BC
DATE: 5/8/72.

SECTION		LOAD									LINE						KW MILES	VOLTAGE DROP		AT POINT
		CONSUMERS					CONCENTRATED			TOTAL KW	CONDUCTOR SIZE CU. EQUIV.	φ	KV	VOLTAGE DROP FACTOR	LENGTH OF SECTION IN MI.			THIS SECTION	TOTAL	
SOURCE END	LOAD END	WITHIN THIS SECTION	BEYOND THIS SECTION	EQUIV. THIS SECTION	KWH PER MONTH	PEAK KW	WITHIN THIS SECTION	BEYOND THIS SECTION	EQUIV. THIS SECTION											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
23C29	23C5	-	55	55	75	13	20	-	20	33	6	1	14.4	1.84	0.82	51.16	0.057	0.777	23C5	
23C32	23C64	-	375	375	75	106	20	370	520	484	2	3	14.4	0.241	2	968	0.23	0.72	23BC4	
23BC2	23C5	-	-	-	-	-	39	7	27	27	6	1	14.4	1.84	4.52	116.6	0.21	0.7	23C3	
23BC1	23C32	12	375	379	75	24.6	11.2	405	410	435	2	3	14.4	0.241	4.68	2035	0.49	0.49	23C32	

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U. S. DEPARTMENT OF AGRICULTURE
RURAL ELECTRIFICATION ADMINISTRATION

VOLTAGE DROP SHEET

SYSTEM DESIGNATION: Norte | SUBSTATION: Varnes | SYSTEM DESIGN:

SYSTEM ENGINEER: C. E. | CIRCUITS: 3 [illegible] | DATE: 5/8/72.

SECTION		LOAD									LINE						VOLTAGE DROP		
		CONSUMERS					CONCENTRATED												
SOURCE END	LOAD END	WITHIN THIS SECTION	BEYOND THIS SECTION	EQUIV. THIS SECTION	KWH PER MONTH	PEAK KW	WITHIN THIS SECTION	BEYOND THIS SECTION	EQUIV. THIS SECTION	TOTAL KW	CONDUCTOR SIZE CU. EQU. V.	ϕ	KV	VOLTAGE DROP FACTOR	LENGTH OF SECTION IN MI.	KW MILES	THIS SECTION	TOTAL	AT POINT
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
3..BC8	3C9	-	16	16	75	6.48	41	-	20.5	27	6	1	14.4	1.84	3.1	83	0.15	2.3	3C9
3..BC6	3..BC8	-	16	16	75	6.48	20	201	211	217	6	3	14.4	0.507	1.37	340	0.172	2.14	3..BC8
3..BC6	3BC7	-	-	-	-	-	45	77.8	99.3	99.	6	2	14.4	0.92	4.07	403	0.37	2.28	3BC7
..BC2	3..BC6	76	16	54	75	18.4	253	129	246	264	6	3	14.4	0.507	5.93	1565	0.79	2	3..BC6
..BC2	3ABC5	-	-	-	-	-	400	550	550	550	2/0	3	14.4	0.151	3.75	2062	0.511	1.42	85..BC5
3..B3	3B4	-	-	-	-	-	51.2	26	41.6	41.6	6	1	14.4	1.84	2.5	104	0.19	1.76	3B4
2..BC2	2..B5	32	-	16	75	6.48	108	131	185	191	6	3	14.4	0.507	4.68	893	0.45	1.57	2AB5
3ABC1	3..BC2	-	124	124	75	38	608	1551	1655	1655	2/0	3	14.4	0.151	4.37	7398	1.117	1.11	73ABC2

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U. S. DEPARTMENT OF AGRICULTURE
RURAL ELECTRIFICATION ADMINISTRATION

VOLTAGE DROP SHEET

SYSTEM DESIGNATION: Norte
SUBSTATION: Montero
SYSTEM DESIGN: 75
SYSTEM ENGINEER: CRE
CIRCUITS: ABC
DATE: 5/8/72

SECTION		LOAD									LINE						VOLTAGE DROP		
		CONSUMERS					CONCENTRATED												
SOURCE END	LOAD END	WITHIN THIS SECTION	BEYOND THIS SECTION	EQUIV. THIS SECTION	KWH PER MONTH	PEAK KW	WITHIN THIS SECTION	BEYOND THIS SECTION	EQUIV. THIS SECTION	TOTAL KW	CONDUCTOR SIZE CU. EQUIV.	ϕ	KV	VOLTAGE DROP FACTOR	LENGTH OF SECTION IN MI.	KW MILES	THIS SECTION	TOTAL	AT POINT
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
ABC 3	ABC 2	–	12	12	75	6,05	136	34	102	107	2	3	14,4	0,24	13,56	381	0,092	4,29	ABC 3
ABC 1	ABC 2	Esta parte corresponde a la caida propia de Montero que aproximadamente es															4,2	4,2	ABC 2

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RURAL ELECTRIFICATION ADMINISTRATION

VOLTAGE DROP SHEET

SYSTEM DESIGNATION	SUBSTATION	SYSTEM DESIGN
Norte	Montero	75
SYSTEM ENGINEER	**CIRCUITS**	**DATE**
CRE	2ABC	5/8/72

SECTION		LOAD									LINE								
		CONSUMERS					CONCENTRATED										VOLTAGE DROP		
SOURCE END	LOAD END	WITHIN THIS SECTION	BEYOND THIS SECTION	EQUIV. THIS SECTION	KWH PER MONTH	PEAK KW	WITHIN THIS SECTION	BEYOND THIS SECTION	EQUIV. THIS SECTION	TOTAL KW	CONDUCTOR SIZE CU. EQUIV.	ϕ	KV	VOLTAGE DROP FACTOR	LENGTH OF SECTION IN MI.	KW MILES	THIS SECTION	TOTAL	AT POINT
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2ABC 6	2B 7	120	–	60	75	20,1	–	5,7	5,7	25,8	6	1	14,4	1,84	7,56	195	0,358	4,44	2B 7
2ABC 4	2ABC 6	32	268	284	75	81	16,5	5,7	14	95	2	3	14,4	0,241	11,5	1092	0,263	4,08	2ABC 6
2ABC 4	2A 5	–	–	–	–	–	26	28	41	41	6	1	14,4	1,84	5,3	217	0,31	1,13	2A 5
2ABC 2	2ABC 4	10	284	289	75	82	30	276	291	373	2	3	14,4	0,241	10	3730	0,899	3,82	2ABC 4
2ABC 2	2ABC 3	–	–	–	–	–	349	–	174	174	1	3	14,4	0,205	3,75	653	0,133	3,06	2ABC 3
2ABC 1	2ABC 2	–	1074	1074	75	298	400	1005	1205	1503	1	3	14,4	0,205	9,5	14278	2,927	2,927	2ABC2

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U. S. DEPARTMENT OF AGRICULTURE
RURAL ELECTRIFICATION ADMINISTRATION

VOLTAGE DROP SHEET

SYSTEM DESIGNATION: Norte | SUBSTATION: Montero | SYSTEM DESIGN: 75

SYSTEM ENGINEER: CRE | CIRCUITS: 3ABC | DATE: 5/8/72

SECTION		LOAD									LINE					KW MILES	VOLTAGE DROP		AT POINT
		CONSUMERS					CONCENTRATED			TOTAL KW	CONDUCTOR SIZE CU. EQUIV.	ϕ	KV	VOLTAGE DROP FACTOR	LENGTH OF SECTION IN MI.		THIS SECTION	TOTAL	
SOURCE END	LOAD END	WITHIN THIS SECTION	BEYOND THIS SECTION	EQUIV. THIS SECTION	KWH PER MONTH	PEAK KW	WITHIN THIS SECTION	BEYOND THIS SECTION	EQUIV. THIS SECTION										
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
3BC 5	3C 6	–	16	16	75	6,48	–	–	–	6,48	4	1	14,4	1,36	1,53	9,91	0,013	6,83	3C 6
3ABC 3	3BC 5	632	176	492	75	135	67	85	118	253	4	2	14,4	0,68	9,37	2370	1,611	6,82	3BC 5
3ABC 3	3A 4	–	32	32	75	11,6	5,6	–	2,8	14,4	6	1	14,4	1,84	3,75	54	0,01	5,22	3A 4
3ABC 2	3ABC 3	390	840	1035	75	280	403	157	358	638	4	3	14,4	0,345	9,5	6061	2,1	5,21	3ABC 3
3ABC 1	3ABC 2	–	1620	1620	75	435	420	560	770	1205	4	3	14,4	0,345	7,5	9037	3,117	3,117	3ABC 2

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RURAL ELECTRIFICATION ADMINISTRATION

VOLTAGE DROP SHEET

SYSTEM DESIGNATION	SUBSTATION	SYSTEM DESIGN
Norte	Montero	75
SYSTEM ENGINEER	**CIRCUITS**	**DATE**
CRE	4 ABC	5/8/72

SECTION		LOAD									LINE						VOLTAGE DROP		
		CONSUMERS					CONCENTRATED												
SOURCE END	LOAD END	WITHIN THIS SECTION	BEYOND THIS SECTION	EQUIV. THIS SECTION	KWH PER MONTH	PEAK KW	WITHIN THIS SECTION	BEYOND THIS SECTION	EQUIV. THIS SECTION	TOTAL KW	CONDUCTOR SIZE CU. EQUIV.	ϕ	KV	VOLTAGE DROP FACTOR	LENGTH OF SECTION IN MI	KW MILES	THIS SECTION	TOTAL	AT POINT
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
4ABC14	4B15	–	14	14	75	5,76	13	–	6,5	12,3	6	1	14,4	1,84	6,25	76,75	0,141	6,28	4B15
4ABC12	4ABC14	92	14	60	75	20,1	271	17,48	153	173	2	3	14,4	0,241	8,5	1470	0,354	6,14	4ABC14
4ABC12	4C 13	120	–	60	75	20,1	11,4	17,5	23,19	43,3	6	1	14,4	1,84	3,18	137,7	0,253	6,04	4C 13
4ABC 8	4ABC12	56	250	278	75	79	20,29	17	327	406	2	3	14,4	0,241	4,32	1754	0,422	5,79	4ABC12
4ABC 8	4ABC11	–	–	–	–	–	–	326	326	326	6	3	14,4	0,507	3,12	1017	0,515	5,88	4ABC11
4ABC 9	4AB 10	–	–	–	–	–	12,74	72,4	78,7	78,7	6	2	14,4	0,92	4,07	320	0,294	6,22	4AB 10
4ABC 8	4ABC 9	–	200	200	75	56,9	6,9	377,7	381	440	6	3	14,4	0,507	2,5	1100	0,557	5,92	4ABC 9
4ABC 5	4ABC 8	–	506	506	75	140	125	1263	1326	1466	2	3	14,4	0,241	8,12	11903	2,87	5,37	4ABC 8
4BC 6	4C 7	–	–	–	–	–	–	14	14	14	6	1	14,4	1,84	2,83	39,6	0,073	3,32	4C 7
4ABC 5	4BC 6	144	48	120	75	37,5	54	14	41	78,8	6	2	14,4	0,92	10,3	812	0,747	3,25	4BC 6
4ABC 2	4ABC 5	–	693	693	75	190	–	1456	1456	1646	2	3	14,4	0,241	2,56	4213	1,015	2,5	4ABC 5
4AB 3	4A 4	–	–	–	–	–	9,1	9,8	14	14	6	1	14,4	1,84	1,38	19	0,035	1,6	4A 4
4ABC 2	4AB 3	–	–	–	–	–	–	46	46	46	6	2	14,4	0,92	1,9	87	0,08	1,57	4AB 3
4ABC 1	4ABC 2	–	–	–	–	–	83	1502	1543	1543	2	3	14,4	0,241	4	6174	1,488	1,488	4ABC 2

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RURAL ELECTRIFICATION ADMINISTRATION

VOLTAGE DROP SHEET

SYSTEM DESIGNATION: Norte
SUBSTATION: Buena Vista
SYSTEM DESIGN: 75
SYSTEM ENGINEER: CRB
CIRCUITS: ABC
DATE: 5/8/72

SECTION		LOAD									LINE						VOLTAGE DROP		
		CONSUMERS					CONCENTRATED			TOTAL KW	CONDUCTOR SIZE CU. EQUIV.	ϕ	KV	VOLTAGE DROP FACTOR	LENGTH OF SECTION IN MI.	KW MILES	THIS SECTION	TOTAL	AT POINT
SOURCE END	LOAD END	WITHIN THIS SECTION	BEYOND THIS SECTION	EQUIV. THIS SECTION	KWH PER MONTH	PEAK KW	WITHIN THIS SECTION	BEYOND THIS SECTION	EQUIV. THIS SECTION										
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
ABC 4	ABC 6	-	170	170	75	50,8	427	284	497	548	2	3	14,4	0,241	11,88	6510	1,57	7,07	ABC 6
ABC 4	ABC 5	-	160	160	75	48,1	527	10,5	274	322	1	3	14,4	0,205	3,75	1207	0,247	5,75	ABC 5
ABC 2	ABC 4	-	590	590	75	162	437	1248	1466	1628	1	3	14,4	0,205	6,25	10175	2,085	5,505	ABC 4
ABC 2	ABC 3	36	240	258	75	74	14,8	208	215	289	6	3	14,4	0,507	10,88	3144	1,594	3,014	ABC 3
ABC 1	ABC 2	-	1106	1106	75	300	674	1907	2244	2544	1	3	14,4	0,205	6,56	16,688	3,42	3,42	ABC 2

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VOLTAGE DROP SHEET

SYSTEM DESIGNATION: Norte | SUBSTATION: Buena Vista | SYSTEM DESIGN: 75

SYSTEM ENGINEER: CRE | CIRCUITS: 2ABC | DATE: 5/8/72

SECTION		LOAD									LINE						VOLTAGE DROP		
		CONSUMERS					CONCENTRATED			TOTAL KW	CONDUCTOR SIZE CU. EQUIV.	ϕ	KV	VOLTAGE DROP FACTOR	LENGTH OF SECTION IN MI.	KW MILES	THIS SECTION	TOTAL	AT POINT
SOURCE END	LOAD END	WITHIN THIS SECTION	BEYOND THIS SECTION	EQUIV. THIS SECTION	KWH PER MONTH	PEAK KW	WITHIN THIS SECTION	BEYOND THIS SECTION	EQUIV. THIS SECTION										
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2ABC 9	2ABC10	–	–	–	–	–	16,1	6	14	14	6	1	14,4	1,84	1,87	26	0,048	2,69	2ABC10
2ABC 8	2AB 9	–	–	–	–	–	43,8	25	47	47	6	2	14,4	0,92	2,5	117	0,107	2,64	2AB 9
2ABC 4	2ABC 8	–	–	–	–	–	7	68,8	72,3	72	1	3	14,4	0,205	2,5	180	0,037	2,54	2ABC 8
2ABC 5	2BC 7	–	–	–	–	–	–	92,5	92,5	92,5	6	2	14,4	0,92	2	185	0,17	5,11	2BC 7
2ABC 5	2AB 6	–	–	–	–	–	–	108,5	108,5	108,5	6	2	14,4	0,92	8,75	949	0,873	5,81	2AB 6
2ABC 4	2ABC 5	36	207	325	75	65,6	420	175	385	451	2	3	14,4	0,241	22,5	10,147	2,44	4,94	2ABC 5
2ABC 2	2ABC 4	–	243	243	75	70	70,4	670,8	706	949	1	3	14,4	0,205	6,25	5931	1,216	2,5	2ABC 4
2ABC 2	2AB 3	–	16	16	75	6,48	92	–	46	52	6	2	14,4	0,92	3,12	162	0,149	1,43	2AB 3
2ABC 1	2ABC 2	20	259	269	75	77,4	169	833	917	956	1	3	14,4	0,205	6,56	6271	1,286	1,286	2ABC 2

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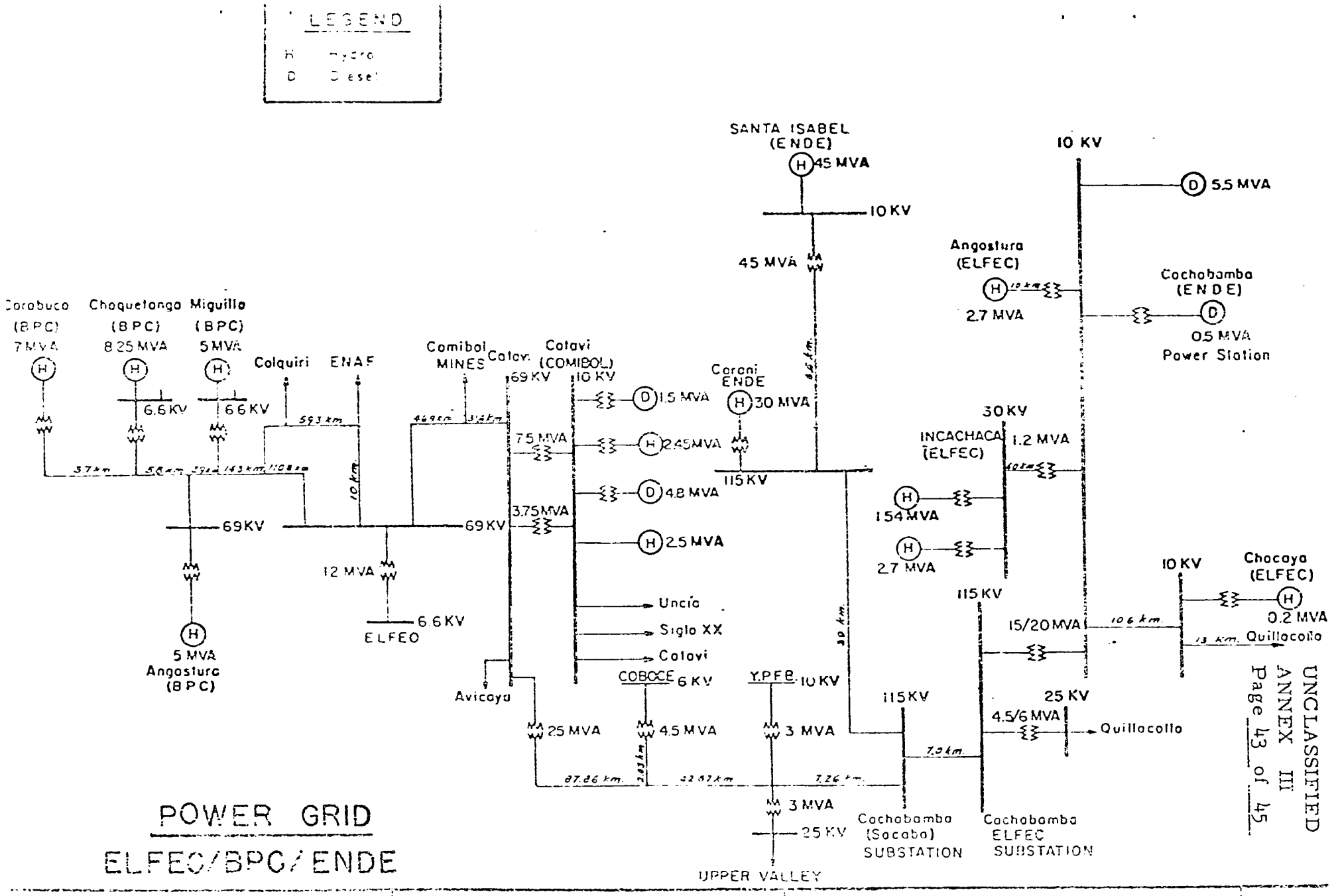

POWER GRID

ELFEC/BPC/ENDE

ELFEC

ONE LINE DIAGRAM OF THE CENTRAL SYSTEM

ANNEX

Designed | Drawing | Checked | Date

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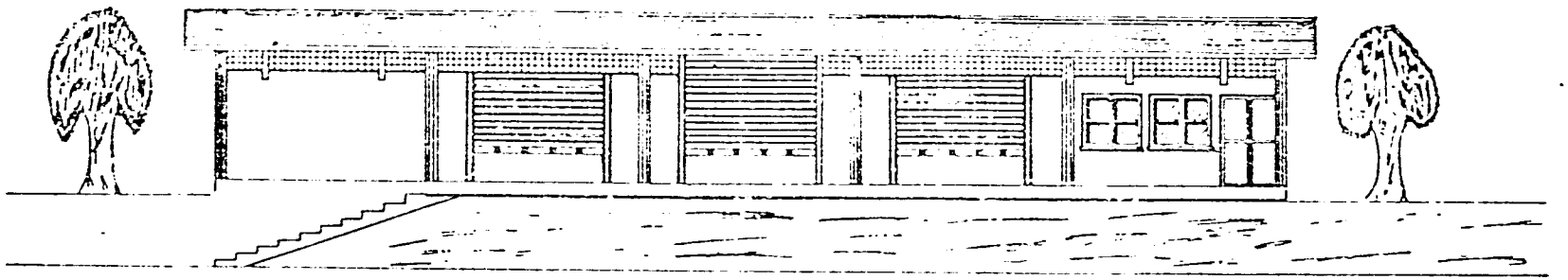

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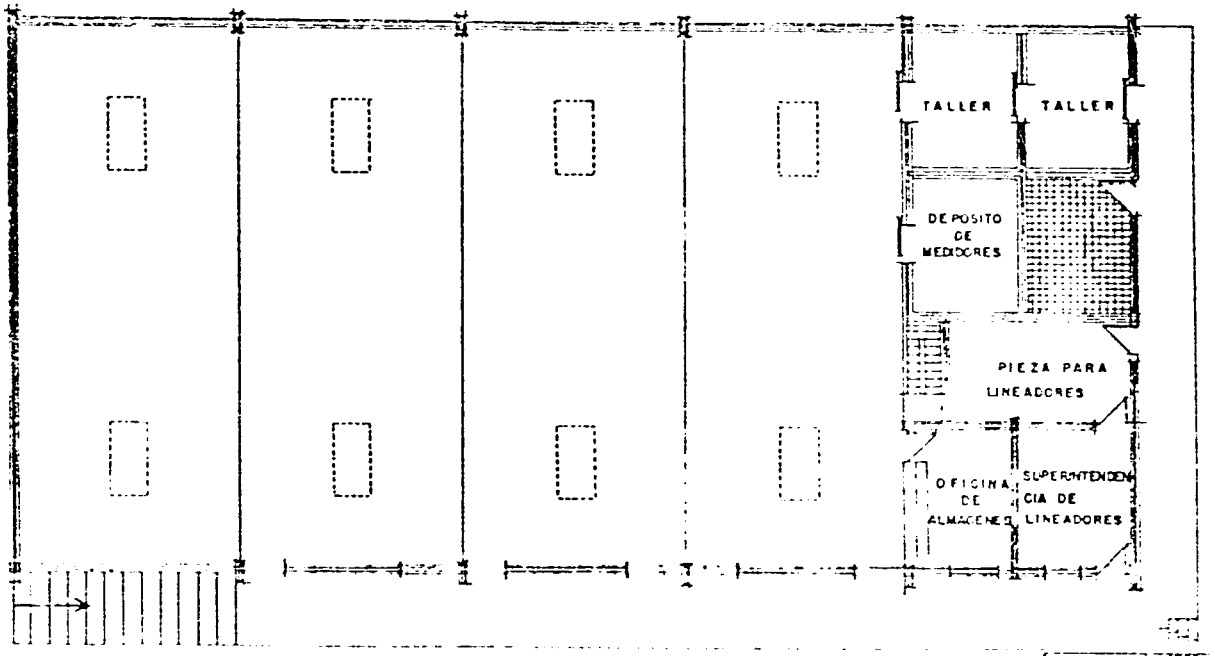

SANTA CRUZ WAREHOUSE

MINISTERIO DE ENERGIA E HIDROCARBUROS
INSTITUTO NACIONAL DE ELECTRIFICACION RURAL

ANTEPROYECTO OFICINAS
BODEGA DE ELECTRIFICACION RURAL

EXHIBIT 28
PAGE 138

SUGERIDO POR | DIBUJO | VICEDIRECTOR | FECHA SEPTIEMBRE 72

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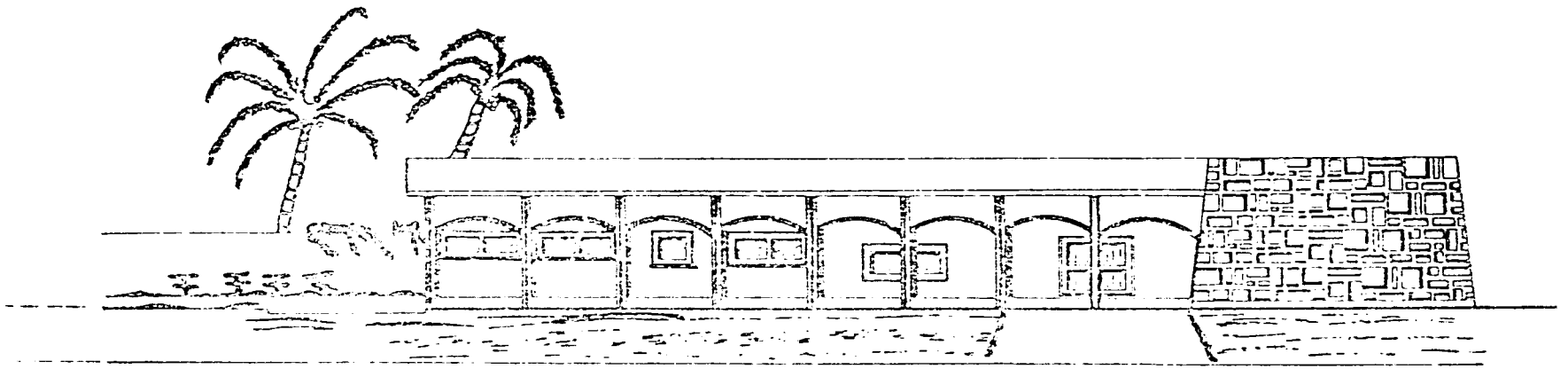

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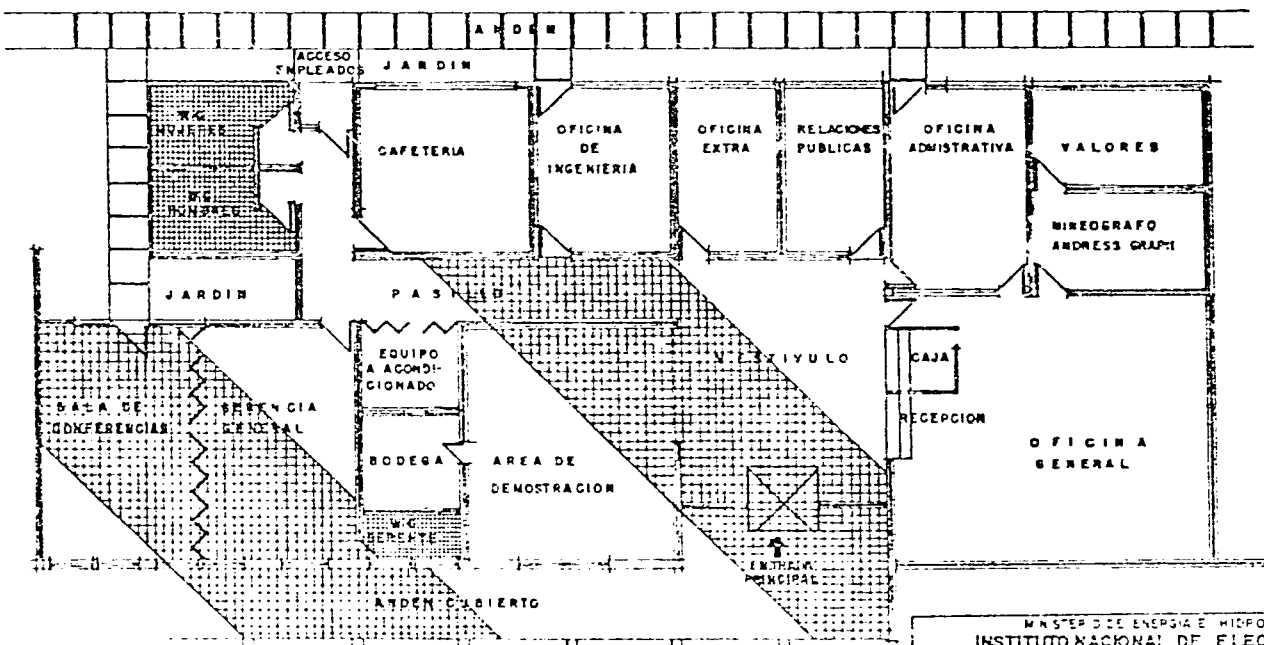

SANTA CRUZ OFFICE BUILDING

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MINISTERIO DE ENERGIA E HIDROCARBUROS
INSTITUTO NACIONAL DE ELECTRIFICACION RURAL

ANTEPROYECTO OFICINAS
COOPERATIVAS DE ELECTRIFICACION RURAL

EXHIBIT 27 PAGE 27	SUGERIDO POR:	DIBUJO:	Vº Bº DIRECTOR:	FECHA AGOSTO 1972

ANNEX IVA - Economic Analysis

Macro Economic Aspects

A. Employment/Income

Presently, unemployment rates in the areas affected by the project average 12 to 18%. Income ranges from 1,600 pesos to 3,800 pesos per capita per annum. The Santa Cruz area suffers an unemployment rate of approximately 12% but the per capita income level is approximately 3,800 pesos. Approximately 300 new people will be employed by this project during construction. The work will consist primarily in the placing of distribution poles, excavation, etc. However, the principal employment effects will reside in the expansion of commerce and industry. New plans for agro-industry are being discussed which would include meat processing, pulp and paper, milk processing, etc. In addition, there is discussion of a furniture industry which would have Brazilian and Paraguayian interests. Electric power distribution will contribute to the development of this Industrial program.

Cochabamba suffers from an unemployment rate of approximately 18% and has a per capita income level of about 2,200 pesos. The recent construction of the highway to the Chapare valley lends itself to substantial increases in agricultural production including wheat, corn, fruits, vegetables and cattle. The demand for electricity should reflect the need to increase processing facilities for agricultural products. Moreover, the highway ties into a navigable river system which should bring Trinidad's semi-tropical products more easily into the La Paz area. Parenthetically, the principal milk industry in Bolivia is located in the Cochabamba area where increased milk production of the Chapare area is sent to Cochabamba for

processing. Milk production is relatively low in Bolivia and the increased production of this fertile region should lead to additional employment opportunities. The time frame for these changes may be 3 to 8 years.

B. Balance of Payments Aspects

Although the project itself does not directly affect Bolivia's balance of payments except the increase in direct imports for the project and the country's external debt, it is anticipated that agricultural growth will lead to increases in non-traditional exports, and possibly import substitution, viz, wheat.* At present, agricultural imports represent about 27% of total imports, primarily wheat, while agricultural exports contribute about 10% to 12% of total exports. The possibility of import substitution for consumer non-durables, such as textiles, appliances, footwear, etc. could reduce Bolivia's import bill by some $25 million. The IBRD makes reference to import substitution in these areas in its recent economic study. The recent devaluation should provide a substantial impetus to non-traditional exports and stimulate increased production of import substitutes.

C. GOB Debt Service Capacity

The decision by the GOB to devalue last October reflects in part the desire of the government to move in the direction of rational economic policies for growth. This decision should have a stimulating effect on both traditional and non-traditional exports which would permit further external borrowing for growth oriented projects on terms suited to Bolivia's relatively low level of development. The GOB retains the obligation to repay this loan and thus its debt service capacity is reviewed in this section.

I. External Debt Service

	Amortization (millions U.S. dollars)	Interest	Total	Total as Percent of Commodity Exports F.O.B.
1967	12.6	3.8	16.4	
1968	12.6	4.4.	17.0	
1969	13.9	6.8	20.7	11.7%
1970	19.5	8.8	28.3	14.7%
1971	21.4	10.6	32.0	18.0%
1972(est.)	23.1	12.4	35.5	16.8%

Sources: Memorias Anuales del Banco Central, IMF 1972 Consultation Report.

*Also, see Annex IV (A) 4 for additional import substitution through the replacement of Kerosene wick lamps by rural power.

II. Projected Exports (FOB) and External Debt Service (Debt Outstanding December 31, 1971)

(In Millions US Dollars)

	Exports FOB	Debt Service[b]	b/a
1973	235	40.5	17.2%
1974	255	39.8	15.6%
1975	285	37.3	13.8%
1976	305	37.9	12.4%
1977	320	36.0	11.2%

Source: Mission estimates

Export performance in last five years has improved due primarily to the increased volume of mineral exports and relatively stable prices for these exports in the world market. 1970 was an exceptional year as world prices for antimony, copper, tin, etc. increased tremendously, however external debt servicing also increased yielding a debt service increase over the previous year. In 1971 world export prices took a dip and volume declined slightly, so that total export receipts declined. Generally, the upward trend resulted in a debt service ratio of 18%. It is estimated that exports have recovered somewhat (substantial growth in non-traditional exports such as cotton have assisted in the recovery) in 1972 while the rate of increase in debt service requirements have slowed down resulting in a decline in the debt service ratio. As a result of the recent devaluation, non-traditional exports will continue to grow resulting in a further decline in the debt service ratio. The IMF in the proposed 1972 Stand-By indicated concern over short term external borrowing by certain governmental entities which resulted in the IMF introducing limitations on official borrowings of less than 15 years. Thus to the extent that the GOB is able to obtain official long term loans a major worsening in the debt service ratio is not expected.

D. Education

Although the GOB allocates about 5% of GDP which exceeds the GDP's share devoted to education by other countries at a similar per capita income level, illiteracy has remained near 60% of the total population. The huge expenditure for this sector has been primarily for salaries and wages of teachers which in part explains the low pupil to teacher ratio of 25 pupils to teacher. Rural education has received substantial support from GOB, but the problem of adult rural education still remains due to inadequate equipment, limitation on night classes, etc.

GOB Expenditures for Rural Education

	Rural Education Expenditure Millions of Pesos	% of Total Central Gov. Budget
1966	76.2	8.8
1967	84.4	9.2
1968	84.3	8.2
1969	98.1	9.4
1970	99.2	7.9
1971	119.2	8.5
1972 E	153.1	7.5

Source: Ministry of Finance, IBRD

It is expected that the expansion in rural electrification will permit the use of educational facilities on a more intensive basis, thereby contributing to the GOB's efforts to reduce illiteracy.

Micro Economic Aspects

A. Benefit/Cost Analysis

1. Opportunity Cost of Capital

The case of Bolivia demonstrates, as in most LDC's, the problems of determining the adequate return level of capital necessary to justify the project. Given the high liquidity preference of the population, the low level of domestic savings, the use of an informal market for lending outside the official monetary system, and the necessity of providing substantial collateral; substantial difficulties exist in determining the objective opportunity cost of capital. The lack of a large project list at the planning level increases the difficulties in comparing the value of these projects to determine the most efficient social allocation of available financial Capital.

In Bolivia the Central Bank through its development fund is channeling financial resources to the industrial sector to expand industrial production and productive capacity at an interest rate of 10% for maturities of 1 to 15 years. This compares somewhat favorably to commercial lending rates which range from 15% to 30% for medium (1 to 2 years) projects in the industrial sector.

The Savings and Loan Association operates in the mortgage market along with the housing banks to provide loans for home construction. These loans run for 20 year periods with an effective interest rate between 14% and 15%. These institutions represent the principal source of long term private lending from domestic savings.

In the Benefit/Cost analysis a selected opportunity cost of capital of 12% has been used in the discount of the cash flows. Parenthetically, the concessional financing proposed herein represents a rather large subsidy in economic terms, which has been addressed in the Cochabamba B/C study (See Annex IV (A) for complete analytic approach.)

B. Indirect Benefits

1. Expansion in Generating Capacity

INER, the rural electrification agency of the GOB, operates at present a system of generator plants in some of the areas affected by this project. The agency estimates that it will be able to transfer this capacity to other rural areas as this project comes on stream. At present the generator system provides approximately 17,400,000 KVA of power to the rural area under consideration. The transfer of this capacity could affect an additional 600,000 people bringing 12% more of the population under some form of electrification. The cost and

benefits of this aspect of the project should be included in the direct benefits and costs, but due to the paucity of information this factor in the benefit stream has been neglected.

2. Agricultural Production

At present the agricultural sector provides about 20% of the GDP and employment for some 50% of Bolivia's workforce. The population density varies considerably in the two areas affected by this project. The principal products of this area are potatoes and tubers, quinua, barley and mutton. Although production growth has taken place, this seems to have resulted from increased labor intensity on given amount of land. The result is generally low incomes and problems of rural unemployment and poverty.

AREA, YIELDS AND PRODUCTION OF SELECTED ALTIPLANO CROPS

	1967	1968	1969	1970	1971
Potatoes					
Area (hectares)	103	88	92	95	97
Aver. Yield (M.T.)	5.0	6.8	6.8	6.9	7.2
Production (000 MT)	520	598	627	655	698
Barley					
Area (hectares)	86	91	92	93	98
Aver. Yield (M.T.)	0.7	0.7	0.7	0.7	0.7
Production (000 MT)	56	60	61	62	66
Quinua					
Area (hectares)	12	14	14	14	15
Aver. Yield (M.T.)	0.6	0.7	0.7	0.7	0.7
Production (000 MT)	7	10	10	10	11

Source: Ministry of Agriculture

Expansion in the production due to increased land use within the zone of influence is not anticipated. However, it is desirable that irrigation will be introduced, therefore, increasing productivity.

The Cochabamba area holds the possibility for substantial increase in wheat, corn and milk production which would probably involve the introduction of fertilizers, seeds, and irrigation. The latter factor could be directly affected by this project. For example, INER through its generating plants provides a KWH of power at one peso per KWh, thus apparently making electric pump irrigation prohibitively expensive. However, under the proposed project this power would be provided at about half the cost per KWh of the present system.* This may induce greater utilization of irrigation along with other advanced techniques of production -- particularly in the case of wheat.

	Wheat
Assumed Price ($b per M.T.)	1,144
a) no irrigation, no fertilizer	
Yield per hectare (assumed) M.T.	1.0
Net Return ($b)	169
% on Investment	19
b) Irrigated, no fertilizer	
Assumed yield M.T.	1.5
Net Return ($b)	-19
% on Investment	--
c) Irrigated, fertilized	
Assumed Yield (M.T.)	2.25
Net Return ($b)	218
% on Investment	10

The importance of combining irrigation with fertilizer is evident. Obviously, irrigation without fertilizer increases the cost of production too much to justify the investment given the assumed price. Since the devaluation and the increase in the world price of wheat, the GOB has been discussing a domestic wheat price policy that would be stimulative to production. Thus, it is possible to discern a possibility for the direct benefit of this program in promoting irrigation. Moreover, the discussions connected with the construction of a fertilizer plan further the desire for the expansion of the proposed distribution system.

ESTIMATED NET RETURNS FOR SELECTED PRODUCTS

	Cotton Lent	Cotton Seed	Soybean
Assumed Prices ($b per MT)	8,800	110	1,110
a) no irrigation, no fertilizer			
assumed yield per hectare (MT)	0.5	1.5	1.5
net return ($b)	1,749		665
% on investment	64		80
b) Irrigated, no fertilizer			
assumed yield (MT)	1.0	2.0	2.2
net return ($b)	3,668		856
% on investment	81		55
c) Irrigated, fertilized			
assumed yield (MT)	1.5	3.0	3.0
net return ($b)	6,214		880
% on investment	129		42

Source: Utah State Study on Irrigation

The relative scarcity of land in Cochabamba implies that the Santa Cruz and the Llanos area in general is the most feasible location for a substantial expansion in agricultural production. Production of import substitutes such as wheat, edible fats, oils, and milk are areas where import substitution opportunities are plentiful. However, the Utah State study indicates that expansion will take place only when a variety of technical inputs are provided, including irrigation, fertilizer, credit, some cases mechanization, etc. The provision of a power distribution system is necessary to accomplish these ends.

RETURNS UNDER THREE TECHNOLOGICALLY DIFFERENT FARM SYSTEMS FOR DISTINCT CROPS
($b pesos)

	Crop	Annual Return To Land and Family Labor and Management		
		(A)[1]	(B)[2]	(C)[3]
	Rice	101	811	839
	Soybeans	488	1,330	1,454
	Cotton	1,749	4,618	7,312
	Forage	286	356	1,124
	Cotton & Wheat	1,949	5,542	8,673
Rotation	Cotton & Soybeans	2,445	6,157	8,977
	Cotton & Green Manure	945	3,814	6,510

1) Without irrigation or fertilizers

2) With irrigation, but no fertilizers

3) With irrigation and fertilizer

Source: Utah State/USAID Study

C Benefit/Cost Santa Cruz

1. Definition of Costs

Costs are defined for this purpose as investment during the first three years of the project; and thereafter administrative expenditures are included as the only cost item. In connection with operation and maintenance costs we have treated them as "dys-benefits" to be deducted from the benefit flow. This treatment coincides with common budgetary usage which separates current and capital accounts.* We have valued costs and benefits at pre-devaluation levels to maintain continuity with some parts of the Moon and Ross reports and also to recognize that contemplated changes in the rate structures have not been officially announced. As to the issue of shadow pricing, it is felt that labor costs could probably be reduced to reflect their economic costs (reflecting the relatively high level of unemployment). However, since labor constitutes only about 16% of total costs and adequate statistical information to construct shadow pricing criteria is lacking, it was concluded that this undertaking should not be attempted at this time. The recent devaluation appears to have brought the nominal exchange rate into close approximation with the real exchange rate. This was reinforced by the GOB's decisions to reduce nominal tariff and surcharge rates. Thus imported items reflect generally their real economic costs.

2. Definition of Benefits

A substantial portion of the benefits of rural electrification are non-quantifiable and therefore must be related to perceived qualitative improvements in the life style of the rural population. The economic growth of the geographic zones affected by this project will reflect itself in increased demand for goods and services of which electrification is one part. Notwithstanding the above, two quantifiable benefits do result from extension of the rural electrical distribution system; (1) the value of the service rendered measured by gross sales to new customers; (2) and the incremental savings generated by extending this system to customers whose alternative system provided power at an incrementally higher price. This latter factor requires further definition. It is assumed that the new customers were receiving some power from the use of motor generators at a price of one peso per Kwh under conditions of uncertain service, viz., frequent interruptions due to breakdown in the motor, lack of spare parts, etc. Although these costs of inconvenience are not measured, we do measure the difference in price per Kwh under the old and new systems which is about 50 centavos (1/2 peso). This incremental savings is included in the benefits to new

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*"Putting the annual maintenance expense in the denominator is illogical and conceptually unsound in terms of the objective. In the ordinary cost accounting procedure and profit and loss statements the concept most often used is that operating expense is a deduction from income before gross profits are stated. It is true, however, where depreciation expense accounting is practiced, depreciation expense would be included in total operating expense. However, the basic concept is still income minus expense gives profits."
Economic Analysis for Highways, Robley Winfrey, ITC, 1969, NY.

consumers in the project. Another possible direct benefit which is not considered is the effect on wholesale prices of the increased load which results from the extension of the distribution system, that is, the possible block power purchasing price redution given to large consumers.

Project Life:

The generally accepted life of a rural electrification project is 30 to 35 years. For purposes of this project, 30 years was the amount of time established for the analysis. Salvage values of the project were determined on this basis.

Internal Rate of Return: The analysis indicated a 14.6% internal rate of return. The conservative definition of given benefits would appear to demonstrate the viability of the Santa Cruz project. (See following tables).

TABLE I

PROJECTED BENEFIT AND COST FLOWS FOR CRE (SANTA CRUZ)

Description of Investment	1	2	3	4	5	6	7	8	9	10
Costs										
Administration	41,666	41,666	41,666	41,666	41,666	41,666	41,666	41,666	41,666	41,666
Engineering	176,650	176,650	176,650	---	---	---	---	---	---	---
Materials	----	3,332,086	1,477,591	---	---	---	---	---	---	---
Construction	---	279,144	602,289	---	---	---	---	---	---	---
Vehicles & equipment	---	212,000	---	---	---	---	---	---	---	---
Buildings, furniture & land	---	210,000	---	---	---	---	---	---	---	---
Technical assistance	33,000	34,000	33,000	---	---	---	---	---	---	---
Wholesale power	---	118,432	257,077	477,405	529,939	564,754	613,711	672,239	739,550	814,906
Sub-total costs	251,316	4,403,978	2,588,273	519,071	571,605	606,420	655,377	713,905	781,216	856,572
Benefits										
Rental & sales + fuel savings	---	438,836	1,213,377	1,902,567	2,045,860	2,143,961	2,268,206	2,385,712	2,529,605	2,700,000
Less (-) Maintenance	---	18,837	37,674	75,899	75,899	75,899	75,899	75,899	75,899	75,899
Sub-total benefits	---	419,999	1,175,703	1,826,668	1,969,961	2,068,062	2,192,309	2,309,813	2,453,706	2,624,101
Operating surplus	-251,316	-3,983,979	-1,412,570	1,307,597	1,398,356	1,461,642	1,536,932	1,595,908	1,672,490	1,767,529

SOURCE: Benefit Data from James E Ross, Economic Evaluation of Proposed Rural Electrification Projects in Bolivia
Cost Data from G. Mcon, Outline for Rural Development: Bolivia

TABLE I

COMPUTATION OF BENEFIT COST RATIO : C.R.E.

Year	Benefits *	Costs	Discount Factor 12%	Discounted Benefits	Discounted Costs
1	-	251,316	.8929		
2	419,999	4,403,978	.7972		
3	1,175,703	2,588,273	.7118		
4	1,826,668	519,071	.6355		
5	1,969,961	571,605	.5674		
6	2,068,062	606,420	.5066		
7	2,192,309	655,377	.4523		
8	2,301,813	713,905	.4039		
9	2,453,706	783,216	.3606		
10	6,088,301**	856,572	.3220		
				9,267,726	7,681,291

Benefit-Cost Ratio (Discounted 12%) = 1.21

* See Exhibit 2 for Economic Discussion on Load Projections.

** Includes salvage valve of $3,464,200

TABLE II

COMPUTATION OF THE INTERNAL RATE OF RETURN : C.R.E.

Year	Operating Surplus	Discount Factor 12%	Present Worth	Discount Factor 15%	Present Worth
1	- 251,316	.8929		.8696	
2	- 3,983,379	.7972		.7561	
3	- 1,412,570	.7118		.6575	
4	1,307,597	.6355		.5718	
5	1,398,356	.5674		.4972	
6	1,461,642	.5066		.4323	
7	1,536,932	.4523		.3759	
8	1,595,908	.4039		.3269	
9	1,672,490	.3606		.2843	
10	1,767,529	.3220		.2472	
			471,442		- 72,470

$$\text{Internal rate of return} = 0.12 + 0.03 \left(\frac{471,442}{471,442 + 72,470}\right) = 14.6\%$$

D. Benefit/Cost: Cochabamba ELFEC

In reviewing the area of concentration of this project, we find a target group of mixed urban/rural population who are the recipients of the expanded distribution system. To justify the introduction of a semi-urban populace we accepted the REA's definition of rural groups which encompasses a population of 1,500 or less. Under this definition we concluded that the principal target areas would be considered semi-rural. The industrial beneficiaries are for the most part rurally located and provide the necessary load to facilitate the expansion of the system. It is questionable that without this mix an adequate load could be obtained including small townships, etc. The expansion of system is required and because of the provincial population location the classification of the target area as rural is reasonable.

The second issue revolves around the low direct benefit/cost ratio which is generally found in projects of this nature. Part of the problem results from the difficulty in quantifying indirect benefits which are usually substantial. In this particular case, we assumed certain direct costs will be substantially higher because of power rate policies followed by the GOB. It appears that the Power Regulatory Agency of the GOB does not base its wholesale prices on size of power blocks sold but traditionally charges increasing amounts to larger customers. In the projections, it is assumed that the wholesale cost of power to ELFEC is about 50% of retail price and we have included an additional 10% cost to ELFEC for line losses. Using this assumption we find wholesale costs rising pari passu with retail sales, thus reducing the net benefits from the project. This conservative approach is justified to the extent that GOB power rate policies continue into the future. The exclusion of benefits from increased income due to the introduction of electricity to handicraft industries which could expand their working hours beyond the daylight period is another factor which has substantial importance in Cochabamba. Their exclusion results from inadequate specific information concerning potential consumers for the expanded system.

The following data indicates the relative importance of this sector to the value added of industry to the economy:

Year	Value $b 000,000 1970 Prices	% Relation to Total Industry Value Added
1966	410.4	39.9
1967	408.4	38.1
1968	430.8	37.6
1969	429.1	36.4
1970	455.9	36.3

Source: Ministry of Planning and World Bank
The average annual rate of growth was 2.7% during this period.

1. Definition of Costs

The wholesale price for power supplied to ELFEC is assumed to be 50% of retail prices plus an additional 10% resulting from line loss which is a cost to ELFEC. These assumptions appear to be fair, but result in a higher cost flow than would be necessary, if the power pricing policies of the GOB are altered to the benefit of large consumers. It is also possible that forthcoming on-line power will be cheaper to ELFEC, thus contributing to a reduction in the cost calculation.

2. Direct Benefits

The calculation of direct benefits includes the value of new sales to be made under the expansion and the incremental savings to the consumer of the substitution of one power source for another. This latter factor results from data supplied by INER which shows about 500 Kwh being replaced at a savings of about US 4 1/2 cents per Kwh. The savings component only represents approximately 7% of total benefits in this calculation. The assumption concerning new consumers comes from ELFEC projections which could be somewhat conservative. The proposed rate increases would increase the value of sales and thus gross benefits.

Project Life

The generally accepted life of a rural electrification project is 30 to 35 years.

In the ELFEC B/C analysis the project life was extended throughout the full term. (See following tables).

TABLE III

COMPUTATION OF BENEFIT COST RATIO : E.L.F.E.C.

Year	Benefits	Costs	Net Benefits	Discount Factor 12%	Discounted Benefits	Discounted Costs
1	16,320	406,454	-390,134	.893	14,574	362,963
2	19,200	2,514,492	-2,485,292	.797	15,302	2,004,050
3	28,800	909,885	-881,085	.712	20,506	647,838
4	387,013	567,969	-180,956	.637	246,527	361,796
5	588,833	618,947	-30,114	.567	333,868	350,943
6	713,394	693,683	19,711	.507	361,691	351,697
7	839,013	769,055	69,958	.452	379,234	347,613
8	1,094,784	922,517	172,267	.404	442,293	372,697
9	1,124,406	940,290	184,116	.361	405,911	339,445
10	1,349,678	1,075,451	274,227	.322	434,596	346,295
SUB-TOTALS	----	----	-------	---	$2,654,502	$5,485,337
11 - 30	*	**	-------	---	$6,509,810	$2,647,368
TOTALS					9,164,312	8,132,705

Benefit-Cost Raito = 1.12

*PW (savings) = [$1,349,678 (P/A, 12%, 20) + 225,396 (P/G, 12%, 20)] (P/F, 12, 10) =$6,509,810

**PW (costs) = [1,075,451 (P/A, 12%, 20) + 2277 (P/G, 12%, 20) + 48,588 (P/G, 12%, 20)] (P/F, 12, 10) =$ 2,647,368

TABLE IV

PROJECTED BENEFIT AND COST FLOWS FOR ELFEC (COCHABAMBA)

Years:	1	2	3	4	5	6	7	8	9	10	11-30
Investment: Ongoing Costs											
Administration	62,790	62,790	62,790	189,748	189,748	189,748	189,748	189,748	189,748	189,748	
Operation: Maintenance	---	18,837	37,674	75,899	75,899	75,899	75,899	75,899	75,899	75,899	
Engineering	55,000	88,804	88,804	----	----	----	----	----	----	----	
Material	213,664	1. ,687	933,267	----	----	----	----	----	----	----	
Construction	14,023	126,204	140,227	70,114	----	----	----	----	----	----	
Equipment	29,700	115,500	----	----	----	----	----	----	----	----	
Building	10,000	138,000	----	----	----	----	----	----	----	----	
Technical Assistance	29,850	29,850	29,850	----	----	----	----	----	----	----	
Wholesale Power*	3,792	11,520	17,280	232,208	353,300	428,036	503,408	656,870	674,643	809,806	
Subtotal	406,454	2,514,492	909,895	567,969	618,947	693,683	769,055	922,517	940,290	1,075,451	
Output: Savings	16,320	19,200	28,800	387,013	588,833	713,394	839,013	1,094,784	1,124,406	1,349,678	
Operating Surplus	-390,134	-2,495,292	-881,095	-180,956	-30,114	19,411	69,958	172,267	184,116	274,227	

SOURCE: Moon Report and Moon Prepared Modifications
INER (Rural Electrification Institute), La Paz.

*Wholesale power costs are increasing on an average of 6% and savings are increasing at an average of 16.7% from period 5 thru 10. These rates of change were extrapolated for the analysis in years 11 through 30. The maintenance factor has been accounted as a 3 percent rate increase per year accounting for technological improvements and maintenance intensification in the latter years.

Year	Oper.Surplus	F/F, 12%	P/F, 15	
1	- 390,134	.8929	.8696	
2	- 1,485,292	.7972	.7561	
3	- 881,085	.7118	.6575	
4	- 180,956	.6355	.5718	
5	- 30,114	.5674	.4972	
6	19,411	.5066	.4323	
7	69,958	.4523	.3759	
8	172,267	.4039	.3269	
9	184,116	.3606	.2843	
10	274,227	.3220	.2472	
11-30		- 2,823,118	- 2,183,010	- 2,514,082
		+ 3,186,651	+ 1,873,163	
		+ 363,533	- 309,847	

$\Delta S-C = \$274,227\ (P/A, \%\ 20) + 174,531\ (P/G, \%\ 20)\ (P/F, \%\ 10)$

Savings @12%[274,227 (7.469) + 174,531 (44.9676)](.3220) = 3,186,654
Savings @15%[274,227 (6.259) + 174,531 (33.5822)](.2472) = 1,873,163

Rate of Return = $12 + (.3)\left(\frac{363,533}{673,380}\right) = 13.62\%$

BOLIVIA - Agricultural Products and Development Sectors

Cotton: Cotton production in Bolivia is concentrated in the Santa Cruz area. Approximately 35,000 workers are required at harvest time, according to the Cotton Growers Association. Workers earn $b 18 a day plus meals valued at $b 4. The average laborer earns $b 8 to $b 12 per day. According to the Association of Cotton Producers, six new cotton gins in addition to seven already in service will be available to process the 1972 crop. Cotton harvest in 1975 is expected to reach 100,000 hectares. About $17 million in foreign exchange is generated by cotton exports. Market prospects are good.

Sugar: A Central Bank of Bolivia loan in May, 1972 made possible the planting of an additional 13,500 acres of sugar cane in the Santa Cruz area, according to the National Commision of Cane and Sugar (CNECA). The local price of sugar has been increased to permit millers to pay cane growers a higher price. Approximately 35,000 hectares were planted in 1971, but a shift to cotton production and and a prolonged drought reduced the area in 1972. Santa Cruz has a sugar cuota of 2,800,000 quintales, but production will be lower. It is anticipated that Bolivia will have to import $10 - $12 million worth of sugar.

Rice: Rice production for 1971 reached 77,000 metric tons making the country self-sufficient in rice and eliminating rice imports. Approximately 82 percent of Bolivia's rice is produced by 16,000 farmers in the Department of Santa Cruz. Most is grown on small farms under dryland conditions and with hand labor. Rice is also grown in the Yungas of La Paz and Cochabamba. Rice marketing is uncertain and governmental action will be required before producers can be certain of a fair profit.

Potato - Quinua: During 1971 potato and quinua production amounted to 610,293 metric tons from 85,695 hectares. Economic and technical assistance for agricultural extension and production inputs is credited for improving production. Potato production is important in both the Altiplano and the valleys of Cochabamba. Improved production practices could increase yields significantly.

Wheat: During 1971 Bolivia harvested 64,000 hectares of wheat. Production was 43,560 metric tons valued at $3,150,000. As a result of increased production, the milling industry is increasing the capacity of flour mills. The dairy cattle and poultry industries are utilizing wheat by-products for feed. A favorable market exists for wheat produced in all three project areas.

Oilseeds: An agro-industrial feasibility study has been completed for oilseeds. The study includes a description of the current production, processing and marketing situation. Projections of edible oil needs, both in Bolivia and neighboring countries, indicate a definite future demand. Bolivia currently consumes between 6 and 7 million liters of refined oil annually. Domestic factories, two in Cochabamba and a small one in Santa Cruz, produce about 50 percent of the oil consumed. A large increase in cotton and soybean production, along with construction of local processing factories, could provide an impetus to livestock production in Bolivia.

Meat: Bolivia is attempting to increase meat production for the Peruvian and Chilean markets. The Santa Cruz region offers good potential for finishing cattle for this export market. The region of Santa Cruz has slaughtering facilities at two sites which are sufficient to handle reasonable increases in quantities of meat. Domestic consumption levels of meat products in Bolivia also represent significant markets for increased meat production. Per capita consumption of meat in Bolivia is 152 grams per week, while consumption in Santa Cruz is 392 grams per week.

Milk: National milk production is estimated at 28 million liters annually. Credit assistance has been received for improving production [illegible] cooperatives. [illegible]

Agricultural Credit: An $8 million loan was made by USAID/Bolivia on Nov. 12, 1971 for agricultural production and marketing. Two previous loans for agricultural credit were made in 1963 and 1966. An industrial loan amounting to $ 7,250,000 which could assist agricultural development is being negotiated. This loan, which will make credit available through the banking system, could be of direct assistance to the rural electrification projects. For example, agricultural producers could borrow funds through the banking system to purchase irrigation pumps.

Agricultural Extension: Work in extension has been concentrated on organization of farm groups, with emphasis on cooperatives. The Ministry has 70 agricultural agents working throughout the country.

Community Development: Efforts are being made to find solutions for socio-economic problems int the rural areas. Self-help programs are emphasized. Work has been concentrated in construction of schools, potable water, latrines, roads, irrigation, bridges and health centers.

Agrarian Reform: The Agrarian Reform Service is assisted by USAID/Bolivia and the British Tropical Mission. Mobile brigades issued 120,000 land-tenure titles in 1971. Agrarian Reform, which many people believed impeded the country's agricultural production did not significantly affect agricultural producers in Santa Cruz.

Agricultural Research: A National Seed Plan, financed by USAID/Bolivia is expected to have significant results for Bolivian agriculture. Research is concentrated on variety selections of potatoes, rice, wheat, forages, quinua, barley, oats, oilseeds, fibers and corn. Work also is being conducted on crop diseases and use of fertilizers.

Principal Crops by Hectares in the
Proposed Santa Cruz Project Area, 1971

Crop	Warnes	Sara	Santiesteban	Ichilo	Andrés Ibañez
Corn	3,500	2,500	3,500	3,000	1,148
Potatoes	-	-	-	-	170
Rice	1,064	5,729	10,544	26,636	-
Sugar cane	6,200	-	7,200	-	2,145
Yuca	1,200	1,400	650	2,500	719
Coffee	350	790	270	250	416
Bananas	-	1,200	370	4,500	228
Fruits	150	-	200	150	275
Tobacco	-	-	-	-	-
Maní	-	-	260	-	-
Forages	3,300	2,300	-	-	3,400
Soybeans	-	-	1,800	-	-
Cacao	-	-	300	200	-
Sorghum	-	-	-	80	40
Tomatoes	-	-	-	-	45
Vegetables	-	-	-	-	42

Source: "Estadisticas Económicas y Sociales del Departamento de Santa Cruz, Federación Departamental de Empresarios Privados, Santa Cruz, Bolivia, 1972

A study by the Ministry of Agriculture, the Agricultural Bank, the Ministry of Public Works and Utah State University in April 1972 states that agricultural development in the Santa Cruz area "offers a large potential for profit and capital growth. Currently, the most profitable and extensively cultivated crop is cotton. Assuming adequate processing and marketing, vegetables grown during the dryer months offer, in the future, possibilities for profitable production on an important scale. What, although less profitable, is recommended for double cropping as a means of improving soil structure and reducing weed competition. If there should be a future decline in cotton prices, such crops as soybeans and peanuts can be expected to play an increasingly important economic role."

Cattle: In 1968 the number of cattle was estimated to be 500,000 head with a value of $ 30 million. Meat consumption in the department was estimated at 6,000 head of sheep and 8,000 tons of beef. It is estimated that in the vicinity of Santa Cruz, an average of one and one-third hectares are required to graze one head of cattle on non-irrigated land. In 1971 beef became a major export from the Santa Cruz area, amounting to $ 1.2 million. Milk production in the area is low, but new dairy herds are being established,

Petroleum and gas: Petroleum reserves are estimated at 800 million barrels, while proven reserves are given at 250 million barrels. Natural gas reserves are about 3,000 million cubic feet. It is estimated that the Department of Santa Cruz has 95 percent of the Bolivian natural gas and petroleum resources.

ANNEX IV (A) - Exhibit 2

Load Projections

This section suggests answers to two questions commonly asked of rural electrification projects: 1) Are growth trends and load projections reasonably consistent with each other; and, 2) Are the load projections accurately scaled to fit into the community priorities and the ability to pay for power on a per capita basis. The paucity of available statistical data remains factual as in most LDCs. Therefore, an approach through the use of the National Income growth trends (extended thru extrapolation) compared to the predicted demand ranges* will align the rural load forecasts. Two assumptions are considered in the exercise, generally that of uniformity in the income distribution** levels and secondly the continuity that is assigned to the growth within the communities as opposed to real discrete bursts and slumps in the development patterns.

Load Projections

As outlined in the Ross report, the following load projections were derived from a survey within one of the project areas. Generally, the survey questionnaires completed in four villages receiving electricity indicated that new consumers would use electricity for lights, radio and an iron. Some respondents stated that electricity had reduced their disposable income. The major share of respondents, however, said electricity had increased their incomes and provided other benefits. Merchants in the four villages were specific in stating that electricity had increased their incomes.

Respondents in unelectrified areas indicated they were spending $b 10 to $b 12 per month for fuels and candles for lighting. With a retail rate of $b·50 per kilowatt hour and a service charge of $b8 per month, they will not save money by using electricity. For an electric bill of $b 12.50 per month***, they will, however, have more convenient, dependable (and brighter) lighting. The $b 12.50 monthly bill will provide 18 kilowatt hours, which will give the consumer an equivalent of 200 watts for 90 hours. With respect to the residential consumption, a 50 kwh/month projection amounts to the possible combination of a few select items from Table II.

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* IBID Ross & Moon Reports

** The use of averages related to per capita incomes suggests uniform distribution. In reality, as in most LDCs, much of the populations income is minimal; whereas a few control the major portion of wealth.

***Based on 1972 rates.

During the initial hook up period, the applicance usage may take on a configuration of say;

year	quantity	appliance	average daily use (hrs.)	monthly kwh
2	1	100 w bulb	5 hrs.	15 kwh
3	2	60 w bulbs	5 hrs.	18 kwh
4	2	60 w bulbs	5 hrs.	50.6 kwh
	1	hand iron	1 hr	
5	2	as above plus radio	(5, 1, 5)	61.9 kwh
	1			
6				
7				
8				
9				
10		2 ea. 60 watt bulb + hand iron + radio + blender	(5,1,5,2)	79.3 kwh

It is relatively simple to ascertain the validity of the load projection for residential consumers. However, the real test is hidden in the ability of the rural dweller to purchase the base appliances plus the retail charge for power, especially where incomes are low (the average per capita income is $317/year). Since the propensity to save plus rents, taxes, etc., may be (optimistically) in the neighborhood of 10%, an annual disposable income (D.I.) equals $285.00 or $0.79 per day. Ironically, $0.79 is the average price for a 60 watt light bulb. And;

Table I

Item	Retail Cost	Daily Cost Ratio Per* Cost/DI/Day	Day-Income
a radio	$10.00	1 day	13 days income
an iron	8.00	1 day	10 days
2-60 watt bulbs	1.60	1 day	2 days
Blender (food mixer)	24.00	1 day	30 days
Sub Total		12 days/yr	55 days income 67 days or 18% of D.I.

As a final step in this exercise the comparison of a uniform growth factor for power consumption which best fits the extrapolited GNP growth curves for Bolivia would prove useful. Current National Income growth has been measured at 6½**.

* The minimum monthly charge amounts to 23 kwh per month $.70
**Nl growth from USAID/Bolivia: Economic Report, 1971

Obviously the oversimplification of the following comparison suggests that the results are presented for "ballpark" assurances that the timing and demand projections lie within the feasibility region of our project. Then, taking Y as our initial hook-up in year two, and r, as the derived growth, for a period t, we have;

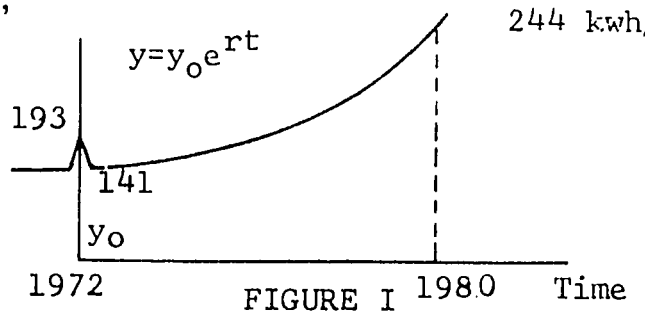

FIGURE I

and, from Table II, y = 141, on the average consumption, y = 244. The average expected consumption in the tenth year would then be represented by;

$$e^{rt} = 1.73$$
$$rt = 3.99 \qquad r = 5.7\% \text{ (average)}$$

The rate of growth expected from the CRE census survey suggests that real power development lies in the region of 5.7%. This illustrates a close fit between the average demand projections and the overall growth pattern of the country.

Summary

The precedding exercise places a degree of credibility to the timing of the project and reliability of the various data. Obviously, when utility projects are designed, tempting assumptions are inserted to facilitate optimistic outcomes.

Here, the approach has been to portray the demand projections favorability with other measurable growth trends. The hypothesis stems from Fremont Felix* who established the direct inter-relationship of Energy demand and the GNP of various LDCs.

* Improved Methods for Forecasting Future Demands for all countries of the World Power Conference - Tokyo 1966.

TABLE II

Projected Number of Consumers and Consumption of Electricity, Santa Cruz Extension

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Projected Number of Consumers

Year	Residential	Commercial	Farms	Agro - Industrial	Total
2	2,567	350	56	27	3,000
3	8,182	1,115	157	46	9,500
4	11,842	1,614	258	86	13,800
5	12,669	1,727	264	90	14,750
6	12,875	1,756	274	95	15,000
7	13,213	1,800	286	101	15,400
8	13,458	1,835	300	107	15,700
9	13,697	1,868	320	115	16,000
10	13,919	1,902	325	124	16,300

Projected Consumption of Electricity in kwh/month

Year	Residential	Commercial	Farms	Agro-Industrial	Total
2	50	50	1,[illegible]	13,[illegible]	1[illegible]
3	[illegible]	[illegible]	1,[illegible]	1[illegible],[illegible]	1[illegible]
4	[illegible]	[illegible]	1,[illegible]	1[illegible],[illegible]	1[illegible]
5	59	59	1,[illegible]	13,[illegible]	172
6	62	62	1,810	14,200	184
7	65	65	1,[illegible]	14,[illegible]	194
8	68	68	2,100	15,100	209
9	71	71	2,200	15,700	226
10	75	75	2,310	16,400	244

Source: CRF projections based on census survey.

REPRESENTATIVE U.S. APPLIANCES:
U.S. WATTAGE RATINGS AND U.S. AVERAGE HOURS USE AND ELECTRICITY USE

APPLIANCE	AVERAGE WATTS	AVERAGE HOURS USE	AVERAGE KILOWATT HRS USED
Air Conditioner (Window)	1,325	1,000	1,325
Air Conditioner (Central-3 ton)	5,560	1,000	5,560
Baby Food Warmer	160	531	85
Carving Knife	85	35	3
Clock	2	8,760	18
Clothes Dryer	4,350	221	960
Coffee Maker	850	118	100
Dehumidifier	250	1,600	400
Dishwasher	1,180	292	345
Electric Blanket	190	684	130
Fan (Attic)	365	890	325
Fan (Circulating)	85	529	45
Fan (Window)	200	875	175
Floor Polisher	335	45	15
Food Blender	290	52	15
Food Freezer, 15 cu. ft.	350	3,000	1,050
Food Freezer, Frostless	440	3,466	1,525
Food Mixer	110	91	10
Food Waste Disposer	400	63	25
Frying Pan	1,160	168	195
Germicidal Lamp	20	7,000	140
Griddle	1,500	83	125
Grill (sandwich)	1,180	25	30

APPLIANCE	AVERAGE WATTS	AVERAGE HOURS USE	AVERAGE KILOWATT-HRS USED
Hair Dryer	260	38	10
Heat Lamp (Infrared)	250	40	10
Heat Pump	4,650	?	?
Heater (Radiant)	1,270	134	170
Heating Pad	60	167	10
Humidifier	70	2,214	155
Iron (hand)	1,085	134	145
Oil Burner	255	1,529	390
Phonograph (Stereo, portable)	30	?	?
Phonograph (Stereo, console)	75	?	?
Radio	75	1,200	90
Range	12,000	100	1,200
Refrigerator (12 cu. ft.)	265	3,226	855
Refrigerator (frostless)	295	3,220	950
Refrigerator-Freezer (14 cu. ft.)	290	4,121	1,195
Refrigerator-Freezer (frostless)	435	3,621	1,575
Roaster	1,325	155	205
Rotisserie	1,500	200	300
Sewing Machine	75	133	10
Shaver	15	133	2
Shoe Polisher	75	27	2
Sun Lamp	280	54	15
TV Portable (black and white)	110	1,500	165
TV Console (black and white)	255	1,373	350
TV Color	315	1,460	460

APPLIANCE	AVERAGE WATTS	AVERAGE HOURS USE	AVERAGE KILOWATT-HRS USED
Toaster	1,130	31	35
Toothbrush	2	3,000 1/	6
Vacuum Cleaner (portable)	210	52	11
Vacuum Cleaner	700	57	40
Waffle Iron	1,080	19	20
Warming tray	325	49	16
Washing machine (automatic)	600	133	80
Washing machine (non-automatic)	280	214	60
Water Heater (quick recovery)	4,500	978	4,400
Water Pump	450	444	200

Sources: Edison Electric Institute, January, 1965, and General Electric Company, 1967 Diary, December, 1966.

1/ Battery charging

ANNEX IV (A) - Exhibit 3

The Cost Reduction (Savings) of Kerosene Lamps Replaced by Rural Electrification for Rural Bolivia

Along with other savings, replacing substitutes such as rural transmitted energy over the use of kerosene lamps, currently in use, offers an interesting measurement. Kerosene consumption represents the most important source for lighting in the rural household and kerosene consumption is itself complementary to the use of a stock of durable--kerosene lamps.* The rate of growth of that stock must also be considered in the overall level of use.

Household characteristics such as those in rural Bolivia suggest that about 1 1/2 kerosene lamps are used per household. To further the analysis the brass or glass base kerosene lamp costs were averaged out at $6.00 U.S. each. Assuming an average economic life of 5 years the depreciation amounts to $1.20/year and the annual maintenance cost, also amounts to $1.20 annually (i.e., wicks (25¢), matches (20¢), and globe (75¢).) The operating expenses for 5 hours use per day at a burning rate of 6 pints of kerosene per week, supply a total operating cost of $3.90 per year.

Once the annual replacement, repair and operation has been established, the kerosene lamp efficiency is compared to at least one electric alternative. Let's consider these alternatives and their brightness:**

* From "Notes on the Appraisal of Rural Electrification Projects." Marcelo Selonsky, World Bank.

** Standard Handbook for Electrical Engineers, Chief Ed. A.E. Knowlton, 9th ed., McGraw-Hill 1970.

	Candles/in^2	Foot-Lamberts
Flame Source*		
Candle	3.3	1,500
Kerosene lamp, flat wich	8.2	3,700
Welsback mantle (gasoline lantern)	40.0	18,100
Incandescent Electric Lamps		
60-watt inside frosted centerspot	55	25,000
60-watt white one 90°	19	8,700
100-watt inside froster centerspot	94	42,300
Fluorescent Lamps (max.)		
20-watt T-12	3.4	1,550
40-watt cool whate (T-17)	2.3	1,050

Alternative	Kerosene Wick Lantern.	60-Watt Bulb
Light Requirement	5 hrs/day	5 hrs/day
Room Size	8' x 8'	
First Cost (Annual) $6.00/5 yr	$1.20	$ .79
Replacement (yr) (Wicks) (3 bulbs)	$1.20	$2.37
Operation (Fuel)	$3,90	$8.40/yr*
Depreciation	$1.20	**
Lighting Activity (sewing, reading, etc.)	1/2 persons	1/4 persons
Brilliance (Foot Lamberts)	3,700	25,000
(Candles/in 2)	8.2	55
Total Annual Cost	$7.50/yr	$10.77/yr

*Illuminating Engineering Society, N.Y., N.Y., International Standards now rate light in terms of foot lamberts, i.e., a brightness standard which is the reflection rate of one lumen per square foot.

The relationship between kerosene consumption and light brilliance becomes:

$$\text{kero} = \frac{\$7.50 \times 2 \text{ persons}}{3{,}700 \text{ Foot Lamberts}} = \$ .0040/\text{FL}$$

$$\text{Power} = \frac{\$10.77 \times 4 \text{ persons}}{25{,}000 \text{ foot lamberts}} = \$.00172/\text{FL}$$

The relationship above may suffice for our particular problem, however, the assumption of personal use of light leaves room for doubt and possibly further speculation.

The alternative relationship would be to establish, in lieu of any "village" standards for reading light, a minimal requirement for the light standard used by the present rural dweller. That standard set by the socio-economic setting is a one wick lamp in an average room size of 8 ft. square. Illumination is measured by candle power and further scaled by the foot candle* requirement set by international standards.**

Then, with respect to the wick lamp, it produces 8.2 candles/in^2 at one foot distant, or 3,700 foot lamberts. The distance (D) (5.6' or the tangent of 4') represents the maximum distance away from a centered light point source a person could retreat to in a room 8' square.

At our maximum distance it would require 6.71 wick lamps to equal the bulb intensity. Therefore, this implies that kerosene costs are increased to $26.12/year for kerosene as compared to the 60-Watt bulb of $10.77 per year for energy derived from rural electrification.

In terms of import substitutuion, the rural electrification program entails 75% of its fixed assets in foreign exchange components and the kerosene wick lamp requires 45%. However, through the energy demand relationship i.e., those costs attributable to the direct operation, the annual equivalent costs for rural electrification power provides an import substitution advantage of 31%.

* The measure of light intensity at right angles to the light source at $\pm$ feet (used in photometric laboratories) i.e., candle power, ap = foot candles x (distance)^2.

** Other factors commonly used are maintenance factor efficiency and color of light. These factors are neglected here.

***USAID/Bolivia Cost Estimates; IBID Gill Moon.

F I N A N C I A L E X H I B I T S

Table of Contents

B A L A N C E S H E E T

As of December 31, 1971 and 1970

	C R E		E L F E C	
	1971	1970	1971	1970
Assets				
Property, plant and equipment at cost				
Production			$140,425	$140,425
Transmission	$3,237,97[illegible]	3,096,670	1,811,818	1,555,495
Other, including franchises	62,59[illegible]	11,104	214,771	204,971
	3,300,568	3,107.774	2,167,014	1,900,891
Less: depreciation	(110,129)	(15,856)	(517,248)	(393,903)
	3,190,439	3,091,918	1,649,766	1,506,988
Work in progress			47,545	80,373
Investigations		1,542	8,767	11,734
Investments	12,610	10,570	1,518	1,518
Long-term accounts receivable-GOB	-	-	-	-
Current assets:				
Cash	25,521	50,902	334,502	617,000
Accounts receivable	249,968	86,782	448,122	285,605
Materials and supplies at cost	149,782	133,530	630,510	636,559
Prepaid expenses	1,056	-	-	-
Taxes receivable from shareholders	-	-	-	-
Total current assets	426,327	271,214	1,413,134	1,639,164
Due from Affiliates:				
Empresa de Luz y Fuerza de Oruro S. A.				
Deferred charges	15,043	8,231	-	577
Total	$3,644,419	3,383,475	3,120,730	3,240,354

B A L A N C E S H E E T
AS OF DECEMBER 31, 1971 AND 1970

	C R E		E L F E C	
	1971	1970	1971	1970
Liabilities				
Shareholder's equity				
Capital stock				
Preferred A stock				
Preferred B stock				
Common stock & certificates	$ 181,970	88,042	924,713	883,712
	181,970	88,042	924,713	883,712
Reinvested earnings				
Earnings segregated for stock dividends				
Earnings segregated for reinvestment				
Earnings segregated for cash dividends			32,564	32,615
Retained earnings			61,429	70,873
	181,970	88,042	1,018,706	987,200
Long-term liabilities	3,190,424	3,242,023	1,008,408	922,065
Current liabilities				
Long-term debt due within one year	101,656	3,843	206,883	184,952
Accounts payable	150,035	46,521	227,335	627,176
Customer deposits	1,005	-	69,417	63,105
Bank loans	-	-	-	-
	252,696	50,364	503,635	875,233
Contribution from third parties and other			149,268	102,221
Reserve for Social Benefits	12,046	2,307	301,480	257,290
Other Reserves			139,233	96,345
Deferred credits	7,283	239		
Due to Parent and Affiliates				
	$3,644,419	3,383,475	3,120,730	3,240,354

Notes: 1. The CRE and ELFEC figures were taken from their Audit Report and Annual Report respectively, and converted into U.S. Dollars at $b12 per US$1.
2. ELFEC - Temporary accounts have been excluded.

PROFIT AND LOSS STATEMENT

FOR THE YEARS 1971 AND 1970

	C R E		E L F E C	
	1971	1970	1 9 7 1	1 9 7 0
Operating revenue	$789,995	82,186	1,253,123	1,123,386
Operating revenue deductions:				
Operating, maintenance and administrative expenses	669,576	71,320	1,087,084	925,153
Taxes - other	-	-	4,916	-
Provision for depreciation	94,273	15,856	116,579	107,562
	763,849	87,176	1,208,579	1,032,715
Operating income	26,146	(4,990)	44,544	90,671
Other income				
Interest, dividends and other	-	800	89,619	71,115
Other expenses				
Interest	-	-	72,734	90,913
NET INCOME:	$ 26,146	(4,190)	61,429	70,873

Notes: The CRE and ELFEC figures were taken from their Audit Report and Annual Report respectively and converted into U. S. dollars at $b 12 por US$ 1.

COOPERATIVA RURAL DE ELECTRIFICACION LTDA.

C.R.E.

PROYECCIONES DE VENTAS DE CRE (CRE: Sales Projections)

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
VENTAS EN MWH										
Residencial Ciudades	25.000	25.980	26.887	27.787	28.687	29.587	30.487	31.387	32.287	33.187
Residencial Granjas .25.	8.450	8.670	8.963	9.263	9.563	9.863	10.163	10.463	10.763	11.063
80 Total MWH	24.810	28.770	32.460	36.670	41.490	47.030	52.940	59.210	67.680	77.155
Nº de Asociados	33.450	34.650	35.850	37.050	38.250	39.450	40.650	41.850	43.050	44.250
KWh/Asociado	741	830	905	989	1.084	1.192	1.302	1.414	1.572	1.744
Sub Total Ventas (miles de $us.) a ($us.0.0335/KWh)	831	964	1.087	1.228	1.390	1.576	1.773	1.984	2.267	2.585
Comercial Pequeño; Profesional										
Total MWH	7.160	8.070	8.480	8.870	9.310	9.790	10.280	10.800	11.350	11.900
5 Nº de Asociados	1.924	1.999	2.074	2.149	2.224	2.299	2.374	2.449	2.524	2.599
KWh/Asociado	3.720	4.037	4.089	4.127	4.186	4.258	4.330	4.410	4.497	4.579
Sub Total Ventas (miles de $us.) ($us. 0.0315/KWh)	225	254	267	279	293	308	325	341	357	375
Comercial Mayor										
Total MWH	7.340	8.050	8.440	8.850	9.290	9.750	10.230	10.770	11.300	11.830
2 Nº de Asociados	1.705	1.735	1.765	1.795	1.825	1.855	1.885	1.915	1.945	1.975
KWh/Asociado	4.305	4.640	4.792	4.930	5.090	5.256	5.427	5.624	5.810	5.990
Sub Total Ventas (miles de $us.) ($us. 0.0403/KWh)	296	325	340	357	374	393	412	434	455	477
Agricultores; Industrial Menor										
Total MWH	8.810	11.570	11.850	12.300	12.650	13.030	13.410	13.810	14.200	14.590
12 Nº de Asociados	294	474	654	834	1.014	1.194	1.374	1.554	1.734	1.914
KWh/Asociado	30.000	24.409	18.119	14.748	12.475	10.913	9.760	8.887	8.189	7.623
Sub Total Ventas (miles de $us.) ($us. 0.0337)	297	390	399	415	426	439	452	465	479	492
Industrial Mayor										
Total MWH	32.230	39.250	47.790	51.090	59.290	66.810	81.600	91.800	102.000	112.200
1 Nº de Asociados	123	138	153	168	183	198	213	228	243	258
KWh/Asociado	262.032	284.420	312.353	304.107	323.989	337.424	383.098	402.631	419.753	434.884
Sub Total Ventas (miles de $us.) ($us. 0.0243)	783	954	1.161	1.242	1.441	1.623	1.983	2.231	2.479	2.726
Alumbrado Público										
Total MWH	3.420	3.690	3.890	4.110	4.340	4.580	4.830	5.110	5.390	5.670
Nº de Asociados (H.Municipalidad)	1	1	1	1	1	1	1	1	1	1
MWH/Asociado	3.420	3.690	3.890	4.110	4.340	4.580	4.830	5.110	5.390	5.670
Sub Total Ventas (miles de $us.) ($us. 0.0302)	103	112	118	124	131	138	146	154	163	171
TOTALES										
Total MWH	83.770	99.400	112.910	121.890	136.370	150.990	173.290	191.500	211.920	233.345
Total Nº Asociados	37.497	38.997	40.497	41.997	43.497	44.997	46.497	47.997	49.497	50.997
Total de Ventas (miles de $us.)	2.535	2.999	3.372	3.645	4.055	4.477	5.091	5.609	6.200	6.826

GEG : AJS : wce.

Santa Cruz, 23 de Septiembre de 1972

COOPERATIVA RURAL DE ELECTRIFICACION LTDA.
SANTA CRUZ - BOLIVIA

B A L A N C E C R E (CRE: Balance Sheet Projections)

(Miles $U.S.) $US x 1,000

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
B. Activo Circulante y Acumulado												
1. Caja y Bancos	7.60	26.07	15.07	7.52	84.9[illegible]	34.42	63.87	199.32	181.77	236.22	249.45	265.44
2. Ctas. Recib. Consumidores A)	104.00	340.00	512.00	580.00	623.00	659.00	713.00	767.00	852.00	930.00	1.014.00	1.106.00
Fondo rotativo para Medidores e instalaciones internas		500.00	577.08	577.08	577.08	577.08	577.08	577.08	577.08	577.08	577.08	577.08
3. Inventarios Materiales y Suministros	650.19	102.06	497.31	497.28	480.08	496.63	496.82	496.54	496.71	497.21	532.65	639.44
Total Activo Corriente	761.79	968.13	1.601.46	1.661.88	1.765.13	1.767.13	1.850.77	2.039.94	2.107.56	2.240.51	2.373.18	2.807.96
Total Activo	3.496.60	8.843.92	10.001.11	9.994.53	10.079.78	10.233.78	10.495.42	10.871.59	11.391.21	12.010.16	12.629.02	13.386.99
Pasivos y Otros Créditos												
A. Capital												
1. Aportaciones de Asociados	215.00	265.00	335.00	370.00	380.00	390.00	400.00	410.00	420.00	430.00	440.00	450.00
2. Donaciones												
3. Superavit o Déficit después de Depreciación	152.00	234.00	175.00	247.00	439.00	703.00	1.078.00	1.571.00	2.221.00	2.954.00	3.767.00	4.723.00
T o t a l	367.00	499.00	510.00	617.00	819.00	1.093.00	1.478.00	1.981.00	2.631.00	3.384.00	4.207.00	5.173.00
B. Deudas a Largo Plazo												
Deuda actual	2.989.98	2.878.47	2.767.96	2.654.38	2.537.63	2.417.63	2.294.27	2.167.44	2.037.06	1.903.01	1.765.17	1.623.44
Deuda proyecto	139.62	5.466.45	6.723.15	6.723.15	6.723.15	6.723.15	6.723.15	6.723.15	6.723.15	6.723.15	6.656.85	6.590.55
Depósitos de Consumidores												
Total Pasivo Circulante	3.129.60	8.344.92	9.491.11	9.377.53	9.260.78	9.140.78	9.017.42	8.890.59	8.760.21	8.626.16	8.422.02	8.213.99
Total Pasivos y Otros Créditos	3.496.60	8.843.92	10.001.11	9.994.53	10.079.78	10.233.78	10.495.42	10.871.59	11.391.21	12.010.16	12.629.02	13.386.99

GLG:AJS:mra.

Santa Cruz, Septiembre de 1972

COOPERATIVA RURAL DE ELECTRIFICACION LTDA.

C R E

B A L A N C E C R E (Miles de $US.)

(CRE Balance Sheet Projections)
$US x 1,000

ACTIVO Y OTROS DEBITOS	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1.- Líneas de transmisión		741.58	741.58	741.58	741.58	741.58	741.58	741.58	741.58	741.58	741.58	741.58
2.- Subestaciones		485.68	485.68	485.68	485.68	485.68	485.68	485.68	485.68	485.68	485.68	485.68
3.- Líneas Distribución	3.001.02	6.643.56	7.337.51	7.537.51	7.793.51	8.113.51	8.593.51	9.097.51	9.890.51	10.743.51	11.383.70	12.330.89
4.- Planta General		442.71	442.71	442.71	442.71	562.71	562.71	562.71	562.71	562.71	802.71	802.71
5.- Int. Durante la - Construcción	2.79	65.26	156.17	156.17	156.17	156.17	156.17	156.17	156.17	156.17	156.17	156.17
6.- Trabajos en proceso												
7.- Intangibles												
TOTAL	3.003.81	8.378.79	9.163.65	9.363.65	9.419.65	10.059.65	10.539.65	11.043.65	11.836.65	12.689.65	13.569.84	14.517.03
Reserva Depreciación	269.00	503.00	764.00	1.031.00	1.305.00	1.593.00	1.895.00	2.212.00	2.553.00	2.920.00	3.314.00	3.738.00
TOTAL activo Fijo Neto	2.734.81	7.845.79	8.399.65	8.332.65	8.314.65	8.466.65	8.644.65	8.831.65	9.283.65	9.769.65	10.255.84	[illegible]9.03

Santa Cruz, 23 de Septiembre de 1972

GEG:AJS:mgv.

COOPERATIVA RURAL DE ELECTRIFICACION LTDA.

C R E

PROYECCIONES DE INGRESOS Y GASTOS (CRE: Profit and Loss Projections)

(Miles de $US.) $US x 1,000

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
INGRESO POR VENTAS DE ENERGIA												
Residencial			831	964	1.087	1.228	1.390	1.576	1.773	1.984	2.267	2.585
Comercial pequeño			225	254	267	279	293	308	325	341	357	375
Comercial mayor			296	325	340	357	374	393	412	434	455	477
Agricultores			297	390	399	415	428	439	452	465	479	492
Industrial mayor			783	954	1.161	1.242	1.441	1.623	1.983	2.231	2.479	2.726
Alumbrado Público			103	112	118	124	131	138	146	154	163	171
Total Ingreso por ventas	1.299	1.901	2.535	2.999	3.372	3.645	4.055	4.477	5.091	5.609	6.200	6.826
Otros Ingresos												
Total ingresos	1.299	1.901	2.535	2.999	3.372	3.645	4.055	4.477	5.091	5.609	6.200	6.826
GASTOS												
Compra de Energía			1.428	1.695	1.925	2.078	2.325	2.574	2.954	3.274	3.623	4.009
Distribución			214	220	225	236	248	261	280	301	324	346
Gastos de clientes			170	174	179	187	197	207	222	239	257	274
Promoción ventas, Administrativos y Generales.			355	364	373	391	411	431	464	499	536	572
Total Operación y Mantenim.	973	1.444	2.167	2.453	2.702	2.892	3.181	3.473	3.920	4.313	4.740	5.201
Depreciación	90	234	261	267	274	288	302	317	341	367	394	424
Total incluyendo Depreciación												
A) Ing.Neto Antes de Depreciac.	326	457	368	546	670	753	874	1.004	1.171	1.296	1.460	1.625
B) " " Después " - "	236	223	107	279	396	465	572	687	830	929	1.066	1.201
C Intereses	84	141	166	207	204	201	197	194	190	186	253	245
A-e Utilidad Neta Antes de - Depreciación	242	316	202	339	466	552	677	810	981	1.110	1.207	1.380
B-e Utilidad Neta después de Depreciación	152	82	(59)	72	192	264	375	493	640	743	813	956
B-e Acumulados	152	234	175	247	439	703	1.078	1.571	2.211	2.954	3.767	4.723

Santa Cruz, 23 de Septiembre de 1972

COOPERATIVA RURAL DE ELECTRIFICACION LTDA.
SANTA CRUZ - BOLIVIA

FLUJO DE FONDOS (CRE: Cash Flow Projections)

(Miles de $U.S.)

APLIACION DE FONDOS		1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	Total
Gastos de Construcción.														
Líneas Transmisión	L/C		478.38											478.38
	F/C		263.20											263.20
Subestaciones	L/C			132.98										132.98
	F/C			352.70										352.70
Líneas Distribución	L/C	57.31	213.10	636.88	200.00	239.00	337.00	480.00	504.00	793.00	853.00	676.00	985.00	5.974.29
	F/C		2.805.44											2.805.44
Edificios, Muebles, Terrenos, Vehículos y Equipo	L/C		172.00				120.00					240.00		532.00
	F/C		260.00											260.00
Organización Adm.														
Promoción	L/C	57.31	57.31	57.32										171.94
	F/C	25.00	25.00	25.00										75.00
Transf., Medidores e Instalaciones Internas	L/C	-.-	-.-	51.82										51.82
	F/C	-.-	1.052.40											1.052.40
Sub-total	L/C	114.62	920.79	879.00										1.914.41
	F/C	25.00	4.406.04	377.70										4.808.74
Total		139.62	5.326.83	1.256.70										6.723.15
Servicio de la Deuda.														
Deuda Actual														
Intereses		81.27	78.56	75.58	72.51	69.34	66.09	62.73	59.27	55.71	52.04	48.25	44.36	765,71
Amortización		162.78	111.50	110.51	113.58	116.75	120.00	123.36	126.82	130.38	134.05	137.83	141.73	1.529.29
Deuda Nueva														
Intereses		2.79	62.47	90.91	134.46	134.46	134.46	134.46	134.46	134.46	134.46	204.39	200.32	1.502.10
Amortización												66.30	135.60	201.90
Total		246.84	252,53	277.00	320.55	320.55	320.55	320.55	320.55	320.55	320.55	456.77	522.01	3.999.00
Total Aplicación Fondos														
Gran Total		386.46	5.579.36	1.533.70	520.55	559.55	777.55	800.55	824.55	1.113.55	1.173.55	1.372.77	1.507.01	16.149.15
Efectivo al Principio del Período		17.44	7.60	26.07	15.07	7.52	84.97	34.42	63.87	199.32	181.77	236.22	249.45	
Efectivo al Final del Período		(9.84)	18.47	(11.00)	(7.55)	77.45	(50.55)	29.45	135.45	(17.55)	54.45	13.23	35.99	
Efectivo Acumulado		7.60	26.07	15.07	7.52	84.97	34.42	63.87	199.32	181.77	236.22	249.45	285.44	

GEG:AJS:mra.

Santa Cruz, Septiembre de 1972

COOPERATIVA RURAL DE ELECTRIFICACION LTDA.

C.R.E.

FLUJO DE FONDOS

(miles de $us.)

(CRE:Cash Flow Projections)
$US x 1,000

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	Total
ORIGEN DE FONDOS													
Generación Interna de Efectivos													
Ingreso neto antes de intereses y depreciación	326.00	457.00	368.00	546.00	670.00	753.00	874.00	1.004.00	1.171.00	1.296.00	1.460.00	1.625.00	10.550.00
Préstamos													
Costo en $b.	114.62	920.79	879.00										
Costo en $us.	25.00	4.406.04	377.70										
Total Préstamo	139.62	5.326.83	1.256.70										6.723.15
Aportaciones	15.00	50.00	70.00	35.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	250.00
Menos: Aumento o disminución de cuentas de clientes no pagados	(104.00)	(236.00)	(172.00)	(68.00)	(43.00)	(36.00)	(54.00)	(54.00)	(85.00)	(78.00)	(84.00)	(92.00)	(1.106.00)
Total origen de Fondos (17.44)	376.62	5.597.83	1.522.70	513.00	637.00	727.00	830.00	960.00	1.096.00	1.228.00	1.386.00	1.543.00	16.417.15

Santa Cruz, Septiembre de 1972

GEG : AJS : wce.

EMPRESA DE LUZ Y FUERZA ELECTRICA
COCHABAMBA S.A.

SALES PROJECTION

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
URBAN										
RESIDENTIAL										
a) N° Consumers	28.646	29.274	31.112	33.019	35.245	37.016	39.940	42.336	44.876	47.569
b) KWH/Cons./year	960.0	980.4	999.6	1.017.6	1.035.6	1.053.6	1.071.6	1.093.0	1.114.9	1.137.2
c) Total MWH	27.500	28.700	31.100	33.600	36.500	39.000	42.800	46.273	50.032	54.095
Revenue US$x1.000 (0.030/KWH)	825.0	861.0	933.0	1.008.0	1.095.0	1.170.0	1.284.0	1.388.2	1.501.0	1.622.9
GENERAL										
N° Consumers	9.096	9.414	9.743	10.133	10.559	10.981	11.354	11.695	12.046	12.287
KWH/Cons./year	2.748	2.974	3.102	3.203	3.254	3.365	3.470	3.574	3.681	3.755
d) Total MWH	25.000	28.000	30.220	32.455	34.360	36.955	39.400	41.798	44.341	46.138
Revenue US$x1.000 (0.029/KWH)	730.0	817.6	882.4	947.7	1.003.3	1.079.1	1.150.5	1.220.5	1.294.8	1.347.2
LARGE INDUSTRIAL										
e) N° Consumers	43	45	47	49	51	54	56	59	61	64
f) MWH/Cons./year	618.6	655.6	702.1	742.9	784.3	829.6	875.0	918.8	973.9	1.022.6
g) Total MWH	26.600	29.500	33.000	36.400	40.000	44.800	49.000	54.209	59.408	65.446
Revenue US$x1.000 (0.02/KWH)	553.3	613.6	686.4	757.1	832.0	931.8	1.019.2	1.127.5	1.235.7	1.361.3
SPECIAL CONTRACTS										
h) Total MWH	12.500	13.800	14.600	15.400	16.200	17.200	17.900	18.800	19.700	20.700
Revenue US$x1.000 (0.019/KWH)	237.5	262.2	277.4	292.6	307.8	326.8	340.1	357.2	374.3	393.3
STREET LIGHTING										
i) Total MWH	4.300	4.700	5.200	5.500	5.800	6.200	6.600	6.900	7.300	7.700
Revenue US$x1.000 (0.023/KWh)	100.6	110.0	121.7	128.7	135.7	145.1	154.4	161.5	170.8	180.2

Empresa de Luz y Fuerza Eléctrica
Cochabamba S.A.

SALES PROJECTION

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
RURAL										
RESIDENTIAL-COMMERCIAL										
N° Consumers	10.252	13.328	13.861	14.415	15.712	16.183	16.668	17.168	17.511	17.861
Kwh/cons./year	360	422	467	501	529	553	574	592	609	624
Total Mwh	3.691	5.624	6.473	7.222	8.312	8.949	9.567	10.163	10.664	11.145
Revenue US$ x 1.000 0.035/Kwh	129.2	196.8	226.5	252.7	290.9	313.2	334.8	355.7	373.2	390
GENERAL										
N° Consumers	150	156	160	163	166	170	173	177	181	185
Kwh/cons/year	4.000	4.230	4.500	4.850	5.180	5.530	5.900	6.313	6.755	7.228
Total Mwh	600	660	720	790	860	940	1.020	1.117	1.223	1.337
Revenue US$ x 1.000 0.030/Kwh	18.0	19.8	21.0	23.7	25.8	28.2	30.6	33.5	36.7	40.1
IRRIGATION										
Total Mwh	3.200	4.500	5.500	6.300	6.700	7.000	7.200	7.200	7.200	7.200
Revenue US$ x 1.000 0.022/Kwh	70.4	99.0	121.0	138.6	147.4	154.0	158.4	158.4	158.4	158.4
STREET LIGHTING										
Total Mwh	540	560	580	585	590	595	600	605	610	620
Revenue US$ x 1.000 0.038/Kwh	20.3	21.0	21.8	21.9	22.1	22.3	22.5	22.7	22.9	23.3
TOTAL Mwh (U + R)	103.931	116.044	127.393	138.232	149.322	161.639	174.087	187.071	200.478	214.381
TOTAL REVENUE (U + R)	2.684.3	3.001.0	3.291.2	3.571.0	3.830.0	4.170.5	4.494.5	4.825.2	5.167.8	5.515.8

Empresa de Luz y Fuerza Eléctrica
Cochabamba S.A.

BALANCE SHEET ($US x 1.000)

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
ASSETS & OTHER DEBITS										
A.- FIXED ASSETS										
1.- General Plant, Total	6.795.8	6.895.8	7.045.8	7.245.8	7.495.8	7.795.8	8.095.8	8.395.8	8.695.8	8.995.8
2.- Int. during construction	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	79.3	76.9
3.- Constructuion in Progress	20.0	30.0	40.0	50.0	60.0	60.0	60.0	60.6	60.0	60.0
4.- Intangibles	22.3	23.2	24.0	24.8	25.7	26.5	27.3	28.2	29.0	29.8
TOTAL	6.919.7	7.030.6	7.191.4	7.402.2	7.663.1	7.963.9	8.264.7	8.566.2	8.864.1	9.162.5
LESS;										
Provision for Depr.	1.313.6	1.544.4	1.778.9	2.020.9	2.269.2	2.525.0	2.788.3	3.059.1	3.337.4	3.623.2
NET FIXED ASSETS	5.590.8	5.470.9	5.397.2	5.366.0	5.379.4	5.423.6	5.461.1	5.491.8	5.526.7	5.539.3
B.- CURRENT & ACCRUED ASSETS										
1.- Cash	869.5	1.203.7	1.552.1	1.887.5	2.174.6	2.492.0	2.837.4	3.110.7	3.429.3	3.765.2
2.- Customers Account Rec.	371.9	434.9	472.2	509.5	550.3	592.8	640.8	687.7	735.8	805.2
3.- Inventory Materials & Supplies	722.4	673.2	648.9	629.8	620.3	628.9	643.7	645.5	661.9	649.9
TOTAL CURRENT ASSETS	1.963.8	2.311.8	2.673.2	3.026.8	3.345.2	3.713.7	4.121.9	4.443.9	4.827.0	5.220.3
TOTAL ASSETS	7.554.6	7.782.7	8.070.4	8.392.8	8.724.6	9.137.3	9.583.0	9.935.7	10.353.7	10.759.6

Empresa de Luz y Fuerza Eléctrica
CochabambaaS.A.

BALANCE SHEET ($us. x 1.000)

LIABILITIES & OTHER CREDITS	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
A.- CAPITAL										
1.- Paid in Patronage Capital	1.299.8	1.299.8	1.299.8	1.299.8	1.299.8	1.299.8	1.299.8	1.299.8	1.299.8	1.299.8
2.- Earned Surplus or Deficit after Depreciation	673.8	951.4	1.280.5	1.640.0	2.013.2	2.454.6	2.929.2	3.439.1	3.988.4	4.569.3
TOTAL	1.9736	2.251.2	2.580.3	2.939.8	3.313.0	3.754.4	4.229.0	4.738.9	5.288.2	5.869.1
B.- LONG TERM LIABILITIES										
1.- Long term Debt										
USAID	4.080.6	4.080.6	4.080.6	4.080.6	4.080.6	4.080.6	4.080.6	3.964.0	3.847.4	3.730.8
ENDE	783.8	721.7	659.5	597.4	535.2	473.1	410.9	348.8	286.6	224.4
TOTAL DEBT	4.864.4	4.802.3	4.740.1	4.678.0	4.615.8	4.553.7	4.491.5	4.312.8	4.161.0	3.955.2
2.- Contributions	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0
3.- Social Welfare	383.3	391.7	408.3	429.2	445.8	475.0	504.2	521.6	538.0	564.7
TOTAL LONGTERM LIABILITIES	5.447.7	5.394.0	5.348.4	5.307.2	5.261.6	5.228.7	5.195.7	5.034.4	4.899.0	4.719.9
C.- CURRENT & ACCRUED LIABILITIES										
Consumer Deposits	133.3	137.5	141.7	145.8	150.0	154.2	158.3	162.4	166.5	170.6
TOTAL LIABILITIES & OTHER CREDITS	7.554.6	7.782.7	8.070.4	8.392.8	8.724.6	2.137.3	9.583.0	9.935.7	10.353.7	10.759.6

EMPRESA DE LUZ Y FUERZA ELECTRICA
COCHABAMBA S.A.

PROFIT & LOSS PROJECTIONS ($US. x 1.000)

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
REVENUE ELECTRICITY SALES										
URBAN										
- Residential	825.0	861.0	933.0	1.008.0	1.095.0	1.170.0	1.284.0	1.388.2	1.501.0	1.622.9
- General	730.0	817.6	882.4	947.7	1.003.3	1.079.1	1.150.5	1.220.5	1.294.8	1.347.2
- Large Industrial	553.3	613.6	686.4	757.1	832.0	931.8	1.019.2	1.127.5	1.235.7	1.361.3
- Special Contracts	237.5	262.2	277.4	292.6	307.8	326.8	340.1	357.2	374.3	393.3
- Street Lighting	100.6	110.0	121.7	128.7	135.7	145.1	154.4	161.5	170.8	180.2
RURAL										
- Residential	129.2	196.8	226.5	252.7	290.9	313.2	334.8	355.7	373.2	390.0
- General	18.0	19.8	21.6	23.7	25.8	28.2	30.6	33.5	36.7	40.1
- Irrigation	70.4	99.0	121.0	138.6	117.4	154.0	158.4	158.4	158.4	158.4
- Street Lighting	20.3	21.0	21.8	21.9	22.1	22.3	22.5	22.7	22.9	23.3
TOTAL REVENUE ELEC. SALES	2.684.3	3.001.0	3.291.2	3.571.0	3.830.0	4.170.5	4.494.5	4.825.2	5.167.8	5.515.8
Other Revenue	79.3	79.3	79.3	79.3	79.3	79.3	79.3	79.3	79.3	79.3
TOTAL REVENUE	2.763.6	3.080.3	3.370.5	3.650.3	3.909.3	4.249.8	4.573.8	4.904.5	5.247.1	5.595.1
EXPENDITURES										
Energy Purchased	1.544.7	1.751.9	1.945.9	2.131.3	2.320.9	2.531.5	2.744.4	2.966.4	3.195.7	3.433.4
Maintenance & Oper	392.2	417.7	444.2	478.8	511.3	546.0	589.6	630.9	673.8	719.6
Administration	264.0	281.2	299.0	322.3	344.2	367.5	397.0	424.8	453.7	484.6
TOTAL EXPENDITURES	2.200.9	2.450.8	2.689.1	2.932.4	3.176.4	3.444.5	3.731.0	4.022.1	4.323.2	4.637.6
Depreciation	228.3	230.8	234.5	242.0	248.3	255.8	263.3	270.8	278.3	285.8
A)Net Income before Dep.	562.7	629.5	681.4	718.1	732.9	805.3	842.8	882.4	923.9	957.5
B)Net Income after Dep.	334.4	398.7	446.9	474.1	484.6	549.5	579.5	611.6	645.6	671.7
C)Interests, loans	124.3	121.1	117.8	114.6	111.4	109.1	104.9	101.7	96.3	90.8
A-C)Net profit before Dep.	438.4	508.4	563.6	601.5	621.5	697.2	737.9	780.7	827.6	866.7
B-C)Net profit after Dep.	210.1	277.6	329.1	359.5	373.2	441.4	474.6	509.9	549.3	580.9
B-C) Cummulatives	673.8	951.4	1.280.5	1.640.0	2.013.2	2.454.6	2.929.2	3.439.1	3.988.4	4.569.3

Empresa de luz y Fuerza Eléctrica
Cochabamba S.A.

CASH FLOW (US$ x 1.000)

		1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
PPLICATION OF FUNDS											
.- Construction Exp.											
Substations	L/C	-	25.5	-	-	-	-	-	-	-	1.000
	F/C	-	224.5	-	-	-	-	-	-	-	-
Distrib. Lines	L/C	-	344.0	518.4	100.0	100.0	150.0	150.0	250.0	250.0	200.0
	F/C	146.4	1.617.0	984.7	-	-	-	-	-	-	-
Equipment	L/C	-	8.5	-	-	-	-	50.0	-	50.0	-
	F/C	-	175.5	-	-	-	-	-	-	-	-
Pole Treating	L/C	4.0	-	-	-	-	-	-	-	-	-
Plant	F/C	36.0	-	-	-	-	-	-	-	-	-
Administration	L/C	41.7	41.7	41.7	-	-	-	-	-	-	-
	F/C	-	-	-	-	-	-	-	-	-	-
Sub Total	L/C	46.7	452.7	626.1	100.0	100.0	150.0	200.0	250.0	300.0	300.0
	F/C	182.4	2.017.0	984.7	-	-	-	-	-	-	-
TOTAL (1)		229.1	2.459.7	1.611.1	100.0	100.0	150.0	200.0	250.0	300.0	300.0
.- Debt Service											
Interests	L/C	1.0	33.0	66.3	81.6	81.6	81.6	81.6	81.6	81.6	81.6
	F/C	-	-	-	-	-	-	-	-	-	-
Principal	L/C	-	-	-	-	-	-	-	-	-	-
	F/C	-	-	-	-	-	-	-	-	-	-
ENDE Loan Int	L/C	52.5	49.2	46.0	42.7	39.5	36.2	33.0	29.8	26.5	23.3
Prins	L/C	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1
TOTAL (2)		115.6	144.3	174.4	186.4	183.2	179.9	176.7	173.5	170.2	167.0
TOTAL APPLICATION OF FUNDS	L/C	162.3	587.0	800.8	286.4	283.2	329.9	376.7	923.5	470.2	467.0
	F/C	182.4	2.017.0	984.7	-	-	-	-	-	-	-
GENERAL TOTAL		344.7	2.604.0	1.785.5	286.4	283.2	329.9	376.7	423.5	470.2	467.0
Cash at beginning of year		22.0	240.4	454.1	605.5	869.2	1.203.7	1.552.1	1.887.5	2.174.6	2.492.0
Cash balance, current year		218.4	213.7	151.4	264.0	334.5	348.4	335.4	287.1	317.4	345.4
Cash at end of year		240.4	454.1	605.5	869.5	1.203.7	1.552.1	1.887.5	2.174.6	2.492.0	2.837.4

Empresa de Luz y Fuerza Electrica
Cochabamba s.a.

CASH FLOW ($us. x 1.000)

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
SOURCES OF FUNDS										
INTERNAL CASH GENERATION										
Net Income before int. & depr.	354.6	344.9	450.7	562.7	629.5	681.4	716.1	732.9	805.3	842.8
BORROWINGS										
Local Costs	-	378.1	518.4	-	- -	-	-	-	-	-
Foreign Costs	182.4	2.017.0	984.7	-	-	-	-	-	-	-
TOTAL BORROWINGS	182.4	2.395.1	1.503.1	-	-	-	-	-	-	-
Stock Shares	33.1	113.5	40.6	48.3	51.2	34.2	33.3	18.5	24.8	17.6
Other Contributions	25.0	-	-	-	-	-	-	-	-	-
Decrease (Increase) in Receivables	(32.0)	(35.8)	(54.8)	(60.6)	/63.0)	(37.3)	(37.3)	(40.8)	(42.5)	(48.0)
TOTAL SOURCES OF FUNDS	563.1	2.817.7	1.939.6	550.4	617.7	678.3	712.1	710.6	787.6	812.4

NEW TARIFFS ANNOUNCED BY ELFEC AND CRE

1. ELFEC

NUEVAS TARIFAS DE ENERGIA ELECTRICA DE LA
EMPRESA DE LUZ Y FUERZA ELECTRICA COCHABAMBA S. A.

Como emergencia de las medidas de Estabilización y Desarrollo adoptadas por el Supremo Gobierno mediante D. S. 10550 y luego de detenidos estudios realizados juntamente con los organismos técnicos especializados que tienen a su cargo el control de este servicio en el orden nacional se establecen las siguientes tarifas a partir de la facturación correspondiente al mes de noviembre:

1. SERVICIO RESIDENCIAL

1.1 TARIFA RESIDENCIAL PEQUEÑO (RP)

Servicio limitado a una carga contratada de 3 Kw y un consumo de 200 Kwh por mes.

Cargo de energía:

-los 10 primeros Kwh/mes	0.65 $b/Kwh
-los 15 siguientes Kwh/mes	0.50 $b/Kwh
-los 35 Kwh/mes siguientes	0.42 $b/Kwh
-Los Kwh adicionales	0.34 $b./

1.2 TARIFA RESIDENCIAL (R)

Servicio limitado a un consumo mensual de 1000 Kwh por mes. Cuando su consumo exceda de este valor en 3 meses individuales sobre un período de 12 meses consecutivos, el abonado será transferido a la tarifa para Servicio General que corresponda.

Cargo de energía

-los primeros 10 Kwh/mes	0.65 $b/Kwh
-los 15 Kwh/mes siguientes	0.50 $b/Kwh
-los 35 Kwh/mes siguientes 1/	0.42 $b/Kwh
-los 140 Kwh/mes siguientes	0.34 $b/Kwh
-los Kwh adicionales	0.30 $b/Kwh

1/ Por cada Kw de potencia base de facturación que exceda de 3 Kw el bloque de energía a 0.42 $b se aumentará en 90 Kwh/mes.

2. SERVICIO GENERAL

2.1 TARIFA GENERAL PEQUEÑO (GP)

Servicio limitado a una potencia contratada de 3 Kw y un consumo mensual de 300 Kwh; si se excede en uno o ambos límites el abonado será transferido a la tarifa G 1

Cargo de energía:

-Primeros 12 Kwh/mes	0.70 $b/Kwh
-Siguientes 38 Kwh/mes	0.58 $b/Kwh
-Siguientes 100 Kwh/mes	0.49 $b/Kwh
-Kwh adicionales	0.39 $b/Kwh

2.2 TARIFA GENERAL EN BAJA TENSION (G1)

Cargo de demanda:

Por cada Kw de la potencia base de facturación que exceda de 3 Kw, cargo mensual 12.0 $b/Kw

Cargo de energía:

-Primeros 12 Kwh/mes	0.70 $b Kwh
-Siguientes 38 Kwh/mes	0.58 $b/Kwh
-Siguientes 100 Kwh/mes	0.49 $b/Kwh
-Siguientes 200 Kwh/mes	0.39 $b/Kwh
-Kwh adicionales	0.33 $b/Kwh
Cargo mensual mínimo	8.40 $b más el cargo de demanda

2.3 TARIFA GENERAL EN ALTA TENSION (G 2)

Servicio limitado a cargas iguales o superiores a 50 Kw.

Cargo de demanda:

Por cada Kw de la potencia base de facturación cargo mensual	12.0 $b/Kw
Cargo de energía:	
-los primeros 180 Kwh por Kw de la potencia base de facturación y por mes	0.30 $b/Kwh
-los Kwh adicionales	0.23 $b/Kwh
Cargo mínimo mensual	500.0 $b. pero no menos del cargo de demanda.

NOTA. - Estas tarifas representan en el promedio general un incremento que varía entre el 25% y el 37% con relación a las tarifas anteriormente vigentes.

2. CRE

CRE INFORMA

En consideración a los efectos de las disposiciones del Decreto de Estabilización No. 10550, y en resguardo de la continuidad, estabilidad y expansión del servicio eléctrico en el área de concesión de CRE, se han realizado cuidadosos estudios conjuntamente con los organismos técnicos especializados que tienen a su cargo el control de este servicio en el orden nacional, habiéndose establecido las siguientes tarifas que regirán a partir de la facturación del mes de Diciembre de 1972:

TARIFA RESIDENCIAL

Cargo de energía:	$b .530/kwh
Cargo mensual mínimo	$b 12,00

TARIFA GENERAL - 1

Cargo de energía:	$b. 0.500/kwh
Cargo mensual mínimo:	$b. 28,00

TARIFA GENERAL - 2

Cargo de energía	$b. 0.700 /kwh
Cargo mensual mínimo	$b. 40.00

TARIFA INDUSTRIAL
BAJA TENSION

Servicio para potencias mayores de 5 kw y menores de 50 kw.

Cargo de demanda:	$b. 15,00/kw x mes
Cargo de energía	$b. 0.410/kwh
Cargo mensual mínimo	Equivalente al cargo de demanda

TARIFA INDUSTRIAL
ALTA TENSION

Servicio para potencias mayores a 50 kw

Cargo de demanda	$b. 15,00/kw x mes
Cargo de energía:	
-los primer 200 kwh/kw	$b. 0.360/kwh
-los kwh adicionales	$b. 0.290/kwh
Cargo mensual mínimo	Equivalente al cargo de demanda

TARIFA DE RIEGO (ESPECIAL)

De hs.000 a hs. 18;00 23,00 a 24,00 hs	
-Cargo de demanda	$b. 15,00/kw x mes
-Cargo de energía	$b. 0,30/kwh
De hs. 18,00 a 23,00	
-Cargo de demanda,	$b. 15,00/kw x mes
-Cargo de energía,	$b. 1,00/kwh

TARIFA ALUMBRADO PUBLICO

Cargo de energía	$b. 0,520/kwh

INVOCAMOS LA COMPRENSION DE NUESTROS ASOCIADOS Y RECALCAMOS QUE LA CRE NO PERSIGUE FINES DE LUCRO.

Santa Cruz, Diciembre de 1972.

DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
Washington, D.C. 20523

UNCLASSIFIED

AID-DLC/P-1070

February 9, 1973

MEMORANDUM FOR THE DEVELOPMENT LOAN COMMITTEE

SUBJECT: Bolivia - Rural Electrification

Attached for your review are the recommendations for authorization of a loan in an amount not to exceed $10,800,000 to the Government of Bolivia to assist in financing the United States dollar and local currency costs of the Rural Electrification Program administered by the Empresa Nacional de Electricidad S.A. (ENDE).

This loan proposal is scheduled for consideration by the Development Loan Staff Committee meeting on Wednesday, February 14, 1973.

Rachel R. Agee
Secretary
Development Loan Committee

Attachments:
Summary and Recommendations
Project Analysis
ANNEXES I-V