PD-AAF-453

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UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
AGENCY FOR INTERNATIONAL DEVELOPMENT
Washington, D. C. 20523

GUATEMALA

PROJECT PAPER

RURAL ELECTRIFICATION III

AID/LAC/P-476

Project Number: 520-0353

UNCLASSIFIED

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT DATA SHEET

1. TRANSACTION CODE: A (A = Add, C = Change, D = Delete) — Amendment Number

DOCUMENT CODE: 3

2. COUNTRY/ENTITY: GUATEMALA

3. PROJECT NUMBER: 530-0353

4. BUREAU/OFFICE: LAC — 05

5. PROJECT TITLE (maximum 40 characters): RURAL ELECTRIFICATION III

6. PROJECT ASSISTANCE COMPLETION DATE (PACD): MM 05 DD 30 YY 95

7. ESTIMATED DATE OF OBLIGATION (Under 'B.' below, enter 1, 2, 3, or 4)

A. Initial FY 89 B. Quarter 3 C. Final FY 91

8. COSTS ($000 OR EQUIVALENT $1 =)

A. FUNDING SOURCE	FIRST FY 89 B. FX	C. L/C	D. Total	LIFE OF PROJECT E. FX	F. L/C	G. Total
AID Appropriated Total	3,000	300	3,300	8,930	1,070	10,000
(Grant)	(3,000)	(300)	(3,300)	(8,930)	(1,070)	(10,000)
(Loan)	( )	( )	( )	( )	( )	( )
Other U.S. 1.						
Other U.S. 2.						
Host Country		2,382	2,382	--	15,061	15,061
Other Donor(s)				150	50	200
TOTALS	3,000	2,682	5,682	9,080	16,181	25,261

9. SCHEDULE OF AID FUNDING ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE 1. Grant	2. Loan	D. OBLIGATIONS TO DATE 1. Grant	2. Loan	E. AMOUNT APPROVED THIS ACTION 1. Grant	2. Loan	F. LIFE OF PROJECT 1. Grant	2. Loan
(1) ARDN	749	062	062			10,000		10,000	
(2)									
(3)									
(4)									
TOTALS						10,000		10,000	

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each): 111 | 112 | 150

11. SECONDARY PURPOSE CODE: 273

12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)

A. Code	BR	BL					
B. Amount							

13. PROJECT PURPOSE (maximum 480 characters)

To expand electrification in rural areas where the introduction of electricity will complement and maximize the productive potential of existing infrastructure and resources.

14. SCHEDULED EVALUATIONS

Interim MM YY | MM 04 YY 92 | Final MM 01 YY 95

15. SOURCE/ORIGIN OF GOODS AND SERVICES: [X] 000 [ ] 941 [X] Local [ ] Other (Specify)

16. AMENDMENTS/NATURE OF CHANGE PROPOSED (This is page 1 of a ____ page PP Amendment.)

I certify that the methods of payment and audit plan are in compliance with the Payment Verification Policy.

Joe O. Hill, Jr.
Controller

17. APPROVED BY

Signature: Anthony J. Cauterucci

Title: Director, USAID/Guatemala

Date Signed: MM 12 DD 31 YY 91

18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION: MM DD YY

AID 1350-4 (6-79)

PROJECT AUTHORIZATION

Name of Country: Guatemala

Name of Project: Rural Electrification III

Number of Project: 520-0353

Pursuant to Section 103 of the Foreign Assistance Act of 1961, as amended, I hereby authorize a Grant for the Rural Electrification III Project for Guatemala involving planned obligations of not to exceed Ten Million United States Dollars ($10,000,000) ("Authorized Amount") in Grant Funds ("Grant") over a four-year period from date of authorization, subject to the availability of funds in accordance with the A.I.D. OYB allotment process, to help in financing foreign exchange and local currency costs for the Project. The planned life of the Rural Electrification III project is six years from date of initial obligation.

The Project ("Project") consists of two main components: (a) assistance to the Government of Guatemala through the National Electrification Institute (INDE) to expand electrification in rural areas where the introduction of electricity will complement and maximize the productive potential of existing infrastructure and resources. The Project will achieve this purpose by financing the installation of new rural connections and the construction of subtransmission lines, distribution networks, transmission and transformation improvements. (b) assistance to a private voluntary organization to carry out a program for the promotion of productive uses of electricity in small rural communities. The activities financed under this component will include provision of credit, training and technical assistance to small rural enterprises and assistance for the institutionalization of a productive uses program within INDE.

The Project Agreement(s), which may be negotiated and executed by the officer to whom such authority is delegated in accordance with A.I.D. regulations and delegations of authority, shall be subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as A.I.D. may deem appropriate.

A. Source and Origin of Goods and Services

Goods and services, except for ocean shipping, financed by A.I.D. under the Grant shall have their source and origin

in the United States, (A.I.D. Ceographic Code 000) or in countries that are members of the Central American Common Market, including Guatemala, except as A.I.D. may otherwise agree in writing. Ocean shipping financed by A.I.D. under the Grant shall, except as A.I.D. may otherwise agree in writing, be financed only on flag vessels of the United States.

B. Conditions Precedent

1. Initial Disbursement

Prior to the first disbursement under the Project, or to the issuance by A.I.D. of documentation pursuant to which disbursement will be made, the Grantee will, except as the Parties may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D. the following:

(a) An opinion of the Ministerio Publico or other counsel acceptable to AID that the Project Agreement has been duly authorized and/or ratified by, and executed on behalf of, the Grantee, and that it constitutes a legally binding obligation of the Grantee in accordance with all of its terms;

(b) A statement of the name of the person holding or acting in the office of the Grantee and of any additional representatives, together with a specimen signature of each person specified in such statement;

(c) A detailed time-phased Project Implementation Plan showing project activities beginning 120 days from the signing of the Project through the end of calendar year 1995. This plan shall include a detailed procurement plan for materials, equipment and services.

(d) An executed agreement between the Ministry of Finance and INDE which stipulates:

i. The amount of local currency funds to be provided by INDE and the GOG, respectively, as Grantee Resources for the Project.

ii. That all counterpart funds provided by the GOG for the Project will be on a non-reimbursable basis.

iii. The source of funding to pay all directly identifiable taxes resulting from

Project-related procurements or other activities. Funds used by INDE or the GOG to pay these taxes shall not be considered as Grantee Resources for the Project.

(e) A statement of INDE's agreement to use a selection system acceptable to AID as a basis for the selection of rural communities to be included in the project. In addition, the specific selection procedure based on the mutually accepted system and all lists of communities to be included in the project will be approved in writing by AID.

(f) Evidence that INDE has designated a Project Manager acceptable to AID.

(g) Evidence that INDE has created a permanent position of Productive Uses Specialist within the Rural Electrification Department to work as counterpart to the Grant-financed Productive Uses Specialist.

(h) A time-phased plan describing the steps INDE will take to improve its financial situation and institutional efficiency.

2. To Subsequent Incremental Funds

Unless AID otherwise agrees in writing, prior to the date of execution by AID of any amendment of the Project Agreement adding incremental funds, the Grantee shall furnish in form and substance satisfactory to AID evidence that progress has been achieved towards reaching the goals of the plan described in Section B.1.h., above.

C. Covenants

The Government of Guatemala, Grantee, covenants and agrees that, except as A.I.D. may otherwise agree in writing, the Grantee shall cause the National Institute for Electrification to:

(a) Furnish to A.I.D. the results of a study, to be conducted during the first three months of Project implementation, to determine the percentage of installation costs to be required in community contributions, the means to collect this contribution and management of the funds.

(b) Submit for A.I.D. approval, by November 30 of each year of Project life, an annual construction schedule covering activities for the next calendar year.

C

(c) Carry out all the necessary steps to assure the completion of the Quezaltepeque substation construction and the El Progreso substation expansion, partially financed under the Rural Electrification Project II, not later than June 30, 1990. The completion of these substations will be financed by INDE and will not use funds provided under this Project.

Anthony J. Cauterucci
Director, USAID/Guatemala

7/17/89
Date

Clearances:

		Date:
PDSO, CHSchoux	CHSchoux	June 15, 1989
PRM, TKellermann		June 15, 1989
OPED, FManteiga		6/16/89
OEPA, SSkogstad		6/26/89
CONT, JOHill		7/10/89
ORD, GStraub		7/14/89
DDIR, PEWhite		
RLA, MJWilliams		June 19, 1989

3801C

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I. SUMMARY AND RECOMMENDATIONS

A. Recommendations

The following recommendations are submitted for approval:

1. $10,000,000 in grant funds be authorized in FY89 for the Rural Electrification III Project (PER III), with a Project Assistance Completion Date (PACD) of April 30, 1995.

2. The Government of Guatemala (GOG) and a PVO will provide an equivalent $15.2 million as contribution to the Project (Exchange rate based on US$1.00 to Q.2.70).

3. Goods and services financed by A.I.D. under this Project shall have their source and origin in countries located in A.I.D. Geographic Code 000 or Guatemala, except as A.I.D. may otherwise agree in writing.

4. The Grantee will be the Government of the Republic of Guatemala acting through the Ministry of Public Finance and the General Secretariat of the National Economic Planning Council (SEGEPLAN). The National Electrification Institute (INDE), the implementing agency for the GOG, will also be a signatory to the Grant Agreement.

5. It is also intended that a Cooperative Agreement be negotiated and signed with ACCION/AITEC for the implementation of the Productive Uses of Electricity Component. ACCION/AITEC will establish a sub-agreement with the Foundation for Social and Economic Development (FUNDAP) for this purpose.

B. Summary Project Description

1. Goal and Purpose

The goal of the PER III Project is to increase the productivity, incomes and employment of the rural poor in Guatemala. The Project purpose is to expand electrification in rural areas where the introduction of electricity will complement and maximize the productive potential of existing infrastructure and resources.

The Project purpose will be accomplished through the construction of sub-transmission and distribution lines and household connections in rural villages, the upgrading of transmission and transformation capacities at three selected substations in the Western Highlands, and the provision of credit, training and technical assistance on a pilot basis to promote productive uses of electricity in the Western Highlands of Guatemala.

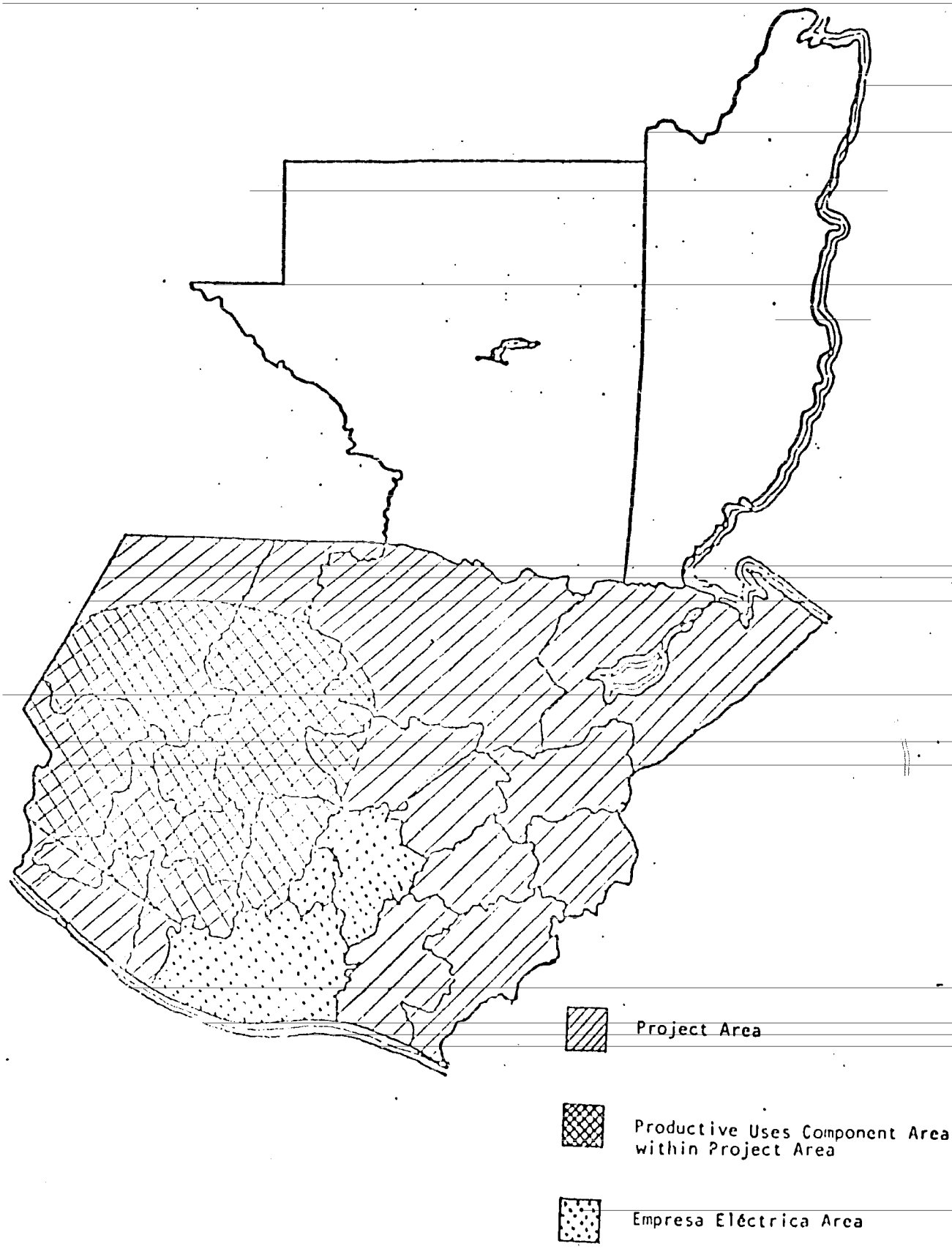
2. Rationale

Guatemala provides electrical service to a smaller percentage (25%) of its overall population than any other Central American country. As a reflection of the traditional imbalance in services provided to rural areas, only 7% of the rural population has access to electrical power. The 1985 Constitution and the government elected in 1985 recognized this situation and have emphasized rural infrastructure investments, specifically including rural electrification, as priority areas of GCG activity.

The National Electrification Institute (INDE) has primary responsibility for the generation and transmission of electricity in Guatemala. In addition, INDE provides the majority of electrical service to rural areas in Guatemala. A private company (Empresa Eléctrica de Guatemala, S.A., or EEGSA) provides limited generation and principal distribution services to the central, more populated region of the country. Under the Rural Electrification II Project (PER II), INDE has electrified over 70,000 rural households in over 350 villages, representing some 30% of the total households INDE serves directly.

In the past, limitations to generation of electrical energy posed substantial constraints to improving electrical service coverage in the country. The inauguration of the 300 MW Chixoy hydroelectric plant in 1985 virtually doubled generation capacity. Thus, the main constraint now lies in electric power distribution. Although both the Interamerican Development Bank (IDB) and the World Bank have provided substantial support to Guatemala's electric sector in the past, primarily for generation and transmission improvements, no donor other than A.I.D. has provided significant support for rural electrification investments.

Many areas of development activity currently underway in Guatemala with USAID and other donor assistance are inhibited by the lack of availability of electrical energy. Electricity has repeatedly been cited as critical to the improvement of agricultural technologies, agricultural


Project Area
Productive Uses Component Area within Project Area
Empresa Eléctrica Area

diversification, irrigation, crop processing, development of agroindustries, upgrading of small businesses and other rural enterprises including micro- and cottage-level industry. Non-traditional export crops, especially vegetables, often require processing for which electricity is essential.

Electricity is also assuming increased importance in environmental sanitation and health. For example, it has been estimated that in approximately five years all available springs for gravity-fed potable water systems will have been used or contaminated in the Highlands region. Given the depth of water tables in the Highlands, hand pumps cannot be used, and thus electric pumps represent the only technically and economically viable solution to the water problem.

Expansion of the electrical network in rural areas will provide a valuable complement to other USAID and GOG development strategies by supporting efforts in irrigation, health, export promotion and employment generation.

Given the importance of electrification for the wide range of USAID development projects in Guatemala, and the high priority the GOG has assigned to rural electrification, this Project will continue to support INDE's successful activities in this area, providing essential foreign exchange for commodity procurement, and will add an important component to promote productive uses of electricity in rural Guatemala. These activities will thus provide necessary infrastructure improvements for rural development in Guatemala, while improving the long-term viability of the power sector's commitment to providing rural electrical service.

As shown in the financial analysis (Annex H), under the conservative assumptions used for the analysis, the project will require a subsidy of approximately $9,736,000. Considering that AID will provide $9,000,000 in grant funds to finance the infrastructure component, the financial subsidy to be provided by the GOG is insignificant compared to the number of beneficiaries.

The 65,000 new users which will be connected under the project will provide a net operational profit to INDE since, as calculated in the Financial Analysis, the marginal revenue that INDE will obtain is larger than the marginal cost of energy for these rural consumers. The initial cost of connection, as in many rural electrification projects will involve a subsidy as described above.

Rural electrification projects, as many other rural infrastructure projects such as roads and potable water are in the great majority of cases subsidized projects, and as such they are not usually analyzed under a financial point of view. Since this project will generate net operational revenues to INDE and will require substantial community contributions, it was possible to calculate the amount of the financial subsidy involved in the project. However, the economic, social and political benefits of the project amply justify the small financial subsidy which it requires.

The project Economic Analysis (Annex I) demonstrates that the infrastructure component of the project will generate a net economic benefit of $28.0 million over the assumed life of the financed infrastructure. The social benefits of rural electrification, although more difficult to describe or measure, are as real and important as the more tangible economic benefits. In Guatemala's rural communities electricity provides an important improvement in the quality of life with important effects in improving education, health, safety and availability of information services. Electricity is perceived as the first step to modernization, providing the rural inhabitants with a sense of belonging to the national mainstream. The importance that rural communities give to electrical service is demonstrated by the impressive number of requests presented by rural communities to INDE and other government institutions. To this date, INDE has recorded requests from 2,000 rural communities where the provision of service is feasible with the existing major transmission lines.

The political importance of a project that will directly benefit more than 350,000 rural inhabitants, most of them in the Western Highlands, is evident. The GOG has recognized this important political impact and has repeatedly expressed at all levels its interest in rural electrification projects. In this sense, the project also responds specifically to the Mission's concern expressed in the CDSS, for improving the living standards of rural Guatemalans as an important factor in promoting political stability.

The CDSS mentions that if democracy is to take firm root in Guatemala, historical patterns of low living standards for large sectors of the population must be reversed through "programs that directly address the needs of Guatemala's neglected poor, particularly the highland Indians". The proposed project will provide an immediate and visible improvement in the standard of living for a large segment of the rural Guatemalan population, with the consequent positive political impact.

C. Summary Findings

This Project is judged to be technically and administratively feasible and economically sound. The Initial Environment Examination recommended a Negative Determination, requiring no further environmental analysis (see Annex F).

D. Statutory Criteria and Mission Director Certification

1. This Project meets all applicable statutory criteria. Appropriate checklists are included in Annex B.

2. A certification by the USAID/Guatemala Mission Director that the GOG has the capability to implement and maintain the Project is included as Annex C.

E. Project Beneficiaries

The Project will benefit inhabitants of small, rural villages throughout Guatemala, with the exception of the remote and sparsely populated El Petén department. The majority of Project beneficiaries will be in the Western Highlands of the country, where the potential for productive uses is greatest.

Through the electrification of approximately 400 communities, an estimated 65,000 households comprising 325,000 inhabitants will directly benefit from the Project. Through the credit and training component, over 800 small enterprises will initially receive credit for electrical machinery, 1,000 employees of these enterprises will receive training in machinery use, and more than 10,000 persons in beneficiary communities will be trained in productive uses of electrical service. Due to the permanence of the rotating credit fund, and based upon loan duration and recovery projections, it is estimated that a total of 2,500 productive uses credits will be provided over the six-year life of the Project.

The 400 communities where electrical distribution infrastructure will be built have a population between 200-500 inhabitants, and are located in the Western highlands (80%) and in the Eastern Region (20%). In general terms, they will be similar to the communities benefitted under the Rural Electrification II project.

The productive uses component will be implemented almost exclusively in Western Highlands communities. Initially, rural communities electrified under PER II will be

benefitted and later the component activities will be extended to PER III populations. Since this component will give priority to areas of high productive use potential, it is expected that beneficiary communities will be those with more population and better infrastructure.

F. Summary Project Budget ($000's)

Description	USAID	GOG/ INDE	PVO	TOTAL
1. INFRASTRUCTURE COMPONENT				
Materials for lines, networks and internal wiring	6,131	3,884	-	10,015
Subtransmission and transformation materials and equipment	517	131	-	648
Labor	-	7,455	-	7,455
Vehicles, tools and equipment	568	-	-	568
Consulting engineering services	-	370	-	370
Engineering and administration	-	1,157	-	1,157
Training and technical assistance	240	-	-	240
SUB-TOTAL	7,436	12,997	-	20,453
2. PRODUCTIVE USES OF ELECTRICITY COMPONENT				
Credit	404	-	-	404
Credit Management	273	-	-	273
Training and technical assistance	171	-	200	371
SUB-TOTAL	848	-	200	1,048
Evaluations, studies and audits	200	-	-	200
Inflation	403	1,414	-	1,817
Contingencies	1,093	650	-	1,743
TOTAL	10,000	15,061	200	25,261

G. Response to PID Review Memorandum

1. Project Design Objectives

The Project will support the Action Plan objective of strengthening the private sector by providing credit, technical assistance and training to local entrepreneurs and commercial enterprises for the productive use of electricity.

2. Sustainability and Replicability of Project Activities

a. The Project Paper recommends that INDE establish a Distribution Department to improve its ability to manage recurrent maintenance and operational requirements.

b. The Project Paper concludes that although present tariff levels generate sufficient revenue to cover operational costs of INDE, this operational profit is not sufficient to cover the debt service and the necessary investments in capacity expansion. Consequently, INDE will have to use a combination of increased tariffs, improved collections, foreign lending and GOG subsidies to finance its ambitious expansion programs.

c. INDE's cost recovery under PER II has been limited. INDE now desires to increase community contributions under the PER III Project. A minimum 10% community contribution will be required, and it is estimated that an average 30% of the installation costs will be provided through community contributions.

3. Continuation of Force Account Construction

a. The PER III Project Identification Document suggests an option for distribution that INDE confine its activities to generation and transmission, and let EEGSA, Departmental Power Authorities and/or electric cooperatives assume responsibility for distribution. The CARES Project indicates that it does not have sufficient budget to adequately research these alternatives. Such a major change in the structure of the electric sector requires extensive consideration and is beyond the scope of PER III.

b. INDE has demonstrated the capability under PER II to construct the electric distribution facilities of the nat e and in the scope that will be required for PER III. The workmanship is good and the productivity rate is sufficient to achieve annual targets projected for PER III. (see Annex K, sections 5.A.1 and 5.A.3)

The use of private contracting firms is not considered a viable alternative for PER III construction. PER III is a relatively small project, especially in terms of the broad area it will cover. The uncertainty of future projects would have to be closely evaluated by a potential private contractor in relation to the start-up and staging costs. Moreover, construction of rural electric distribution facilities requires special tools and equipment and work skills and knowledge not readily available to general contractors.

c. It is prudent management to employ a consulting engineering firm to oversee any construction project. This function has been successfully carried out under PER II by a competent private Guatemalan firm. The present contract was examined and a similar arrangement and scope of work are outlined and recommended for PER III. (see Annex K, section 5.B)

4. Institutional Development

The implementing capability of the various INDE departments has been evaluated. The technical assistance and training needs will be closely coordinated with the comprehensive CARES program. Three areas of special concern have been identified and appropriate funding is allocated for activities to address these concerns: technical assistance for the institutionalization of productive uses, the development of technical manuals, and the establishment of a safety program (see Annex J).

5. PER II Targets

With the authorized extension to the PER II Project PACD, LOP targets will be exceeded by approximately 30% with no increase in A.I.D. funding. The increase results from the devaluation of the Quetzal, an increase in counterpart financing by INDE, and the transfer of dollars, originally programmed for labor, to commodity procurement.

6. Project Components

a. Constraints to Expanding Rural Electrification

INDE has a ten-year plan for expanding the capability of the national power supply system of generation, transmission and substations. The planned periodic additions will assure adequate supply in relation to PER III project demands. Findings are that the major constraint to rural electrification is the lack of distribution lines. (see Annex K)

b. Service Types and Community Labor

The potential for Project financing of electrical connections for community services can be explored in target communities by Social Promotors from the Implementing Unit in conjunction with local pro-electrification committees. Potential community services that will benefit from electrification include schools, health posts, public meeting halls, public wells and pilas (community clotheswashing facilities), marketplaces, etc. The committee or the municipal government could contract with INDE for installation costs recovery and payment for electric service. The committee or municipality could obtain requisite funds through modest charges for facility usage.

Safety, quality and efficiency considerations advise against the use of untrained persons for the majority of electric distribution installation or maintenance services: community labor inputs should be limited to unskilled tasks.

c. Site Selection

The Demand Assessment Model currently being developed by the CARES Project will be adapted to Guatemala and used as the principal community selection criteria for implementing Project activities. Bilateral funding from the CARES Project will support adaptation and preliminary application of the model in FY89. USAID review and approval of sites selected by the model will be required prior to initiation of individual site construction activities.

d. Credit and Training

i) Market rates of interest will be charged for all loans to new and existing businesses as described in section III.D.3 of the Project Paper.

ii) A PVO specializing in micro-enterprise development has been selected as implementor of the credit and training for productive uses component. This PVO is currently providing credit, skills training and technical assistance for another USAID private sector development Project focusing on micro-enterprise development in the principal target area of the PER III Project.

iii) The role of women in productive uses, together with their credit requirements, is discussed in Annex M (Social Soundness Assessment).

iv) Productive uses will be institutionalized in INDE by expanding the Promotion Section in the rural electrification Implementing Unit and by training the Promotors as Advisors in productive uses. CARES and AITEC/FUNDAP will provide the training, and CARES will provide continuing technical assistance.

7. Project Budget

The Project budget provides funds for Project audits. Inflation and contingencies have been separately budgeted for at the component level. The six-year disbursement schedule reflects the detailing of these items.

8. Procurement by AID

To ensure the timely availability of materials and equipment, USAID/G will continue to directly procure all offshore dollar-financed commodities and services required by the Project.

H. Project Development Team

USAID/Guatemala

Roberto Figueroa, Chairman, Project Development Officer
Alfredo Szarata, Electrical Engineering Project Officer
Guillermo Matta, Private Sector Officer
Gilberto Méndez, Education Officer
Thomas Kellerman, Program Officer
Alejandro Pontaza, Financial Analyst
Rosario Reyes, Economist

National Electrification Institute

César Garzaro, Executive Director PER II Implementing Unit
Edgar Cordón, Financial Advisor
Julio Carlos Prado, Planning Department
Hugo Ventura, Planning Department
Edgar Morales, Financial Department

Price Waterhouse/NRECA

Edward Gaither, Team Coordinator
Everett Bristol, Electrical Engineer
Gabriel Castillo, Productive Uses Specialist
James Waddell, Economist
Bruce Newman, Editor

I. USAID Executive Project Review Committee

Anthony J. Cauterucci, Director
Paul E. White, Deputy Director
Richard Burke, Chief, Program Office
Christina H. Schoux, Chief, Project Development & Support Office
Gordon Straub, Chief, Office of Rural Development
Liliana Ayalde, Chief, Office of Human Resources
Felipe Manteiga, Chief, Office of Private Sector
Samuel Skogstad, Chief, Office of Economic Policy and Analysis
Joe O. Hill, Controller
Edward Aker, Executive Officer

II. BACKGROUND

A. Project Setting

Guatemala ranks last among its Central American neighbors in electrical service coverage of total population and second lowest in terms of rural population coverage: only 7% of the rural population has access to electricity.

Country	% of Population with Electrical Service Total	Rural
Belize	59	29
Costa Rica	75	45
El Salvador	40	11
Guatemala	25	7
Honduras	30	5
Panama	56	24

In the past, Guatemala's limited generation capacity has been a major constraint to improving electrical service coverage. Major investments in generation, culminating in the 1985 inauguration of the 300 MW Chixoy hydroelectric plant, have greatly alleviated this limitation. At present, distribution infrastructure investments must be made in order to increase electrical service coverage.

The electric power sector in Guatemala is comprised of the National Electrification Institute (INDE), an INDE-owned utility (Empresa Eléctrica de Guatemala, S.A., or EEGSA) structured as a private company and serving the populous central region of the country, and 11 municipal power companies. EEGSA and several of the municipals have limited generation capacity; the majority of Guatemala's generation is provided by INDE. The entire electrical complex is tied together through the National Interconnected System (NIS), and regionally linked through the Guatemala-El Salvador Interconnection.

The NIS currently has a reliable generation capacity of some 645 MW. Nearly half of this capacity, however, is provided by the Chixoy hydroelectric plant, comprised of five 60-MW turbines. Chixoy is currently the only hydroelectric facility with yearly reservoir management capabilities; the others, with the exception of the Amatitlán Lake-supplied Jurún Marinalá, are "run-of-the-river" generation units. Installed

fossil-fuel generation capacity currently accounts for some 30% of total system capacity and approximately 15% of energy supplied to the NIS in an average year.

For the next five years, INDE has 4 major generation improvement projects:

a) Repair and rehabilitation of thermal steam units Nos. 1 and 2 in Mauricio Power Plant with a capacity of 28 and 54 MW, respectively. This project is already underway with German, Swiss and Italian suppliers' credit.

b) Installation of a 37 MW gas turbine in EEGSA's Laguna Plant which has already started, financed with INDE's own funds.

c) Increase in steam thermal generation of 100-125 MW currently being negotiated with Italy and Japan.

d) The 69 MW, Santa María II, hydroelectric power plant and the 15 MW Zunil geothermal power plant to be financed by IDB Loans.

In addition, INDE is currently discussing a Central American Interconnection Project with an approximate cost of $600 million, to be financed probably through a loan from the Spanish government which would greatly improve the reliability of electric energy supply for all the Central American countries.

B. INDE/GOG Strategy for Rural Electrification

As indicated above, EEGSA provides distribution to the three central, and most densely populated, Departments of the country. Electrical service in the rest of the country is primarily the responsibility of INDE. Most rural electrification in Guatemala is therefore provided by INDE. A rural electrification Implementing Unit was organized within INDE under the PER II Project. INDE intends to institutionalize the rural electrification effort by transforming the Implementing Unit into a Rural Electrification Department, which will have responsibility for coordinating all external financing for rural electrification projects.

Because of the strong support of the GOG for rural electrification, INDE is actively seeking funding for this purpose from bilateral and multilateral agencies. These rural electrification projects are included in INDE's Master Plan for

System Expansion, and will be closely coordinated with investments for the increase of generation capacity and improvements in major transmission and regional transformation facilities.

C. Sector Constraints

1. Structural Deficiencies

INDE is the institution assigned by law with the authority and responsibility for producing, transmitting and distributing electricity in Guatemala. Under this mandate, INDE is distributing power by block sales to EEGSA and eleven municipalities, and by direct sales to approximately 250,000 individual customers. Inasmuch as the more urban areas are served by block sales to EEGSA, INDE's distribution by direct sales is essentially the rural electrification program for Guatemala.

INDE's total installed system capacity is some 630 MW, which includes approximately 438 MW of hydro-generation. The present maximum load on the National Interconnected System is 375 MW; consequently, it would appear that there is adequate reserve capacity to meet any emergency. This, however, is not the case as most of the fossil-fueled units are incapable of producing their rated capacity due to lack of regular maintenance and timely overhaul. The reliable operating capacity of the hydroelectric plants is reported to be approximately 400 MW.

Additionally, it should be noted that severe and extended drought would substantially reduce INDE's hydro-generation capability and would require conservation measures and load management programs. There are currently no appropriate means to promote efficient load management, such as special tariffs for interruptible service or seasonally differentiated pricing, which would encourage more efficient and productive use of energy.

Upon the completion of PER III, INDE will be providing direct sales to over 300,000 individual customers who will require approximately 30 MW at peak load periods. This is less than 10% of the present maximum load and 5% of the reported available capacity.

Since direct sales represent such a small portion of INDE's capacity, it would seem logical that it should concentrate on generation and transmission for bulk sales and transfer distribution responsibility to other entities.

Distribution options include:

- Transferring distribution facilities to EEGSA, which has a history of good distribution operations.

- Establishing Departmental Power Authorities to assume distribution responsibility in the respective Departments.

- Organizing Rural Electric Cooperatives, which are providing reliable rural service in Costa Rica and other parts of the world.

Any of the above options or a combination of them would permit INDE to concentrate on bulk power supply and thereby become a more efficient and productive utility. However, political realities at INDE and throughout the country have thus far not permitted success in any efforts at transfer of distribution responsibilities. This situation is beyond the scope of this Project. The on-going Mission policy dialogue with the GOG, however, should continue to address the matter of decentralization of electric power distribution in Guatemala.

2. Institutional Inadequacies

INDE has numerous institutional inadequacies which are described in more detail in the Institutional Analysis of this project. Principal among these inadequacies are a difficult financial situation with very heavy foreign debt, aggravated by strong political pressure against raising tariffs.

INDE's original administrative structure was designed as an engineering and implementing institution for the electrification of the country. This structure is poorly suited for the efficient management of a distribution system. As a result, the distribution, maintenance and commercial activities of INDE need to be improved. Productive uses of electricity, in particular, are inadequately addressed by INDE.

3. Policy Environment

Any development program which has a direct impact on disadvantaged groups is likely to have political implications. Rural electrification is no exception, and Guatemalan politicians will undoubtedly try to exert political pressure to have their constituent communities included in PER III. The Mission must insist that selection criteria based on

economic factors, as described in the Detailed Project Description section of this document, alone be used for PER III community prioritization and selection.

The second important policy consideration is INDE'S tariff structure, which is substantially below the cost of service. This subject is analyzed in the economic and financial analyses sections, but deserves mention here. The Central Government for political reasons, has not allowed INDE to raise electrical tariffs to compensate for the substantial increase in external debt service caused by the devaluation of the Quetzal. Senior INDE officials consulted during the PP preparation did not foresee a tariff increase before the 1990 presidential elections. In lieu of a tariff increase, INDE has been trying to increase revenues through an improvement in collections and is also exploring other possibilities for tariff increases such as small automatic increases, indexed to other economic indicators. The Mission, through its on-going policy dialogue with the GOG, should continue to emphasize the need for tariff reform, which is also being recommended by other donors in the energy sector.

The third policy consideration is that of cost recovery of some percentage (to be determined) of the investment required to extend service to a community. INDE currently favors requiring community co-payment of installation costs, and many communities accept this requirement. Supplementary charges to the monthly electric bill were employed under PER II to recover internal wiring costs, and may represent an appropriate and politically acceptable mechanism to increase community co-participation in installation cost recovery.

The fourth major policy consideration is INDE's excessive labor force which aggravates the financial problem. INDE currently has between 7,500-7,600 employees, most of them, badly trained and poorly motivated. Of these, 3,500-4,000 employees are in excess of INDE's needs. The excess personnel are a result of a large workforce which was employed for the construction of Chixoy and other projects who should have been terminated when the projects were completed. Political appointees in the last two years number a maximum of 100, and INDE has been careful to select them so they can perform their functions adequately. Most of the excess personnel are unskilled laborers working in rural areas; they are poorly educated and would be very difficult to train for more sophisticated jobs. According to senior INDE officials,

serious consideration is being given to using these 3,500-4,000 employees in reforestation activities, badly needed in the watersheds of major hydroelectric power plants.

Finally, INDE's labor union has achieved considerable power at all levels of INDE operations in recent years. Indeed, the INDE labor union is among the most influential of public employee unions in Guatemala, influencing overall GOG policy formulation as well as INDE's internal operations. Examples of the union's power include eroding the effectiveness of supervisory personnel, blocking the transfer of distribution areas to EEGSA, opposition to increased tariffs, continuous pressure for salary increases and opposition to efforts at streamlining INDE's large labor force. Inasmuch as the problems posed by the union outstrip the scope of this Project, Mission policy dialogue should encourage a more constructive approach to the GOG/INDE/union relationship Other Mission resources such as the Development Training and Support Project should be considered to encourage greater responsibility within the union itself.

D. Other Donor Assistance

Currently, A.I.D. is the only donor providing assistance to INDE for rural electrification. INDE is contemplating a request for bilateral assistance from a number of European governments for rural electrification in one or two Departments. INDE has expressed reservations with regard to the restrictions involved in this assistance which would probably impose European standards incompatible with the current INDE system, which is primarily based on U.S. standards. It is unlikely in any case that such assistance would be provided before 1990-1991.

The only other rural electrification project currently being implemented in Guatemala is a small World Bank-sponsored program limited to EEGSA distribution areas.

E. Relationships to A.I.D. Policy, Strategy and Other A.I.D. Projects

The Mission's FY1989-90 Action Plan contains specific private sector strengthening objectives which are addressed by this Project. These include support for small enterprise development, cooperatives, agroindustries, and export promotion. Virtually any private sector activity in the rural area will require an adequate supply of electrical energy.

The 1986 CDSS emphasizes the need to increase the participation of the rural poor in the benefits of economic growth. This Project is specifically designed to improve the rural sector's access to the benefits of past GOG investments in the electrical generation sector, and specifically addresses productivity and income concerns through the development and promotion of productive uses of electricity. The PER III Project also follows CDSS recommendations through improving the efficiency of existing country resource base utilization in development activities. The pressing need for the expansion of rural electrification was also given specific mention in the Report of the National Bipartisan Commission on Central America (NBCCA) as part of its recommendations on infrastructure and housing projects.

Improvements planned under this Project in the capacity of the electrical system respond directly to constraints identified in the USAID/Guatemala 1988-1992 Agriculture Sector Development Strategy, which cites the lack of sufficient and reliable electrical power as a critical barrier to rural industrial development and calls for improvement of processing services and development of small cottage industries.

Given the importance of electrification for the wide range of USAID development projects in Guatemala, and the high priority the GOG has assigned to rural electrification, this Project will continue to support INDE's successful activities in this area, providing essential foreign exchange for commodity procurement, and will add an important component in promoting productive uses. These activities will thus provide necessary infrastructure improvements for rural development in Guatemala, while improving the long-term viability of the power sector's commitment to providing rural electrical service.

F. Relationship to GOG Policy and Strategy

The Government of Guatemala has defined electrification of rural areas as one of its most important infrastructure investment priorities. The GOG has emphasized the need to increase investment in rural infrastructure through the concept of the "social debt", which it defines as the investment needed in rural areas to promote their development and to compensate for the lack of attention received from previous governments. This commitment to the rural sector is reflected in all government plans and is especially stressed in the National Reorganization Plan published in 1987.

The interest of the Guatemalan Government in rural electrification projects has been expressed repeatedly at all levels. In September 1986, President Cerezo sent a letter to then A.I.D. Administrator M. Peter McPherson requesting A.I.D. financing for a third phase of the ongoing rural electrification project. The letter identified rural electrification as an important element for the development of Guatemala and committed the GOG to counterpart funding for the project.

III. DETAILED PROJECT DESCRIPTION

A. Project Goal and Purpose

1. Project Goal

The goal of the PER III Project is to increase the productivity, incomes and employment of the rural poor in Guatemala.

2. Project Purpose

The Project purpose is to expand electrification in rural areas where the introduction of electricity will complement and maximize the productive potential of existing infrastructure and resources.

The Project purpose will be accomplished through the construction of sub-transmission and distribution lines and household connections in rural villages, the up-grading of transmission and transformation capacities at three selected substations in the Western Highlands, and the pilot provision of credit, training and technical assistance to promote productive uses of electricity in the Western Highlands of Guatemala.

B. Project Strategy

Guatemala provides electrical service to a smaller (25%) percentage of its overall population than any of the Central American countries. Reflecting the traditional imbalance in services provided to rural areas, only 7% of the rural population has access to electrical power. The GOG recognizes this situation and now places emphasis on rural infrastructure investments, specifically including rural electrification, as part of its overall development strategy.

In the past, limitations to generation of electrical energy posed substantial constraints to improving electrical service coverage in the country. The inauguration of the 300 MW Chixoy hydroelectric plant in 1985 virtually doubled generation capacity. Thus, the main constraint now lies in electric power distribution, especially in rural areas. The difficult financial situation of INDE requires that assistance be provided to promote rural electrification in general and productive uses of electricity in particular.

Improvements in the capacity of the electrical system under this Project respond directly to constraints identified in the USAID/Guatemala 1988-1992 Agriculture Sector Development

Strategy. Expansion of the electrical network in rural areas will provide a valuable complement to other USAID and GOG public and private sector development strategies by supporting efforts in irrigation, health, export promotion and employment generation. The importance of electrification for the wide range of USAID and GOG development projects in Guatemala provides the basis for continued support of INDE's successful activities in this area, and increased emphasis on the promotion of productive uses of electricity. These activities will provide necessary infrastructure improvements for rural development in Guatemala, while strengthening the power sector's commitment to providing rural electrical service.

The Project itself consists of two integrated components: 1. Infrastructure Component which includes construction of lines and electric installations, and subtransmission and transformation improvements; and 2. Productive Uses of Electricity Component. The first component, to be implemented by the Rural Electrification Implementing Unit of INDE, continues the highly successful activities conducted under the terminating PER II Project and will also undertake necessary electrical subtransmission and transformation system upgrades in key Project areas where additional growth potential for productive uses is high. The second component charges a private voluntary organization with training in productive uses, the management of a credit fund for electrical equipment and machinery purchase, and the provision of technical assistance in the use of such equipment. Additionally, this component will support the institutionalization of productive uses within INDE. These components in the aggregate will have substantial impact on the achievement of the Project goal.

Policy and Institutional Issues

Several important policy and institutional issues that could affect project implementation and sustainability were identified during the Project Paper development. Some of these issues can be addressed within the context of this project and specific interventions will be programmed for this purpose. The three main policy and institutional issues which will be addressed under the project are the following:

1) Excessive centralization of rural electric systems management.

INDE suffers from the excessive centralization that characterizes all GOG organizations. Decentralization of rural electric systems management would help improve service to the rural consumer. However, decentralization is difficult and

could encounter legal and labor problems in INDE. During project negotiations with INDE officials, it was agreed that the best way to initiate the process would be to include funds in PER III for the strengthening of a pilot INDE regional office, through technical assistance and provision of basic equipment to test the feasibility of decentralization. If this pilot effort is successful, the concept could be extended to other INDE regional offices.

2) Technical selection of communities to be included in the Project.

INDE has agreed that the selection of communities to be included in PER III should be based on technical and not political criteria. A clear definition of the selection criteria will be included in the agreement, reserving approval authority for AID over the selection methodology and results.

3) Community contributions to finance rural systems.

INDE has agreed to the establishment of a policy requiring financial contributions from the communities to be included in PER III. The details of collection mechanisms and contribution percentage will have to be defined during the first semester of project implementation, but a minimum 10% contribution will be required. This contribution will be collected with the monthly bill, and a downpayment will be required to formalize connection arrangements.

Broader Policy Issues

The broader policy issues which are subject of GOG-INDE negotiations and GOG major policy decisions are beyond the scope of this project. However, the Mission should use policy dialogue to address these broader issues with INDE and the GOG. The leverage that this project will provide to the Mission will facilitate the discussions and provide opportunity for a continuous monitoring of progress in these areas. During the Project Paper preparation, policy issues were discussed at length with senior INDE officials. Although no immediate solutions were proposed, it was evident that INDE is well aware of the problems and is working to resolve them. The most important broad policy issues that were identified, their current status and possible solutions are the following:

1) INDE's financial situation and current tariff structure.

In late 1987 the Central Government cancelled the subsidy that it provided to INDE for the payment of its

external debt. Under this subsidy INDE was permitted to obtain foreign exchange from the Central Bank at a special 1:1 rate. Currently, INDE is required to purchase foreign exchange at the official 1:2.7 rate. However, the Central Government, for political reasons, has not allowed INDE to raise electrical tariffs to compensate for elimination of the subsidy. As a result, although INDE's operational revenues exceed its operational expenses, this operational profit is not sufficient to cover the external debt service.

According to senior INDE officials, a 70-80% real tariff increase is required to solve INDE's financial problems. However, for political reasons, they do not foresee a tariff increase before the 1990 presidential elections. In lieu of a tariff increase, INDE has been trying to increase revenues through an improvement in collections. This effort has been successful, and INDE has been able to increase collections for residential consumption to 98% and to collect Q30 million in electricity bills from EMPAGUA, the Guatemala City water utility. INDE is also exploring other possibilities for tariff increases such as small automatic increases, indexed to other economic indicators. This would help avoid the kind of public outcry that occurred in October 1987 when the GOG attempted a massive (40%) increase in INDE tariffs.

In June 1988, INDE and the World Bank signed a Loan Agreement for $70 million to finance the so-called Fifth Energy Project which includes several distribution improvements, feasibility studies and institutional strengthening. The Agreement includes Conditions Precedent, which require substantial improvements in INDE's financial returns and a plan for increasing its ratio of electricity consumers to employees. The senior INDE officials consulted during Project Paper preparation, consider that this conditionality, as currently stated will be difficult to meet. INDE is trying to negotiate some flexibility with the World Bank, such as viewing INDE's revenue situation as a whole and not considering tariff increases and improved collections as separate issues. Disbursement of funds from the World Bank loan is essential for INDE's expansion plans and they will try to reach an agreement with the Bank that is politically feasible.

In general terms, INDE plans to address its financial problems in two stages: In the short term (next three years), even with a possible tariff increase, INDE will need subsidies from the Central Government to operate and to initiate necessary investments in additional generation. A commission including representatives from INDE, MINFIN, SEGEPLAN and the Central Bank has already been formed to

negotiate this financial assistance in the short term. The commission is working on a plan (Plan de Saneamiento Financiero del INDE), which will be formalized through an agreement to provide financial assistance to INDE, and which will include measures to improve the institution's financial, management and labor problems. New members from key GOG offices and Ministries have been added to INDE's Board of Directors to work on the financial assistance plan and to help program necessary institutional reforms. For the medium term, INDE believes that a substantial tariff increase must be authorized by the Central Government. Whatever government comes to power in 1991 will have to increase the tariff or face very serious energy shortages around 1993.

Although this is a major policy issue, outside the scope of the PER III Project, Mission policy dialogue with the GOG should be used to emphasize the need for more realistic tariff rates, reinforcing other donors recommendations in this aspect.

2. Size of INDE's workforce.

As requested in the Mission Executive Committee Review of the Project Paper of January 13, 1989, the Project Design Committee discussed with INDE senior management the possibility of a commitment by INDE to freeze employee levels at current levels. Although a hiring freeze is possible, INDE considers that it would not really help to solve the problem of excessive personnel, since the attrition rate is low, and it is difficult to retrain these personnel for jobs which require additional skills. As explained before, INDE is giving serious consideration to using its 3,500-4,000 excess employees in reforestation activities, badly needed in the watersheds of major hydroelectric power plants. INDE has already initiated contacts with DIGEBOS and the Ministry of Agriculture for this purpose, and INDE's senior management is optimistic about the possibility of overcoming union objections to this plan.

3) Other alternatives of generation.

It is important to note that, according to senior INDE officials, the GOG attitude towards cogeneration has changed substantially and is now much more favorable than in previous years. In the last six months INDE and the Ministry of Energy and Mines (MEM) have taken important steps to formalize cogeneration agreements with private sector companies, particularly sugar mills. A commission has been formed which is already discussing with the sugar mills the terms of a cogeneration agreement. As could be expected, the private companies are seeking guarantees that INDE will buy

their surplus energy at acceptable prices before making the necessary investments in their plants. Cogeneration is not prohibited by law, but INDE and MEM must approve any cogeneration or private generation project.

C. End-of-Project Status

By the end of the Project in 1995, INDE will have completed the construction of lines and electric installations that will provide a distribution system for supplying power and energy to 65,000 new consumers in over 400 villages selected for their high potential for productive uses development. The construction activities undertaken by the Project will have strengthened the on-going capability of INDE to conduct efficient rural electrification activities in the future through the institutionalization of appropriate construction standards, community evaluation and selection, and improved maintenance capabilities and practices. The design of the distribution networks will provide for the future connection of additional consumers and for increased consumption as productive uses are developed.

Subtransmission and substation transformation improvements in the Western Highlands region will permit the connection of households planned under PER III as well as more than 20,000 future consumers in three target areas with high productive uses potential. Improved reliability of service, better voltage regulation, and reduced line losses will also benefit both current and future users in the Western Highlands regional system. These capacity and reliability improvements are essential to productive use development.

Productive uses of electricity will be promoted in 90 communities of the Western Highlands through the training of over 10,000 persons in electricity use, productive potential, and credit. Productive uses will result from the provision of 2,500 fixed-asset loans and 1,100 working capital loans to approximately 2,000 borrowers over the life of the Project. The recycling of loan repayments will provide for a permanent productive uses credit fund in the Western Highlands for small entrepreneurs, artisans and other producers in rural areas.

D. Project Components

1. Infrastructure Component ($9,100,000)

-- Construction of Lines and Electric Installations ($8,257,947)

a. Overview

The major technical component of the Project is the construction of new distribution facilities that will provide electric service to 65,000 new consumers in rural Guatemala. Approximately 80% of new connections will be in the Western region of the country and 20% in the Eastern region. The 65,000 new connections will be distributed as follows:

- 25,000 connections to existing distribution networks
- 15,000 connections to expanded distribution networks in villages previously electrified
- 25,000 connections in villages newly electrified under the Project.

The new facilities will include 300 km of primary distribution lines, 1,200 km of network lines (primary and secondary voltages); 1,857 transformer installations; 65,000 service drops and meters; and the interior wiring for 65,000 houses. Connections will be made at the rate of 13,000 per year during the last five years of the Project.

The service to be provided will be one or three- phase service, depending on the technical characteristics of the system, expected loads and number of consumers.

Design and construction standards will be utilized that are suitable to the unique characteristics of rural electric systems. The reduction of INDE's investment per consumer is recognized as an important factor in view of the low level of revenues to be generated in the early stages of development; thus low cost design and construction technologies are central to the component.

b. Description of Component Activities

Several separate activities must be properly planned, coordinated and executed in order to effect the timely and efficient completion of the Project: community selection, promotion and sign-up of consumers, design and construction of distribution infrastructure, and the transfer of responsibility to the Operations and Commercial departments of INDE for ongoing customer services.

The mid-term evaluation of the PER II Project estimated that approximately one-half of communities actually electrified by the Project failed to fully meet formal selection criteria. A recent analysis of PER II historical billing data, moreover, reveals that a substantial proportion of communities have not developed loads reflecting productive uses sufficient to justify investment costs. Other communities have demonstrated very positive patterns of growth in energy usage and economic productivity. It is clear that the overall viability of rural electrification activities in Guatemala can only be improved through a more rigorous site selection methodology oriented towards economic factors. USAID should also continue to review and approve final site selection.

The Demand Assessment Model (DAM) developed by ROCAP/CARES will be adapted to Guatemala and used as the principal community selection criteria for implementing Project activities. Bilateral funding from the CARES Project will support adaptation and preliminary application of the model in FY89. The Project includes specific funds under the technical assistance and training line item to assist in this activity, and provides support for a productive uses specialist within INDE for the institutionalization of productive uses and the adaptation and application of the DAM for site selection. An illustrative scope of work for this position is included in Annex J. The adaption of the DAM model to Guatemala is currently being developed by the CARES program and it is expected that a complete methodology, ready to be field-tested will be available in May 1989. Field-testing in cooperation with INDE personnel will take place between May and June and the DAM model, adapted to Guatemala and field-tested will be ready for PER III activities in July 1989. The model provides a series of steps to select and rank communities as follows:

Preliminary Screening: General geographic and other golbal characteristics are used to perform an initial screening, based upon donor, utility and GOG guidelines.

- Cost Screening and Preliminary Ranking: Screening and ranking of communities, based upon preliminary cost-per-user criteria defined by the donor and the utility.

- Benefit/Cost Considerations: Financial Net Present Value (NPV) calculation and ranking, based upon field data, relating utility cost (including any associated system improvements necessary) and potential benefit (sales).

Economic NPV may also be calculated if shadow price coefficients are available to reflect secondary benefits.

Socio-economic Adjustments: Socio-economic considerations, based upon field data, are considered in light of NPV indicators. Adjustments may be made based upon pre-determined guidelines established by the donor, utility and the GOG.

The DAM Model allows for the introduction of specific selection criteria at different levels, particularly at the Preliminary Screening level. This feature will be used to introduce complementarity with other Mission projects as one of the selection criteria for communities to be included in PER III. The flexibility of the model will allow to choose which type of project will be considered as more desirable to complement with the introduction of electricity.

More than 2,000 community applications for electrical service have been received by INDE in the last three years. Using the DAM, approximately 400 communities will be selected as the best candidates for rural electrification, within the context of the Project and its emphasis on productive uses. Use of the DAM in the community screening process will incorporate PER II information and experience. In addition, the selection process and DAM inputs and parameters will benefit from recent knowledge regarding rural electricity usage patterns, and from current surveys and studies of socioeconomic and other factors predictive of productive uses.

Initial data collection in the field has been provided in the past by the PER II Implementing Unit's social promoters. Effective use of the DAM will depend upon field information. PER III social promoters will receive training to improve the quality of field information, particularly regarding productive uses potential. In addition, promotion and follow-up activities to assist community pro-electricity organizations will form part of their training. The social promoters will be exposed to and act in coordination with the credit and training activities of the PVO charged with the productive uses component. A senior employee within the Implementing Unit will be designated and trained to assist in the adaptation of the DAM and become responsible for its application within INDE.

Design and construction of the distribution infrastructure works will be coordinated by the Implementing Unit. Unit personnel will perform the actual design work, which is reviewed by the Planning and Design Division. The Construction Department of the Construction Works Division will undertake actual construction of the distribution networks. Internal wiring is to be performed, as under PER II, by special crews within the Implementing Unit. Upon completion of all construction activities, the responsibility for maintenance and billing is assumed by the Operations and Commercial Divisions, respectively.

c. Implementation Plan

Construction of lines and installation of electric equipment will require the coordinated efforts of USAID and INDE personnel. Principal implementation responsibilities are as follows:

- The INDE Rural Electric Implementing Unit will be responsible for community selection, promotion, customer service applications, and design. USAID will review and approve the lists of selected communities.

- The INDE Planning and Design Division will be responsible for determining the adequacy of the power grid in the target areas, recommending any appropriate changes, and checking the design for each community to assure compatibility with overall system expansion.

- The INDE Construction Department will construct the lines and install the equipment according to design plans and will supervise and inspect all work to assure compliance with construction standards. USAID will supervise construction to assure quality of workmanship, appropriate management of materials and compliance with community selection procedures.

- USAID will procure all materials, except poles, to permit the construction work to proceed according to schedule.

- The independent consulting engineering firm which will be contacted with counterpart funds will review all designs for conformance to standards and recommend desirable changes. Additional responsibilities include monitoring the progress of the Project and the verification of the quantities and quality of workmanship of all construction.

- INDE's Operations and Commercial Divisions are the final link in the implementation plan. They will be responsible for the ongoing operation and maintenance of the systems and for the billing, collection and maintenance of records related to consumers, energy and revenues.

The capabilities of all participating INDE units have been assessed in relation to Project requirements and have been found adequate to achieve the target of 13,000 connections per year. As recommended in other analyses, technical assistance will be provided as required to strengthen specific aspects of the rural electrification program.

d. Inputs

Summary Component Budget

Materials	$6,131,650
Training and technical assistance	240,000
Vehicles and tools	567,800
Inflation	346,973
Contingencies	971,524
TOTAL	$8,257,947

Materials to be imported for the project include approximately 5,400 km of primary and secondary conductor; 1,960 km of service conductor; 1,857 distribution transformers; and 65,000 meters and necessary hardware to frame 30,000 poles in a single-phase configuration. Training inputs provided by the CARES Project will be supplemented to develop and reproduce design and maintenance manuals, and develop a safety program. To reinforce the capabilities of the construction, operations and commercial units, as well as the PER II Implementing Unit, 18 light, medium and heavy trucks, 10 motorcycles and 10 pole and 3 hot-line trailers will be

procured. A limited quantity of tools and instruments will be provided to the Operations Division. This component also includes $240,000 for training and technical assistance. Included in this line item are TA for Design Standards Preparation ($38,000); TA for a Safety Program ($22,000); hiring of a Productive Uses Advisor for 2 years ($80,000); TA and equipment for establishment and operation of a pilot decentralized INDE Regional Office ($100,000).
As counterpart, INDE will contribute the Quetzal equivalent of $14,761,816 for local procurement of poles, labor, transportation, engineering and supervision; required for the construction of lines and the installation of electric equipment.

e. Outputs

The construction of lines and electric installations will provide a distribution system for supplying power and energy to 65,000 new consumers in some 400 villages. The system will consist of 1,200 km of distribution network and 300 km of subtransmission line. In addition to the 65,000 connections, the basic framework will be established to permit the future connection of additional consumers and for increased consumption as productive uses are developed.

-- Subtransmission and Transformation Improvements ($642,053)

a. Overview

As indicated earlier, approximately 80% of the new connections under PER III will be in the Western Region. More than half of these will likely be in the areas of San Marcos, Quetzaltenango and Huehuetenango, which have been identified as areas with high potential for productive uses. The electrical systems in these areas are presently fully loaded and in some cases overloaded. It will not be possible to connect additional consumers without increasing the power supply capability in these areas.

The system upgrades proposed for this component are the most cost-efficient system changes that will permit the connection of the prospective new consumers.

b. Description of Component Activities

The Project will finance the following:

- San Marcos: Construction of 14 km of 3-phase, 34.5 kV subtransmission line from the present San Marcos substation to a new 1.5 MVA, 34.5/13.8 kV substation near the town of San Sebastián, San Marcos. (FX`$203,891, LC`$136,399)

- Huehuetenango: Construction of 18 km of 3-phase subtransmission line from the present Huehuetenango substation to a new 1.5 MVA, 34.5/13.8 kV substation near the town of San Sebastián, Huehuetenango. (FX`$209,196, LC`$155,641)

- Quetzaltenango: Replacement of the existing 5 MVA, 69/34.5 kV transformer in the La Esperanza substation with a new 10-14 MVA, 69/34.5 kV transformer. (FX $103,712, LC`$10,222)

c. Implementation Plan

The Planning and Design Division of INDE will be responsible for preparing the detailed design specifications for the proposed improvements. USAID will procure the materials and equipment (except for the poles) under the direct procurement plan, similar to the procedure used for PER II. INDE's Construction Department will construct the lines and substations and replace the overloaded transformer as described. The consulting engineering firm will review designs and specifications and provide appropriate assistance, promoting the simple designs and standards that are more suitable and economical for rural distribution substations.

d. Inputs

Summary Component Budget

Materials		$516,799
Inflation		35,839
Contingencies		89,415
	TOTAL	$642,053

The principal input to this system improvement component will be the procurement of $516,799 of imported materials, including three substation transformers, two complete substation structures, 158 km of primary

conductor, crossarms and hardware to frame 384 poles in 3-phase configuration. As counterpart, INDE will provide labor, poles, transportation, and administrative and engineering support equivalent to $299,501 in Project contributions.

e. Outputs

This component will increase system capacity to permit connections for PER III households and more than 20,000 future consumers in the three target areas. Improved reliability of service, better voltage regulation, and reduced line losses will also result for both current and future users of the system. In addition, the existing 5 MVA La Esperanza transformer, to be replaced by the Project, can be used to relieve overloading of the Huehuetenango 69/34.5 kV substation. This will result in additional capacity and enhanced reliability for users served by this substation.

-- Evaluations, Studies and Audits ($200,000)

The infrastructure component also includes a line item for evaluations studies and audits which will de distributed as follows: Baseline study ($28,000); Mid-term Evaluation ($25,000); Final Evaluation ($30,000); Audits ($90,000) which will be 3 biannual audits and have been estimated to cost $30,000 each.

2. Productive Uses of Electricity ($900,000)

a. Overview

Rural electrification projects are frequently characterized by low consumption rates which make them difficult to justify from the utility's financial point of view. The tendency is caused by low consumer density and low incomes among the rural population. At the same time, rural consumers have constraints to use electricity more effectively and in larger amounts. Culturally, or geographically isolated rural consumers may be unaware of the possible advantages of using electricity to improve or develop income - producing activities. They may also lack access to credit, training and technical assistance.

One way of overcoming the low consumption and inefficient use tendencies described above is to create conditions leading to the productive uses of electricity in rural areas. Productive uses are those which create new work opportunities and/or result in reduced costs or increased

efficiency in rural enterprises, with the final result of increasing incomes for the new users. The utility will also be benefitted by the increased consumption which will make the rural infrastructure more profitable.

The experience of rural electrification projects in other countries and the PER II experience in Guatemala has demonstrated that productive uses will arise spontaneously after a certain period of time. However this is a lengthy process and a much more positive and rapid economic impact can be achieved if productive uses are deliberately promoted.

This pilot component addresses the need to promote and facilitate the productive use of electricity. It is of paramount importance to INDE, that the financial return from rural electrification be improved by increasing consumer use and the ability to pay for increased use. This component contributes to the Project goal by providing otherwise unavailable training and credit for productive uses to inhabitants of communities electrified under the PER II and PER III Projects, and establishes a permanent mechanism to extend these benefits beyond the PER III PACD.

b. Description of Sub-components

Activities under this component fall into two major areas: (1) training programs in productive uses, and (2) establishment of a credit fund for the purchase of electrical equipment and machinery, and the provision of technical assistance in its use. Because INDE cannot, by Guatemalan law, engage in credit provision activities, alternative mechanisms must be used. Initially, both training and credit sub-components will be implemented by one private voluntary organization, Acción Internacional (AITEC), in association with a Guatemalan PVO (the Fundación para el Desarrollo Integral de Programas Socio-económicos, or FUNDAP) based in the geographical area (Quetzaltenango) where the Project will initially be implemented.

The two sub-components will be presented to the target population as an integrated package, increasing awareness and orientation towards productive uses in general, and by providing credit and technical assistance in electrical equipment operation to encourage individuals and small enterprises to develop economically viable productive uses. Institutionalization of a productive uses program within INDE will also be supported by the project.

Based upon socio-economic studies and surveys performed by Stewart, Alvarez and Associates between November 1987 and August 1988, this component will be limited to primarily PER II and some PER III communities in the Western Highlands. This area includes portions of the Departments of Quetzaltenango, Totonicapán, Sololá, Huehuetenango, Chimaltenango, San Marcos and Quiché. Initially, the component will concentrate in the first three of these Departments, where FUNDAP presently has a developed infrastructure established. Later, the program will be expanded to include other communities in the region which show a high potential for productive uses.

i. Training for Productive Uses of Electricity

The training component will be implemented by AITEC through FUNDAP. Both are private voluntary organizations with extensive experience in development projects both internationally and in Guatemala. AITEC/FUNDAP are currently implementing the credit and technical assistance aspects of the Mission's Micro-enterprise Project in the Western Highlands.

The Project will train over 10,000 individuals in productive activities which may use electricity as their principal source of energy. An additional 1,000 persons will be trained in the use of activity-specific electrical equipment and machinery, and in the availability and use of credit to acquire such equipment.

General training will be directed towards communities in the target area discussed above. The focus of this training will be on generic aspects of electricity, including its use and importance; service characteristics and safety aspects; specific productive applications appropriate to the nature of the community; and on the availability of credit and technical assistance for the purchase of application-specific electrical equipment or machinery.

A mid-term evaluation of the Project, to be undertaken in 1991, will determine the impact of this training on both general electrical usage and the development of productive uses in rural areas. If the results of the evaluation prove satisfactory, community-level training will be incorporated into the new Consumer Services Department of the Commercial Division of INDE, as a step towards the institutionalization of all service-related activities.

ii. Credit and Technical Assistance for Small Local Enterprises

Credit and technical assistance will also be provided by AITEC/FUNDAP. Initially, approximately 100 small enterprises already in operation and new businesses in recently electrified communities will be targeted for attention. Credit amounts will generally be small, and available for both equipment purchase and limited working capital, appropriate for the size and capacity of these small enterprises. Credit and technical assistance will be provided as a package in order to assure not only that the borrower acquires the appropriate electrical equipment or machinery, but also to guarantee that full advantage is made of the equipment's potential. AITEC/FUNDAP will also provide orientation and training in micro-business fundamentals of operations.

The interest rates charged on loans by AITEC/FUNDAP will reflect market rates charged in similar projects in the target geographical area as of the date of approval. The interest rate covers both administrative costs and the provision of technical assistance, and allows a mechanism for expansion of the credit fund over time. The effective annual rate on direct credits for the purchase of equipment and technical assistance will be approximately 20%.

c. Implementation Plan

AITEC/FUNDAP will have primary responsibility for implementation of the productive uses component. Social promoters from the PER III Implementing Unit will receive basic training in productive uses and the FUNDAP credit/technical assistance mechanism from a project-financed productive uses expert in order to assure proper coordination and promotional activities by both institutions. AITEC will monitor and oversee FUNDAP's field activities, and will fulfill financial and reporting requirements, as well as provide technical backstopping for FUNDAP.

The expected implementation plan is as follows:

- Formalization of the USAID/ITEC Agreement: May 1989

- USAID review and approval of AITEC/FUNDAP Agreement, including legal aspects of credit management: June 1989

- Formalization of the AITEC/ FUNDAP Agreement: June 1989
- Initial disbursement to AITEC: August 1989
- Procurement and start-up processes: July-August 1989
- Initiation of credit and TA activities: October 1989

d. Inputs

Summary Component Budget

Training and technical assistance	$170,778
Credit funds	403,889
Credit management	272,924
Inflation	20,000
Contingencies	32,409
TOTAL	$900,000

Funds programmed for training will be used primarily during the first five calendar years of the Project, and concentrated during the third through fifth year.

Technical assistance will be linked to credit for equipment and machinery, and, unlike general productive uses of electricity training, it will be provided during all six years of the Project. The expected yearly costs of the technical assistance will not be uniform, since credit will gradually grow towards a peak in the third, fourth and fifth years, levelling off in the final year of the Project.

In terms of the funds available for credit, approximately $378,460 will be used for fixed-asset purchase loans and $67,810 will be reserved for related working capital loans. The expected rotation of funds over the life of the Project is three times for fixed-asset loans and eight times for associated working capital loans. The $403,889 credit line will act as seed money, with funds from loan repayments used to replenish the credit line and recycled for the same purpose indefinitely.

The Project budget includes under the Infrastructure Component $80,000 for a productive uses specialist within INDE to assist in the adaptation of the CARES Demand Assessment Model to Guatemala and to train Productive

Uses Advisors. This activity will strengthen the institutionalization of a productive uses orientation in INDE's rural electrification programs. An illustrative scope of work for the productive uses specialist is included in Annex J, Exhibit 5.

e. Outputs

The following results are expected from the productive uses component based on the planned level of inputs:

- Training seminars conducted in 4 communities during the first year, 12 during the second, 20 during the third and 27 per year in years four and five, for a total of 90 communities.

- Technical assistance for over 2,000 borrowers, approximately 10% of which will be provided during the first two years, 40% over the following two years, and 50% during the final two years of the Project.

- Given an expected average fixed-asset loan amount of less than $520 and working capital loans of $185, the credit line will provide over 800 fixed-asset and 135 working capital loans with the initial $403,889 funds budgeted. Based on anticipated reflows, a total of 2,500 fixed-asset and 1,100 working capital loans will be provided during the life of the Project.

- The recovery on loans provided through the credit sub-component will, by the end of 1993, generate sufficient funds to recycle them indefinitely, thus providing a permanent productive uses financing alternative for small entrepreneurs, artisans and other producers in the rural Western Highlands region of Guatemala. The funds obtained from the recovery of loans will continue to be managed by FUNDAP.

- The Demand Assessment Model will be adapted for demand forecast and site selection and the institutionalization of a productive uses orientation in INDE initiated.

IV. COST ESTIMATE AND FINANCIAL PLAN

A. Cost Estimate

The total estimated cost of the PER III Project is $25,261,317, of which $10,000,000 will be provided in A.I.D. grant funds. INDE and the GOG will provide the local currency equivalent of $15,061,317 in counterpart funds and a PVO will provide a $200,000 counterpart contribution. The project consists of: (1) infrastructure component covering construction and support equipment with an estimated cost of $24,161,317 and (2) productive uses of electricity component including credit, training, and technical assistance with an estimated cost of $1,100,000. The infrastructure component includes $200,000 in AID grant funds for evaluations, studies and audits.

The construction program will provide 65,000 new rural connections as well as subtransmission and transformation improvements. The cost estimates assume the following distribution of new connections:

Newly electrified areas	25,000
Extensions of distribution networks	15,000
Connections to existing networks	25,000

Based on this distribution of connections, the following component requirements are estimated:

Primary line	300 km
Network	1,200 km
Poles	30,000
Transformers	1,857
Services and meters	65,000
Interior wiring	65,000

The total estimated construction costs for lines, networks and household connections is $10,015,750 ($6,131,650 from A.I.D. and 3,884,100 from GOG/INDE counterpart) for materials and $8,854,656 in GOG/INDE counterpart equivalent for labor, supervision and overhead. A.I.D. funds will provide the foreign exchange needed for subtransmission and transformation equipment, estimated at $516,799. GOG/INDE counterpart equivalent to $258,456 will be provided for associated substation construction costs.

An estimated $567,800 in A.I.D. funds will be used to finance support equipment for the Project, including vehicles, tools, and other equipment. The cost estimate for support equipment is based on the current costs of the following materials:

Heavy duty truck - 8T	3
Pickup truck - 4WD	4
Service pickup trucks - 4WD	5
Pickup trucks (medium)	3
Pole trailers	10
Hot line trailer - complete	3
A-frame truck	3
Tools	5 lots
Instruments	5 lots
Safety and job training	1 lot
Motorcycles	10

Details supporting the cost estimates for construction and support equipment are contained in Annex K.

Inflation allowances are based on a five percent annual rate for all materials, excluding poles which are produced locally. This rate of inflation approximates the current GNP price deflator in the United States. Imported construction materials were assumed to be purchased during the first three years of the Project at the following rates:

Year 1	(1989-1990)	40%
Year 2	(1990-1991)	30%
Year 3	(1991-1992)	30%

Advance purchase of materials is considered desirable in order to replenish inventories and avoid installation bottlenecks, and also to minimize the costs associated with inflation. Support equipment will be purchased entirely in the first year. Local costs are programmed in equal amounts over the six-year period, based on a constant rate of new connections during the period. Local inflation is budgeted at three percent --in U.S. dollars-- and assumes little inflation other than that associated with exchange rate changes.

Contingencies were calculated as approximately fourteen percent of total costs for construction materials and support equipment.

The costs associated with training and technical assistance were estimated as $240,000.

The credit fund is intended to establish a pilot program for funding productive uses of electricity. The $403,889 budgeted for this purpose will be disbursed in the initial year of the Project.

The line item for evaluations, studies, and audits is budgeted for bi-annual Project audits, a mid-term and a final evaluation. A baseline study, and a management audit of INDE's Commercial Department will also be financed under this line item. The costs are based on experience in the PER II program and estimates by local auditors.

Inflation estimates for training, credit management, and evaluations is based on U.S. dollar inflation of five percent per year. Details supporting the cost estimates for these elements are presented in Annex L.

B. Financial Plan

A.I.D. will finance all imported construction materials, support equipment, technical assistance and training, and evaluation, studies, and audits at an estimated cost of $9,100,000. The Government of Guatemala/INDE will provide the local currency equivalent of $15,061,317 for the cost of poles, labor, engineering, supervision and administration to complete construction.

A.I.D. will provide $900,000 to cover the costs of a program for the productive uses of electricity, which includes training, technical assistance, and credit.

The PVO which will receive the $900,000 Grant for the productive uses of electricity component will provide an in-kind contribution in technical assistance and credit management personnel for credit management with an estimated cost of $200,000.

The A.I.D. contribution for the infrastructure component is projected as follows:

1. All of the foreign exchange costs of off-shore procurement of equipment and materials required for the construction of the subtransmission and distribution system and related maintenance and service equipment ($7,216,249).

2. Technical assistance and training ($240,000).

3. Contingency and inflation factors ($1,443,750).

4. All of the costs required to procure special studies, bi-annual audits, a mid-term evaluation, and a final evaluation ($200,000).

The A.I.D. contribution for the productive uses of electricity component is projected as follows:

1. All training and technical assistance costs ($170,778).

2. All of the costs associated with credit fund management and initial capital for the fund itself ($676,813).

3. Contingency and inflation factors of $52,409.

The Government of Guatemala/INDE counterpart contribution is projected as follows:

1. All of the local currency costs of installation and local materials related to the construction of the subtransmission/distribution system ($12,997,242).

2. Contingency and inflation factors ($2,064,075).

This counterpart funding includes the contribution of participating rural communities. This contribution cannot be estimated with any precision at this point; however, based on experience under PER II, communities can be expected to contribute roughly $2,000,000 equivalent in cash contributions to be collected by INDE.

The detailed budget for the Project, summary cost estimate and financial plan, disbursement schedule, and costing of Project outputs are shown in the following tables:

DETAILED BUDGET FOR PER III
INFRASTRUCTURE COMPONENT

(US DOLLARS)

Line Item	YEAR 1 AID	YEAR 1 GOG/INDE	YEAR 1 Total	YEAR 2 AID	YEAR 2 GOG/INDE	YEAR 2 Total	YEAR 3 AID	YEAR 3 GOG/INDE	YEAR 3 Total	YEAR 4 AID	YEAR 4 GOG/INDE	YEAR 4 Total
Construction Costs												
Primary Line	136,080	284,700	420,780	102,060	284,700	386,760	102,060	284,700	386,760	0	284,700	284,700
Distribution Network	916,320	1,439,600	2,355,920	687,240	1,439,600	2,126,840	687,240	1,439,600	2,126,840	0	1,439,600	1,439,600
Transformers	334,260	0	334,260	250,695	0	250,695	250,695	0	250,695	0	0	0
Services & Meters	650,000	54,167	704,167	487,500	54,167	541,667	487,500	54,167	541,667	0	54,167	54,167
Interior Wiring	416,000	90,242	506,242	312,000	90,242	402,242	312,000	90,242	402,242	0	90,242	90,242
Subtransmission/Transformation	516,799	258,456	775,255	0	0	0	0	0	0	0	0	0
Consulting Engineering	0	61,667	61,667	0	61,667	61,667	0	61,667	61,667	0	61,667	61,667
Engineering and Administration	0	192,751	192,751	0	192,751	192,751	0	192,751	192,751	0	192,751	192,751
SUBTOTAL	2,969,459	2,381,582	5,351,041	1,839,495	2,123,126	3,962,621	1,839,495	2,123,126	3,962,621	0	2,123,126	2,123,126
Vehicles, Tools, and Equipment												
Construction Dept	138,500	0	138,500									
Operations Dept.	346,300	0	346,300									
Commercial Dept.	47,000	0	47,000									
Implementing Unit	36,000	0	36,000									
SUBTOTAL	567,800	0	567,800	0	0	0	0	0	0	0	0	0
Evaluations, Studies and Audits	40,000	0	40,000	15,000	0	15,000	30,000	0	30,000	35,000	0	35,000
Technical Assistance/Training	120,000	0	120,000	60,000	0	60,000	15,000	0	15,000	15,000	0	15,000
Inflation	184,863	71,447	256,310	95,725	129,298	225,023	94,225	196,871	291,096	2,500	266,471	268,971
Contingencies	513,919	119,079	632,998	264,200	106,156	370,356	260,060	106,156	366,216	7,000	106,156	113,156
TOTAL	4,396,041	2,572,109	6,968,150	2,274,420	2,358,580	4,633,000	2,238,780	2,426,153	4,664,933	59,500	2,495,753	2,555,253

DETAILED BUDGET FOR PER 111
INFRASTRUCTURE COMPONENT

(US DOLLARS)

Line Item	YEAR 5 AID	YEAR 5 GOS/INDE	YEAR 5 Total	YEAR 6 AID	YEAR 6 GOS/INDE	YEAR 6 Total	TOTAL AID	TOTAL GOS/INDE	TOTAL Total
Construction Costs									
Primary Line	0	284,700	284,700	0	284,700	284,700	340,200	1,708,200	2,048,400
Distribution Network	0	1,439,600	1,439,600	0	1,439,600	1,439,600	2,290,800	8,637,600	10,928,400
Transformers	0	0	0	0	0	0	835,650	0	835,650
Services & Meters	0	54,167	54,167	0	54,167	54,167	1,625,000	325,000	1,950,000
Interior Wiring	0	90,242	90,242	0	90,242	90,242	1,040,000	541,450	1,581,450
Subtransmission/Transformation	0	0	0	0	0	0	516,799	258,456	775,255
Consulting Engineering	0	61,667	61,667	0	61,667	61,667	0	370,000	370,000
Engineering and Administration	0	192,751	192,751	0	192,751	192,751	0	1,155,506	1,155,506
SUBTOTAL	0	2,123,126	2,123,126	0	2,123,126	2,123,126	6,648,449	12,997,212	19,645,661
Vehicles, Tools, and Equipment									
Construction Dept							138,500		138,500
Operations Dept.							346,300		346,300
Commercial Dept.							47,000		47,000
Implementing Unit							36,000		36,000
SUBTOTAL	0	0	0	0	0	0	567,800	0	567,800
Evaluations, Studies and Audits	30,000	0	30,000	50,000	0	50,000	200,000	0	200,000
Technical Assistance/Training	15,000	0	15,000	15,000	0	15,000	240,000	0	240,000
Inflation	2,250	338,159	340,409	3,250	411,997	415,247	382,812	1,414,244	1,797,057
Contingencies	6,300	106,156	112,456	9,459	106,156	115,615	1,060,938	649,861	1,710,799
TOTAL	53,550	2,567,441	2,620,991	77,709	2,641,279	2,718,988	9,100,000	15,061,317	24,161,317

DETAILED BUDGET FOR PER III
PRODUCTIVE USES OF ELECTRICITY COMPONENTS
(US DOLLARS)

Line Item	YEAR 1 AID	YEAR 1 P V O	YEAR 1 Total	YEAR 2 AID	YEAR 2 P V O	YEAR 2 Total	YEAR 3 AID	YEAR 3 P V O	YEAR 3 Total	YEAR 4 AID	YEAR 4 P V O	YEAR 4 Total
Training/Technical Assistance	10,519	40,000	50,519	19,815	40,000	59,815	35,222	40,000	75,222	49,000	40,000	89,000
Credit												
Credit Fund	71,111	0	71,111	77,778	0	77,778	115,000	0	115,000	106,667	0	106,667
Management Costs	37,363	0	37,363	48,623	0	48,623	59,152	0	59,152	64,652	0	64,652
SUBTOTAL	108,474	0	108,474	126,401	0	126,401	174,152	0	174,152	171,319	0	171,319
Inflation	2,706	0	2,706	4,606	0	4,606	4,606	0	4,606	4,253	0	4,253
Contingencies	4,385	0	4,385	7,464	0	7,464	7,464	0	7,464	6,891	0	6,891
Total	126,084	40,000	166,084	159,286	40,000	199,286	221,444	40,000	261,444	231,463	40,000	271,463

Line Item	YEAR 5 AID	YEAR 5 P V O	YEAR 5 Total	YEAR 6 AID	YEAR 6 P V O	YEAR 6 Total	TOTAL AID	TOTAL P V O	TOTAL Total
Training/Technical Assistance	56,222	40,000	96,222				170,778	200,000	370,778
Credit									
Credit Fund	33,333	0	33,333				403,889	0	403,889
Management Costs	63,134	0	63,134				272,924	0	272,924
SUBTOTAL	96,467	0	96,467				676,813	0	676,813
Inflation	3,829	0	3,829				20,000	0	20,000
Contingencies	6,205	0	6,205				32,409	0	32,409
Total	162,723	40,000	202,723	0	0	0	900,000	200,000	1,100,000

SUMMARY PROJECT BUDGET - ($000/'s)

Description	USAID	GOG/INDE	PVO	TOTAL
1. Infrastructure				
Materials for lines, networks, internal wiring	6,131	3,884	--	10,015
Subtransmission and transformation materials and equipment	517	131	--	648
Labor	--	7,455	--	7,455
Vehicles, Tools and Equipment	568	--	--	568
Consulting Engineering Services	--	370	--	370
Engineering and Administration	--	1,157	--	1,157
Training and Technical Assistance	240	--	--	240
SUB-TOTAL	7,456	12,997	--	20,453
2. Productive Uses of Electricity Component				
Credit	404	--	--	404
Credit Management	273	--	--	273
Training and Technical Assistance	171	--	200	371
SUB-TOTAL	848	--	200	1,048
3. Evaluations, Studies and Audits	200	--	--	200
4. Inflation	403	1,414	--	1,817
5. Contingencies	1,093	650	--	1,743
TOTAL	10,000	15,061	200	25,261

(3356C)

SUMMARY COST ESTIMATE AND FINANCIAL PLAN--INFRASTRUCTURE COMPONENT
(US DOLLARS)

SOURCE	AID FX	AID LC	GofG/INDE FX	GofG/INDE LC	TOTAL FX	TOTAL LC
Construction Costs						
Primary Line	340,200			1,708,200	340,200	1,708,200
Distribution Network	2,290,800			8,637,600	2,290,800	8,637,600
Transformers	835,650			0	835,650	0
Services & Meters	1,625,000			325,000	1,625,000	325,000
Interior Wiring	1,040,000			541,450	1,040,000	541,450
Subtransmission/Transformation	516,799			258,456	516,799	258,456
Consulting Engineering	0			370,000	0	370,000
Engineering and Administration	0			1,156,506	0	1,156,506
SUBTOTAL	6,648,449			12,997,212	6,648,449	12,997,212
Vehicles, Tools, and Equipment						
Construction Dept.	138,500				138,500	0
Operations Dept.	346,300				346,300	0
Commercial Dept.	47,000				47,000	0
Implementing Unit	36,000				36,000	0
SUBTOTAL	567,800			0	567,800	0
Evaluations, Studies and Audits	110,000	90,000		0	110,000	90,000
Technical Assistance	160,000	80,000			160,000	80,000
Inflation	382,812			1,414,244	382,812	1,414,244
Contingencies	1,060,938			649,861	1,060,938	649,861
TOTAL	8,930,000	170,000		15,061,317	8,930,000	15,231,317

SUMMARY COST ESTIMATE AND FINANCIAL PLAN--PRODUCTIVE USES OF ELECTRICITY COMPONENT
(US DOLLARS)

SOURCE	AID FX	AID LC	PVO FX	PVO LC	TOTAL FX	TOTAL LC
Training/Technical Assistance		170,778	150,000	50,000	150,000	220,778
Credit						
Credit Fund		403,889			0	403,889
Management Costs		272,924			0	272,924
SUBTOTAL		676,813			0	676,813
Inflation		20,000			0	20,000
Contingencies		32,409			0	32,409
TOTAL		900,000	150,000	50,000	150,000	950,000

PROJECTION OF EXPENDITURES BY YEAR
INFRASTRUCTURE COMPONENT
(US Dollars)

YEAR	AID	GOG/INDE	Total
YEAR 1	3,697,259	2,381,582	6,078,841
YEAR 2	1,914,495	2,123,126	4,037,621
YEAR 3	1,884,495	2,123,126	4,007,621
YEAR 4	50,000	2,123,126	2,173,126
YEAR 5	45,000	2,123,126	2,168,126
YEAR 6	65,000	2,123,126	2,188,126
Inflation factor	382,812	1,414,244	1,797,057
Contingencies	1,060,938	649,861	1,710,799
TOTAL	9,100,000	15,061,317	24,161,317

PROJECTION OF EXPENDITURES BY FISCAL YEAR
PRODUCTIVE USES OF ELECTRICITY COMPONENT
(US Dollars)

FISCAL YEAR	AID	PVO	TOTAL
YEAR 1	118,993	40,000	158,993
YEAR 2	146,216	40,000	186,216
YEAR 3	209,374	40,000	249,374
YEAR 4	220,319	40,000	260,319
YEAR 5	152,689	40,000	192,689
YEAR 6	0	0	0
Inflation factor	20,000	0	20,000
Contingencies	32,409	0	32,409
TOTAL	900,000	200,000	1,100,000

COSTING OF PROJECT INPUTS/OUTPUTS
(US Dollars)

Project Inputs	Project Outputs			
	No. 1	No. 2	No.3	Total
AID Appropriated				
Construction Costs	6,648,449			6,648,449
Vehicles, Tools, and Equipment		567,800		567,800
Training/Technical Assistance			240,000	240,000
Credit			847,591	847,591
Evaluations, Studies, Audits	169,260	14,195	16,545	200,000
Inflation	340,885	29,100	32,827	402,812
Contingencies	947,662	80,897	64,788	1,093,347
SUBTOTAL	8,106,256	691,992	1,201,751	10,000,000
GOG/INDE				
Construction Costs	12,997,212			12,997,212
Vehicles, Tools, and Equipment				
Training/Technical Assistance			200,000	
Credit				
Evaluations, Studies, Audits				
Inflation	1,414,244			1,414,244
Contingencies	649,861			649,861
SUBTOTAL	15,061,317			15,061,317
TOTAL	23,167,573	691,992	1,201,751	25,061,317

No. 1--Subtransmission/distribution system installed and operating to serve 65,000 rural customers.

No. 2--INDE's operations capability improved.

No. 3--Credits provided with training and technical assistance to promote productive uses.

C. Methods of Implementation and Financing

The AID funding for the Infrastructure Component will be used to finance construction materials and equipment, vehicles, tools, technical assistance, training, studies, evaluations and audits. For the Productive Uses Component, AID will provide funding for training, technical assistance, credit management costs and the credit fund.

All the procurement of AID-financed construction materials, equipment, vehicles and tools will be carried out as a direct AID procurement, in order to ensure the timely availability of the required commodities. During the PER II project, the Mission successfully carried out several large procurements, which resulted in substantial savings for the project. These AID direct procurements of imported commodities require the use of Direct Letters of Commitment since this is the method most widely accepted by foreign suppliers. The use of Bank Letters of Commitment will be avoided as much as possible given the lengthy and cumbersome process required for their issuance. The AID Project Officer will authorize payments for the procured commodities based on INDE's receiving reports, supplier's shipping documents and direct inspection of the delivered commodities.

Most of the training and technical assistance under the infrastructure component, as well as required studies audits and evaluations will also be contracted directly by AID.

The funds for the credit program, credit management costs, training and TA for productive uses will be managed through a Cooperative Agreement with a US PVO which in turn will sign a subagreement with an indigenous PVO. It is expected that the usual method of financing for the Productive Uses Component will be Direct Reimbursement to the selected PVO. Since the PVO has limited resources, it is expected that periodic advances will be required to finance the credit fund and the credit management. Both the US and the indigenous PVO which have been proposed for implementation of the Productive Uses Component have ongoing projects with USAID Guatemala so no major deviations are expected from the usual contracting, advance and reimbursement procedures.

The methods of implementation and financing and the approximate amounts which will be managed through each method are summarized in the chart below.

METHODS OF IMPLEMENTATION AND FINANCING

Method of Implementation	Method of Financing	Approximate Amount (U.S. $000)
Procurement of construction materials, equipment, tools and vehicles - Direct AID Procurement	Direct L/Com.	7,216
Training and technical assistance - Direct AID Procurement	Direct Pay	240
Credit Fund - US/Indigenous/PVO	Advance/Reimbursement to PVO	404
Credit Management US/Indigenous/PVO	Advance/Reimbursement to PVO	273
Training and TA for Productive Uses - US/Indigenous/PVO	Advance/Reimbursement to PVO	171
Evaluations, studies and audits - Direct AID Procurement	Direct Pay	200
Inflation and Contingencies		1496
Total Project		10,000

V. IMPLEMENTATION PLAN

A. Administrative Arrangements

1. A.I.D. Responsibilities

Within USAID, the Project will be managed by an Engineering Officer with extensive consulting experience in electrification, who also served as Project Manager for PER II in its final two years. Implementation support will be provided by an FSN project development officer.

The USAID Project Manager will have overall monitoring responsibility for the infrastructure component. The credit and technical assistance components of the Project will be managed by an FSN project development officer. USAID will have final approval authority for electrification site selection, which will be conducted according to the Demand Assessment Model, which is described in Section III.D.1.

Because of cumbersome and lengthy GOG procurement procedures, USAID will continue to provide direct procurement services for all imported materials and equipment. This task has been adequately managed in PER II, and the workload involved in the proposed Project will be similar.

USAID will also contract the necessary audits, studies and evaluations for the Project.

2. GOG/INDE Responsibilities

The INDE Rural Electric Implementing Unit will be responsible for community selection, promotion, customer service applications, and design. The INDE Planning and Design Division will be responsible for determining the adequacy of the power grid in the target areas, and assuring compatibility with overall system expansion planning.

The INDE Construction Department will construct lines, networks and substation improvements and will supervise and inspect all work to assure compliance with construction standards.

INDE will procure the services of a consulting engineering firm, under a host country contract, which will review all designs for conformance to standards and recommend changes as necessary. The consulting engineering firm will also monitor progress of the Project and verify all construction as to quantities completed and the quality of workmanship.

Finally, INDE's Operations and Commercial Divisions will be responsible for the ongoing operation and maintenance of the system, and for the billing, collection and maintenance of records related to consumers, energy and revenues. The Consumer Services Department of the Commercial Division will eventually become responsible for incorporating the productive uses promotion activities as part of normal INDE operations.

3. PVO Responsibilities

A Cooperative Agreement for the productive uses component of this Project will be signed between A.I.D. and Acción/AITEC, a U.S.-based PVO. Acción/AITEC will sign a sub-agreement for field implementation of the productive uses component with FUNDAP, a local PVO with extensive experience in the Project's main target area in the Western Highlands.

The competitive process for the execution of a Cooperative Agreement with ACCION/AITEC will be waived based on "exclusive or predominant capability, based on experience, specialized facilities or technical competence (Handbook 13, Chapter 2, Section 3B)". The predominant capability of ACCION/AITEC-FUNDAP has been established through studies and a detailed analysis described in Annex L. The possibility of executing a Cooperative Agreement with ACCION/AITEC waiving competition has already been consulted with the Regional Legal Advisor. A Cooperative Agreement will be used in this case in view of the closer monitoring that the Mission wants for this pilot component.

Acción/AITEC will transfer funds to FUNDAP and will supervise the field execution of the community training, loan granting and technical assistance programs. Acción/AITEC will provide FUNDAP with necessary technical assistance so that it may carry out these programs efficiently, including assistance in areas such as:

- Budgeting, accounting and internal control
- Identification of potential credit recipients
- Generation of strategies and action plans
- Promotion of services
- Collections on outstanding loans
- Technology transfer
- On-going education for employees

Acción/AITEC will submit quarterly reports to USAID detailing the activities conducted with and by FUNDAP, including detailed accounting, budget execution, and Project progress reports.

FUNDAP will execute the community training and credit and technical assistance programs, directly or through sub-contracting arrangements. FUNDAP will be limited in its use of Project funds for purposes specified in the USAID-Acción/AITEC Cooperative Agreement. FUNDAP will receive periodic disbursements from Acción/AITEC and provide quarterly reports describing component implementation, including the following information:

- Summary financial statements
- Budgetary execution
- Loan portfolio status reports
- Planned vs Actual activities (communities visited, loans approved and disbursed, technical assistance visits, etc.)

FUNDAP will contract the services of an outside auditing firm to conduct yearly internal auditing.

B. Monitoring Plan

Monthly progress reports will be produced by INDE's Implementing Unit and by the consulting engineering firm. The USAID Project Manager will receive and review these reports, and supplement this information with periodic field visits to the Project areas and constant communication with the Implementing Unit offices in Guatemala City. The Project Manager will report Project progress to Mission management through bi-weekly Project implementation reviews and semi-annual reports and reviews.

AITEC/FUNDAP will also produce detailed quarterly financial and progress reports. The internal Mission review process and general monitoring procedures will be the same as outlined above.

C. Procurement

1. Commodities

The timely availability of materials and equipment was a major obstacle in the early stages of PER II Project implementation. INDE's procurement procedure of some 13 separate steps required as long as 18 months to buy and receive materials. Consequently, to move the Project forward, a procedure for direct USAID procurement was instituted and the time span for receiving materials and equipment was reduced to 6-8 months. This procurement procedure likewise significantly reduced procurement costs and assured better control over

shipment and delivery to designated warehouses and storage yards.

It is vitally important that the momentum of PER II be maintained, and that the procedures contributing to the successful achievement of PER II goals be continued. The USAID direct procurement program should therefore be continued under PER III, to ensure continuity in the implementation process.

It is recognized that this solution does not provide a long-term answer to INDE's procurement problems. Earlier evaluations and audits have taken note of the complicated and lengthy process within INDE for purchasing materials and equipment. Training in administrative and management practices is included in the CARES program, and will address materials management, procurement, warehousing and inventory control procedures. It is recommended that the appropriate INDE personnel be designated to participate in such training.

2. Technical Assistance

The Engineering (Annex K) and Institutional (Annex J) Analyses indicate that most of INDE's technical assistance and training needs can be met by the CARES program. Three specific needs were identified which require technical assistance beyond the scope of the CARES program, and have been budgeted for in the PER III Project. These three areas of assistance are:

a. Publications

Three volumes of reference manuals will be published and distributed so that all construction crews, all design technicians and all operations supervisors will possess a reference manual relevant to their functions. The $38,000 program will be implemented in the first year of the Project.

b. Safety and Job Training

A basic safety program, including a safety procedures manual, will be developed and integrated into INDE's construction and operations departments. This program will cost $22,000 and be implemented in the first year of the Project.

c. Adaptation of the CARES DAM to Guatemala

CARES will provide assistance in the procurement of qualified consultants for the adaptation of the

general Demand Assessment Model to Guatemala. Funds have also been reserved for the contracting of a productive uses specialist to work in the PER III Implementing Unit. This specialist will collaborate in the adaptation of the DAM to Guatemala, and will act as liaison between INDE and FUNDAP to promote the institutionalization of the productive uses component of this Project within INDE. The adaptation of the DAM and the contracting of the productive uses specialist must be conducted during the first months of Project implementation.

E. Implementation Schedule

It is anticipated that the necessary approvals and the fulfillment of contractual agreements will be completed by May, 1989.

The implementation schedule will be:

- Formalization of USAID-GOG-INDE Agreement	August 89
- Formalization of USAID/AITEC Agreement	August 89
- USAID approval of AITEC/FUNDAP Agreement, including legal aspects of credit management	August 89
- Formalization of AITEC/FUNDAP Agreement	September 89
- Fulfillment of CP's by INDE	October 89
- Completion of co-financing study by INDE	November 89
- Initial disbursement to AITEC	November 89
- Purchase orders executed for 40% of commodities and all vehicles, tools and equipment	November 89
- Community selection commences	November 89
- Productive uses start-up processes and program initiation	December 89

- Procurement of technical assistance for Publications and Safety Program	Dec.89/Jan.90
- First shipment of commodities (40%) and all vehicles, tools and equipment	May 90
- Construction commences	June 90
- Purchase orders executed for additional 30% of commodities	October 90
- Second shipment of commodities	May 91
- First Project audit	October 91
- Midterm evaluation	May 92
- Purchase orders executed for final 30% of commodities	June 92
- Final shipment of commodities	October 92
- Second Project audit	August 93
- Construction completed	April 95
- Final Project audit and evaluation	May/Aug. 95
- PACD	August 95

VI. SUMMARY OF PROJECT ANALYSES

A. Technical Analysis

1. Engineering

The long-range national plan for the power sector includes a commitment by the Government of Guatemala to electrify rural communities. INDE proposes to add some 40,000 new electric consumers nationwide each year over the next ten years, contributing to the expected 6.5% annual growth in electric power and energy. Included in this growth projection are the 65,000 rural consumers to be added under PER III. The GOG recognizes that a healthy, productive rural economy will contribute to the overall wellbeing of the country. Although rural electrification alone cannot assure that this goal will be met, reliable, affordable electric energy is considered to be a necessary prerequisite.

INDE has bulk power supply capability exceeding the present 375 MW demand and is planning, with donor assistance, periodic additions of generation and high voltage grid components to stay ahead of increasing power and energy needs.

Even though the basic high voltage grid is in place, PER III will require subtransmission and transformation additions ($516,799 in offshore procurement) in the Western Highlands where new consumers and productive uses are to be concentrated under the Project. The remainder of the offshore procurement budget will be used to construct 300 km of primary lines and 1,200 km of network lines, install 1,857 transformers, connect 65,000 service loops and meters, and install interior wiring in 65,000 houses.

The design of the PER III distribution facilities will be in compliance with recently revised construction standards for rural electrification. The unique characteristics of rural systems, utilizing single phase configurations, will provide adequate capacity and reliability at minimum cost.

Implementation of the Project will be accomplished by existing institutions engaged in PER II:

- Promotion and design by the INDE rural electric Implementing Unit.

- Coordination and integration of the designed systems into the grid by INDE Planning and Design Division.

- Procurement of commodities (except poles) by USAID.

- Construction and installation of lines, equipment and subtransmission and transformation by the INDE Construction Department.

- Engineering oversight, inspection and monitoring by a private consulting firm.

- Interior wiring and meter installation by the INDE rural electric Implementing Unit.

- Connection, energization and continuing responsibility for operations and maintenance by the INDE Operations Department.

- Meter reading, billing, collecting and consumer accounting by the Commercial Division.

Coordinated efforts by participating INDE units are achieving successful completion of PER II and these same implementation arrangements will effectively accomplish the PER III program.

Technical assistance and additional vehicles, tools and equipment will be provided to further improve system design and increase construction productivity and maintenance capability. These continuing efforts will result in more reliable and better constructed distribution systems at a lower investment per consumer.

In view of the productive uses focus of PER III, there will be a concerted effort to improve ongoing operations and preventive maintenance programs. Assuring the uninterrupted flow of electricity and providing customer-oriented services are essential to productive users.

2. Productive Uses

The productive uses component of the PER III Project includes the transfer of technology and the provision of credit. The latter eliminates INDE as a potential implementing unit, since its by-laws forbid the institution from lending money. A 1987 study performed for USAID by

Molina, Woolford and Associates attempted to identify the potential institutions to carry out this component. The overwhelming conclusion was that what seemed to be the obvious choice due to its existing rural infrastructure, BANDESA, is too inefficient in moving its credit lines and in collecting on its outstanding loans. Molina, Woolford and Associates recommended that a PVO implement this component, but its choice was an institution with no previous credit or training experience.

USAID contacted two PVO's with credit and training experience in the geographical area of interest, the Western Highlands of Guatemala, and the subsequent analysis of these two institutions, Acción/AITEC and the Fundación para el Desarrollo Integral de Programas Socio-económicos (FUNDAP), indicated that they are both willing and able to carry out this component. AITEC will manage project under this component and supervise FUNDAP's operations; the Fundación will execute community training and the provision of credit and technical assistance.

The productive uses component will start in July, 1989, with project funding of $900,000 through 1993. The annual disbursement of funds will range from $126,084 in 1989 to $182,723 in 1993. These funds will benefit between 90 and 100 communities in general training, and over 2,000 individuals and cooperative organizations in credit and technical assistance over a four-five year period.

Interest rates charged on the credit component must be attractive to the target population, but must also exceed inflation to avoid decapitalizing the lender. In Guatemala, there are very few credit alternatives for the rural poor. The USAID-funded urban micro-enterprise project currently being implemented by FUNDAP charges 2.5% per month, which, although low in comparison to rates charged by individual lenders in the region, is deemed high for the purpose of this Project. Bank market rates (16 to 17%), on the other hand, are considered low due to the risk of default inherent in this type of activity and the need for "bundling" technical assistance with credit. Therefore, the effective rate to be charged for credit has been preliminarily set at 20% per year.

The funds recovered on loan payments will be reinvested for the same purpose; on the basis of projected collections and interest, it is expected that the credit sub-component will not require additional USAID assistance after 1993.

B. Institutional Analysis

INDE's Rural Electrification Unit (currently known as the PER II Implementing Unit) is situated in the Construction Department and has responsibility for selecting communities to be electrified; promoting the Project by obtaining signed applications for service; designing the required physical facilities for implementation by the construction department; wiring the premises and installing the meter after construction is completed.

The Unit has developed a methodology which is working well and will be able to achieve the targets of PER III, i.e., 13,000 connections per year over the last five years of the Project. The methodology is outlined below:

- A community electrification committee submits an application for service.
- Social workers visit the community to determine the demographics, e.g., community infrastructure, potential connections, distance from existing facilities, etc.
- The information is analyzed by a computer program which determines the community ranking.
- If the community qualifies, the unit coordinates with the Planning Department to determine whether sufficient system capacity is available to serve the community.
- Promotors then visit the community to explain the program in detail and obtain applications for service.
- When sufficient applications are obtained, the information is furnished to the design section to design the electrical facilities.
- After the design is completed, it must be approved by INDE's Design Department and the Consulting Engineering firm.
- The design is then forwarded to the Construction Department for construction. Construction material comes from Unit's five regional warehouses.

- During construction, the work in progress is regularly checked by the Consulting Engineer who submits periodic reports to the Unit and AID.

- Upon completion of construction, the Unit's Construction section (installers) install the inside wiring and the meters.

The completed facilities are then turned over to the Operations Division for energization, operations and maintenance. At present, the R.E. Unit has no further responsibility for the connected customers.

PER II has focused on connecting 90,000 new consumers. PER III will add another 65,000 consumers for a total of 155,000, more than doubling the number of retail consumers INDE served prior to PER II. The additional facilities to be operated and maintained, and the meter reading, billing and collecting for 155,000 more consumers, represent a significant increase in work load.

INDE has demonstrated the ability to make connections at very acceptable rates; emphasis, however, has been on construction, with inadequate attention to management, operations and maintenance problems of the distribution system.

The operation of INDE's generation and transmission system is satisfactory, but the distribution management, operations and maintenance of the system is not sufficiently reliable and must be improved, especially in light of PER III's emphasis on productive uses. The success of the productive uses program will be influenced strongly by the reliability of electric service and by the kind of customer services provided by the Commercial Management Division of INDE.

Adequate voltage levels and dependable 24-hour service are essential if people are to be persuaded to invest in equipment, and, in effect, become dependent upon electric energy. After the lines are built and the connections are made, there must be an ongoing commitment by INDE to providing good electric service and responsive customer services.

Additionally, a better method must be established to facilitate the connection of additional customers after initial connections in a community have been made. This process at present is excessively burdensome and discouraging to prospective consumers. INDE's local offices should have the authority, as well as the materials, equipment and personnel to deal more directly with people requesting service. A simpler process would save time for INDE personnel as well as the customer.

Mission policy dialogue should be used to stress the need for acceptance by INDE management of the following objectives to achieve efficient and reliable electric utility operations:

- The need for, and the commitment to, good quality electric service.

- Decentralization of rural electric system management for more effective coordination.

- Establishment of accepted standards of performance for maintenance, operations and customer services.

- Provision of orientation and training related to rural electric distribution system management.

- Provision of the necessary tools and equipment for implementing the program.

As a first step to accomplishing these improvements, INDE should divide the Operations Division into two Departments: Transmission and Substations, and Distribution. The Distribution Department would be responsible for operations and maintenance from the substations up to and including the consumer's meter. Vehicles and equipment are inadequate for operating and maintenance of the distribution system. Consequently, at least $300,000 of the $567,800 programmed for construction equipment will be utilized for distribution operations.

Another required step in the institutionalization of productive uses is the expansion of the Implementing Unit's Promotion Section and the training of Promotors to be Productive Uses Advisors. The Productive Uses Advisors may be transferred to the Consumer Services Department in the Commercial Division when that Department becomes operational.

Field services need to be improved by activating the already-approved Consumer Services Department to handle the increased needs of consumers. Meter reading, billing and collecting services should also be improved, and the procedures for obtaining new connections after the original facilities are energized should be simplified.

INDE should also ensure maximum participation in the Participant Training Programs offered by CARES as well as in training opportunities offered by this Project.

The above institutional improvements do not necessitate additional personnel; rather, present personnel can be reassigned and retained for new duties and responsibilities to improve the organizational effectiveness and efficiency of INDE. Also, the improvements are not essential for the construction of facilities under PER III, they are necessary to ensure the on-going success of the productive uses component of the Project.

Finally, INDE should move to comply with the covenant to decentralize distribution contained in the World Bank loan agreement. An example of one methodology to accomplish this is described in detail in Annex J. The PER III Project will contribute to promote decentralization providing $100,000 to finance equipment and technical assistance to strengthen and operate a pilot decentralized INDE Regional Office.

It is important to note that well-managed and operated rural electrification distribution systems invariably attract other donors. Such follow-on or add-on funding for rural electrification programs from other donors has occurred in Bangladesh, India, Indonesia, Pakistan and the Philippines.

C. Social Analysis

This Project will primarily be carried out in the Western Highlands of Guatemala, and the principle beneficiaries will be the Mayan population. An advantage of this focus is the strong attachment of Mayan groups to their traditional towns. Members of these groups tend to look for income-producing activities other than farming that will allow them to remain at home or at least maintain their traditional homes as a base of operations. This has important implications for any productive uses program in rural electrification, since the target population will realize that such programs will allow them to improve their productive economic position without the need for migration.

Native handicraft ability presents an opportunity for artisans to diversify production in response to new market demands. Handicrafts competitive on the market today are not limited to the traditional blouses and other clothing items, but rather items with design, materials, dying, and other input from individuals with access to the demands of today's international market. This market orientation may mean adapting to new machinery and techniques, including those using electricity. The principal target groups of this Project are not averse to modifying their traditional crafts and techniques.

The overall social impact of the Project will be positive, particularly because of the productive uses component, due to three key elements:

- The Project will be carried out in areas where the population seeks economically viable, income-enhancing activities in their traditional homelands.

- The Project will provide information on the types of activities which the beneficiary population can either begin or upgrade to improve their economic position.

- The Project will provide the essential credit to permit the acquisition of the electric machinery needed for productive use of electricity.

The number of individuals who will benefit directly from the education aspect of the productive uses component is initially over 6,300 --100 persons in each of 63 communities--and by the end of the Project this number will reach 10,000. These individuals will learn about productive uses, the types of electric machinery available, the economic advantages of electricity, and the credit and training packages offered as part of this component.

The number of direct beneficiaries of the credit and training component is calculated at 1,260 owner-operators of small industries, or 20 beneficiaries in each of 63 communities. In addition, an average of 1.5 groups per community will be included among the beneficiaries. Estimating the number of members in these groups at an average of 20, the total number of group beneficiaries will be 1,890. Together, the individual and group direct beneficiaries total 3,150 persons.

With respect to electrification beneficiaries, electrical connections will be provided to 65,000 rural homes in 400 communities, so that some 325,000 rural inhabitants will be directly benefitted by the introduction of electricity.

Indirect benefits of this Project will also result because increased income in an electrified community means increased purchasing power in market towns where the direct beneficiaries buy products. In other cases, the market town functions as a center for piecework, such as in the case of San Antonio Sija, where much of the population sews together clothes farmed out to them by an entrepreneur in San Francisco El Alto. The Project should thus also increase the incomes of market town entrepreneurs who work with the people in such communities.

The importance of women in supplementing the rural domestic household economy is well-known, as the widespread textile and sewing skills of rural women in Guatemala demonstrate. An important source of income for women in the Highlands comes from craft production, especially textiles. The productive uses component must exploit these skills for the benefit of the target groups. The productive uses component of PER III has built-in flexibility to direct resources to rural women to enhance their productivity and economic benefit.

Although microenterprise surveys have indicated that women prodominate in urban commercial microenterprises, this conclusion might not be applicable to the PER III Productive Uses Component target group. The Productive Uses Component will include gender data among the information to be collected for the selection of credit recipients. If the data show a lack of women participation in the credit and training program, specific actions will be taken to increase women participation.

The Project, as designed, is oriented toward extensive community participation. Communities will participate in the educational campaign on the productive uses of electricity. Following the educational sessions, beneficiary participation depends on the desire of individuals and groups to participate in the credit and technical training aspect of the component. Of particular importance is the fact that the beneficiaries are not limited to the productive uses defined by the implementing agencies, but are free to suggest other uses that occur to them.

D. Financial Analysis

Financial analysis of the PER III project was conducted for two purposes:

- To determine the financial feasibility of the rural electrification program

- To determine the financial position of the executing agency --the National Electrification Institute (INDE)-- in order to evaluate its ability to maintain and support Project investments and to continue rural electrification programs after the current program ends.

1. Project Analysis

The Project analysis consists primarily of internal rate of return calculations that evaluate the

financial costs and benefits of the program from INDE's viewpoint.

Since the price of electricity to the consumer is a key variable, three different electrical tariff scenarios were considered for the analysis: (a) No change in tariffs for the next 30 years, (b) 20% tariff increase in the third year of the project with no further increases, (c) A 40% tariff increase in the third year of the project with no further increases. The final analysis was developed for the third scenario. The assumption of a 40% tariff increase in the third year of the project (approximately mid- 1992) was carefully analyzed and discussed at length with senior INDE officials. Although it still is a conservative assumption, it is considered politically feasible and consistent with other donors' recommendations.

Likewise, three different community contribution schemes were considered for the analysis: (a) Ten percent initial payment and twenty percent payment over five years, (b) Ten percent initial payment and forty percent payment over five years, (c) Ten percent initial payment and ninety percent payment over five years. It is considered that the maximum average contribution that beneficiary communities will be able to provide is 30% and therefore, the final analysis is based on cofinancing scheme (a) above.

INDE operates a mixed thermal-hydroelectric generating system. In order to reduce fuel costs, as much demand as possible is met with hydroelectric generation. The marginal cost of electrical energy delivered to rural consumers was determined through a study conducted by NRECA under the CARES project. The study determined that no thermal-based generation is needed to supply electricity to new rural consumers during 7 months of the year (June-December) or 58.3% of the time. Using this assumption to calculate generation costs, adding costs of generation, transmission and substation capacity and 16.4 percent of transmission losses, the study arrived to 0.0989 Q/kWh as the total cost of marginal energy for rural consumers. Monthly billing costs are estimated at Q1.00.

At these costs, the revenue received from virtually any rural consumer will be larger than the cost of providing service. Therefore, the revenues obtained from additional sales derived from project-financed connections will exceed the costs of generating and transmitting electricity. As a result, additional sales will provide a financial contribution towards recovering the costs of program investments. However, at current tariff levels, and assuming a 40% tariff increase in

the third year of the project, this financial contribution will not be sufficient to totally offset the cost of the initial investment for the connections with the assumptions used for the analysis. Based on these assumptions, a 40% tariff increase in the third year of the project, a 30% community contribution and a 30 year period, the net present value of 65,000 additional consumers is approximately - Q26.3 million or approximately -$9.7 million. The derivation of this result is shown in detail in Annex H-5.

This result implies that implementation of the project's infrastructure component will require a financial subsidy of approximately $9,736,000. Considering that AID will provide $9,000,000 in grant funds to finance the infrastructure component, the financial subsidy to be provided by the GOG to INDE is only $736,000. During project negotiations, it was agreed that the GOG will provide the necessary subsidy to INDE to finance the infrastructure investment. The GOG counterpart contribution will be clearly defined in the grant agreement to be signed between AID, the GOG and INDE. The required financial subsidy must be evaluated against the substantial economic benefits described in Annex I and the non-quantifiable social and political benefits of the project.

The productive uses component has more favorable financial results. The proposed interest rate (20% annual effective) is sufficient to provide a positive return, yet it is lower than alternative sources of loans for the borrowers.

2. Financial Condition of INDE

INDE's financial projections are based on the current tariff structure and they indicate an unfavorable financial position unless INDE increases its revenue generation in the following years.

According to INDE's Projected Income Statement (1986-1997) (Annex H-8), for all years, INDE's operating revenues exceed its operating expenses yielding a positive net income before the debt service. However, this operational profit is not sufficient to cover the debt service and the expansion investments, and therefore, a financial deficit is projected for all the period.

Financial projections for INDE illustrate the need to increase revenues in the upcoming years. In addition INDE will need substantial borrowing to support its countrywide generation and transmission construction program. The projections reveal an annual shortage of funds of at least Q150 million during the next six years.

Year	Cash Deficit (Q millions)
1989	153.0
1990	221.7
1991	202.3
1992	242.8
1993	368.0
1994	476.8

During 1993 and 1994, the projected deficit exceeds total operating revenues. Given the foregoing, INDE must increase its revenue generation during the next six years or it will be forced to delay its planned system-wide construction program.

According to senior INDE official consulted during the Project Paper preparation, INDE plans to address its financial problems in two stages: In the short term (next three years), even with a possible tariff increase, INDE will need subsidies from the Central Government to operate and to initiate necessary investments in additional generation. A commission including representatives from INDE, MINFIN, SEGEPLAN and the Central Bank has already been formed to negotiate this financial assistance in the short term. The commission is working on a plan (Plan de Saneamiento Financiero del INDE), which will be formalized through an agreement to provide financial assistance to INDE, and which will include measures to improve the institution's financial, management and labor problems. For the medium term, a substantial tariff increase will be necessary to finance the needed investments in generation and transmission. The political feasibility of these increases will be much higher after the 1990 presidential elections.

E. Economic Analysis

The economic analysis of the Project focuses on whether or not the Project improves the general welfare of Guatemala. Economic benefits depend on the value of electricity to users, rather than on the price they are required to pay for it. Economic costs reflect the underlying value of resources required to provide the service, excluding taxes, subsidies and other transfers. This conservative approach to costs does not take into account that INDE's labor costs, attributed to this Project, are essentially fixed institutional costs which will be incurred whether Project activities are undertaken or not.

Under the assumptions used for the economic analysis, the Project will provide net economic benefits to the country. The substantial reduction in the energy costs that rural households will experience is more than enough to offset the costs of connection. The net present value of electrification to residential households ranges from +Q680 to +Q1,668 per connection, depending on required distribution investments.

These estimates are based on the monthly reductions in fuel expenditures[1] plus the increase in consumer surplus associated with the ability to purchase additional energy at lower cost, less the economic costs of generation, transmission and customer accounting.

The economic cost of connections is estimated to be about five percent less than the financial cost; the difference represents the lower economic costs of unskilled labor, relative to the minimum wage. The economic cost of a new connection to an existing distribution system is estimated to be about Q177. Connections in newly electrified areas and connections requiring extensions of existing distribution networks have estimated economic costs of Q1,185 and Q951, respectively. At these costs, all types of residential connections contemplated by this Project will yield positive economic benefits.

The total economic benefit of the Project thus depends on the mix of the types of connections that are made. Under the present plan of 25,000 connections in newly electrified areas, 15,000 connections requiring extension of distribution networks and 25,000 connections to existing facilities, the construction program has a net economic benefit of +Q75.5 million.

The above calculations do not include the estimated Q518,460 benefits derived from increased consumption due to the productive uses credit and training component, to be implemented in communities previously electrified under PER II. See Annex L, Exhibit 8 for further details.

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[1] A 1988 study conducted by INDE estimates average monthly expenditures in non-electrified households to be Q10.14 for illumination and Q4,29 for small appliance operation.

F. Environmental Analysis

An Initial Environmental Examination (IEE) of this Project has been carried out. The results of the IEE indicate that the environmental impact of the Project is minimal, and therefore it recommended a Negative Determination, requiring no additional environmental analysis.

The Negative Determination was approved by the LAC Bureau Chief Environmental Officer on April 1, 1988 (IEE No. 88-12). A copy of the Negative Determination is contained in Annex F.

VII. CONDITIONS AND COVENANTS

A. Conditions

The importance of using sound technical criteria in the community selection process has been discussed in other sections of this document. In order to assure appropriate community selection procedures, sufficient support in INDE for the institutionalization of a productive uses program and timely implementation of the Project, the following will be requested from the GOG-INDE as Conditions Precedent to the first disbursement under the Grant:

(a) An opinion of the Ministerio Publico or other counsel acceptable to AID that the Project Agreement has been duly authorized and/or ratified by, and executed on behalf of, the Grantee, and that it constitutes a legally binding obligation of the Grantee in accordance with all of its terms;

(b) A statement of the name of the person holding or acting in the office of the Grantee and of any additional representatives, together with a specimen signature of each person specified in such statement;

(c) A detailed time-phased Project Implementation Plan showing project activities beginning 120 days from the signing of the Project through the end of calendar year 1995. This plan shall include a detailed procurement plan for materials, equipment and services.

(d) An executed agreement between the Ministry of Finance and INDE which stipulates:

i. The amount of local currency funds to be provided by INDE and the GOG, respectively, as Grantee Resources for the Project.

ii. That all counterpart funds provided by the GOG for the Project will be on a non-reimbursable basis.

iii. The source of funding to pay all directly identifiable taxes resulting from Project-related procurements or other activities. Funds used by INDE or the GOG to pay these taxes shall not be considered as Grantee Resources for the Project.

(e) A statement of INDE's agreement to use a selection system acceptable to AID as a basis for the selection of rural communities to be included in the project. In addition, the specific selection procedure based on the mutually accepted system and all lists of communities to be included in the project will be approved in writing by AID.

(f) Evidence that INDE has designated a Project Manager acceptable to AID.

(g) Evidence that INDE has created a permanent position of Productive Uses Specialist within the Rural Electrification Department to work as counterpart to the Grant-financed Productive Uses Specialist.

(h) A time-phased plan describing the steps INDE will take to improve its financial situation and institutional efficiency.

In addition, the following will be requested from the GOG/INDE as a Condition Precedent to subsequent incremental funding for the Project after the initial obligation:

- Unless AID otherwise agrees in writing, prior to the date of execution by AID of an amendment of the Project Agreement adding incremental funds, the Grantee shall furnish in form and substance satisfactory to AID evidence that progress has been achieved towards reaching the goals of the plan described in Section A(h) above.

B. Covenants

The Government of Guatemala and INDE will covenant in the Grant Agreement to:

(a) Furnish to A.I.D. the results of a study, to be conducted during the first three months of Project implementation, to determine the percentage of installation costs to be required in community contributions, the means to collect this contribution and management of the funds.

(b) Submit for A.I.D. approval, by November 30 of each year of Project life, an annual construction schedule covering activities for the next calendar year.

(c) Carry out all the necessary steps to assure the completion of the Quezaltepeque substation construction and the El Progreso substation expansion, partially financed under the Rural Electrification Project II, not later than June 30, 1990. The completion of these substations will be financed by INDE and will not use funds provided under this Project.

VIII. EVALUATION ARRANGEMENTS

The fact that the PER III Project has two independent components means that the collection of baseline data and the plan for later evaluation must be carried out separately. The following sections detail the two parts of the baseline and evaluation plans.

A. Infrastructure Component

PER III electrification is to be carried out in communities which demonstrate potential for productive uses as demonstrated through the application of the Demand Assessment Model. This Model will select and rank communities first on the basis of cost-benefit (the NPV). This ranking will be subject to adjustment on the basis of the socioeconomic questionnaire. As a result, the final ranking of communities should represent the best possible determination of the potential of each community for productive uses.

The baseline survey will be carried out in a sample of these communities. The sampling process should include 10% of the communities selected randomly to be statistically valid. Thus, the baseline will be carried out in 30 of the approximately 300 communities selected for electrification through the Demand Assessment Model. Within each community a similar sample percentage should be taken. Assuming an average of 100 users per electrified community, the baseline will include 300 individuals.

The baseline should focus on family income from all sources and including all persons resident in the homes to be electrified, as well as a detailed study of household expenses. The final evaluation will be based on the same data collection instrument but will include questions on productive use of electricity following electrification.

The cost of this baseline study should be around $28,000. It is difficult to calculate the cost of repeating

the study at EOP, but funds for the evaluation should be sufficient for replication of the baseline as well as for analysis.

B. Productive Uses of Electricity Component

The productive uses program will not use the same sort of baseline as the electrification component. For this component it will be necessary to develop a simpler baseline instrument to survey present use of electricity for productive purposes (i.e. for other than purely domestic uses). It should be possible to survey each of the 63 communities in the three departments to determine what machinery is presently in use. Data collection will be the responsibility of the implementing agencies, although the survey itself will probably be supervised by an specialized outside person or agency.

The instrument will be complemented by the information gathered in the socioeconomic questionnaire that forms part of the Demand Assessment Model. This questionnaire should be applied to each of the communities at the end of the Project to detect changes in the socioeconomic situation, some of which will have been brought on by participation in the productive use component. In addition, the actual amount of electric machinery in use in these communities must be tallied to compare with the situation at the beginning of the project.

If possible, the evaluation will include data on actual electricity consumption gathered by INDE, and this information will be compared with other communities, perhaps from other but similar areas of the country, which have electricity but which were not included in the productive use component.

The EOP evaluation will require the presence of a field team of three in each community for one day. If the evaluation were carried out today, it would cost around $25,000, excluding a comparative study of actual consumption in participating and non-participating communities. The Project budget includes $28,000 for a baseline study, $25,000 for a mid-term evaluation and $30,000 for a final evaluation.

ACTION MEMORANDUM FOR THE DIRECTOR

THROUGH: DD, Paul E. White

FROM: C/PDSO, Christina H. Schoux

DATE: February 9, 1988

SUBJECT: Rural Electrification III 520-0353 -- Results of PID Review and Request for PID Approval

PROBLEM:

The subject PID was reviewed by the Mission Executive Review Committee on Friday, January 29, 1988. The Project Design Committee was commended for a well-written PID and effective project defense.

The PID for the project was approved at the Executive Committee review, and following minor revisions, is hereby submitted for your approval.

DISCUSSION:

During the meeting the following guidance points were agreed upon.

1. Project Design Objectives: The PID states that electrification, together with credit and training, will complement and maximize the productive potential of existing infrastructure and resources.

   -- It was agreed that as the PID states, PER III is designed to enhance productivity, income and employment in rural areas and to assist in the effort to redress the long-standing imbalance in resource allocations between urban and rural Guatemala. While PER III can be expected to contribute to increasing the value of agricultural production (primarily in value-added), the PID should clearly indicate that the project will support the Action Plan objective of strengthening the private sector.

-- Given the long lag times for measurable economic impacts to develop, care should be taken in revising the PID (both text and Logical Framework indicators) to not overstate the impact that it is feasible to expect the project to produce during the LOP or immediate Action Plan periods.

2. Sustainability and Replicability of Project Activities: The PID does not discuss the current capability of INDE to manage and finance recurrent maintenance and operational costs, nor INDE's ability to continue to expand coverage of electrification in rural areas beyond the PACD.

-- The PP should clearly recognize the subsidized nature of rural electrification and clearly state the policy and economic environment in which the project will be carried out. The PP should emphasize the pilot nature of combining the credit and productive uses promotion activities with electrification as so as to accelerate consumption and thereby improve the financial viability of rural electrification.

-- The impact of financial and institutional issues on project sustainability and replicability should be identified and discussed. As many of these issues transcend the PER III project - e.g., nonpayment of electric bills on the part of many GOG institutions - mention should be made of how the Mission and/or other donor efforts intend to address these areas of concern. The World Bank, for example, delayed its energy loan for five years pending a substantial increase in electrical rates. The policy climate in the energy sector should be fully discussed in the PP as it relates to PER III. It was recommended that consideration be given at the PP stage to inclusion of a covenant in the Project Agreement requiring the GOG to assess the financial viability of INDE and develop a plan to enable INDE to continue expanding rural electrification using its own resources.

-- The PP should discuss INDE's cost recovery record under PER II and what might be expected under PER III. The PP should also explore alternative co-financing schemes to increase the percentage of costs recovered from direct users and communities receiving electrical service.

3. Implementing Institutions for Electrification: The PID proposes that INDE be the provider of electrical service

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and undertake the construction by force account. The review brought out the fact that INDE is the only entity in Guatemala with legal authority to generate and distribute electrical power. While the CARES project will provide assistance to strengthen municipal electrical enterprises, INDE appears to have a bias against municipal systems. The PP should discuss the policy and legal issues with regard to INDE for both electrical generation and distribution in rural areas such as municipal systems, private companies, and cooperatives. Also, the PP should discuss NRECA's willingness to fund research with regard to INDE alternatives. Also, the PP should discuss the influence of regional projects, such as Los Alamos, in complementing PER III activities.

The PP should include discussion of the rationale for continuing force account construction by INDE, and both the PID and PP should note INDE's increasing contracting out to the private sector for large-scale electrical construction. The PID should clearly state that all PER III construction supervision will be done by private engineering firms.

4. INDE Institutional Development: The project does not include funding for technical assistance or training for INDE, relying instead on the ROCAP/CARES project to address institutional strengthening issues. The PP should, however, present a careful analysis of INDE's institutional capability vis a vis PER III and identify technical assistance and training requirements for the INDE implementation unit and related divisions. These needs should then be related to assistance to be provided by CARES and identify any gaps that may require additional USAID resources. The PID should be revised to reflect the foregoing.

5. PER II Targets: The PID should be revised to identify clearly the reasons for PER II exceeding its output targets by nearly 30 percent -- i.e., impact of devaluation and INDE decision to increase counterpart financing.

6. Project Components:

-- Electrical Construction and Installations

(a) Constraints to Expanding Electrification Services: The PID identifies distribution as the main constraint to provision of electrical energy in

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Guatemala. The constraints section and technical analysis in the PP should examine the validity of this assumption and its implications for project implementation and discuss the extent to which generation of electrical power is also a constraint.

(b) Service Types: The PID notes the potential importance of electricity for environmental sanitation and health. At the review, mention was made of the possibility that PER III might finance electrical connections for community services, such as schools, public wells, and other community services. The PP should discuss the types of community services that may be financed, and provide information on collection mechanisms for these types of services, including the possibility of building on the existing local electrification committees. Use of community contracts should also be examined at the PP stage as a means to provide for maintenance and cost recuperation. The experience of PER II in community collections should be discussed. It was suggested that the PP team might include an expert in management of community services to assist in identifying community services that may enhance local economic development.

While a case was made that electrical construction requires highly specialized labor, it was agreed that possibilities for increasing community labor in construction would be examined at the PP stage.

(c) Site Selection: While site selection criteria used in PER II (pre-conditions include availability of potable water, roads, and a school; existence of a certain level of economic activity, including, for example, a cooperative, handicrafts, cottage or other small enterprises, while not mandatory, is highly desirable and may be decisive in selecting among eligible communities) are considered satisfactory, the question was raised in the review meeting if PER III site selection could or should also be coordinated with agricultural diversification sites. The feasibility of more closely linking electrification sites with this and other Mission (or other donor) activities in rural areas should be analized during PP development.

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-- Credit and Training

(a) The PID should be revised to reflect that market rates of interest will be charged for all loans to new and existing businesses under the credit component.

(b) The PP should explore how experience gained elsewhere could be adapted to involve private sector vendors and sales representatives to promote awareness and training in productive uses of electricity for enterprises receiving electrification or credit under the project.

(c) The PP should indicate organizational arrangements within USAID to ensure appropriate coordination of PER III with the Mission's other microenterprise and skills training activities.

(d) Since women are expected to be major users of electricity for productive activities, some of which may require credit, the PP should identify what restrictions, if any, exist on credit to rural women and how the project will address the issue.

(e) Although the productive uses component of PER III is to be clearly identified as a pilot program, the PID indicates that by PACD, a productive uses focus is expected to be institutionalized in rural electrification programs. How this is to be done - through INDE or alternative means and how it is to be financed - should be discussed in the PP.

7. Project Budget

-- The PID should be revised to provide funds for project audits and, to separate out the inflation factor currently included in various budget line items.

-- The PP should provide detail on calculations for contingencies and inflation and relate these to the procurement schedule in order to demonstrate adequate reservation of funds for these items during LOP.

8. Procurement: The issues of USAID/G continuing to directly procure all foreign cost commodities and services under the project was identified as a generic issue that could not be addressed by the project.

RECOMMENDATION:

That you approve the PID for Rural Electrification III and authorize Mission staff to proceed with PP development by signing the PID Facesheet, attached.

Drafted:PDSO:JFLombardo/CHSchoux

Executive Review Committee Clearances:

PRM, RBurke
PDSO, CHSchoux
OEPA, SSkogstad
ORD, BWing
OHRD, LAyalde
OPSP, FManteiga
CONT, JHill
ADM, AWalsh

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ANNEX B

COUNTRY CHECKLIST

(Included in Fiscal Administration Project Paper No. 520-0371)

SC(2) - PROJECT CHECKLIST

Listed below are statutory criteria applicable to projects. This section is divided into two parts. Part A includes criteria applicable to all projects. Part B applies to projects funded from specific sources only: B(1) applies to all projects funded with Development Assistance; B(2) applies to projects funded with Development Assistance loans; and B(3) applies to projects funded from ESF.

CROSS REFERENCES:	IS COUNTRY CHECKLIST UP TO DATE?	Yes.
	HAS STANDARD ITEM CHECKLIST BEEN REVISED FOR THIS PROJECT?	Yes.

A. GENERAL CRITERIA FOR PROJECT

1.	FY 1989 Appropriations Act Sec. 523; FAA Sec. 634A. If money is sought to obligated for an activity not previously justified to Congress, or for an amount in excess of amount previously justified to Congress, has Congress been properly notified?	The project was initially justified to Congress in the 1988 Congressional Presentation. A Congressional Notification has been prepared to notify Congress of the specific amounts to be obligated in FY 1989 of the authorized Life of Project funding proposed in the Project Paper.
2.	FAA Sec. 611 (a)(1). Prior to an obligation in excess of $500,000, will there be (a) engineering, financial or other plans necessary to carry out the assistance, and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?	a. Yes. b. Yes.
3.	FAA Sec. 611 (a)(2). If legislative action is required within recipient country, what is the basis	Legislative action is not required within recipient country.

	tion that such action will be completed in time to permit orderly accomplishment of the purpose of the assistance?	
4.	FAA Sec. 611(b); FY 1989 Appropriations Act Sec. 501. If project is for water or water-related land resource construction, have benefits and costs been computed to the extent practicable in accordance with the principles, standards, and procedures established pursuant to the Water Resources Planning Act (42 U.S.C. 1962, et seq)? (See A.I.D. Handbook 3 for guidelines.)	Not applicable.
5.	FAA Sec. 611(e). If project is capital assistance (e.g., construction), and total U. S. assistance for it will exceed $1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability to maintain and utilize the project effectively?	Yes, see Annex C.
6.	FAA Sec. 209. Is project susceptible to execution as part of regional or multilateral project? If so, why is project not so executed? Information and conclusion whether assistance will encourage regional development programs.	No. Project is Guatemala specific and not susceptible to execution as a regional program. Project technical assistance activities will be partially supported by the regional Central American Rural Electrification Support (CARES) Project, funded by ROCAP. Methodologies and information about the project activities in Guatemala will be shared with other countries in the Central American Region.

7.	FAA Sec. 601(a). Information and conclusions on whether projects 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.	a. Yes, project will require substantial amounts of imported commodities from the U.S. b. Yes, project will use private firms for construction supervision and will provide electrical infrastructure, credit, training and TA to small private rural enterprises. c. Indirectly by providing electrical service to areas where these institutions operate. d. Yes, by making available electrical service, credit, training and TA to a large number of potential users. e. Yes, introduction of electricity will definitely improve technical efficiency of productive activities. f. Not applicable.
8.	FAA Sec. 601(b). Information and conclusions on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).	Project will use considerable amounts of U.S.-made electrical materials, equipment, vehicles, tools, safety equipment and instruments.
9.	FAA Secs. 612(b), 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 in lieu of dollars.	Guatemala will provide a contribution to the project in local currency equal to 167% of AID's input.

10. FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?	No.
11. FY 1989 Appropriations Act Sec. 521. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar or competing commodity?	Not applicable.
12. FY 1989 Appropriations Act Sec. 549. Will the assistance (except for programs in Caribbean Basin Initiative countries under U.S. Tariff Schedule "Section 807," which allows reduced tariffs on articles assembled abroad from U. S.-made components) be used directly to procure feasibility studies, prefeasibility studies, or project profiles of potential investment in, or to assist the establishment of facilities specifically designed for export to the United States or to third country markets in direct competition with U.S. exports, of textiles, apparel, footwear, handbags, flat goods	Not applicable.

(such as wallets or coin purses worn on the person), work gloves or leather wearing apparel?	
13. FAA Sec. 119(g)(4)-(6) & (10). Will the assistance (a) support training and education efforts which improve the capacity of recipient countries to prevent loss of biological diversity; (b) be provided under a long-term agreement in which the recipient country agrees to protect ecosystems or other wildlife habitats; (c) support efforts to identify and survey ecosystems in recipient countries worthy of protection; or (d) by any direct or indirect means significantly degrade national parks or similar protected areas or introduce exotic plants or animals into such areas?	No.
14. FAA 121(d). If a Sahel project, has a determination been made that the host government has an adequate system for accounting for and controlling receipt and expenditure of project funds (either dollars or local currency generated therefrom)?	Not applicable.
15. FY 1989 Appropriations Act. If assistance is to be made to a United States	Yes.

PVO (other than a cooperative development organization), does it obtain at least 20 percent of its total annual funding for international activities from sources other than the United States Government?	
16. FY 1989 Appropriations Act Sec. 538. If assistance is being made available to a PVO, has that organization provided upon timely request any document, file, or record necessary to the auditing requirements of A.I.D., and is the PVO registered with A.I.D.?	Yes.
17. FY 1989 Appropriations Act Sec. 514. If funds are being obligated under an appropriation account to which they were not appropriated, has prior approval of the Appropriations Committees of Congress been obtained?	Not applicable.
18. State Authorization Sec. 139 (as interpreted by conference report). Has confirmation of the date of signing of the project agreement, including the amount involved, been cabled to State L/T and A.I.D. LEG within 60 days of the agreement's entry into force with respect to the United States, and has the full text of the agreement been pouched to those same offices? (See Handbook 3, Appendix 6G for agreements covered by this provision).	Not applicable.

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

a. FY 1989 Appropriations Act Sec. 548 (as interpreted by conference report for original enactment). If assistance is for agricultural development activities (specifically, any testing or breeding feasibility study, variety improvement or introduction, consultancy, publication, conference, or training), are such activities (a) specifically and principally designed to increase agricultural exports by the host country to a country other than the United States, where the export would lead to direct competition in that third country with exports of a similar commodity grown or produced in the United States, and can the activities reasonably be expected to cause substantial injury to U.S. exporters of a similar agricultural commodity; or (b) in support research that is intended primarily to benefit U.S. producers?	**Not applicable.**

b. FAA Secs. 102(b), 111, 113, 281(a). Describe extent to which activity will (a) effectively involve the poor in development by extending access to economy at local level, increasing labor-intensive production and the use of appropriate technology, dispersing investment from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using appropriate U.S. institutions; (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward a better life, and otherwise encourage democratic private and local governmental institutions; (c) support the self-help efforts of developing countries; (d) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (e) utilize and encourage regional cooperation by developing countries.

a. Introduction of electricity to rural areas together with credit, training and TA to promote productive uses of electricity will definitely help to involve the rural poor in development, promote incorporation of rural areas to the national economic mainstream, promote investment in rural areas and improve general quality of life for the rural poor.

b. Cooperatives will be directly benefited by the installation of electricity and may be elegible beneficiaries for the credit program.

c. The project will support the efforts of small rural enterpreneurs and will help them to join to the economic mainstream.

d. Women will be directly benefited by the introduction of electricity to the household. Women-owned small rural enterprises will be directly benefited by the credit and training program.

e. Technologies and methods for rural electrification construction and promotion of productive uses will be shared with other Central American countries.

c.	FAA Secs. 103, 103A, 104, 105, 106, 120-21; FY 1989 Appropriations Act (Development Fund for Africa). Does the project fit the criteria for the source of funds (functional account) being used?	Yes.
d.	FAA Sec. 107. Is emphasis placed on use of appropriate technology (relatively smaller, cost-saving, labor-using technologies that are generally most appropriate for the small farms, small businesses and small incomes of the poor)?	Yes, rural electrification standards which will be used by the project have been designed to reduce costs, and to be appropriate for the use of rural installations and loads.
e.	FAA Secs. 110, 124(d). Will the recipient country provide at least 25 percent of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or is the latter cost-sharing requirement being waived for a "relatively least developed" country)?	Yes
f.	FAA Sec. 128(b). If the activity attempts to increase the institutional capabilities of private organizations or the government of the country, or if it attempts to	Yes

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	stimulate scientific and technological research, has it been designed and will it be monitored to ensure that the ultimate beneficiaries are the poor majority?	
g.	FAA Sec. 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 civil education and training in skills required for effective participation in governmental processes essential to self-government.	The project's implementing unit, the National Institute for Electrification (INDE) has received requests for electrical service from more than 2,000 rural communities. INDE will have full responsibility for project implementation and will receive TA and training under this project to strengthen its administrative and rural services capability. Rural communities organize local committees to promote project execution and these communities receive support from the project's social workers.
h.	FY 1989 Appropriations Act Sec. 536. Are any of the funds to be used for the performance of abortions as a method of family planning or to motivate or coerce any person to practice abortions?	No.
	Are any of the funds to be used to pay for the performance of involuntary sterilization as a method of family planning or to coerce or provide any financial incentive to any person to undergo sterilization.?	No.

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	Are any of the funds to be used to pay for any biomedical research which relates, in whole or in part, to methods of, or the performance of, abortions or involuntary sterilization as a means of family planning?	No.
i.	FY 1989 Appropriation Act. Is the assistance being made available to any organization or program which has been determined to support or participate in the management of a program of coercive abortion or involuntary sterilization?	No.
	If assistance is from the population functional account, are any of the funds to be made available to voluntary family planning projects which do not offer, either directly or through referral to or information about access to, a broad range of family planning methods and services?	Not applicable.
j.	FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?	Yes.

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k.	FY 1989 Appropriations Act. What portion of the funds will be available only for activities of economically and socially disadvantage enterprises, historically black colleges and universities, colleges and universities having a student body in which more than 40 percent of the students are Hispanic Americans, and private and voluntary organizations which are controlled by individuals who are black Americans, Hispanic Americans, or Native Americans, or who are economically or socially disadvantaged (including women)?	To be determined. Gray Amendment organizations will be given strong consideration in the procurement of goods and services.
l.	FAA Sec. 118 (c). Does the assistance comply with the environmental procedures set forth in A.I.D. regulation 16? Does the assistance place a high priority on conservation and sustainable management of tropical forests? Specifically, does the assistance, to the fullest extent feasible: (a) stress the importance of conserving and sustainably managing forest resources; (b) support activities which offer employment and income	The project complies with the environmental procedures set forth in AID Regulation 16 (See Annex F) but is not specifically focused on conservation and sustainable management of tropical forests. a. Increased access to information brought by electrification will facilitate the dissemination of conservation-related information and will increase awareness to the problem. b. Project includes a productive uses of electricity component which will provide credit and TA to small rural enterprises promoting creation of alternative rural employment and increasing rural incomes.

alternatives to those who otherwise would cause destruction and loss of forests, and help countries identify and implement alternatives to colonizing forested areas; (c) support training programs, educational efforts, and the establishment or strengthening of institutions to improve forest management; (d) help and destructive slash-and-burn agriculture by supporting stable and productive farming practices; (e) help conserve forests which have not yet been degraded by helping to increase production on lands already cleared or degraded; (f) conserve forested watersheds and rehabilitate those which have been deforested; (g) support and training, research, and other actions which lead to sustainable and more environmentally sound practices for timber harvesting, removal, and processing; (h) support research to expand knowledge of tropical forests and identify alternatives which will prevent forest destruction, loss, or degradation; (i) conserve biological diversity in forest areas by sup-	c. Not applicable. d. Introduction of electricity will improve and promote stable and productive farming practices. e. Introduction of electricity will increase productivity of land already cultivated. f. Not applicable. g. Not applicable. h. Not applicable. i. Not applicable.

	porting efforts to identify, establish, and maintain a representative network of protected tropical forest ecosystems on a worldwide basis, by making the establishment of protected areas a condition of support for activities involving forest clearance or degradation, and by helping to identify tropical forest ecosystems and species in need of protection and establish and maintain appropriate protected areas: (j) seek to increase the awareness of U.S. government agencies and other donors of the immediate and long-term value of tropical forests; and (k) / utilize the resources and abilities of all relevant U.S. government agencies?	j. Not applicable. k. Not applicable.
m.	FAA Sec. 118 (c) (13). If the assistance will support a program or project significantly affecting tropical forests (including projects involving the planting of exotic plant species), will the program or project (a) be based upon careful analysis of the alternatives available to achieve the best sustainable use of the	Not applicable.

	land, and (b)/take full account of the environmental impacts of the proposed activities on biological diversity?	
n.	FAA Sec. 118 (c) (14). Will assistance be used for (a) the procurement or use of logging equipment, unless an environmental assessment indicates that all timber harvesting operations involved will be conducted in a environmentally sound manner and that the proposed activity will produce positive economic benefits and sustainable forest management systems; or (b) actions which will significantly degrade national parks or similar protected areas which contain tropical forests, or introduce exotic plants or animals into such areas?	No.
o.	FAA Sec. 118 (c) (15). Will assistance be used for (a) activities which would result in the conversion of forest lands to the rearing of livestock; (b) the construction, upgrading, or maintenance of roads (including temporary haul roads for logging or other extractive industries) which pass through relatively	No.

	undegraded forest lands; (c) the colonization of forest lands; or (d) the construction of dams or other water control structures which flood relatively undegraded forest lands, unless with respect to each such activity an environmental assessment indicates that the activity will contribute significantly and directly to improving the livelihood of the rural poor and will be conducted in an environmentally sound manner which supports sustainable development?	
p.	FY 1989 Appropriations Act. If assistance will come from the Sub-Saharan Africa DA account, is it (a) to be used to help the poor majority in Sub-Saharan Africa through a process of long-term development and economic growth that is equitable, participatory, environmentally sustainable, and self-reliant; (b) being provided in accordance with the policies contained in section 102 of the FAA; (c) being provided, when consistent with the objectives such assistance, through African, United States and other PVOs that have	Not applicable.

demonstrated effectiveness in the promotion of local grassroots activities on behalf of long-term development in Sub-Saharan Africa; (d) being used to help overcome shorter-term constraints to long-term development, to promote reform of sectoral economic policies, to support the critical sector priorities of agricultural production and natural resources, health, voluntary family planning services, education, and income generating opportunities, to bring about appropriate sectoral restructuring of the Sub-Saharan African economies, to support reform in public administration and finances and to establish a favorable environment for individual enterprise and self-sustaining development, and to take into account, in assisted policy reforms, the need to protect vulnerable groups; (e) being used to increase agricultural production in ways that protect and restore the natural resource base, especially food production, to maintain and improve basic transportation and communication net-

	works, to maintain and restore the natural resource base in ways that increase agricultural production, to improve health conditions with special emphasis on meeting the health needs of mothers and children, including the establishment of self-sustaining primary health care systems that give priority to preventive care, to provide increased access to voluntary family planning services, to improve basic literacy and mathematics specially to those outside the formal education system and to improve primary education, and to develop income-generating opportunities for the unemployed and underemployed in urban and rural areas?	
q.	FY 1989 Appropriations Act Sec. 515. If deob/reob authority is sought to be exercised in the provision of DA assistance, are the funds being obligated for the same general purpose, and for countries within the same general region as originally obligated, and have the Appropriations Committee of both Houses of Congress been properly notified?	Not applicable.

ANNEX C

CERTIFICATION PURSUANT TO SECTION 611 (e)

OF THE FOREIGN ASSISTANCE ACT OF 1961, AS AMENDED

I, Anthony J. Cauterucci, the principal officer of the Agency for International Development in Guatemala, CERTIFY that to the best of my knowledge and belief Guatemala possesses both the financial capability and human resources to effectively maintain and utilize the rural electrification infrastructure and equipment to be financed under the $10,000,000 Rural Electrification III Project (520-0353) which will be implemented by the National Electrification Institute (INDE).

This judgement is based primarily on the fact that INDE possesses the technical capacity, personnel, equipment and resources necessary to effectively maintain and utilize the infrastructure to be built. INDE has provided appropriate maintenance and has effectively utilized the electrical infrastructure financed under two previous AID-funded rural electrification projects. The proposed Project will further improve this capability providing additional equipment, training, and technical assistance specifically targeted for rural installations.

Anthony J. Cauterucci
Director, USAID/Guatemala

7/17/89
Date

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FORMA 74E3.03

INSTITUTO NACIONAL DE ELECTRIFICACION
I. N. D. E.
GUATEMALA, C. A.

DIRECCION CABLEGRAFICA
INDE GUATEMALA
TELEX-INDE-5324-GU

NUMERO PE-0-362-89
REFERENCIA

Al contestar, sírvase mencionar este numero y referencia

PDSO w/Encl

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Guatemala, 12 de julio de 1989

RECEIVED
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USAID/GUATEMALA

7/25/89

Señor
Anthony J. Cauterucci
Director Agencia para el
Desarrollo Internacional -AID-
Ciudad

Estimado señor Cauterucci:

Tengo el agrado de dirigirme a usted, en relación a los planes que el Gobierno de la República de Guatemala y el Instituto Nacional de Electrificación tienen para ampliar la cobertura de la electrificación rural del país, en respuesta a las demandas de las comunidades rurales y como parte esencial de los planes de desarrollo rural del Gobierno de la República.

Como es de su apreciable conocimiento, el Plan de Electrificación Rural II (PER II), proyecto que contó con financiamiento de $10.600,000 de AID, terminó el 30 de marzo de 1989. Dicho proyecto puede considerarse como un éxito desde todo punto de vista. Las metas originales del proyecto de 70,000 nuevas conexiones rurales, así como las metas en kilómetros de líneas y redes fueron ampliamente superadas. El Proyecto ha tenido un considerable impacto en el área rural de Guatemala, beneficiando a más de 400,000 habitantes con el servicio eléctrico. A pesar de ello y de los esfuerzos del INDE con fondos propios, la cobertura de electrificación rural en Guatemala es todavía sumamente baja, lo que constituye un serio obstáculo para el desarrollo integral del país. Evidencia de esta baja cobertura es la enorme demanda de servicio eléctrico, que rebasa ya las 2,000 solicitudes de comunidades rurales.

Conscientes de la necesidad de continuar con el esfuerzo de electrificación rural, tanto el Gobierno Central como el INDE iniciaron gestiones ante AID para obtener financiamiento para la continuación del plan de electrificación rural. De esta forma en septiembre de 1986, el Presidente Vinicio Cerezo dirigió una carta al entonces Administrador de AID, señor Peter McPherson, confirmando solicitudes previas del INDE a AID. Posteriormente, en mayo de 1988 el INDE nombró una comisión expecífica para trabajar con personeros de AID en la formulación de lineamientos generales para una continuación del programa de electrificación rural que se ha titulado Plan de Electrificación Rural

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Señor Anthony J. Cauterucci
Director AID

III (PER III), el cual sería financiado parcialmente con fondos de AID. Tenemos entendido que el trabajo de esta comisión ha sido fructífero, habiendo logrado definir los aspectos generales de un posible proyecto.

Por lo anterior, el Instituto Nacional de Electrificación, por este medio solicita la consideración formal de AID para el financiamiento del Plan de Electrificación Rural III (PER III) destinado a ampliar la cobertura de la electrificación en las áreas rurales de Guatemala en las que la energía eléctrica complemente la infraestructura y recursos existentes, con énfasis en la promoción de los usos productivos de la electricidad.

De acuerdo a las estimaciones realizadas, el PER III proporcionaría servício eléctrico a 65,000 nuevos usuarios rurales en aproximadamente 400 comunidades, construyendo aproximadamente 1,200 kilómetros de redes. 300 kilómetros de líneas de distribución y ampliando 3 subestaciones en el Altiplano Occidental. El proyecto está programado para ejecutarse en 6 años, de 1989 a 1995.

El costo estimado del proyecto es de $24.161,317 de los cuales $9.100,000 serían fondos no reembolsables de AID, y $15.061,317 serían fondos de contrapartida del Gobierno de Guatemala y del INDE, que incluyen contribuciones en especie. De los fondos de contrapartida se ha estimado que aproximadamente $9.974,003 serían fondos que provendrían de las asignaciones regulares del presupuesto del INDE, los cuales servirían para financiar principalmente los costos administrativos, de ingeniería, y la mano de obra necesaria para la ejecución del proyecto. Aproximadamente $5.087,314 serían fondos adicionales que el INDE y el Gobierno de Guatemala proporcionarían durante los seis años de la duración del proyecto.

Tal como se ha convenido en conversaciones con funcionarios de la Misión AID, previo a la firma del convenio que formalice el financiamiento para el proyecto propuesto, el INDE presentará a AID un plan calendarizado que muestre los pasos que el INDE tomará durante los próximos cinco años para mejorar su situación financiera y eficiencia institucional.

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INSTITUTO NACIONAL DE ELECTRIFICACION
I. N. D. E.
GUATEMALA, C. A.

DIRECCION CABLEGRAFICA
INDE GUATEMALA
TELEX-INDE-5324-GU

FORMA 74103.03

NUMERO PE-0-362-89
REFERENCIA

Al contestar, sírvase mencionar este numero y referencia

Señor Anthony J. Cauterucci
Director AID

Creemos que el proyecto propuesto logrará un significativo mejoramiento en la calidad de vida de los habitantes del área rural guatemalteca y proporcionará un importante elemento para la promoción del desarrollo de las áreas rurales, especialmente por el énfasis que dará el proyecto a los usos productivos de la electricidad.

Agradeciendo de antemano la colaboración de AID para este importante esfuerzo, es grato suscribirme,

Atentamente,

ING. RAUL EDUARDO CASTAÑEDA ILLESCAS
PRESIDENTE EJECUTIVO

RECI/rgdc.

ANNEX E

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

LIFE OF PROJECT:
From: FY1989 to FY1995
Total U.S. Funding: $10,000,000
Date Prepared: September 29, 1988

PROJECT TITLE AND NUMBER: RURAL ELECTRIFICATION III (PER III) 520-0353

SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
GOAL Increase the productivity, incomes and employment of the rural poor in Guatemala.	1. Average income of communities provided with electrical service, credit and training increases more rapidly than non-electrified communities.	1. Comparison of average income between electrified and non-electrified communities through a baseline study conducted at Project initiation and an impact evaluation carried out at the end of the Project.	1. Political stability in Project's target areas. 2. General economic conditions of the country stay relatively stable.
	2. Number and size of small local enterprises is larger in electrified communities at the end of the Project than in non-electrified communities.	2. Comparison between baseline study and Project impact evaluation study about number and size of small local enterprises.	3. Legal and fiscal framework for the initiation and operation of privately-owned small enterprises does not experiment substantial negative modifications.
PURPOSE Expand electrification in rural areas where the introduction of electricity will complement and maximize the productive uses potential of existing infrastructure and resources.	EOPS 1. 65,000 new rural users provided with reliable electrical service.	1. INDE's Commercial Department and Rural Electrification Department records.	1. National electrical generation needs satisfied either by INDE or by private generation authorized and regulated by the GOG and INDE.
	2. 400 rural communities with potential for the productive use of electricity provided with electrical service and productive uses training.	2. USAID Project files.	
	3. 100 rural enterprises with increased profits by PACD; 10% of rural Project households engaged in productive activities with electrical power.	3. Implementing Agency records and Project reports.	
	4. Productive uses focus institutionalized in rural electrification programs.	4. Project consultant's progress and final reports.	
		5. Project mid-term and final evaluations.	

SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
OUTPUTS			
1. Subtransmission lines and distribution networks constructed and operating. Service drops, meters and internal wiring installed.	1. (a) 300 km of electrical subtransmission lines built (b) 1,200 km of electrical distribution networks built. (c) 65,000 service drops, meters internal wiring installed.	1. INDE records and progress reports.	1. INDE and GOG counterpart contributions (in cash and in-kind) are provided as agreed.
2. Improvement in the productivity of small enterprises through the introduction or upgrading of electrical machinery in their operations and training of their employees to operate such machinery.	2. (a) 2,000 small rural enterprises provided with loans to buy electrical machinery. (b) 1,000 employees of the rural enterprises which received credit, trained in the operation of small electrical machinery.	2. Project consultant's progress and final reports. 3. Implementing agency records and project's reports. 4. USAID loan files. 5. Project's mid-term and final evaluations.	Credit and training implementing agency provides support for credit and training component as agreed.
3. Development of credit system targeted to small-scale enterprises to enhance the impact of electrification efforts.	3. (a) Credit system operational.		
4. Increased awareness of the potential productivity uses of electricity among inhabitants of PER II and III communities.	4. (a) 10,000 potential rural entrepreneurs trained in productive uses of electricity.		

(in $000,000)

INPUTS	AID	PVO	INDE	TOTAL
1. Electrical materials, equipment and labor for the construction of lines and electrical installations.	6.65	-	11.46	18.11
2. Vehicles/tools/equipment	.57	-	-	.57
3. Consulting Engineering Services	-	-	.37	.37
4. Engineering and Administration	-	-	1.16	1.16
5. Training/Technical Assistance	.41	-	-	.41
6. Credit	.40	-	-	.40
7. Credit Management	.28	.20	-	.48
8. Evaluation, Studies, and Audits	.20	-	-	.20
9. Inflation	.40	-	1.42	1.82
10. Contingencies	1.09	-	.65	1.74
TOTAL	10.00	.20	15.06	25.26

1. GOG support for rural electrification activities continues as agreed.

LAC-IEE-86-12

ENVIRONMENTAL THRESHOLD DECISION

Project Location	:	Guatemala
Project Title	:	Rural Electrification III
Project Number	:	520-0353
Funding	:	$10,000,000
Life of Project	:	Six Years
IEE Prepared by	:	Roberto Figueroa USAID/Guatemala
Recommended Threshold Decision	:	Negative Determination
Bureau Threshold Decision	:	Concur with Recommendation
Comments	:	None
Copy to	:	Anthony J. Cauterucci, Director USAID/Guatemala
Copy to	:	Roberto Figueroa USAID/Guatemala
Copy to	:	Frank Zadroga, ROCAP, San Jose
Copy to	:	Donald Boyd, LAC/DR/CEN
Copy to	:	IEE File

James S. Hester Date APR - 1 198

James S. Hester
Chief Environmental Officer
Bureau for Latin America
and the Caribbean

INITIAL ENVIRONMENTAL EXAMINATION

Project Location	:	Guatemala
Project Title	:	Rural Electrification III (520-0353)
Funding	:	$10,000,000

I. Background

AID has supported rural electrification in Guatemala through two previous projects. The first project, Rural Electrification I, was dedicated to the construction of major transmission lines and substations while the second, Rural Electrification II (PER II), emphasized the construction of subdistribution lines, networks and household connections. PER II will be completed in December 1988 and it is expected that by the end of the project, approximately 90,000 new consumers will be provided with electrical connections in 475 rural communities.

Despite these efforts, however, electrical service to Guatemala's rural areas is still extremely low - only 7% of the rural population has access to electricity. Until 1985 one of the basic reasons for this low coverage was the lack of abundant electrical energy in the country, but with the successful start-up of the 300 MW Chixoy hydroelectric power plant, this obstacle is diminishing and the main constraint is now distribution.

II. Project Description

The goal of the project is to increase the productivity, incomes and employment of the rural poor in Guatemala.

The purpose of the project is to expand electrification in rural areas where the introduction of electricity will complement and maximize the productive potential of existing infrastructure and resources.

The project target area will be the entire country with the only exception of the Department of El Petén. It is expected, however, that the major share of project activity will occur in the Western Highlands.

The project has three major components, all of which contribute to the purpose of providing electricity for productive uses. These components are:

1. Construction of lines and electrical installations.

2. Training of community members in productive uses of electricity.

3. Credit for small local enterprises.

The construction component will build approximately 400 kms. of electrical subtransmission lines, 800 kms. of electrical distribution networks, and provide household connections to 50,000 new rural users in 300 communities. No major transmission lines or substations will be built under this project.

The credit component will provide loans for the procurement of small electrical machinery to approximately 100 small rural enterprises. The project will also provide training for approximately 5,500 rural inhabitants. The training will be basically of two types: training for approximately 500 employees of the small enterprises mentioned above in the operation of small machinery purchased through the credit component, and training for approximately 5,000 persons in the beneficiary communities regarding the proper and productive use of electrical services.

III. Environmental Impact

The environmental impact of the proposed project will be minimal. The construction of electrical infrastructure will be limited to subtransmission lines, networks and household installations. The networks and household installations will be built along the streets or paths of existing communities so that clearing of vegetation will be minimal.

The subtransmission lines to be built under the project will be 34.5 kv. lines at a maximum. These lines are primarily single-pole lines; clearing of trees and shrubbery along the lines' right-of-way will thus be minimal. In areas where lines

go through cultivated land, the interruption or damage to crops will also be minimal given the fact that lines are single-pole.

The operations of the small enterprises and industries which will benefit from the provision of electrical services, credit and training, will have little if any impact on the environment. Examples of these small industries are carpenters, tailor shops, shoemaking, weaving, handicrafts, small stores and corn mills.

IV. Recommendation

Based on the considerations detailed above, the Mission has concluded that the project will not have a significant impact on the environment and therefore recommends that the Rural Electrification III Project (520-0353) be given a Negative Determination requiring no further environmental review.

Concurrence

Anthony J. Cauterucci
Mission Director

3/17/88
Date

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ANNEX G

EXECUTIVE SUMMARY OF THE MID-TERM EVALUATION OF THE RURAL ELECTRIFICATION II PROJECT (PER II)

PROJECT BACKGROUND

The Project purpose, as summarized from the Project Paper, Guatemala - Rural Electrification (revised) June 12, 1978, AID-DLC/P-2269, and later amendments and implementation letters, is to provide electric service to small villages in rural areas in the Western and Central Highlands, Eastern and South Coast Regions of Guatemala. The Project will provide 70,000 new connections, approximately 33,000 in previously non-electrified populations and 37,000 in electrified populations. The construction of 56 kilometers of 69 kV transmission lines and 901 kilometers of distribution networks will service 342 beneficiary communities. Project financing is provided by a $10.6 million AID loan and $12.6 million GOG counterpart contribution for a total Project cost of $23.2 million.

METHODOLOGY

As agreed with USAID/Guatemala staff, the Statement of Work was the prime guideline for undertaking and completing the evaluation. During the evaluation the evaluators conducted numerous interviews with staff of USAID, PER-2 (the implementing unit of INDE), INDE headquarters, regional and sub-regional personnel, the Project consultants and beneficiaries in villages.

FINDINGS AND RECOMMENDATIONS

Physical and Financial Advance of the Project Against Programmed Targets

Findings - Physical Advance

Actual findings on physical advances against programmed targets are as follows:

Original targets are taken from the Loan Agreement, USAID Loan Number 520-T-031, signed between USAID and the Ministry of Finance of the Government of Guatemala (GOG) on May 21, 1979. Procedural delays in internal GOG approval prevented the initial implementation until July 1980. The original programmed targets were changed in the reprogramming document, Plan de Electrificación Rural No. 2 (PER-2) - Reprogramación, March 1983. While the reprogramming document does not explicitly state the total number of villages to be electrified, it does list those already electrified. It also lists those to be electrified between 1983 and 1985. The consultants' reports list an additional 158 previously non-electrified and 114 previously

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partially electrified villages to be completed under the program, for a grand total of 342 villages as follow:

222 previously non-electrified
120 previously partially electrified

The evaluators have used the targets as amended by the March 1983 Cronograma de Trabajo as a basis for reporting on the physical advance of the Project. In general term, the advance of the Project through June 30, 1985 against programmed physical targets is as follows:

	Target	Completed	% Completed
Primary Distribution Lines	321.1 Kms.	205.0 Kms.	63.8%
Secondary Distribution Lines	901.2 Kms.	758.1 Kms.	84.1%
Consumer Connections	70,000	38,946	55.6%
Transmission Line	56.0 Kms.	50.4 Kms.	90.0%
Substation	1	0	0.0%

The main reasons cited by Project staff and others for this lack of progress against programmed targets were (1) the complex nature of the procurement procedures and (2) the intervention in INDE by the GOG in 1984.

The procedures within INDE for all but extremely minor purchases appear to be extremely slow.

Efforts are being made to speed up the procurement process by AID procuring all foreign cost commodities for the Project.

Recommendations - Physical Advance

The evaluators strongly recommend that the date for completion of the Project be extended. The length of the extension should be set by mutual agreement between USAID/Guatemala and the GOG-INDE.

Findings - Financial Advance

Original inputs are taken from the loan agreement and indicate a total Project cost of some $15 million, with USAID Loan Number 520-T-031 providing $8.6 million and the GOG/INDE providing counterpart funding of $6.4 million.

The original programmed inputs were changed in the Reprogramming Document, Plan de Electrificación Rural No. 2 (PER-2) - Reprogramación, March 1983, page 94 of which appears in the Programa de Financiamiento. With slight modification, these inputs were agreed to by USAID in Project Amendment No. 1, signed between USAID and representatives of the GOG and INDE on September 30, 1983. (A copy of Amendment No. 1 is attached as

Attachment No. 5.) This Amendment added some $7.9 million to the inputs of the Project, with $2 million being provided by USAID (Loan No. 520-T-038) and $5.9 million in counterpart funding by GOG/INDE, bringing the total funding for the Project to $22.9 million.

These reprogrammed inputs were slightly modified by Implementation Letter No. 40, dated May 8, 1984, which provided for an additional input for GOG/INDE of some $300,000 into the Labor line item under construction and the transfer by USAID of $300,000 from the Labor line item to the Service, Maintenance and Construction Equipment line item. The additional inputs from GOG/INDE brought the total inputs of the Project to the present $23.2 million. Actual expenditures for the Project through June 30, 1985 are as follows:

Line Item	Expenditures	Percent of Total Budget
	(000)	
Construction	13,998.2	73.7%
Consultancy	250.1	85.4%
Engineering and Administration	1,454.2	97.7%
Service, Maintenance and Equipment	301.4	36.2%
Technical Assistance and Training	22.3	6.3%
Aerial Photography	150.0	100.0%
Inflation	22.3	6.0%
Contingency	0.0	0.0%$
TOTALS	16,204.5	69.0%

Recommendations - Financial Advance of the Project

The evaluators recommend that USAID, the Implementing Unit and GOG/INDE plan an early meeting to discuss the counterpart inputs into this Project to assure sufficient local funding to meet projected Project outputs. Perhaps some of the funds allocated to Inflation and Contingency could be transferred to line items 1, 2, 3 and 4.

The evaluators recommend that more monies be provided so that the Consultancy Services can be extended to coincide with the extended life of the Project, if such an extension of the Project is agreed to by all parties.

It is also highly recommended that INDE and the implementing unit take advantage of the training and technical assistance component of this Project.

Preliminary Statistical Information on Usage Patterns for New INDE Consumers Connected by PER-2 as of March 1983

The usage information made available to the evaluators about new consumers connected under the PER-2 program, indicates there is a total of 24,252 new consumers the average consumption per consumer per month is 12.24 kWh and the average bill per consumer per month is Q2.54 (or approximately US$.85 at the current exchange rate of three quetzales for one U.S. dollar).
The Project Paper projected an annual usage per consumer of some 200 kWh per year (see page 104 of the Project Paper). The annual consumption of almost 150 kWh per consumer (12 months x 12.24 kWh) is under that projection by 25 percent. This is not unusual in new rural electrification programs, but if the projects are to become financially viable, INDE must undertake a serious productive uses of electricity program. Experience shows that the broader usage of electricity in the rural villages and farms provides economic justification for future projects.

Assessment of INDE's and Implementing Unit's Capabilities to Successfully Implement the Project in the Areas of Promotion and Selection of Villages, Procurement Procedures, Human Resources and Construction Equipment.

This was one of the more difficult areas to assess because assessing total capability under these circumstances is almost impossible. INDE is a large and complex organization while the organization of the implementing unit for PER-2 is less complex. The assessment which follows is primarily based on observable results to date in Project achievement, review of policies and procedures implemented (or not implemented) and in-depth interviews with the principles involved in carrying out the projects.

Selection and Promotion of Villages (NOTE: the villages first had to be selected and, once selected, the promotion phase began)

a) Findings - Selection of Villages

Selection criteria for the initial selection of villages are enumerated on pages 26 through 28 of the reprogramming document (Plan de Electrificación Rural No. 2 (PER-2), Reprogramación, March 1983). The capability of INDE staff demonstrated in setting these criteria was excellent. The process of selection appears to be based on sound criteria. The four criteria used are used in pre-feasibility studies for rural electrification programs around the world: the length of the secondary distribution lines, a maximum cost per household connection (Q600), an infrastructure factor (6 on a scale of 10) and an economy factor. However, there seems to have been an omission in setting a minimum eligibility factor for the economy factor of the villages to

be selected. It appears that subjective, rather than objective, decisions were made when the villages did not meet the cost criteria of Q600 per consumer or less for household connections and/or a point factor of 6 or more in infrastructure.

The evaluators examined 26 of the 160 village questionnaires from the Eastern Region of PER-2, 20 from newly electrified areas and 6 from previously or partially electrified areas. Selection of the questionnaires analyzed was done on a random basis, that is, every fifth questionnaire from newly electrified areas (100) was selected, and every tenth questionnaire from the previously electrified areas (60) was selected.

Of the 20 questionnaires from newly electrified areas, the analysis shows the following:

10 villages fully met the criteria of cost and infrastructure
6 villages met only the cost criteria
4 villages met only the infrastructure criteria

If this analysis is valid, and it were applied to the 222 villages previously non-electrified, it would mean that:

50% or 111 villages fully meet the criteria
30% or 67 villages meet only the cost criteria
20% or 44 villages meet only the infrastructure criteria

b) Recommendations - Selection Criteria

The evaluators recommend that selection of villages follow the criteria as set, unless there is some overriding political or economic reason that dictates a different selection criteria. When other criteria are used, the program staff should indicate why different criteria were used and what criteria were used to include non-qualifying villages in the program.

c) Findings - Promotion in Villages

The capability of the "promotores" is excellent and of the highest caliber. This can be attested to by the high percentage of connections in the areas of the newly electrified villages under PER-2. (Visual observations by the evaluators in a few selected villages indicate approximately 80% of potential customers in each of the energized villages visited by the team are already connected.)

d) Recommendations - Promotion in Villages

The only recommendation which pertains to this statement of work is that INDE, and the implementing unit, maintain the high capability which it has developed as it completes promotion in villages yet to be electrified under PER-2. At this time, INDE should ascertain whether PER-2 has sufficient personnel to meet the targets as outlined in the Project and assure that these personnel have sufficient vehicles and other support items.

Additional recommendations are as follows:

If plans are developed by INDE's Commercial Department to have an ongoing Promotion (Productive Uses of Electricity) Program, the "promotores," with additional training, could form the nucleus of such a promotion staff.

Either PER-2 or the Commercial Department of INDE should undertake the training of its consumers in the safe use of electricity, including such courses as how to wire their homes and/or small businesses and how to use and repair their electrical appliances and other electric devices.

If further rural electrification programs are developed, this staff should be utilized as "promotores".

Human Resources

a) Findings - Human Resources

From observations and interviews, the evaluators feel that the human resources assigned to the Project generally appear to have been both sufficient in number and of the necessary capability to successfully implement the Project. This may not have been true if existing INDE staff has not been available to be assigned to the implementing unit, if personnel in the planning and Projects Departments had not been available to give the necessary support, coordination and backstopping, and INDE's Construction Department personnel had not been available to undertake and complete the construction of the lines.

The evaluators did find, however, that INDE and the implementing unit have not effectively utilized the training and technical assistance component that was built into the Project. They have used only $22,300 of the programmed $350,000. This was included to provide Project personnel and others the opportunity to increase INDE's capabilities in rural electrification management and in rural electrification design standards and construction procedures.

From Project documentation and interviews it has been ascertained that the following training has taken place:

training of some 275 local electricians
one short-term training course in financial management in Mexico
short courses in English language training by 16 engineers
one two-years Master's of Engineering degree

The implementing unit might be encouraged to made fuller use of the talent available in other sections of INDE. Working in isolation from other sections of INDE does not seem to have had a significant effect on the implementing of the Project.

b) Recommendations - Human Resources

It is highly recommended that INDE and the implementing unit take advantage of the training and technical assistance component of this Project. A number of general areas have been discussed among the evaluators, USAID, PER-2 and INDE personnel and others. The order of priority appears to be the following:

promotion or productive uses of electricity programs
rural electrification design standards
rural electrification construction practices
rural electrification systems management and administration
procurement procedures
safe uses of electricity
job training and safety programs

Construction Equipment

a) Findings - Construction Equipment

The evaluators found an extreme shortage of both vehicles and equipment to enable the extremely capable and experienced crews of the INDE Construction Department to adequately and efficiently carry out construction. What equipment they do have is already worn out or will soon be worn out. But, in spite of these shortages, the construction crews have done an excellent job of construction.

The evaluators also observed that most of the members of the crews were lacking what is considered proper wearing apparel for the safety of the work force. Very few hard hats were observed, and very few of the men had the proper shoes. No first aid kits were in evidence.

b) Recommendations - Construction Equipment

Through the evaluators realize that it may not be within the means of either PER-2 or INDE at this time, we strongly recommend that INDE adopt policies and procedures for a safety of the work force and the compliance with adopted safety practices and procedures.

General Appraisal of the Operating Project

a) Technical and Administrative Performance

1. Findings - Outage Performance

The present power outage performance is not recorded for distribution systems. Periodic power outages at high voltage levels (69 kV and above) are recorded and maintained, but normal rural distribution system repairs are performed at the consumer's request. In some isolated areas, outages may last over 24 hours due to distance from municipal offices, lack of telecommunications and normal shortage of replacement materials.

Recommendation - Outage Performance

Records of distribution system outages should be kept in order to be able to forecast needs and stock emergency repair materials. These records will aid INDE in determining what materials may be needed in addition to those needed to meet their routine maintenance requirements.

2. Findings - Present Condition and Adequacy of Generation Equipment

The present PER-2 rural electric distribution systems are supplied through existing three-phase 69/13.2 kV substations which provide energy to the three-phase 34.5 kV and 13.2 kV feeders and single-phase 19.9 kV and 7.6 kV secondary lines. The adequacy of the power supply equipment is satisfactory with the exception of a near maximum loaded to capacity 2.5 MVA transformer which will handle the immediate demand and the PER-2 distribution load supplied from this substation.

There is an indication on the books of INDE of an excess of installed capacity, but this is somewhat deceptive because of the deteriorated condition of the thermal plants, many of which need to be taken out of

There is a definite shortage of capacity during the summer months (November to May). This is being partially solved by USAID's Electric Power Reserve Project (No. 520-0344) which will provide INDE with a 41.9 MW diesel unit on a loan basis until the hydroelectric facility, Chixoy, come on line.

3. Findings - Present Condition and Adequacy of Distribution Lines

The present condition and adequacy of distribution lines is excellent for all rural areas visited by the evaluators, however, future design and construction of primary and secondary distribution lines should be modified to incorporate lighter materials for such items as pole types, pole heights and wire size to permit performing the same functions at reduced costs without sacrificing mechanical strength and electric reliability.

Time and manpower did not permit an exhaustive examination of INDE's present designs and specifications.

Recommendation - Present Condition and Adequacy of Distribution Lines

The present INDE designs and specifications for rural primary and secondary distribution lines should be analyzed more fully by design engineers with extensive experience in rural electrification systems design.

INDE should establish a regular inspection program with the pole fabricators in order to monitor quality production according to the specifications. INDE should also follow a routine pole inspection in their regular maintenance program.

4. Findings - Present Condition and Adequacy of Office and Equipment

Observation of present office conditions shows them to be satisfactory throughout the regional offices. Office equipment was satisfactory. Equipment for field use was sparse or nonexistent. The meter testing equipment in the Quetzaltenango regional office was lacking an automatic calibrator; calibration had to be done by hand. The engineering and field staff on the operations units lacked such essential items as meggars, voltage testers, short-circuit testing equipment and watt/hour meters.

Recommendations - Present Condition and Adequacy of Office and Equipment

The operations crews should be provided with the proper equipment for testing the adequacy, reliability and safety of the systems before they are energized.

b) Current Project Practices

1. Findings - Line Construction

Specified standards are used. Designs are planned in Guatemala City. Construction is done by INDE personnel. Specified standards are now being implemented for 19.9 kV and 7.6 kV distribution systems for design as well as for construction. During the early stages of the construction phase, field installations were made on the basis of routine experience carried over from other earlier distribution projects. Although the crews did not have hard copies of the design standards in hand in the field, field installations almost exactly met the issued design standards.

The Administrative Structure of the Implementing Unit and Its Relationships with Other Divisions of INDE in Coordinating the Project.

1. Findings - The Administrative Structure of the Implementing Unit

As of July 30, 1985, the PER-2 staff numbered 152, with four vacancies. A breakdown of staff by sections is as follows:

Executive Director	1
Administrative Section	16
Coordination of Loans	4
Engineering and Construction	107
Social Work and Promotion	24

The Executive Director of PER-2 reports directly to the Manager of the Works and Production Division. It should be noted that there has been a significant change from the administrative or coordinating unit that was envisioned in the Project Paper. But the structure that has evolved is an excellent structure for an administrative unit for a new program of rural electrification.

It has been NRECA'S experience that, when significant rural electrification programs are planned, it is almost always more effective and efficient to create a new rural electrification department, section or unit to be totally

responsible for the implementation of such a program. The validity of this observation can be attested to by the rate of advance toward programmed targets before and after the organizational and staffing changes were effected. The organizational structure as it presently exists is more than adequate to carry out the objectives of PER-2.

The unit might be strengthened by filling the position of Deputy Director. There seems to be no unit head for the Social and Promotion Workers, and thus it is assumed that this group of people report directly to the Executive Director of PER-2.

There had been some problems with the Planning Department and the Projects Department concerning the overlapping functions of PER-2 staff and the staffs of these departments but, generally speaking, these problems have been or are being worked out.

The working relationships with all other divisions and/or departments appear to be excellent, save for the normal problems in a rather large, bureaucratic organization.

FINANCIAL ANALYSIS

I. INTRODUCTION AND SUMMARY

Financial analysis of the PER III Project was conducted for two purposes.

1. To determine the financial feasibility of the rural electrification program

2. To determine the financial position of the executing agency -The National Electrification Institute (INDE)- in order to evaluate its ability to maintain and support Project investments and to continue rural electrification programs after the current program ends.

The recommended AID methodology for financial analysis of projects described in AID Handbook 3, Appendix 3E, provides different methods for what it calls commercially and non-comercially operated projects. Non-commercially operated projects are those which do not produce sufficient revenues to be financially self- sustaining and must rely external support for all or part of their expenditures. Commercially operated projects are "those which expect to generate sufficient revenues to cover all necessary capital and operating costs and to generate a profit". A rural electrification project is generally a subsidized type of project in which the generated revenues are not sufficient to cover all expenses, but that also provides benefits which are difficult to quantify. In fact Handbook 3, (Appendix 3D, Section 4.2) gives "changes in quality of life from a rural electrification project" as a specific example of benefits which are difficult or impossible to quantify. For the proposed Rural Electrification Project III, it was decided to use the more rigorous and conservative approach of analyzing the project as a commercially operated project. This decision was taken because the project will generate net operational revenues and will require substantial community contribution and therefore it was possible to calculate the rate of return of the investment or the amount of financial subsidy which the project would require.

Therefore, the financial feasibility review consists primarily of net present value calculations that evaluate the financial costs and benefits of the programs from INDE's viewpoint. This analysis concludes that the revenues obtained from additional sales derived from project-financed connections

will exceed the costs of generating and transmitting electricity. As a result, additional sales will provide a financial contribution towards recovering the costs of program investments. However, at current tariff levels, and assuming a 40% tariff increase in the third year of the project, this financial contribution will not be sufficient to offset the cost of the initial investment for the connections with the assumptions used for the analysis described in the following pages.

Project implementation will require a financial subsidy of approximately $9,736,000 to finance the infrastructure investment. Considering that AID will provide $9,000,000 in grant funds to finance the infrastructure component, the financial subsidy to be provided by the GOG to INDE is only $736,000. During project negotiations, it was agreed that the GOG will provide the necessary subsidy to INDE to finance the infrastructure investment. The GOG counterpart contribution will be clearly defined in the grant agreement to be signed between AID, the GOG and INDE. The required financial subsidy must be evaluated against the substantial economic benefits described in Annex I and the non-quantifiable social and political benefits of the project.

It must be emphasized that these financial analysis results are based on a 40% tariff increase in the third year of the project with no further increases for the rest of the project life. This is clearly a conservative approach, but it was considered that it was the only tariff increase that could safely be estimated, given the current conditions.

The assumption of a 40% tariff increase in the third year of the Project (approximately mid-1992) was carefully analyzed and discussed at length with senior INDE officials. While a tariff increase is not considered politically feasible before the 1990 presidential elections, according to INDE officials, whatever government comes to power in early 1991 will have to increase tariffs or face an unmanageable deficit in INDE. A 40% increase is a conservative figure since INDE estimates that a 70-80% real tariff increase will be needed in the next five years.

The credit program has more favorable financial results. The proposed interest rate (20% annual effective) is sufficient to provide a positive return, yet it is lower than alternative sources of loans for the borrowers.

The current financial position of INDE is not strong. Internal financial projections were provided by INDE during the preparation of this document. The financial projections and discussions with officials from INDE's Planning Department revealed that a deficit is expected for 1988. INDE's financial situation will be affected in future years by the following factors: (1) Investments in capacity expansion, (2) Electrical tariffs, (3) Hydroelectric and thermal generation mix, (4) Reliability of Chixoy, (5) Labor costs.

To improve its financial position, INDE must employ some combination of cost reduction, government support, and tariff increase that will permit it to generate additional cash. While each of these solutions imply potential political difficulties, INDE's ambitious generation expansion plan will necessitate the transfer of resources from other obligations unless its financial position is thus improved.

In the following sections, the results of the Project analysis and the analysis of INDE's financial position are reported.

II. PROJECT ANALYSIS

A. Benefits of the Project

Benefits of the Project consist of the revenues received by INDE as a result of providing additional subscriber connections and selling additional electricity. Project revenues will be in two forms -subscriber capital contributions and tariff revenues- and will depend on the number of new subscribers that are connected and the amount of electricity they purchase.

The goal of the PER III program is to connect 13,000 new subscribers per year over a five-year period. It is apparent that sufficient demand exists to achieve this goal. There is a substantial list of communities that have applied for service -- 1,513 as of July 1986-- but less than 25 percent of these can be connected given the resources of the PER III program. Further, the PER II program has experienced no shortage of demand for connection and has connected more subscribers than originally planned. The only contributions required of PER II connections, however, are payments of 44 centavos per month for the installation of inside wiring. Increases in this charge to cover today's higher cost of wiring and to obtain subscriber capital contributions may reduce the

level of demand for connection. No estimates of the elasticity of subscriber demand are available. Because the current demand for connection far exceeds the number of new connections available, it can safely be assumed that sufficient demand exists to ensure that additional subscribers can be connected as planned.

The demand for energy can be analyzed by reviewing the billing records for PER II participants. INDE extracted billing data for PER II participants for the month of December, years 1984 through 1987. Selected results of this analysis are as follows:

Year	Consumers	kWh sales	Average Consumption per consumer (kWh/mo.)
1984	17,023	201,870	11.86
1985	32,353	444,910	13.75
1986	48,063	781,832	16.27
1987	55,898	1,042,812	18.66

These data represent all PER II connections made since 1984, and thus mix villages with differing periods of time since connection. In order to sharpen the analysis of growth in demand over time, the data were recalculated based on time since connection. As indicated elsewhere in the Project Paper, many inappropriate communities appear to have been selected for electrification under PER II, and demonstrated poor initial demand and subsequent growth in demand. Because the PER III Project is expected to considerably improve the site selection methodology, the 75th percentile of demand was utilized in the following table.

Year	kWh/connect	Increase over prior year
0	16.9	-
1	17.7	4.7%
2	20.2	14.1%
3	22.5	11.4%

The pattern of growth in demand shows an initially slow increase, perhaps due to initial drain on consumer capital caused by community contributions to the construction effort. A strong increase in demand is noted in the second year of connection, decreasing gradually in subsequent periods. For the purpose of projecting growth in demand, it has been assumed that annual growth rates of 4.7, 14.1, 11.4, 9.0 and 7.0% will be obtained for the first five years. Thereafter, 5.0%, less than INDE's system-wide average growth has been used. Because

this Project includes connection of additional subscribers in already electrified areas, no growth in consumers per village has been included in the assumptions used for the financial and economic analyses. Thus, true growth in demand over the thirty year period of analysis will likely exceed the conservative estimates used here. This potential growth in demand would improve the financial situation of the project.

The financial analysis of PER III is based on an initial consumption of 203 kWh per year (or 16.9 kWh per month). This figure assumes that tighter selection criteria will be applied under PER III that will select communities more likely to use electricity intensively. The expected monthly consumption is still substantially less than the average monthly consumption of all INDE residential customers of 34.3 kWh per month. This figure has been almost constant since 1982; prior to that time it was much higher. Historic consumers, sales, and sales per connection, by customer class, are shown in Annex H-1.

INDE's demand forecast shows a projected growth of kWh sales per residential consumer of about 6.8%. Newly electrified connections can be expected to grow more quickly, as they are beginning to acquire electricity-using appliances. This growth rate is expected to moderate overtime, as they begin to approach average usage for the system.

There is no available analysis of the rate classes represented by PER III connections. In theory, all PER II connections are residential connections, but field observations contradict this expectation. In the absence of such analysis, it is conservatively assumed that 95 percent of all PER III connections will be residential; four percent will be commercial and industrial; and one percent will be government, municipal and public lighting. Commercial and industrial uses are expected to have 55.3 kWh per month and government, municipal, and public lighting will use 128.9 kWh per month.

The assumptions used for projecting subscriber demands for PER III beneficiaries are summarized and compared to subscriber demands for INDE's direct service customers in the following table:

	PER III	INDE directly served customers (1986)
Residential		
- Subscribers	95%	92%
- Base monthly consumption per connection	16.9 kWh	34.3
Commercial, Industrial		
- Subscribers	4%	6%
- Base monthly consumption per connection	55.3 kWh	691.2
Government, Municipal, Public Lighting		
- Subscribers	1%	2%
- Base monthly consumption per connection	128.9 kWh	547.7
- Annual growth rate per connection		
1989-		6.8%
1989-90	4.7%	
1990-91	14.1%	
1991-92	11.4%	
1992-93	9.0%	
1993-94	7.0%	
1994-	5.0%	

The revenues that will be generated by sales to PER III customers also depend on the tariff. The current INDE tariff has three separate schedules for residential customers. Within each tariff, the structured is one of declining prices. The tariff that is applied depends on the amount of energy purchased. Greater consumption puts the customer on a higher tariff. Because of the expected small size of the PER III consumers, it is likely that the lowest tariff, R11-A, will be applied in almost all cases. Similarly, INDE has six different tariffs for commercial, industrial, and diverse users, and six tariffs for government and municipal users. The small size of the users connected pursuant to the rural electrification program will result in them receiving service under the C 14, I14 and D14 tariffs and under the M13 and G13 tariffs.

The applicable tariffs are as follows:

R11-A

0 - 7 kWh	Q 1.00
8 - 20 kWh	Q .154/kWh
21 - 120 kWh	Q .120/kWh
121 - 300 kWh	Q .110/kWh

R11-B

300 - 500 kWh	R11-A x 1.2

R11-C

more than 500 kWh	R11-B x 1.4

C14, D14 and I14

Fixed monthly charge	Q 2.30
0 - 14 kWh	Q .068/kWh
15 - 40 kWh	Q .147/kWh
41 -150 kWh	Q .139/kWh
more than 150 kWh	entire charge is multiplied by 1.4

M13 and G13

Fixed monthly charge	Q 2.30
0 - 14 kWh	Q .1568/kWh
15 - 40 kWh	Q .1974/kWh
41 - 240 kWh	Q .1694/kWh
more than 240 kWh	Q .1498/kWh

Given the estimated monthly consumption per subscriber developed above, average and marginal revenue per kWh can be developed as follows:

Class	Average	Average Revenue	Marginal Revenue
Residential	17	.150	.120
Commercial, Industrial Diverse	55	.164	.139
Government, Municipal	129	.191	.169

Actual average revenue per kWh for PER II participants in June 1988 was Q0.173. Allowing Q0.44 for the PER II user contribution, reduces the average revenue per kWh to Q0.148, although it is apparent from the billing records that not all connections were assessed this charge. Examination of the average revenue per kWh for each agency reveals that ten of the 32 agencies had figures above Q0.15. This result indicates that the agencies either had a substantial number of connections that were not residential or, more likely, had a large number of subscribers consuming below the minimum. Further, using the estimated growth rates, the average residential subscriber will soon fall into the third

block in the tariff and face a marginal price of Q0.12. For these reasons, the calculations use average revenue from new residential connections of Q0.15 and marginal revenue from increased residential subscriber consumption of Q0.12. For computational simplicity, a monthly connection charge was imputed and the marginal price was applied to kWh sales.

Three different scenarios were considered for the analysis: (a) No change in tariffs for the next 30 years; (b) 20% tariff increase in the 3rd year of the project with no further increases, (c) A 40% tariff increase in the 3rd year of the project with no further increases during 30 years.

The final analysis was developed for the third scenario and the following comments are based on that assumption. Although it is still conservative, it would be unrealistic to assume other tariff increases in the near future.

The second source of revenues to INDE that may result from providing service to additional subscribers is the contribution of capital by customers. Under the PER II program, new subscribers contributed Q0.44 per month to cover the costs of inside wiring. For PER III, INDE has not defined a policy, but is considering a required contribution of 30 percent -- 10 percent initial payment plus 20 percent paid over the first five years of the Project through a fixed monthly addition to the subscriber's bill. The contribution would be based on the average cost, per connection, of providing distribution and connections to the community in which the subscriber is located. because carrying charges would not be added to the contribution that is paid over five years, the actual value of the subscriber's contribution will be less than 30 percent.

Several points should be raised with reference to co-financing options:

1. User contributions are clearly necessary to make the Project financially viable. In fact, the contribution needed is much greater than that currently being considered.

2. High initial contributions will tend to reduce the capital available for purchasing electricity-using appliances and may thereby reduce future sales. At the extreme, a high required contribution may eliminate potential subscribers. This is not necessarily an undesirable result, especially when INDE must select a small percentage of applicant

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communities for inclusion in the program. Higher initial charges will help to ensure that electricity is supplied to those communities that are most able to use it efficiently.

3. A charge based on the cost of supplying electricity to a community will also provide an incentive for communities to electrify only when it is cost-effective to do so. In contrast, a single flat charge for all subscribers will encourage demands by communities that are more costly to serve.

4. There are greater administrative difficulties in basing the contribution on the cost of connection. The Commercial Department of INDE, however, gave assurances that these difficulties were relatively minor and would not greatly complicate the billing process.

5. There are advantages to collecting the user contribution through an initial payment rather than monthly fees. Monthly charges will leave INDE at risk for a greater portion of this capital if the user decides to leave the system. A combination of a low initial charge and high monthly charges will tend to encourage initial subscribers but risk subsequent disconnection for non-payment.

6. INDE should ensure that all subscribers make their appropriate contribution, calculated on a present value basis. If communities wish to pay over time, they should contribute to the financing costs associated with delayed payments. Financing of the contribution may be beneficial if INDE's cost of capital is less than the rural community's. INDE's financing is not cost-free, however, and the communities should be charged these costs.

7. Distribution equipment generally has an economic life of between 30 and 45 years. Consideration should be given to extending the payment period, both as a means of increasing the total contribution and reducing the subscribers monthly payment. For example, at a 12 percent interest rate, a 30 percent contribution over 12 years has lower monthly payments than a 20 percent contribution over five years.

In this financial analysis, three alternative co-financing schemes are considered:

(1) Ten percent initial payment, and twenty percent payment over five years

(2) Ten percent initial payment, and forty percent payment over five years

(3) Ten percent initial payment, and ninety percent payment over five years

It is considered that the maximum average contribution that beneficiary communities will be able to provide is 30% and therefore, the final analysis is based on cofinancing scheme No. (1).

B. Project Costs

The costs associated with the PER III Project can be separated into direct costs and indirect costs. Direct costs include those "out-of-pocket" costs associated with the Project and with sales of electricity to the Project beneficiaries. Such costs would include fuel used in generation, metering and billing, and equipment and installation costs incurred in connecting new subscribers. Indirect costs would include any resulting expansion of generation, transmission, and distribution capacity, plus any additional administrative or overhead costs. These indirect costs are more difficult to quantify because the energy sold to Project beneficiaries will be extremely small relative to total system energy. Further, indirect costs vary in the degree to which they can be attributed to Project participants. As a result, this analysis attributes generation and transmission costs but not administrative or overhead costs.

INDE's generation system is a mixed thermal-hydro system, and will remain so throughout the Project life. The majority of capacity and energy are provided by hydroelectric units, but marginal increases in energy demand will normally be met by thermal units. INDE uses a generation simulation model to develop its system planning, including the amount and type of capacity to install, retire, and replace.

INDE's recent National Electrification Plan (Electric System Planning Unit, May 1988) presents the following forecast of generation requirements:

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	Demand		Energy	
Year	Annual Peak (MW)	Percentage Increase	Annual Total GWh	Percentage Increase
1987	375		1,866	
1988	403	7.4	2,026	8.6
1989	433	7.4	2,195	8.3
1990	460	6.4	2,344	6.8
1991	493	7.0	2,518	7.4
1992	528	7.2	2,704	7.4
1993	564	7.0	2,899	7.4
1994	602	6.6	3,102	7.0
1995	637	5.8	3,288	6.0
1996	676	6.2	3,502	6.5
1997	718	6.3	3,736	6.7
1998	763	6.2	3,982	6.6
1999	811	6.3	4,247	6.7
2000	859	5.9	4,513	6.3

To meet these substantial increases in demand and provide a sufficient reserve margin to ensure reliable service, INDE is planning to install additional generation capacity during the 1990's. These additions can be summarized as follows:

Project	Type of Unit	Capacity (MW)	Expected Energy (GWh)	Year of Initial operation
Geo Zunil I	geothermal	15	110	1992
Río Bobos	hydro	9	46	1993
Steam III	steam	50	350	1993
Santa Mar a	hydro	68	205	1995
El Palmar	hydro	55	177	1996
Jocot n	hydro	40	180	1996
Sechil	hydro	80	209	1998
Geothermal II	geothermal	55	430	1999
Total		372	1,709	

The Zunil I geothermal unit has been delayed substantially in construction. It was originally expected to come on-line in 1989 and provide substantial fuel savings relative to the alternative thermal generation.

Annex H-2 presents the total renewable resource and thermal generation that are expected to result under this demand forecast and capacity expansion. The tabl. also shows the average cost of thermal generation by year and type of fuel.

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Under INDE's economic dispatching procedures, as much demand as possible will be met with hydro and geothermal generation. Requirements above that level will be served by thermal units. In all years thermal generation will be required, ranging from a minimum of 17.5% in 1989 to a maximum of 36.4% in 1994.

In order to determine the marginal cost of energy applicable to new rural consumers, the National Rural Electric Cooperative Association (NRECA) through the Central American Rural Electrification Support (CARES) Project conducted a study of load patterns for the National Interconnected System (NIS) and typical rural electrification systems to determine their differences. The study also examined the power provided by the NIS by fuel source, time of year and time of day in order to determine the availability and cost of energy for new rural electrification projects.

A copy of the NRECA document is presented as Annex H-10 and its results were used to determine the marginal cost of energy applicable to PER III users. The most important conclusions of the study are the following:

a) Considering typical rural electrification systems load patterns and INDE's hydroelectric and thermal generation capacity, no thermal-based generation is needed to supply electricity to new rural consumers during 7 months of the year (June-December) or 58.3% of the time.

b) Given current rural load patterns, daytime productive uses can be introduced without requiring additional capacity in either INDE generation or the rural electrification distribution system. To the contrary, such loads would improve the overall system load factor and efficiency of operations.

The costs of generation equipment in INDE's capacity expansion plan is high, ranging from about $1,000 (USA) per kW for the steam plant to almost $2,500 (USA) per kW for the hydro station at Jocotán. All of these costs are too high to use as the cost of generation capacity. Both hydro and geothermal generation require relatively large capital costs, but will permit substantial reductions in fuel costs. These saving should be subtracted from the capital cost of the plant. Similarly, steam plants offer fuel savings relative to diesel-fired, internal combustion generation. In fact, if units were to be installed solely for the purpose of providing megawatts during the system peak, combustion turbines would likely be selected. The cost of such equipment ranges from $200 - $300 (USA) per kilowatt, depending on its specific characteristics.

Assuming a load factor of 0.41 (typical of feeder lines such as San Juan Ostuncalco, compared to about a 0.60 load factor for the INDE system), 65,000 users with average consumption of 30 kWh/month will require 6.515 MW of additional capacity(1).

Assuming a generation unit cost of $200/kW, the necessary $1,303,000 investment using a 15 percent cost of money and a conservative 25-year equipment life (Capital Recovery Factor = 0.1574 (2)) yields an annual cost of $201,574. To this figure should be added $20,157, as 10% annual operations and maintenance costs. Dividing the total annual cost of $221,731 by the estimated 23,400,000 kWh/year yields an average cost of $0.0095/kWh, or Q0.0256/kWh for additional generation capacity.

PER III project-related transmission and substation improvements are estimated to cost $775,255. This figure is taken from the project budget and includes foreign exchange ($516,799) and local currency ($131,418), costs for commodities and local currency ($127,038) for labor. With a 0.1547 capital cost recovery factor and an estimated 10% annual operations and maintenance costs, an annual cost of $131,925 is obtained yielding a unit cost of $0.0056/kWh or Q 0.0152/kWh.

For fuel costs, the conclusions of the NRECA study (Annex H-10) and INDE's forecasts for energy generation by fuel source (Annex H-2) were used. INDE estimates that from 1989 through year 2000, 11,857 GWh will be produced from a mix of thermal fuels costing a total of Q1,410,500,000. This yields an average cost of thermal energy of Q0.1197/kWh for the period 1989-2000. However, according to the NRECA study, marginal increases in energy demand associated with the PER III project will be met through available hydroelectric generation during seven months of the year of 58.3% of the time. Thus, the average marginal kWh will cost Q0.0499 to generate.

Technical and other losses of 16.4 percent were used in the analysis. This figure is based on the losses experienced by the National Interconnected System. Using this assumption, losses contribute an additional Q 0.00082/kWh to generation costs.

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(1) Capacity = (30 kWh x 12 months x 65,000 users)/ 365 days x 24 hours x 0.41 = 6.515 MW.

(2) Capital Recovery Factor = $i/1-(1+i)^{-n}$, where i=interest rate (15%) and n=life of equipment in years (25).

Estimated marginal costs of energy for PER III consumers, including the adjustment for losses are the following:

SUMMARY MARGINAL COSTS OF ENERGY (QUETZALES/kWh)

Generation Capacity (6.515MW)	0.0256
Transmission/substation:	0.0152
Generation Costs (variable):	
Fuel	0.0499
Transmission losses	0.0082
Sub-total	0.0837
TOTAL COST OF MARGINAL ENERGY	0.0989

Distribution costs (34.5 KV and below) are direct costs associated with the Project. These costs (including inside wiring, meter, and service drop) are estimated as follows:

Wiring:

Type of Connection	Q. per Connection Materials	Labor
Connection in newly electrified areas	336.78	910.46
Connection requiring expansion of the secondary distribution network	300.04	701.42
Connection to an existing distribution network	145.41	40.78

INDE'S Commercial Department expects that customer accounting for PER III connections will be accomplished primarily through a system whereby an INDE employee reads the meter, prepares the bill, and collects payment from the customer. Under this system, the employee is paid a commission of 70 or 80 centavos per connection (depending on the number of connections). According to INDE's Commercial Department, the cost of processing an electric bill is Q0.17 and the transportation and other costs for a monthly bill are Q0.012. Therefore, the billing and collection costs per month can be integrated as follows:

Bill processing	Q 0.17
Transportation and other costs	0.012
Average commission	0.75
TOTAL	Q 0.932

A monthly billing and collection cost of Q1.00 will be used in the analysis to account for contingencies and necessary system improvements.

A bad debt allowance of two percent of total billings was used in calculating Project revenues. As INDE has no write-off policy, this figure is based on experience in other systems and a review of accounts payable.

INDE currently has over 200 percent of its normal monthly billing value outstanding more than 150 days. Much of this amount, however, is due from industrial, government, and municipal users. Analysis of residential billings shows that 98 percent of billings are paid within 120 days. Because most PER III subscribers are expected to be residential, and because cut-off procedures are instituted 120 days after billing, the two percent bad debt figure was used.

C. Contribution Analysis

In order to justify a new connection on a financial basis, the net present value of the tariff and other revenues must exceed the present value of all associated costs. Three different scenarios were considered for the analysis: (a) No increase in electrical tariffs, (b) 20% increase in electrical tariffs, (c) 40% increase in electrical tariffs. Annex H-3 presents the results of the analysis of the customer contribution for various sizes of consumers in the residential and commercial classes, for scenarious (a) and (c) above.

The prices currently changed to rural residential and commercial consumers exceed the cost per kilowatt hour calculated for typical rural connections, in almost all levels of consumption.

Therefore, even with the current tariff, a positive financial contribution will result from all levels of residential and commercial consumption, with the only exception of residential consumers with a very low energy usage (approximately half of the consumption estimated for typical PER III users). With a 40% tariff increase, the financial contribution is substantially improved, and almost all types of consumers will generate contributions in excess of the cost of service.

The scenario which was used for the net present value analysis was a 40% tariff increase in the third year of the project. This assumption, although conservative, is consistent with the estimates of senior INDE officials, and also responds to specific World Bank recommendations.

D. Net Present Value Analysis

Net present value analysis was prepared for a thirty-year period.

The financial costs and benefits depend on the types of connections made, the class of customer served, and the amount of user contribution. The analysis was therefore conducted separately for each alternative and then aggregated to estimate the returns of the total project.

To estimate the aggregate net present value of the construction program, the following distribution of customers by type of connection given in the budget was used:

- Newly electrified communities	25,000 connections
- Extensions of the distribution network	15,000 connections
- Direct connections to existing facilities	25,000 connections

Within each type of connection, the following distribution of customer classes was assumed:

- Residential	95%
- Commercial/Industrial/Diverse	4%
- Municipal/Government	1%

Three different scenarios for community contributions were considered over a period of 5 years: 30%, 50% and 100% contribution.

A summary of results and details of sample calculations are shown in Annex H-4. The results of the analysis for residential connections, for the different types of connections can be summarized as follows:

FINANCIAL NET PRESENT VALUE ANALYSIS

TYPE OF CONNECTION	CO-PAYMENT 30%	50%	100%
RESIDENTIAL			
Newly Electrified	-770	-520	103
Network Extension	-604	-404	96
Direct Connection	-34	3	96
COMMERCIAL/INDUSTRIAL/DIVERSE			
Newly Electrified	-173	76	700
Network Extension	-1	199	700
Direct Connection	570	607	700
GOVERNMENT/MUNICIPAL			
Newly Electrified	1241	1491	2114
Network Extension	1413	1614	2114
Direct Connection	1984	2021	2114

In general terms, although a positive financial contribution results from almost all levels of residential and commercial consumption, it is not sufficient to offset the cost of the initial investment, and therefore, only the 100% community contribution scenario produces a positive net present value.

Based on the experience obtained in the implementation of PER II and preliminary studies conducted by INDE, the most probable average for community contribution is a 30% of the cost of connection and this is the alternative that will be considered for the project analysis.

Based on the assumptions described above, assuming a 40% tariff increase in the third year of the project, a 30% community contribution and a 30 year period, the net present value of 65,000 additional consumers is approximately - Q26.3 million or approximately - $9.7 million. The derivation of this result is shown in detail in Annex H-5, and is summarized below:

FINANCIAL ANALYSIS
NET PRESENT VALUE OF ADDITIONAL SUBSCRIBERS
(Quetzales)

	RESIDENTIAL	COMMERCIAL INDUSTRIAL DIVERSE	GOVERNMENT MUNICIPAL	TOTAL
ELECTRIFIED COMMUNITIES	(18,287,500)	(173,000)	310,250	(18,150,250)
NETWORK EXTENSIONS	(8,607,000)	(600)	211,950	(8,395,650)
DIRECT CONNECTIONS	(807,500)	570,000	496,000	258,500
	(27,702,000)	396,400	1,018,200	(26,287,400)

Net present value analysis of the credit program is positive. Payments from borrowers are expected to yield an effective rate of interest of 20%. Discounted at 15.0 percent per year, the returns are sufficient to offset the costs of funds, bad debts, and administrative expenses. The results of this analysis are shown in Annex H-6.

E. Other Financial Analysis

INDE's recent loan agreement with the World Bank includes several covenants concerning future financial performance. The principal covenants are:

- Rate of return on net fixed assets of:

  1988 -- 4.6%
  1989 -- 4.3%
  1990 and after 5.0%

- Debt service coverage ratio of 1.5
- Operating ratio of 56%
- Consumer-to-employee ratio of:

  40:1 by December 31, 1989
  75:1 by December 31, 1993

In order to comply with these covenants, INDE will have to increase its tariffs. Depending upon the magnitude of tariff increases, the amount of the financial subsidy needed to pay for the initial infrastructure in this Project will be substantially reduced or eliminated.

III. FINANCIAL CONDITION OF INDE

Both the historical and future financial condition of INDE were examined. Annex H-7 summarizes INDE's financial statements for the period 1983-1987. Summarized financial projections for 1988-1997 are shown in Annex H-8.

Throughout the past five years, INDE was able to support a construction program substantially larger than its level of depreciation charges. It reports positive net income in each year, although working capital fell substantially in 1984. Performance on key financial ratios was as follows:

	Ratio of Return on Fixed Assets in Operation (%)	Operating Ratio (%)	Current Ratio
1987	2.29	59.5	2.05
1986	3.63	47.1	1.67
1985	4.67	63.8	1.03
1984	3.75	79.1	.73
1983	9.80	62.8	1.60

These statistics show that INDE has had difficulty attaining the level of financial performance that it must meet, according to its agreement with the World Bank.

According to INDE's Projected Income Statement (1986-1997) (Annex H-8), for all years, INDE's operating revenues exceed its operating expenses yielding a positive net income before the debt service. However, this operational profit is not sufficient to cover the debt service and the expansion investments, and therefore, a financial deficit is projected for all the period.

The financial projections for INDE illustrate that it must increase tariffs in order to improve its financial position. In addition INDE will need substantial borrowing to support its system-wide generation and transmission construction program. The projections reveal an annual shortage of funds of at least Q150 million during the next six years. It is apparent that, in its current position, INDE faces difficulties in supporting its planned construction.

Under the constraints of its current tariffs, INDE projects annual deficits that by 1993 will exceed corresponding operating revenues:

	Total Operating Revenues	Cash Deficit	Deficit as a % of Revenues
1989	206.0	153.0	74.3
1990	224.1	221.7	98.9
1991	235.8	202.3	85.8
1992	247.6	242.8	98.1
1993	283.4	368.0	129.9
1994	303.8	476.8	156.9

Given the foregoing, INDE must increase its revenue generation during the next six years, or it will be forced to delay its planned system-wide construction program. Complying with the World Bank covenants will contribute significantly to improve INDE's financial condition and will reduce the projected deficits discussed above.

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Annex H-1

Historic Sales and Connections by Class of Customer

Class of End User	Total Sales--MWH 1986	1985	1984	1983	growth rate
Residential	86,972	75,303	68,848	65,418	9.96%
Commercial	20,375	17,129	16,882	17,038	6.14%
Industrial (<50 MW)	11,528	8,302	6,653	7,953	13.17%
Industrial (>50 MW)	87,004	53,723	44,308	40,875	29.61%
Government and Municipal	15,656	14,029	11,244	11,625	10.43%
Public Lighting	10,964	10,378	10,099	9,730	4.06%
Total	234,499	178,864	158,034	152,639	15.39%

	Percent of Total Sales 1986	1985	1984	1983
Residential	37.09%	42.10%	43.57%	42.86%
Commercial	8.69%	9.58%	10.68%	11.16%
Industrial (<50 MW)	4.92%	4.64%	4.21%	5.21%
Industrial (>50 MW)	37.95%	30.04%	28.04%	26.78%
Government and Municipal	6.68%	7.84%	7.11%	7.62%
Public Lighting	4.68%	5.80%	6.39%	6.37%
Total	100.00%	100.00%	100.00%	100.00%

Class of End User	Number of Connections 1986	1985	1984	1983	growth rate
Residential	211,525	192,918	177,367	154,791	10.97%
Commercial	13,644	11,160	10,974	10,651	8.61%
Industrial (<50 MW)	815	654	680	636	8.62%
Industrial (>50 MW)	117	112	140	102	4.68%
Government and Municipal	3,528	3,313	3,133	2,920	6.51%
Public Lighting	522	521	508	506	1.04%
Total	230,151	208,678	192,802	169,606	10.71%

	Percent of Total Connections 1986	1985	1984	1983
Residential	91.91%	92.45%	91.99%	91.27%
Commercial	5.93%	5.35%	5.69%	6.28%
Industrial (<50 MW)	0.35%	0.31%	0.35%	0.37%
Industrial (>50 MW)	0.05%	0.05%	0.07%	0.06%
Government and Municipal	1.53%	1.59%	1.62%	1.72%
Public Lighting	0.23%	0.25%	0.26%	0.30%
Total	100.00%	100.00%	100.00%	100.00%

Class of End User	Average Sales per Connection 1986	1985	1984	1983	growth rate
Residential	34	33	32	35	-0.91%
Commercial	124	128	129	133	-2.27%
Industrial (<50 MW)	1,179	1,058	815	1,042	4.19%
Industrial (>50 MW)	63,393	38,972	26,374	33,395	23.82%
Government and Municipal	370	352	299	332	3.65%
Public Lighting	1,750	1,660	1,657	1,602	2.99%

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Annex H-2

Year	Renewable Resources	BUNKER GWH	BUNKER Gal.	BUNKER Quetzales	DIESEL GWH	DIESEL Gal.	DIESEL Quetzales	CRUDO GWH	CRUDO Gal.	CRUDO Quetzales	TOTAL Thermal Gen GWH	TOTAL Thermal Gen Quetzales
1989	1810	258	20.5	31.9	26		4.3	101		7.6	385	43.8
1990	1810	452		55.8	0			82		4.9	534	60.7
1991	1810	606		76.2	0			102		7.7	708	83.9
1992	1879	652		82.5	14		2.3	159		15.8	824	100.6
1993	1974	843		101	0			82		4.9	925	105.9
1994	1974	1018		124.1	1		0.01	111		9	1130	133.1
1995	2145	1019		124.4	0			125		10.9	1144	135.3
1996	2456	926		112.1	0			120		10.3	1046	122.4
1997	2456	1051		128.8	64		10.9	166		16.9	1281	156.6
1998	2665	1059		129.7	85		14.7	173		18	1317	162.4
1999	3098	993		121	15		2.6	141		13.3	1149	136.9
2000	3098	1091		132.8	137		23.7	196		21.4	1414	177.9

National Electrification Plan
Forecast Energy Generation by Fuel Source

Year	Total Generation (GWH)	Renewable Resource (Percent)	Thermal Generation (Percent)	Average Cost Thermal Gen (centavos/kWh)
1989	2195	1810	385	11.38
1990	2344	1810	534	11.37
1991	2518	1810	708	11.85
1992	2703	1879	824	12.21
1993	2899	1974	925	11.45
1994	3104	1974	1130	11.78
1995	3289	2145	1144	11.83
1996	3502	2456	1046	11.70
1997	3737	2456	1281	12.22
1998	3982	2665	1317	12.33
1999	4247	3098	1149	11.91
2000	4512	3098	1414	12.58

Average Cost and Percentage of Thermal Generation by Type of Fuel
(centavos/kWh)

Year	Bunker Cost	Bunker Percent	Diesel Cost	Diesel Percent	Crude Cost	Crude Percent
1989	12.36	67.01%	16.54	6.75%	7.52	26.23%
1990	12.35	84.64%		0.00%	5.99	15.36%
1991	12.57	85.57%		0.00%	7.55	14.41%
1992	12.65	79.13%	16.43	1.70%	10.00	19.17%
1993	11.98	91.14%		0.00%	5.98	8.86%
1994	12.19	90.09%		0.09%	8.11	9.82%
1995	12.21	89.07%		0.00%	8.72	10.93%
1996	12.11	88.53%		0.00%	8.59	11.47%
1997	12.25	82.05%	17.03	5.00%	10.18	12.96%
1998	12.25	80.41%	17.29	6.45%	10.40	13.14%
1999	12.19	86.42%	17.33	1.31%	9.43	12.27%
2000	12.28	76.45%	17.30	9.65%	10.92	13.95%

BILLING ANALYSIS

COST OF SUPPLY		REVENUES					
Connection: 1.00 per month Energy: 0.0989 per kWh		Residential			Commercial		
Monthly Usage	Cost of Supply	Price	Monthly Bill	Net Contribution	Price	Monthly Bill	Net Contribution
0	1.000		1.000	0.000		2.300	1.300
5	1.495		1.000	-0.494	0.095	2.776	1.282
10	1.989	0.216	1.647	-0.342	0.095	3.252	1.263
15	2.484	0.216	2.725	0.241	0.206	3.839	1.355
20	2.978	0.216	3.803	0.825	0.206	4.868	1.890
25	3.473	0.168	4.643	1.170	0.206	5.897	2.424
30	3.967	0.168	5.483	1.516	0.206	6.926	2.959
35	4.462	0.168	6.323	1.861	0.206	7.955	3.493
40	4.956	0.168	7.163	2.207	0.206	8.984	4.028
45	5.451	0.168	8.003	2.552	0.195	9.957	4.506
50	5.945	0.168	8.843	2.898	0.195	10.930	4.985
55	6.440	0.168	9.683	3.243	0.195	11.903	5.463
60	6.934	0.168	10.523	3.589	0.195	12.876	5.942
65	7.429	0.168	11.363	3.934	0.195	13.849	6.420
70	7.923	0.168	12.203	4.280	0.195	14.822	6.899
75	8.418	0.168	13.043	4.625	0.195	15.795	7.377
80	8.912	0.168	13.883	4.971	0.195	16.768	7.856
85	9.407	0.168	14.723	5.316	0.195	17.741	8.334
90	9.901	0.168	15.563	5.662	0.195	18.714	8.813
95	10.396	0.168	16.403	6.007	0.195	19.687	9.291
100	10.890	0.168	17.243	6.353	0.195	21.633	10.743
110	11.879	0.168	18.923	7.044	0.195	23.579	11.700
120	12.868	0.168	20.603	7.735	0.195	25.525	12.657
130	13.857	0.154	22.143	8.286	0.195	27.471	13.614
140	14.846	0.154	23.683	8.837	0.195	29.417	14.571
150	15.835	0.154	25.223	9.388	0.195	31.363	15.528
160	16.824	0.154	26.763	9.939	0.272	34.087	17.263
170	17.813	0.154	28.303	10.490	0.272	36.811	18.998
180	18.802	0.154	29.843	11.041	0.272	39.536	20.734
190	19.791	0.154	31.383	11.592	0.272	42.260	22.469
200	20.780	0.154	32.923	12.143	0.272	44.985	24.205
210	21.769	0.154	34.463	12.694	0.272	47.709	25.940
220	22.758	0.154	36.003	13.245	0.272	50.433	27.675
230	23.747	0.154	37.543	13.796	0.272	53.158	29.411
240	24.736	0.154	39.083	14.347	0.272	55.882	31.146
250	25.725	0.154	40.623	14.898	0.272	58.607	32.882

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Financial Analysis

Residential Class
Newly Electrified Connection

Cofinancing: 30% Term: 5 years

Connection charge	7.20	
Revenue/kWh	0.120	0.168
Cost/kWh	0.0989	
Cost/connection	12.00	
Bad debts	2.0%	
Initial Payment	10.0%	
Discount Rate	15.0%	

Year	Sales	Tariff Revenue	Cost of Sales	Net Revenue	Connection Cost	Initial Payment	Periodic Payments	Net Cash Flow
0					1247	124.7		-1122
1	203	31	32	-1			74	73
2	212	33	33	0			74	74
3	242	48	36	12			74	86
4	270	52	39	14			74	88
5	294	56	41	15			74	90
6	315	60	43	17				17
7	331	63	45	18				18
8	347	65	46	19				19
9	364	68	48	20				20
10	383	71	50	21				21
11	402	75	52	23				23
12	422	78	54	24				24
13	443	81	56	26				26
14	465	85	58	27				27
15	488	89	60	29				29
16	513	93	63	30				30
17	538	98	65	32				32
18	565	102	68	34				34
19	594	107	71	36				36
20	623	112	74	38				38
21	654	117	77	40				40
22	687	122	80	43				43
23	721	128	83	45				45
24	758	134	87	47				47
25	795	141	91	50				50
26	835	147	95	53				53
27	877	154	99	56				56
28	921	162	103	59				59
29	967	169	108	62				62
30	1015	178	112	65				65
NPV		399	276	103	1247	125	249	-770

Financial Analysis

Residential Class
Extension of Distribution Network

Cofinancing: 30% Term: 5 years

Connection charge	7.20	
Revenue/kWh	0.120	0.168
Cost/kwh	0.0989	
Cost/connection	12.00	
Bad debts	2.0%	
Initial Payment	10.0%	
Discount Rate	15.0%	

Year	Sales	Tariff Revenue	Cost of Sales	Net Revenue	Connection Cost	Initial Payment	Periodic Payments	Net Cash Flow
0					1001	100.1		-901
1	203	31	32	-1			60	59
2	212	32	33	-1			60	59
3	242	47	36	11			60	71
4	270	51	39	13			60	73
5	294	55	41	14			60	74
6	315	59	43	16				16
7	331	61	45	17				17
8	347	64	46	18				18
9	364	67	48	19				19
10	383	70	50	20				20
11	402	73	52	21				21
12	422	77	54	23				23
13	443	80	56	24				24
14	465	84	58	26				26
15	488	87	60	27				27
16	513	91	63	29				29
17	538	96	65	30				30
18	565	100	68	32				32
19	594	105	71	34				34
20	623	110	74	36				36
21	654	115	77	38				38
22	687	120	80	40				40
23	721	126	83	42				42
24	758	132	87	45				45
25	795	138	91	47				47
26	835	145	95	50				50
27	877	151	99	53				53
28	921	159	103	56				56
29	967	166	108	59				59
30	1015	174	112	62				62

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Financial Analysis

Residential Class
Direct Connection

Cofinancing: 30% Term: 5 years

Connection charge	7.20	
Revenue/kWh	0.120	0.168
Cost/kwh	0.0989	
Cost/connection	12.00	
Bad debts	2.0%	
Initial Payment	10.0%	
Discount Rate	15.0%	

Year	Sales	Tariff Revenue	Cost of Sales	Net Revenue	Connection Cost	Initial Payment	Periodic Payments	Net Cash Flow
0					186	18.6		-167
1	203	31	32	-1			11	10
2	212	32	33	-1			11	10
3	242	47	36	11			11	22
4	270	51	39	13			11	24
5	294	55	41	14			11	25
6	315	59	43	16				16
7	331	61	45	17				17
8	347	64	46	18				18
9	364	67	48	19				19
10	383	70	50	20				20
11	402	73	52	21				21
12	422	77	54	23				23
13	443	80	56	24				24
14	465	84	58	26				26
15	488	87	60	27				27
16	513	91	63	29				29
17	538	96	65	30				30
18	565	100	68	32				32
19	594	105	71	34				34
20	623	110	74	36				36
21	654	115	77	38				38
22	687	120	80	40				40
23	721	126	83	42				42
24	758	132	87	45				45
25	795	138	91	47				47
26	835	145	95	50				50
27	877	151	99	53				53
28	921	159	103	56				56
29	967	166	108	59				59
30	1015	174	112	62				62
NPV		393	296	96	186	19	37	-34

Commercial/Industrial/Diverse Classes
Newly Electrified Connection

Cofinancing: 30% Term: 5 years

Connection charge	27.60	
Revenue/kWh	0.139	0.1946
Cost/kwh	0.0989	
Cost/connection	12.00	
Bad debts	2.0%	
Initial Payment	10.0%	
Discount Rate	15.0%	

Year	Sales	Tariff Revenue	Cost of Sales	Net Revenue	Connection Cost	Initial Payment	Periodic Payments	Net Cash Flow
0					1247	124.7		-1122
1	664	117	78	40			74	114
2	695	122	81	41			74	115
3	793	178	90	88			74	162
4	883	195	99	96			74	171
5	963	211	107	103			74	178
6	1030	223	114	110				110
7	1081	233	119	114				114
8	1136	244	124	119				119
9	1192	254	130	125				125
10	1252	266	136	130				130
11	1315	278	142	136				136
12	1380	290	149	142				142
13	1449	303	155	148				148
14	1522	317	163	155				155
15	1598	332	170	162				162
16	1678	347	178	169				169
17	1762	363	186	177				177
18	1850	380	195	185				195
19	1942	397	204	193				193
20	2039	416	214	202				202
21	2141	435	224	212				212
22	2248	456	234	221				221
23	2361	477	245	232				232
24	2479	500	257	243				243
25	2603	523	269	254				254
26	2733	549	282	266				266
27	2870	574	296	278				278
28	3013	602	310	292				292
29	3164	630	325	305				305
30	3322	661	341	320				320

Financial Analysis

Commercial/Industrial/Diverse Classes
Extension of Distribution Network

Cofinancing: 30% Term: 5 years

Connection charge	27.60	
Revenue/kWh	0.139	0.1946
Cost/kwh	0.0989	
Cost/connection	12.00	
Bad debts	2.0%	
Initial Payment	10.0%	
Discount Rate	15.0%	

Year	Sales	Tariff Revenue	Cost of Sales	Net Revenue	Connection Cost	Initial Payment	Periodic Payments	Net Cash Flow
0					1001	100.1		-901
1	654	117	78	40			60	100
2	695	122	81	41			60	101
3	793	178	90	88			60	148
4	883	195	99	96			60	156
5	963	211	107	103			60	163
6	1030	223	114	110				110
7	1091	233	119	114				114
8	1136	244	124	119				119
9	1192	254	130	125				125
10	1252	266	136	130				130
11	1315	278	142	136				136
12	1380	290	149	142				142
13	1449	303	155	148				148
14	1522	317	163	155				155
15	1598	332	170	162				162
16	1678	347	178	169				169
17	1762	363	186	177				177
18	1850	380	195	185				185
19	1942	397	204	193				193
20	2039	416	214	202				202
21	2141	435	224	212				212
22	2248	456	234	221				221
23	2361	477	245	232				232
24	2479	500	257	243				243
25	2603	523	269	254				254
26	2733	548	282	266				266
27	2870	574	296	278				278
28	3013	602	310	292				292
29	3164	630	325	305				305
30	3322	661	341	320				320
NPV		1491	791	700	1001	100	200	-1

Commercial/Industrial/Diverse Classes
Direct Connection

Cofinancing: 30% Term: 5 years

Connection charge	27.60	
Revenue/kWh	0.139	0.1946
Cost/kwh	0.0989	
Cost/connection	12.00	
Bad debts	2.0%	
Initial Payment	10.0%	
Discount Rate	15.0%	

Year	Sales	Tariff Revenue	Cost of Sales	Net Revenue	Connection Cost	Initial Payment	Periodic Payments	Net Cash Flow
0					186	18.6		-167
1	664	117	78	40			11	51
2	695	122	81	41			11	52
3	793	178	90	88			11	99
4	893	195	99	96			11	107
5	953	211	107	103			11	115
6	1030	223	114	110				110
7	1081	233	119	114				114
8	1136	244	124	119				119
9	1192	254	130	125				125
10	1252	266	136	130				130
11	1315	278	142	136				136
12	1380	290	149	142				142
13	1449	303	155	148				148
14	1522	317	163	155				155
15	1598	332	170	162				162
16	1678	347	178	169				169
17	1762	363	186	177				177
18	1850	380	195	185				185
19	1942	397	204	193				193
20	2039	416	214	202				202
21	2141	435	224	212				212
22	2248	456	234	221				221
23	2361	477	245	232				232
24	2479	500	257	243				243
25	2603	523	269	254				254
26	2733	548	282	266				266
27	2870	574	296	278				278
28	3013	602	310	292				292
29	3164	630	325	305				305
30	3322	661	341	320				320

Municipal/Government Classes
Newly Electrified Connection

Cofinancing: 30% Term: 5 years

Connection charge	20.40	
Revenue/kWh	0.169	0.2366
Cost/kWh	0.0989	
Cost/connection	12.90	
Bad debts	2.0%	
Initial Payment	10.0%	
Discount Rate	15.0%	

Year	Sales	Tariff Revenue	Cost of Sales	Net Revenue	Connection Cost	Initial Payment	Periodic Payments	Net Cash Flow
0					1247	124.7		-1122
1	1547	276	165	111			74	186
2	1619	288	172	116			74	190
3	1848	448	195	254			74	328
4	2059	497	216	282			74	356
5	2244	540	234	306			74	381
6	2401	577	249	327				327
7	2521	605	261	343				343
8	2647	634	274	360				360
9	2779	664	287	378				378
10	2918	697	301	396				396
11	3064	730	315	415				415
12	3217	766	330	436				436
13	3378	803	346	457				457
14	3547	842	363	480				480
15	3724	884	380	503				503
16	3911	927	399	528				528
17	4106	972	418	554				554
18	4312	1020	438	581				581
19	4527	1070	460	610				610
20	4753	1122	482	640				640
21	4991	1177	506	672				672
22	5241	1235	530	705				705
23	5503	1296	556	740				740
24	5778	1360	583	776				776
25	6067	1427	612	815				815
26	6370	1497	642	855				855
27	6689	1571	674	897				897
28	7023	1648	707	942				942
29	7374	1730	741	989				989
30	7743	1815	778	1038				1038
NPV		3853	1739	2114	1247	125	249	1241

Municipal/Government Classes
Extension of Distribution Network

Cofinancing: 30% Term: 5 years

Connection charge	20.40	
Revenue/kWh	0.159	0.2366
Cost/kWh	0.0989	
Cost/connection	12.00	
Bad debts	2.0%	
Initial Payment	10.0%	
Discount Rate	15.0%	

Year	Sales	Tariff Revenue	Cost of Sales	Net Revenue	Connection Cost	Initial Payment	Periodic Payments	Net Cash Flow
0					1001	100.1		-901
1	1547	276	165	111			60	171
2	1619	288	172	116			60	176
3	1848	448	195	254			60	313
4	2059	497	216	282			60	341
5	2244	540	234	306			60	366
6	2401	577	249	327				327
7	2521	605	261	343				343
8	2647	634	274	360				360
9	2779	664	287	378				378
10	2918	697	301	396				396
11	3064	730	315	415				415
12	3217	766	330	436				436
13	3378	803	346	457				457
14	3547	842	363	480				480
15	3724	884	380	503				503
16	3911	927	399	528				528
17	4106	972	418	554				554
18	4312	1020	438	581				581
19	4527	1070	460	610				610
20	4753	1122	482	640				640
21	4991	1177	506	672				672
22	5241	1235	530	705				705
23	5503	1296	556	740				740
24	5778	1360	583	776				776
25	6067	1427	612	815				815
26	6370	1497	642	855				855
27	6689	1571	674	897				897
28	7023	1648	707	942				942
29	7374	1729	741	989				989
30	7743	1815	778	1038				1038

Financial Analysis

Municipal/Government Classes
Direct Connection

Colinancing: 30% Term: 5 years

Connection charge	20.40	
Revenue/kWh	0.169	0.2366
Cost/kwh	0.0987	
Cost/connection	12.00	
Bad debts	2.0%	
Initial Payment	10.0%	
Discount Rate	15.0%	

Year	Sales	Tariff Revenue	Cost of Sales	Net Revenue	Connection Cost	Initial Payment	Periodic Payments	Net Cash Flow
0					186	18.6		-167
1	1547	276	165	111			11	122
2	1619	288	172	116			11	127
3	1848	448	195	254			11	265
4	2059	497	216	282			11	293
5	2244	540	234	306			11	317
6	2401	577	249	327				327
7	2521	605	261	343				343
8	2647	634	274	360				360
9	2779	664	287	378				378
10	2918	697	301	396				396
11	3064	730	315	415				415
12	3217	766	330	436				436
13	3378	803	346	457				457
14	3547	842	363	480				480
15	3724	884	380	503				503
16	3911	927	399	528				528
17	4106	972	418	554				554
18	4312	1020	438	581				581
19	4527	1070	460	610				610
20	4753	1122	482	640				640
21	4991	1177	506	672				672
22	5241	1235	530	705				705
23	5503	1296	556	740				740
24	5778	1360	583	776				776
25	6067	1427	612	815				815
26	6370	1497	642	855				855
27	6689	1571	674	897				897
28	7023	1648	707	942				942
29	7374	1730	741	989				989
30	7743	1815	778	1038				1038
NPV		3853	1739	2114	186	19	37	1984

FINANCIAL NET PRESENT VALUE ANALYSIS

TYPE OF CONNECTION	CO-PAYMENT 30%	50%	100%
RESIDENTIAL			
Newly Electrified	-770	-520	103
Network Extension	-604	-404	96
Direct Connection	-34	3	96
COMMERCIAL/INDUSTRIAL/DIVERSE			
Newly Electrified	-173	76	700
Network Extension	-1	199	700
Direct Connection	570	607	700
GOVERNMENT/MUNICIPAL			
Newly Electrified	1241	1491	2114
Network Extension	1413	1614	2114
Direct Connection	1984	2021	2114

FINANCIAL ANALYSIS
NET PRESENT VALUE OF ADDITIONAL SUBSCRIBERS
(Quetzales)

	RESIDENTIAL	COMMERCIAL/ INDUSTRIAL/ DIVERSE	GOVERNMENT/ MUNICIPAL	TOTAL
ELECTRIFIED COMMUNITIES	(18,287,500)	(173,000)	310,250	(18,150,250)
NETWORK EXTENSIONS	(8,607,000)	(600)	211,950	(8,395,650)
DIRECT CONNECTIONS	(807,500)	570,000	496,000	258,500
	(27,702,000)	396,400	1,018,200	(26,287,400)

Financial Analysis of the Credit and Training Components

Discount Rate	15.00%
Effective Annual Interest Rate	20.00%
Annual Loss of Principal	2.00%
Percent of Assets Placed	75.00%

Year	Initial Fund	Fund Mgmt	Training, Technical Assistance	Average Fund Balance	Effective Balance Placed	Interest Paid	Collections on Loans	Cash Flow
1	71,111	37,363	10,519	71,111	53,333	10,667	0	(108,326)
2	77,778	48,623	19,815	69,689	52,267	10,453	131,111	(4,652)
3	115,000	59,152	35,222	68,235	51,221	10,244	282,889	94,759
4	196,667	64,652	49,999	65,929	50,197	10,039	477,777	267,497
5	33,333	63,134	56,222	65,591	49,193	9,839	630,000	487,150
Net Present Value								353,150

SUMMARIZED INCOME STATEMENTS 1983 - 1987
(thousands of quetzales)

	1987	1986	1985	1984	1983
OPERATING REVENUES					
Sales	138,716	136,709	108,010	85,802	93,315
Other	328	258	222	134	77
Total operating revenues	139,044	136,967	108,232	85,936	93,392
OPERATING EXPENSES					
Fuel	8,730	2,014	33,663	32,478	26,404
Depreciation	35,401	32,808	11,516	11,137	11,279
Operations and maintenance	18,956	13,666	14,576	10,007	13,449
Administration and general	8,607	8,880	4,741	11,055	4,479
Other	10,969	6,276	4,544	3,341	3,043
Total operating expenses	82,663	64,444	69,040	68,018	58,654
Operating income	56,381	72,523	39,192	17,918	34,738
OTHER INCOME AND (EXPENSES)					
Other income	8,111	4,703	2,744	5,480	9,565
Interest	(28,884)	(27,496)	(4,283)	(3,502)	(10,518)
Other expenses	(8,386)	(7,261)	(3,639)	(8,316)	(3,775)
Net other	(29,158)	(30,054)	(5,178)	(6,338)	(4,728)
NET INCOME	27,223	42,469	34,014	11,580	30,010

SUMMARIZED BALANCE SHEETS, 1982 - 1986
(Thousands of Quetzales)

ASSETS	1986	1985	1984	1983	1982
	Miles de quetzales				
Fixed assets					
Plant and Equipment	1,317,826.2	1,242,393.9	395,264.5	379,414.5	364,917.1
Work in Process	249,570.3	263,863.6	1,010,012.4	915,550.3	818,605.5
Gross Fixed Assets	1,567,396.5	1,506,257.5	1,405,276.9	1,294,964.8	1,183,522.6
Accumulated Depreciation	(128,124.2)	(95,680.4)	(84,618.6)	(72,143.1)	(59,709.2)
Net fixed assets	1,439,272.3	1,410,577.1	1,320,658.3	1,222,821.7	1,124,113.4
Total Investments	97,549.5	72,563.9	72,146.0	55,605.6	13.3
Current assets					
Cash	70,804.9	35,575.8	22,151.9	24,992.6	20,414.5
Fund for Amortization	1,477.4	1,348.4	1,236.9	205.9	206.5
Government and Receivable	0.0	0.0	0.0	21,059.9	27,913.0
Deposits	3,145.4	2,329.2	2,034.0	5,279.4	4,603.7
Net accounts receivable	56,191.4	22,942.9	25,346.4	34,709.1	31,464.3
Inventory	38,108.7	38,807.2	35,805.5	34,230.3	33,599.6
Total current assets	169,727.8	101,003.5	87,574.7	120,455.2	118,301.6
Total deferred assets	6,971.7	15,836.8	16,024.7	16,448.5	21,955.6
Total assets	1,713,521.3	1,599,981.3	1,496,403.7	1,415,341.0	1,264,393.9
Equity and liabilities					
Equity					
Capital	909,169.0	875,134.8	828,555.1	794,185.4	722,955.4
Government support EEGSA	47,951.0	47,961.0	47,961.0	47,951.0	0.0
Investment EEGSA	32,297.6	26,127.8	19,223.6	1,175.5	0.0
Retained earnings	163,615.4	121,146.2	89,623.3	75,552.4	45,541.2
Total equity	1,153,043.0	1,070,369.8	985,363.0	918,974.3	768,497.6
Long-term debt	457,625.3	427,542.6	387,503.0	416,609.7	385,723.6
Total current liabilities	101,549.6	98,126.8	119,541.2	75,402.1	105,591.9
Total deferred liabilities	1,303.4	3,942.1	3,996.5	4,454.8	4,580.8
Total equity and liabilities	1,713,521.3	1,599,991.3	1,496,403.7	1,415,340.9	1,264,393.9

INDE: PROJECTED INCOME STATEMENT
1986-1997
(Millions of Quetzales)

	Base	Projection									
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Operating Revenues											
Sales to EEGSA	95.7	121.1	138.8	149.4	151.9	153.3	177.3	178.0	182.8	193.3	190.2
Retail Sales	43.1	57.5	66.9	74.4	83.6	94.1	105.8	125.5	142.5	161.6	183.5
Other Income	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Total operating revenues	139.1	178.9	206.0	224.1	235.8	247.7	283.4	303.8	325.6	355.2	374.0
Operating Expenses											
Fuel and lubricants	8.5	24.0	43.9	60.6	84.0	100.6	105.8	133.2	135.2	122.5	156.7
Operation and maintenance	19.1	19.7	21.6	23.0	25.1	29.1	32.2	34.2	36.8	39.4	42.0
Administrative and general	8.7	12.4	14.6	15.4	16.2	17.0	17.9	18.7	19.3	19.4	20.5
Other	11.0	13.2	14.4	14.9	15.4	16.7	17.8	18.1	19.5	20.8	22.3
Depreciation	35.4	53.9	56.2	58.0	60.5	67.2	72.9	74.4	81.6	88.4	96.6
Total operating expenses	82.7	123.2	150.7	171.8	201.2	230.6	246.6	278.6	292.4	291.0	338.1
Operating income	56.4	55.7	55.2	52.3	34.6	17.0	36.8	25.2	33.2	64.8	35.8
Non-operating income	(0.1)	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Net income before debt service	56.3	55.9	55.5	52.6	34.9	17.3	37.1	25.5	33.5	64.6	36.1
Interest charged to operations	32.5	52.2	95.6	99.4	66.3	55.5	67.2	78.6	76.5	129.4	150.6
Net income	23.8	3.7	(40.1)	(46.9)	(31.4)	(38.2)	(30.1)	(53.1)	(42.9)	(64.8)	(114.5)
Participation in EEGSA	6.3	2.3	5.2	5.2	6.2	6.6	5.9	5.9	5.9	5.9	5.9
Operating Ratio (%)	59.5	68.9	73.2	76.7	85.3	93.1	87.0	91.7	89.8	81.9	90.4
Rate of Return (%)	4.7	3.7	3.0	2.8	1.8	0.8	1.7	1.1	1.4	2.5	1.3
Rate base	1,556.0	1,519.4	1,868.7	1,891.6	1,915.1	2,027.1	2,195.9	2,260.3	2,350.4	2,535.9	2,732.5

INDE: SERVICES AND USES OF FUNDS
1986-1997
(Millions of Quetzales)

SOURCES	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	TOTAL PERIOD 87-97
	Projection											
Gross internal generation of cash	91.7	109.8	111.7	110.5	95.4	84.5	110.0	99.9	115.2	153.0	132.7	1,214.4
Less: Debt service	84.9	139.1	197.9	218.7	167.1	155.1	179.8	244.8	235.1	277.5	322.4	2,222.4
Net internal generation of cash	6.8	(29.3)	(86.2)	(108.2)	(71.7)	(70.6)	(69.8)	(144.9)	(119.9)	(124.5)	(189.7)	(1,008.0)
Dividends from EEGSA	30.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	31.2
Government support	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loan Proceeds	5.7	66.3	184.5	132.6	147.2	170.8	192.5	128.9	345.9	254.5	479.2	2,108.1
Government contributions	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL SOURCES	42.7	37.1	98.4	24.5	75.6	100.3	122.8	(15.9)	226.1	130.1	289.6	1,131.3
USES												
Construction program	47.0	140.4	268.2	214.5	256.3	355.4	475.7	331.1	833.8	688.2	1,159.8	4,820.4
Change in working capital	15.1	(70.9)	(16.8)	31.7	21.6	(12.2)	15.2	79.8	(33.4)	86.6	(35.4)	81.3
TOTAL USES	62.1	69.5	251.4	246.2	277.9	343.2	490.9	460.9	800.4	774.8	1,124.4	4,901.7
SURPLUS (DEFICIT)	(19.4)	(32.4)	(153.0)	(221.7)	(202.3)	(242.8)	(368.0)	(476.8)	(574.3)	(644.7)	(834.8)	(3,770.2)
TOTAL USES - SURPLUS (DEFICIT)	42.7	37.1	98.4	24.5	75.6	100.3	122.8	(15.9)	226.1	130.1	289.6	1,131.4

INDE: BALANCE SHEET
1986-1997
(Millions of Quetzales)

	Projection										
ASSETS	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Total fixed assets (Net)	1,306.2	1,998.5	2,092.4	2,184.7	2,377.4	2,588.6	2,884.9	3,154.7	3,741.8	4,121.7	4,914.5
Other assets											
Investment EEGSA	93.2	95.5	100.7	105.9	112.1	118.7	124.6	130.5	136.4	142.3	148.2
Other	144.2	167.4	167.4	46.3	34.8	58.3	44.8	130.0	38.5	25.8	66.6
Total other assets	237.4	262.9	268.1	152.2	146.9	177.0	169.4	260.5	174.9	168.1	214.8
Current assets											
Cash	58.9	26.8	30.9	33.6	35.4	37.1	42.5	45.6	48.8	53.3	43.1
Accounts receivable EEGSA	62.0	15.1	17.4	18.7	19.0	19.2	22.6	22.3	22.9	24.2	13.0
Other	23.8	14.4	16.7	18.6	21.7	23.5	26.5	31.4	35.6	40.4	45.9
Inventory	42.0	21.8	31.2	42.9	66.9	69.9	92.4	135.5	193.9	224.9	310.8
Other	8.2	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6
Total current assets	194.9	88.7	106.8	124.4	153.6	160.3	194.6	245.4	311.8	353.4	423.4
Total assets	1,738.5	2,350.1	2,467.3	2,461.3	2,677.9	2,925.9	3,248.9	3,660.6	4,228.5	4,643.2	5,552.7
LIABILITIES AND EQUITY											
Equity											
Capital	954.7	1,007.1	1,007.1	1,007.1	1,007.1	1,007.1	1,007.1	1,007.1	1,007.1	1,007.1	1,007.1
Retained earnings	229.3	224.3	224.4	219.2	181.7	139.5	106.3	41.5	(7.4)	(75.9)	(278.4)
Reserve for revaluations	0.0	648.5	648.5	648.5	848.5	1,048.5	1,305.7	1,848.5	2,178.2	2,600.0	3,299.2
Total equity	1,183.0	1,879.9	1,880.0	1,874.8	2,037.3	2,195.1	2,419.1	2,897.1	3,177.9	3,531.2	4,027.9
Long - term debt	440.5	326.3	391.5	423.3	470.9	529.1	555.4	525.7	723.5	806.2	1,092.6
Current liabilities											
Current portion of long - term debt	8.7	102.3	119.3	100.8	99.6	112.6	166.2	158.6	148.1	171.8	192.8
Accounts payable	72.3	29.6	64.5	50.4	58.0	77.0	96.1	67.1	166.9	121.9	227.3
Other	2.6	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Total current liabilities	83.6	141.9	193.8	161.2	167.6	199.6	272.3	235.7	325.0	303.7	430.1
Other liabilities	31.4	2.0	2.0	2.0	2.1	2.1	2.1	2.1	2.1	2.1	2.1
Total liabilities and equity	1,738.5	2,350.1	2,467.3	2,461.3	2,677.9	2,925.9	3,248.9	3,660.6	4,228.5	4,643.2	5,552.7

SUMMARY OF CONNECTION COSTS (Q)

	Direct Connection	Network Extensions	Newly Electrified
Foreign Ex.	145.41	300.04	336.78
Local Costs	40.78	701.42	910.46
Total	186.19.	1,001.46	1,247.24

PER III - CONNECTION COSTS

	FX	LC
Direct Connections		
Transformers	835,650	0
Services & Meters	1,625,000	325,000
Interior Wiring	1,040,000	541,450
	3,500,650	866,450
O/H Factor *		1.1331
	3,500,650	981,774
Total Connections	65,000	65,000
Unit Cost ($)	53.86	15.10
Unit Cost (Q)	145.41	40.78

Total Cost/Unit Q186.19

*O/H Factor:

Consulting Engineering	370,000
Engineering and Administration	1,156,506
Total O/H	1,526,506
Total Construction Costs	12,997,212
Less Total O/H	1,526,506
	11,470,706

O/H Percentage = 1,526,506/11,470,706 = 13.31%

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PER III - CONNECTION COSTS
DISTRIBUTION NETWORK AND PRIMARY LINE

	FX	LC
Additional Cost of Distribution Network		
Distribution Network	$2,290,800	$8,637,600
O/H Factor		1.1331
	$2,290,800	$9,787,265
Connections Requiring Distribution Network	40,000	40,000
Unit Cost ($)	57.27	244.68
Unit Cost (Q)	154.63	660.64
Total Cost/Unit Q815.27		

Additional Cost of Primary Line		
Primary Line	$ 340,200	$1,708,200
O/H Factor		1.1331
	$ 340,200	$1,935,561
Connections Requiring Primary Line	25,000	25,000
Unit Cost ($)	13.61	77.42
Unit Cost (Q)	36.74	209.04
Total Cost/Unit Q245.78		

NRECA Demand Assessment Model Analyses

Objectives:

Examine the load patterns of the National Integrated System (Sistema Integrado Nacional, or SIN) and typical rural electrification systems to determine their differences.

Examine the power provided to the SIN by fuel source, time of year and time of day, in order to determine the availability and cost of energy for new RE projects.

Revise the cost estimates performed for the PER III Project Paper (PP) in light of the foregoing.

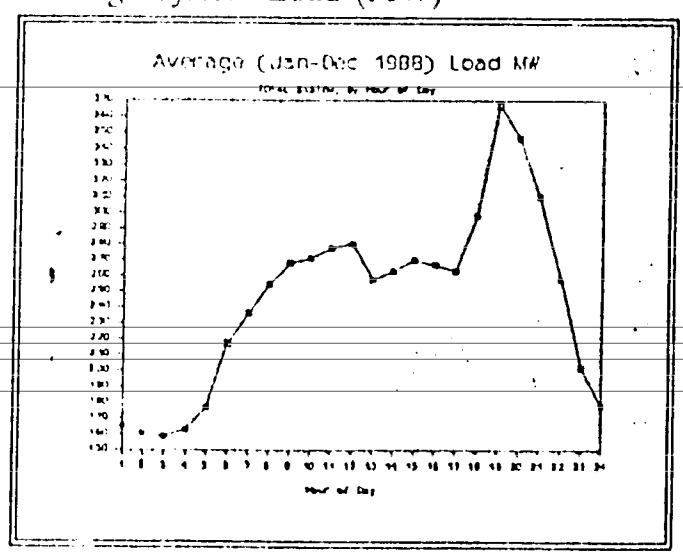
Methodology:

INDE's Programming Unit of the Operations and Maintenance Division provided detailed hourly system load data, including the type and amount of power provided by hydro and the various thermal (bunker, gas, diesel) units connected to the SIN. These data correspond to the third Wednesday of each month during 1988. Matching load data were obtained for two RE areas in the Western Highlands: San Juan Ostuncalco, served by the La Esperanza substation, and Sacapulas, served by the Huehuetenango substation.

Results:

The data were loaded into electronic spreadsheets for further analysis. The average load by hour for the SIN, San Juan Ostuncalco and Sacapulas are presented in graphic form in Figures 1, 2, and 3.

Figure 1
Average System Load (MW)



The system average load shows the peak demand to occur at about 7 p.m. A secondary peak may be observed at about 11:00 a.m. RE loads are coincident with the system peak, but show secondary peaks early in the morning (5-6 a.m.), and essentially no daytime load. Indeed, in the case of Sacapulas, the morning load is actually lower than the nighttime load, suggesting that virtually no productive uses are present.

These data suggest that to estimate capacity charges, the addition load to system peak should be used. On the other hand, daytime productive uses can be introduced without requiring additional capacity in either the total INDE or RE system itself. To the contrary, such loads would improve the overall system load factor and efficiency of operations.

Figure 2
Average Load (kW)
San Juan Ostuncalco

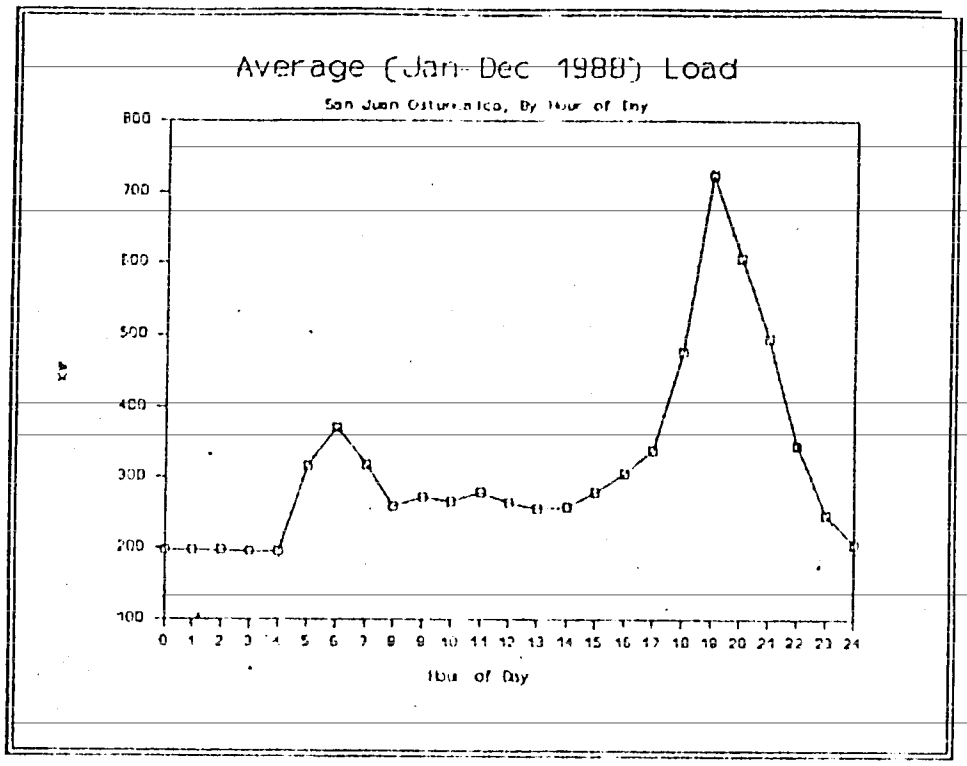
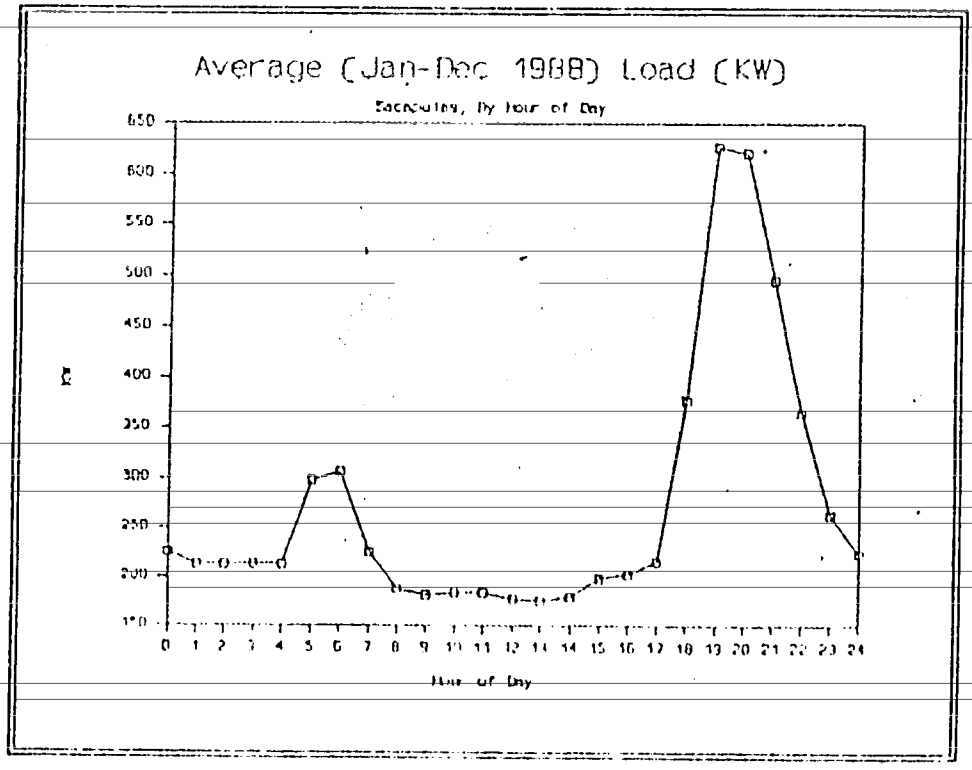


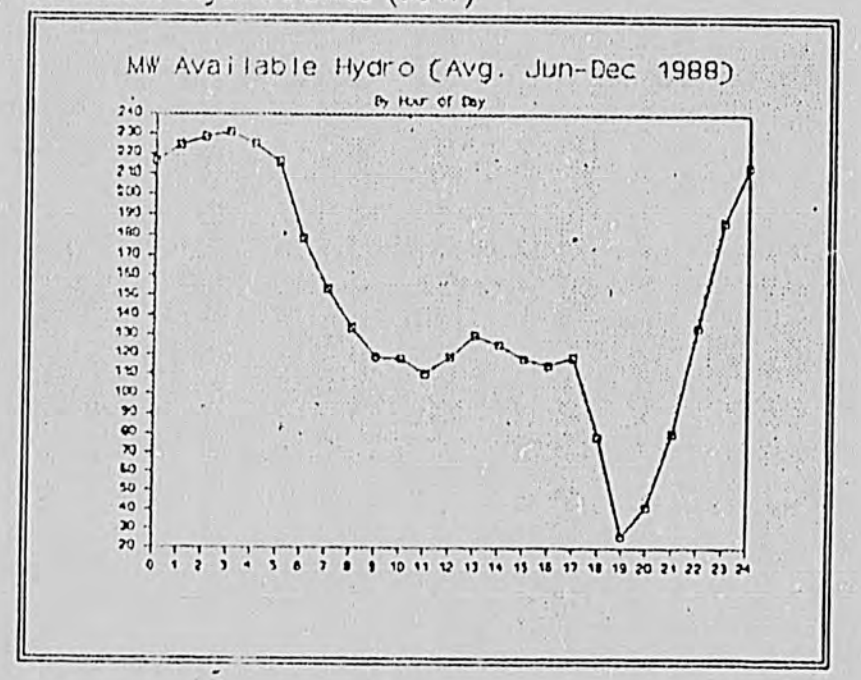
Figure 3
Average Load (kW)
Sacapulas



The marginal cost of energy use is determined by the availability of hydroelectric capacity given current system loads at different times of year and hour of day. Thus, energy use at peak loads would require thermal generation if available hydroelectric capacity was fully utilized at the time of such use. This assumption is based upon standard economic dispatching procedures which will use least-cost energy sources in a mixed hydro-thermal generation system first. INDE maintains generation records which indicate the relative amounts of hydro, bunker, gas and diesel generation on an hourly basis throughout the year.

The data were loaded into electronic spreadsheets and analyzed. No thermal-based power was required by the SIN during the months of June-December, 1988, but thermal units were on-line providing base energy 24 hours a day during the months of January-May, indicating a lack of available hydroelectric resources during these five months of the year. Figure 4 shows the average hourly availability of hydro power for the period June-December, 1988. Availability was estimated by taking the largest load served by hydro units during the period (391.1 MW) and subtracting the total system load. This method assumes that any additional load up to the observed hydroelectric capacity would in fact be served from hydro sources. It is known that the Chixoy hydroelectric facility spills water during an estimated 2.5 months, and thus this assumption likely holds for most, if not all, of the seven month period.

Figure 4
Available Hydro Power (MW)



The minimum hydro power availability actually observed was during the 7:00 p.m. system peak during the month of November, and was 9.1 MW. Given the RE demand curves presented above, and estimated PER III marginal loads, no thermal units would be required during the June-December period.

These data provide a basis for estimating both marginal energy and power costs for RE projects, such as those contemplated under PER III. First, productive uses would generate additional loads during off-peak, daytime, periods, and thus require no additional generation capacity. Marginal loads at peak, such as those generated by RE residential users, require that generation capacity cost allocations be made.

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Table I
National Interconnected System Load (MW)

1988 Hourly Load (MW)
National Interconnected System (INDE)
Third Wednesday of Each Month

Time	20 Jan	17 Feb	16 Mar	20 Apr	18 May	15 Jun	20 Jul	17 Aug	21 Sep	19 Oct	16 Nov	21 Dec
1	164	157	160	179	168	156	164	164	167	163	165	173
2	153	154	158	175	164	151	160	162	160	162	163	166
3	156	152	154	173	160	148	160	158	160	161	159	163
4	160	154	154	176	168	152	163	165	163	164	164	173
5	169	170	182	191	180	165	178	178	179	177	174	180
6	222	218	224	237	215	209	216	210	218	205	212	219
7	234	234	229	247	235	231	238	228	242	237	239	238
8	242	241	249	266	247	249	259	240	258	269	268	264
9	252	258	263	270	264	257	264	257	275	285	281	287
10	256	265	269	281	270	261	266	256	269	291	286	285
11	258	264	277	290	275	268	271	273	276	295	296	287
12	271	254	283	290	279	271	272	270	286	296	297	290
13	244	243	261	258	257	245	253	253	261	272	274	268
14	253	249	263	273	264	242	257	262	265	274	278	273
15	254	255	270	275	269	267	264	271	273	280	283	272
16	252	249	263	270	266	267	262	281	275	268	277	271
17	246	242	260	272	256	273	257	264	271	264	280	268
18	282	265	267	297	277	280	259	279	314	343	367	343
19	358	355	359	373	361	347	356	373	366	376	391	383
20	339	336	348	352	348	336	350	346	343	347	351	363
21	301	299	311	314	308	297	316	306	312	314	316	328
22	248	251	260	267	254	243	258	250	257	265	258	281
23	198	191	196	204	203	190	202	197	199	206	213	225
24	175	166	175	186	180	167	171	178	178	183	185	190

Table II
San Juan Ostuncalco Load (kW)

Hourly Load (kW)
San Juan Ostuncalco Feeder of Quetzaltenango Substation (13.8kV)
Third Wednesday of each Month

Time	20 Jan	17 Feb	16 Mar	20 Apr	18 May	15 Jun	20 Jul	17 Aug	21 Sep	19 Oct	16 Nov	21 Dec
0	175	175	200	200	200	200	250	175	200	200	200	200
1	175	175	200	200	200	200	250	175	200	200	200	200
2	175	175	200	200	200	200	250	175	200	200	200	200
3	175	175	200	200	200	200	250	175	200	175	200	200
4	175	175	200	200	200	200	250	175	200	200	200	200
5	300	300	350	400	300	300	350	350	400	250	300	200
6	500	400	350	400	400	300	350	300	400	250	300	500
7	375	350	300	300	350	250	300	250	350	250	350	400
8	259	300	300	250	300	200	225	175	250	200	300	350
9	245	300	300	300	300	200	250	200	300	200	300	350
10	225	300	300	300	300	200	275	200	250	200	300	350
11	225	300	300	350	300	200	275	200	300	200	350	350
12	225	300	300	250	300	200	250	200	300	200	300	350
13	225	275	300	250	250	200	250	175	300	200	300	350
14	225	275	300	200	250	200	250	175	300	250	300	375
15	325	300	300	250	300	250	250	250	300	200	250	375
16	325	325	289	250	250	250	325	300	400	250	350	350
17	350	325	300	350	350	300	350	300	400	300	350	400
18	500	425	500	350	350	250	400	350	700	650	675	600
19	775	800	750	650	750	450	700	700	800	700	775	850
20	600	600	625	650	650	550	700	600	700	625	600	700
21	420	500	450	500	500	450	600	500	600	450	450	550
22	350	375	275	350	300	300	400	300	600	300	250	350
23	250	250	225	225	250	225	300	300	300	200	200	250

Table III
Sacapulas System Load (kW)

Hourly Load (kW)
Sacapulas Feeder of Huehuetenango Substation (13.8kV)
Third Wednesday of each Month

Time	20 Jan	17 Feb	16 Mar	20 Apr	18 May	15 Jun	20 Jul	17 Aug	21 Sep	19 Oct	16 Nov	21 Dec
0	200	200	250	225	225	225	225	225	225	250	200	250
1	200	200	200	225	225	225	225	225	225	200	200	200
2	200	200	200	225	225	225	225	225	225	200	200	200
3	200	200	200	225	225	225	225	225	225	200	200	200
4	200	200	200	225	225	225	225	225	225	200	200	200
5	300	275	250	350	275	300	325	300	275	300	300	325
6	400	325	350	300	275	250	275	275	300	300	300	325
7	250	350	200	175	200	200	200	225	200	250	225	225
8	200	175	200	175	175	200	175	175	175	200	225	175
9	200	175	200	175	175	175	175	175	175	200	175	175
10	200	175	200	175	175	175	175	175	175	200	175	200
11	200	175	200	175	175	175	175	175	200	175	175	200
12	175	175	200	175	175	175	175	175	175	175	175	175
13	175	175	200	150	175	175	175	175	175	175	175	175
14	175	175	200	175	175	175	175	175	175	175	175	200
15	200	200	200	200	200	200	175	175	200	225	200	200
16	200	200	200	200	200	200	200	175	200	225	200	225
17	200	200	200	225	200	200	200	175	200	300	200	275
18	350	275	400	275	275	250	200	300	400	575	625	600
19	600	600	625	650	650	650	550	625	625	650	625	675
20	600	600	600	650	650	650	600	625	625	600	600	650
21	500	500	500	450	500	550	500	500	500	450	475	525
22	375	400	300	350	400	350	350	375	350	350	375	400
23	225	300	250	250	250	250	275	300	250	250	250	300

Table IV
Hydroelectric Power Availability (MW)

Hydroelectric Power Availability (MW) At Zero Effective Marginal Cost

Time	Jan-May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0.0	226.5	218.4	213.4	217.4	214.2	218.2	207.7
1	0.0	232.5	226.9	226.7	221.7	220.1	225.7	217.7
2	0.0	240.5	230.9	229.0	228.7	217.1	227.7	224.7
3	0.0	243.5	230.9	233.0	228.7	222.1	231.7	227.9
4	0.0	239.5	222.9	226.0	225.7	218.1	226.7	217.9
5	0.0	226.5	212.9	213.0	214.7	218.1	216.7	210.9
6	0.0	182.5	175.4	181.0	173.7	188.6	178.7	171.9
7	0.0	160.5	153.9	163.0	144.7	146.6	151.7	153.4
8	0.0	142.5	131.9	151.0	132.7	128.2	122.7	127.4
9	0.0	133.6	126.9	134.0	118.7	105.5	110.2	104.4
10	0.0	130.5	125.4	135.0	119.7	104.5	105.2	106.4
11	0.0	123.5	120.4	118.0	108.7	102.5	95.2	104.4
12	0.0	132.5	132.4	121.0	115.7	107.5	112.2	110.9
13	0.0	145.8	138.4	138.0	123.7	124.0	117.2	122.9
14	0.0	148.8	134.4	129.0	119.2	115.0	113.2	117.9
15	0.0	124.2	127.4	120.0	117.2	112.7	107.7	118.9
16	0.0	124.2	129.4	110.0	101.7	105.7	113.7	119.9
17	0.0	118.2	133.7	126.7	101.7	116.7	111.0	122.9
18	0.0	111.2	131.9	111.7	75.4	49.7	24.0	47.9
19	0.0	49.2	40.9	33.7	17.4	17.7	15.0	9.9
20	0.0	65.2	40.9	44.7	41.4	31.7	39.7	27.9
21	0.0	114.2	74.9	84.7	77.4	75.7	74.7	62.9
22	0.0	148.2	132.9	140.7	140.4	132.7	132.7	109.9
23	0.0	201.2	189.4	193.7	192.4	184.2	178.2	166.4
24	0.0	224.2	220.4	212.7	217.4	214.2	206.2	200.9

Note: Thermal units are on-line 24 hours/day Jan-May.
Thus, ZERO available hydroelectric power is assumed.
Maximum hydro load served was 391.1 MW in Nov. 1988.
Availability = 391.1 - load served (MW).

ANNEX I

ECONOMIC ANALYSIS

1. INTRODUCTION

Economic analysis of the Project focuses on whether or not the Project improves the general welfare of Guatemala. While financial analysis examines on the flows of cash to and from INDE, economic analysis considers whether the Project is beneficial to the country as a whole. Economic analysis thus considers the value of electricity to users and compares it to the underlying cost of providing service - excluding taxes, subsidies, and other transfers.

On the basis of the economic analysis, the Project will provide net benefits to the country. The substantial reduction in the energy costs that rural households will experience is more than enough to offset the costs of connection. According to a recently-completed study by INDE, monthly household expenditures on non-electric illumination (candles, kerosene, etc.) are estimated to be at least Q10.14. With electrification, the cost of providing an equivalent amount of electric illumination is estimated to be Q1.60. In addition, electricity offers a higher quality service and provides rural households an opportunity to purchase additional low cost energy. The INDE study also found that a surprisingly high average of Q4.29 per month is spent on energy for small appliance operation (batteries, etc.). These factors combine to provide benefits to rural households.

2. APPROACH

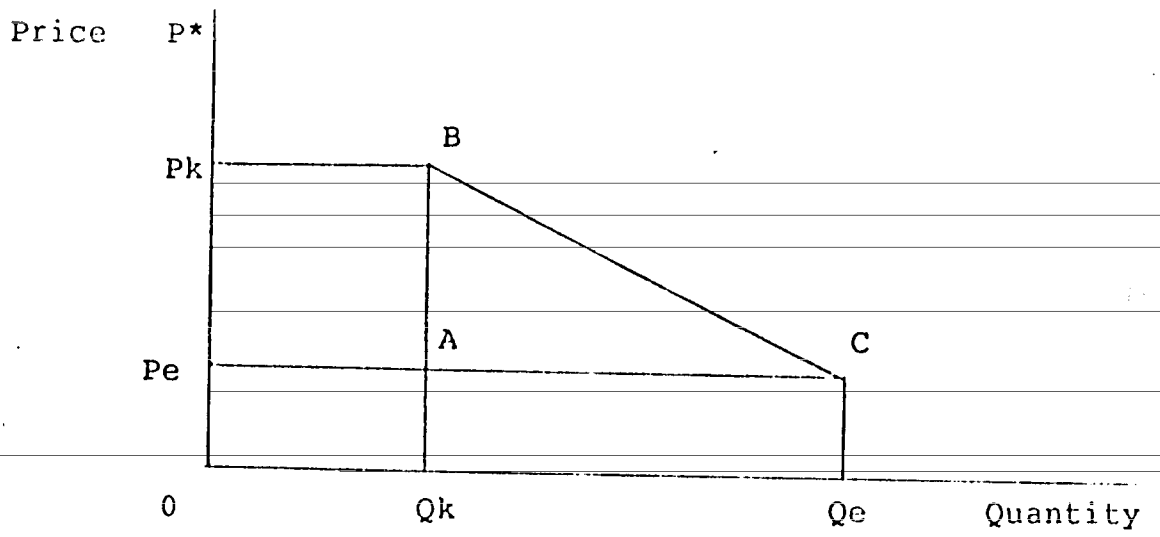
The economic analysis was conducted through an analysis of the economic costs and benefits of the Project. Economic costs can differ substantially from financial costs. First, economic costs are based on the "opportunity costs" of the inputs employed. Second, economic analysis establishes "shadow prices" to reflect the cost of supplying inputs. Both of these concepts are closely related.

Opportunity costs are the value of resources in their best alternative use. For many of the resources required for this Project, the opportunity cost is simply the market price. The best alternative use of new distribution equipment is given by the price that INDE or another electricity system must pay to purchase the equipment. In other cases, such as equipment already installed on the INDE system, the opportunity cost may differ substantially from the market price. For example, existing capacity that is under-utilized has few alternative uses and low opportunity costs, despite the fact that its replacement (market) cost may be very high.

Shadow prices are constructed to reflect the value of the resources employed in the Project. Shadow prices exclude taxesand subsidies, as these are transfers to or from the government and do not affect the true social cost. For example, if the national price of fuel is set below the world' market price, the difference is a transfer from the government to the fuel producer. Fuel purchases cost the country an amount equal to the world market price, even if the financial cost to INDE is reduced through a subsidy.

Economic benefits to new subscribers consist of reductions in their monthly expenditures for fuel and lighting. In addition, consumers not only displace their current expenditures of high cost fuels but also obtain the opportunity to purchase additional energy at a lower price than they were previously charged. Both of these economic benefits are measured as the change in "consumer surplus" that beneficiaries experience.

The benefit calculation is depicted in the following figure:



The downward sloping line connecting points B and C represents the consumer's demand for energy. Prior to electrification, the consumers purchased candles or kerosene; at a price of P_k, Q_k units were purchased. Following electrification, the customer will pay a price of P_e for Q_e units of electricity. The demand curve indicates that the customer is willing to pay $OP^*C\ Q_e$ for Q_e units of electricity, but has to pay only OP_eCQ_e. The difference given by triangle $P_e\ P^*C$ -- is the consumer's surplus.

To the consumer, the additional benefits of electrification are given by the savings achieved through lower fuel prices for the existing fuel consumption -- given by $P_e P_k BA$ -- plus the increase in consumer surplus of triangle ABC. These benefits can be estimated through the following formula:

$$B = \sum_{i=1}^{t} K_i \left(G_i + 1/2\, G^i{}_2 E\right)$$

where:

Ki= Expenditures on kerosene/candles that would be made in year i.

G = Percentage difference between the cost of an equivalent amount of kerosene lighting and one kWh of electric light.

E = Price elasticity of demand for electric lighting, in absolute value.

t = Life of Project, in years.

The value of this expression provides an estimate of the subscriber's willingness to pay for electric service.

The new subscriber's savings on purchases of candles and kerosene also represent a loss of income to producers of these items. This analysis follows the evaluation set forth in the PER II Project Paper and excludes these potential cost from the analysis. This decision was made for several reasons:

1. To the extent that electricity displaces kerosene, the loss is borne primarily by foreign oil producers and not by Guatemala.

2. To the extent that electricity displaces wood torches, there is probably a net social benefit by reducing the threat of deforestation.

3. To the extent that electricity displaces candles, there is some loss to domestic candle producers, although this is offset somewhat by the availability of these resources to other sectors.

3. ECONOMIC BENEFITS

This analysis conservatively assumes that the value of subscribing for electricity is given solely by the ability to purchase low cost energy. This conservative assumption implies that there is no value to the connection independent of the value of the energy that can be purchased.

Several estimates of the value of electricity to consumers can be developed. The minimum value is given by the price actually paid by users. Since the average PER II consumer is estimated to pay 17 centavos per kWh, the consumer must value electricity at least that much. At the upper extreme, INDE'S generation planning criteria include a value of $1,500 (USA) per MWh. According to this assumed parameter, consumers experience a loss of Q 4.5 per kWh when electricity cannot be provided. At this upper level, virtually any electricity supply project can be justified.

Using the welfare analysis developed above, the value of electricity can be estimated. Expenditures for lighting by non-electrified households were estimated to be Q10.14 per month, according to a survey conducted by INDE in mid-1988. Additional energy expenditures for small appliances averaged Q4.29 per month.

The cost reduction factor, G, was obtained by updating the analysis contained in the Project Paper for PER II. Using the current kerosene price of Q2.42 per gallon, it costs the kerosene lighting household Q6.21 per kWh equivalent. At a average cost per kWh of Q0.17, the electricity cost reduction factor is 97.3 percent.

The price elasticity of demand, for residential customers, is not estimated by INDE. We have assumed a fairly elastic demand and used a value of -1.3. Using these parameters, we can estimate the value of electricity as 1.59 times the current expenditures for non-electric fuels, or Q22.94 per electrified household.

The economic benefit of electrification for productive uses vary depending on the exact use of the electricity. Because naturally occurring productive use sales will be a small portion of total sales, the lighting benefits per kWh were conservatively used as a proxy, in the following manner.

A value of Q16 per connection was used as the economic benefit of the first 20 kWh per month. For additional energy, the benefit factor of 1.59 was applied to the tariff price to estimate economic benefits.[1]

In addition, there are substantial non-quantifiable social benefits (see Annex M) of the rural electrification program.

4. ECONOMIC COSTS

For most of the financial costs calculated in Annex I, no adjustment is required to develop economic costs.

Because there is limited excess capacity in the generation, transmission, or distribution systems, the economic cost is conservatively estimated as the cost of expansion. For generation, this expansion cost is offset by fuel savings, as most of the capital costs of hydroelectric units will be offset by reductions in the use of thermal fuels.

Labor costs, for unskilled workers, are artificially increased by minimum wage legislation. The analysis uses an estimate of the shadow price of unskilled labor at one-half the minimum wage (Q 2.25 per day), a guideline used in other A.I.D. projects in Guatemala. Based on engineering estimates that 25 percent of labor required for the program is unskilled, this adjustment will reduce the economic costs of the program by about five percent, relative to the financial costs.

There are no major capital rationing programs in Guatemala, although at present long-term capital is in short-supply. A 15 percent discount rate was used to reflect the scarcity of capital. This figure is consistent with the rate used by A.I.D. in Guatemala. Although INDE can currently obtain financing from International Development Banks at 8 - 8 1/2 percent, this rate understates the cost of borrowing for several reasons:

(1) The banks require substantial commitment fees that increase the effective cost of borrowing.

(2) The loans are at variable rates and thus must be increased to reflect interest rate risks.

(3) The loans must be repaid in foreign currencies and impose significant exchange rate risks.

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[1] Although not included in the above calculations, a more detailed analysis of the benefits derived from Project-promoted productive uses was performed, and is presented in Annex L, Exhibits 6, 7 and 8.

The 2.70 exchange rate is expected to be a market-clearing rate over the near term, absent any major economic stocks. There is presently no rationing of foreign exchange nor are there informal markets for hard currencies. Accordingly, the 2.70 exchange rate was used.

INDE is not taxed by the central government and its imports of materials and equipment are free of import duties. Thus, no adjustment is necessary for taxes.

While INDE is apparently subsidized by the central government to some extent through below-market fuel prices and favorable exchange rate treatment, these subsidies are not publicly disclosed and are not contained in the planning documents on which the cost elements of the Project analysis are based. As a result, these subsidies have been appropriately excluded from the Project analysis.

5. ECONOMIC ANALYSIS

The results of the economic analysis show benefits for all classes of residential connections. For direct connections, which require no additional distribution network lines, the economic benefits of this type of connection are particularly high (Q1,688 per connection).

For connections requiring distribution facilities --either newly electrified communities or those requiring extensions of the distribution network-- the net economic benefits are smaller but still positive. This result is obtained due to the high installation cost associated with distribution facilities.

The net economic benefits of performing residential connections is summarized as follows:

	Net Economic Benefit
Newly electrified communities	+ Q680
Network extensions	+ Q914
Direct connections	+ Q1,688

These results are summarized in Annex I-1, with sample calculations.

The net benefits of electricity sales to residential --exclusive of connection costs-- is estimated as Q1,865 per connection. Thus, any residential connection with costs of less than Q1,865 is expected to have economic benefits. Because imported materials costs for connections in newly electrified communities (the most expensive type of connection) are estimated to be Q337, INDE's installation and pole costs must be less than Q1,528 to justify this activity of the Project. INDE's current estimated costs for this type of connection is Q910, resulting in a net economic benefit of Q680 after the adjustment for unskilled labor discussed above has been made.

The aggregate economic benefits of the PER III construction program are presented in Annex I-2. Based upon the planned distribution of connections among classes and types of connections, the program will have a net economic benefit of Q75.5 million.

ECONOMIC NET PRESENT VALUE ANALYSIS

	Residential	Commercial/ Industrial/ Diverse	Municipal/ Government
Newly Electrified Connections	680	1,172	2,682
Extension of Distribution Networks	914	1,406	2,916
Direct Connections	1,688	2,180	3,690

Economic Analysis

Residential Class
Newly Electrified Connection

Benefit per year	275.32	
Revenue/kWh	0.120	0.168
Cost/kwh	0.0989	
Cost/connection	12.00	
Discount Rate	15.0%	

Year	Sales	Benefit	Cost of Sales	Net Benefit	Connection Cost	Initial Payment	Periodic Payments	Net Cash Flow
0					1185			-1185
1	203	300	32	268				268
2	212	301	33	268				268
3	242	316	36	280				280
4	270	321	39	282				282
5	294	325	41	284				284
6	315	328	43	285				285
7	331	331	45	286				286
8	347	334	46	287				287
9	364	337	48	289				288
10	383	340	50	290				290
11	402	343	52	291				291
12	422	346	54	292				292
13	443	350	56	294				294
14	465	353	58	295				295
15	488	357	60	297				297
16	513	361	63	299				299
17	538	366	65	301				301
18	565	370	68	302				302
19	594	375	71	304				304
20	623	380	74	306				306
21	654	385	77	309				309
22	687	391	80	311				311
23	721	397	83	313				313
24	758	403	87	316				316
25	795	409	91	318				318
26	835	416	95	321				321
27	877	423	99	324				324
28	921	430	103	327				327
29	967	438	108	330				330
30	1015	446	112	333				333
NPV		2161	296	1865	1185	0	0	680

Economic Analysis

Residential Class
Extension of Existing Distribution Network

Benefit per year	275.32	
Revenue/kWh	0.120	0.168
Cost/kwh	0.0989	
Cost/connection	12.00	
Discount Rate	15.0%	

Year	Sales	Benefit	Cost of Sales	Net Benefit	Connection Cost	Initial Payment	Periodic Payments	Net Cash Flow
0					951			-951
1	203	300	32	268				268
2	212	301	33	268				268
3	242	316	36	280				280
4	270	321	39	282				282
5	294	325	41	284				284
6	315	328	43	285				285
7	331	331	45	286				286
8	347	334	46	287				287
9	364	337	48	288				288
10	383	340	50	290				290
11	402	343	52	291				291
12	422	346	54	292				292
13	443	350	56	294				294
14	465	353	58	295				295
15	488	357	60	297				297
16	513	361	63	299				299
17	538	366	65	301				301
18	565	370	68	302				302
19	594	375	71	304				304
20	623	380	74	306				306
21	654	385	77	309				309
22	687	391	80	311				311
23	721	397	83	313				313
24	758	403	87	316				316
25	795	409	91	318				318
26	835	416	95	321				321
27	877	423	99	324				324
28	921	430	103	327				327
29	967	438	108	330				330
30	1015	446	112	333				333
NPV		2161	296	1865	951	0	0	914

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Economic Analysis

Residential Class
Direct Connection

Benefit per year	275.32	
Revenue/kWh	0.120	0.168
Cost/kwh	0.0989	
Cost/connection	12.00	
Discount Rate	15.0%	

Year	Sales	Benefit	Cost of Sales	Net Benefit	Connection Cost	Initial Payment	Periodic Payments	Net Cash Flow
0					177			-177
1	203	300	32	268				268
2	212	301	33	268				268
3	242	316	36	280				280
4	270	321	39	282				282
5	294	325	41	284				284
6	315	328	43	285				285
7	331	331	45	286				286
8	347	334	46	287				287
9	364	337	48	288				288
10	383	340	50	290				290
11	402	343	52	291				291
12	422	346	54	292				292
13	443	350	56	294				294
14	465	353	58	295				295
15	488	357	60	297				297
16	513	361	63	299				299
17	538	366	65	301				301
18	565	370	68	302				302
19	594	375	71	304				304
20	623	380	74	306				306
21	654	385	77	309				309
22	687	391	80	311				311
23	721	397	83	313				313
24	758	403	87	316				316
25	795	409	91	318				318
26	835	416	95	321				321
27	877	423	99	324				324
28	921	430	103	327				327
29	967	438	108	330				330
30	1015	446	112	333				333
NPV		2161	296	1865	177	0	0	1688

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Economic Analysis

Annex I-1

Commercial/Industrial/Diverse Classes
Newly Electrified Connection

Benefit per year	275.32	
Revenue/kWh	0.139	0.1946
Cost/kwh	0.0989	
Cost/connection	12.00	
Discount Rate	15.0%	

Year	Sales	Benefit	Cost of Sales	Net Benefit	Connection Cost	Initial Payment	Periodic Payments	Net Cash Flow
0					1185			-1185
1	664	368	78	290				290
2	695	372	81	291				291
3	793	430	90	339				339
4	883	447	99	348				348
5	963	463	107	355				355
6	1030	476	114	362				362
7	1081	486	119	367				367
8	1136	496	124	372				372
9	1192	507	130	377				377
10	1252	519	136	383				383
11	1315	531	142	389				389
12	1380	544	149	395				395
13	1449	557	155	402				402
14	1522	571	163	409				409
15	1598	586	170	416				416
16	1678	602	178	424				424
17	1762	618	186	432				432
18	1850	635	195	440				440
19	1942	653	204	449				449
20	2039	672	214	458				458
21	2141	692	224	468				468
22	2248	713	234	478				478
23	2361	735	245	489				489
24	2479	758	257	501				501
25	2603	782	269	512				512
26	2733	807	282	525				525
27	2870	834	296	538				538
28	3013	862	310	552				552
29	3164	891	325	566				566
30	3322	922	341	581				581
NPV		3148	791	2357	1185	0	0	1172

Commercial/Industrial/Diverse Classes
Extension of Distribution Network

Benefit per year	275.32	
Revenue/kWh	0.139	0.1946
Cost/kwh	0.0989	
Cost/connection	12.00	
Discount Rate	15.0%	

Year	Sales	Benefit	Cost of Sales	Net Benefit	Connection Cost	Initial Payment	Periodic Payments	Net Cash Flow
0					951			-951
1	664	368	78	290				290
2	695	372	81	291				291
3	793	430	90	339				339
4	883	447	99	348				348
5	963	463	107	355				355
6	1030	476	114	362				362
7	1081	486	119	367				367
8	1136	496	124	372				372
9	1192	507	130	377				377
10	1252	519	136	383				383
11	1315	531	142	389				389
12	1380	544	149	395				395
13	1449	557	155	402				402
14	1522	571	163	409				409
15	1598	586	170	416				416
16	1678	602	178	424				424
17	1762	618	186	432				432
18	1850	635	195	440				440
19	1942	653	204	449				449
20	2039	672	214	458				458
21	2141	692	224	468				468
22	2248	713	234	478				478
23	2361	735	245	489				489
24	2479	758	257	501				501
25	2603	782	269	512				512
26	2733	807	282	525				525
27	2870	834	296	538				538
28	3013	862	310	552				552
29	3164	891	325	566				566
30	3322	922	341	581				581
NPV		3148	791	2357	951	0	0	1406

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Economic Analysis

Commercial/Industrial/Diverse Classes
Direct Connection

Benefit per year	275.32	
Revenue/kWh	0.139	0.1946
Cost/kwh	0.0989	
Cost/connection	12.00	
Discount Rate	15.0%	

Year	Sales	Benefit	Cost of Sales	Net Benefit	Connection Cost	Initial Payment	Periodic Payments	Net Cash Flow
0					177			-177
1	664	368	78	290				290
2	695	372	81	291				291
3	793	430	90	339				339
4	883	447	99	348				348
5	963	463	107	355				355
6	1030	476	114	362				362
7	1081	486	119	367				367
8	1136	496	124	372				372
9	1192	507	130	377				377
10	1252	519	136	383				383
11	1315	531	142	389				389
12	1380	544	149	395				395
13	1449	557	155	402				402
14	1522	571	163	409				409
15	1598	586	170	416				416
16	1678	602	178	424				424
17	1762	618	186	432				432
18	1850	635	195	440				440
19	1942	653	204	449				449
20	2039	672	214	458				458
21	2141	692	224	468				468
22	2248	713	234	478				478
23	2361	735	245	489				489
24	2479	758	257	501				501
25	2603	782	269	512				512
26	2733	807	282	525				525
27	2870	834	296	538				538
28	3013	862	310	552				552
29	3164	891	325	566				566
30	3322	922	341	581				581
NPV		3148	791	2357	177	0	0	2180

Economic Analysis

Municipal/Government Classes
Newly Electrified Connection

Benefit per year	275.32	
Revenue/kWh	0.169	0.2366
Cost/kwh	0.0989	
Cost/connection	12.00	
Discount Rate	15.0%	

Year	Sales	Benefit	Cost of Sales	Net Benefit	Connection Cost	Initial Payment	Periodic Payments	Net Cash Flow
0					1185			-1185
1	1547	537	165	372				372
2	1619	549	172	377				377
3	1848	713	195	518				518
4	2059	762	216	547				547
5	2244	806	234	572				572
6	2401	843	249	594				594
7	2521	872	261	610				610
8	2647	902	274	628				628
9	2779	933	287	646				646
10	2918	966	301	665				665
11	3064	1000	315	685				685
12	3217	1037	330	706				706
13	3378	1075	346	728				728
14	3547	1115	363	752				752
15	3724	1157	380	776				776
16	3911	1201	399	802				802
17	4106	1247	418	829				829
18	4312	1295	438	857				857
19	4527	1346	460	887				887
20	4753	1400	482	918				918
21	4991	1456	506	951				951
22	5241	1515	530	985				985
23	5503	1577	556	1021				1021
24	5778	1642	583	1059				1059
25	6067	1711	612	1099				1099
26	6370	1782	642	1140				1140
27	6689	1858	674	1184				1184
28	7023	1937	707	1230				1230
29	7374	2020	741	1279				1279
30	7743	2107	778	1330				1330
NPV		5606	1739	3867	1185	0	0	2682

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Economic Analysis

Municipal/Government Classes
Extension of Distribution Network

Benefit per year	275.32	
Revenue/kWh	0.169	0.2366
Cost/kwh	0.0989	
Cost/connection	12.00	
Discount Rate	15.0%	

Year	Sales	Benefit	Cost of Sales	Net Benefit	Connection Cost	Initial Payment	Periodic Payments	Net Cash Flow
0					951			-951
1	1547	537	165	372				372
2	1619	549	172	377				377
3	1848	713	195	518				518
4	2059	762	216	547				547
5	2244	806	234	572				572
6	2401	843	249	594				594
7	2521	872	261	610				610
8	2647	902	274	628				628
9	2779	933	287	646				646
10	2918	966	301	665				665
11	3064	1000	315	685				685
12	3217	1037	330	706				706
13	3378	1075	346	728				728
14	3547	1115	363	752				752
15	3724	1157	380	776				776
16	3911	1201	399	802				802
17	4106	1247	418	829				829
18	4312	1295	438	857				857
19	4527	1346	460	887				887
20	4753	1400	482	918				918
21	4991	1456	506	951				951
22	5241	1515	530	985				985
23	5503	1577	556	1021				1021
24	5778	1642	583	1059				1059
25	6067	1711	612	1099				1099
26	6370	1782	642	1140				1140
27	6689	1858	674	1184				1184
28	7023	1937	707	1230				1230
29	7374	2020	741	1279				1279
30	7743	2107	778	1330				1330
NPV		5606	1739	3867	951	0	0	2916

Municipal/Government Classes
Direct Connection

Benefit per year	275.32	
Revenue/kWh	0.169	0.2366
Cost/kwh	0.0989	
Cost/connection	12.00	
Discount Rate	15.0%	

Year	Sales	Benefit	Cost of Sales	Net Benefit	Connection Cost	Initial Payment	Periodic Payments	Net Cash Flow
0					177			-177
1	1547	537	165	372				372
2	1619	549	172	377				377
3	1848	713	195	518				518
4	2059	762	216	547				547
5	2244	806	234	572				572
6	2401	843	249	594				594
7	2521	872	261	610				610
8	2647	902	274	628				628
9	2779	933	287	646				646
10	2918	966	301	665				665
11	3064	1000	315	685				685
12	3217	1037	330	706				706
13	3378	1075	346	728				728
14	3547	1115	363	752				752
15	3724	1157	380	776				776
16	3911	1201	399	802				802
17	4106	1247	418	829				829
18	4312	1295	438	857				857
19	4527	1346	460	887				887
20	4753	1400	482	918				918
21	4991	1456	506	951				951
22	5241	1515	530	985				985
23	5503	1577	556	1021				1021
24	5778	1642	583	1059				1059
25	6067	1711	612	1099				1099
26	6370	1782	642	1140				1140
27	6689	1858	674	1184				1184
28	7023	1937	707	1230				1230
29	7374	2020	741	1279				1279
30	7743	2107	778	1330				1330
NPV		5606	1739	3867	177	0	0	3690

AGGREGATE NET PRESENT VALUE OF PROJECT

	Residential	Commercial/ Industrial/ Diverse	Municipal/ Government	Total
Number of Subscribers by Type and Class				
Newly Electrified Connections	23,750	1,000	250	25,000
Extension of Distribution Networks	14,250	600	150	15,000
Direct Connections	23,750	1,000	250	25,000
	61,750	2,600	650	65,000
Net Present Value of Additional Connections				
Newly Electrified Connections	16,150,000	1,172,000	670,500	17,992,500
Extension of Distribution Networks	13,024,500	843,600	437,400	14,305,500
Direct Connections	40,090,000	2,180,000	922,500	43,192,500
Total	69,264,500	4,195,600	2,030,400	75,490,500

INSTITUTIONAL ANALYSIS

I. PURPOSE

The purpose of the Institutional Analysis is to analyze INDE's institutional capability vis a vis PER III and identify the improvements necessary to implement the Project. An additional objective is to identify the technical assistance and training requirements for the INDE implementation unit and related divisions. These needs are compared to the assistance to be provided by CARES and the gaps that require additional USAID resources are identified.

II. BACKGROUND

The PER II Project overcame a very slow start and early implementation problems, and produced impressive results in 1986 and 1987. By the end of 1987, the Project had completed or exceeded all Project targets with the exception of a distribution substation to be constructed in 1988. With a recently authorized 15-month PACD extension, all LOP targets will be exceeded by approximately 30% with no increase in A.I.D. financing. The increase in targets is a consequence of the 1985 Quetzal devaluation and an increase in counterpart financing provided by INDE.

INDE's Rural Electrification Unit (currently known as PER II Implementing Unit) is presently situated in the Construction Department (Figs. 1 & 2) and has the responsibility to select the communities to be electrified; to promote the Project by obtaining signed applications for service; to design the required physical facilities and deliver the design to the construction department for construction; perform the inside wiring of households and install the meter upon completion of construction.

The Unit has developed a satisfactory implementation methodology which will permit PER III targets (13,000 connections per year over the last five years of the Project) to be achieved. This methodology is:

- A community electrification committee submits an application for service.

- Social workers go to the community to investigate demographics, community infrastructure, potential connections, distance from existing facilities, etc.

- The information is analyzed by a computer program which determines the community ranking.

- If the community qualifies, the unit coordinates with the Planning Department to determine whether sufficient system capacity is available to serve the community.

- Promotors then go to the community to explain the program in detail and obtain applications for service.

- When sufficient applications are obtained, the information is furnished to the design section of the implementing unit to design the electrical facilities.

- After the design is completed, it must be approved by INDE's Design Department and the Consulting Engineering firm.

- The design is then forwarded to the Construction Department for construction. Construction material for Project construction is separately stored at INDE's five regional warehouses.

- During construction, the work in progress is regularly checked by the Consulting Engineer who submits periodic reports to the Unit and USAID.

- Upon completion of construction, the Unit's Construction section (installers) perform the inside wiring and connect the meters.

The completed facilities are then turned over to the Operations Management for energization, operations and maintenance. At present, the R.E. Unit has no further responsibility for the connected customers.

The unit has developed a high degree of expertise in project promotion, design, construction supervision and general coordination. The Construction Management has developed an unusually good capability to construct lines and networks for rural electrification connections. Although the Construction Management's implementation capability can be improved through the provision of loan-financed construction vehicles and equipment, the Project design provides only limited funding for this purpose, and specifically directs one-half of available funds for vehicle and equipment purchase to improve the operation of the distribution system *per se*.

The importance of institutionalizing the rural electrification effort has recently been recognized by INDE through the establishment of a Rural Electrification Department, which will be placed in the Planning and Design Division. The new Department will coordinate all INDE's activities in rural electrification. Nonetheless, one of the most important reasons for the implementing unit's effectiveness under PER II has been the considerable degree of autonomy that it has enjoyed. It is considered that it is essential that this autonomy continues under PER III.

Connecting rural consumers to an electric utility's distribution network is just the beginning of a rural electrification program. To develop an economically viable and beneficial program, consumers must be educated in the safe and productive uses of electricity, provided affordable credit and trained in the use of electrical equipment which will improve their production and economic well being as well as the economic and financial viability of the electric utility. INDE must develop this capability of customer assistance to continue carrying out the GOG social mandate of extending electric service to rural areas or, otherwise, face continued financial deterioration.

At present, INDE is the only entity in Guatemala with legal authority to generate and distribute electric power. The organization (Fig. 3) is centrally managed from Guatemala City. There are regional offices each staffed with a commercial supervisor, a construction supervisor and an operations supervisor. Each report to their respective Management in Guatemala City and are responsible for the total INDE operation in their region as it relates to commercial, construction and operations activities. This equates to each Management having proportionate responsibility for INDE's generation, transmission, transformation and distribution.

There is no separate division or organization which has the sole responsibility for distribution which includes management, operation and maintenance of the distribution physical facilities; customer meter reading, billing and collecting; customer services, including complaints, connect & disconnects, applications for service and education and assistance in the productive uses of electricity.

III. CURRENT STATUS

The emphasis in PER II has focused on connecting 90,000 new consumers. PER III will add another 65,000 consumers making the total 155,000, virtually doubling the number of retail consumers INDE served prior to PER II. The additional

facilities to be operated and maintained and the meter reading, billing and collecting for 155,000 more consumers represent a significant increase in work load.

Under the PER II Project, INDE has clearly demonstrated its ability to make household connections. INDE's emphasis, however, has been on construction with very little apparent consideration of the management, operations and maintenance problems of the distribution system.

Several consultants have studied INDE's administrative capability and have made observations on areas in which INDE's management, planning and operations need improvement. USAID personnel and consultants have detected certain weaknesses that will constrain INDE from providing efficient and reliable rural electric services.

Specific deficiencies noted are:

- No organizational unit with the specific responsibility for distribution management, operations and maintenance.
- No regular or systematic right-of-way maintenance program.
- No preventative maintenance program for distribution facilities.
- No systematic patrol of distribution lines to detect and correct problems to prevent outages.
- Limited response for emergency restoration of service (presently emergency crews are available up to 8 p.m., Monday through Friday).
- No safety and job training program.
- No planned preventative vehicle maintenance.

The operation of INDE's generation and transmission system is satisfactory, but distribution management, operations and maintenance are not presently reliable and must be improved to support PER III's emphasis on productive uses. The success of the productive uses program will be influenced dramatically by the reliability of electric service and by the kind of customer services provided by the commercial department. This Project will finance procurement of vehicles and equipment to strengthen INDE's operations and maintenance activities. Specific recommendations are given below to improve the administrative structure of INDE.

Adequate voltage levels and dependable 24-hour service are essential if people are to be persuaded to invest in equipment, and, in effect, become dependent upon electric energy. After the lines are built and the connections are made, there must be an ongoing commitment by INDE to good electric service and responsive customer services.

IV. RECOMMENDATIONS

Mission policy dialogue should stress the need for the acceptance by INDE management of the following objectives to achieve efficient and reliable electric utility operations.

- The need for, and the commitment to, good quality rural electric service.
- Decentralization of rural electric system management for more effective coordination.
- Establishment of accepted standards of performance for maintenance, operations and customer services.
- Provide orientation and training related to rural electric distribution system management.
- Provide the tools and equipment necessary for implementing the program.

a. Improved INDE Management and Distribution Operation Capacity

1. To initiate this improvement, INDE should, as a first step, divide the Operations Management into two departments, i.e., transmission, and substations and distribution, each with a department manager reporting to the Operations Management (Fig. 3).

The Distribution Department would have the responsibility for operations from the substations up to and including the consumer's meter and should establish standards for and implement the following operational maintenance programs.

- Regular patrol of the distribution lines to detect and correct problems to prevent outages.
- Regular, systematic right-of-way maintenance.
- Preventative maintenance program to periodically inspect the system and repair or replace deficiencies.

- Establish after-work-hour emergency crews to restore service 365 days per year.

- Make connects and disconnects in a timely manner.

- Establish and implement a comprehensive safety and job training program for the operations crews.

- Assume the responsibility for vehicle maintenance and establish a systematic vehicle maintenance program.

Assistance to accomplish this can be provided by CARES.

To effectively implement these improvements, the Distribution Department will need substantially more equipment, tools and vehicles than are presently available. Consequently, one-half of the Project funds budgeted for vehicles and equipment will be utilized for that purpose.

In order to initiate the decentralization process in the Operations Management the project will finance equipment and technical assistance for a pilot decentralized INDE Regional Office. $100,000 have been included under the Training and Technical Assistance line item of the project budget for the purpose.

b. Institutionalize the Productive Uses Program

The Productive Uses component provides both credit and training. Since INDE cannot act as a lending institution, according to its internal operating procedures and by law (Reglamento Interno), another institution must be selected to implement this component of PER III. A complete institutional analysis of the Productive Uses component is presented in Annex L.

Promotion of productive uses will require utility counterpart participation. The responsibility for long-term success in productive uses promotion must eventually correspond to the utility. Although INDE is prohibited by law from handling the funding, it must become very much involved in the training and assistance portions of the proposed activities to ensure Project replicability and sustainability.

To accomplish the institutionalization of productive uses promotion, INDE will contract, subject to AID approval, a Project-funded Productive Uses Specialist to work within INDE. The Specialist will provide needed technical assistance to AITEC and FUNDAP, and assure technical feasibility and support

within INDE for the promotion of specific productive use activities. He will also supervise and train INDE's Productive Uses Advisors and will serve as a liaison between INDE, FUNDAP and CARES to coordinate productive uses-related activities of the three institutions. An illustrative scope of work for the Productive Uses Specialist is provided in Exhibit 5.

The Rural Electrification Implementing Unit is doing an excellent job of promoting and coordinating the installation of new connections. The Promotion Section explains the R.E. program to prospective consumers and obtain applications for service. This section should be expanded and the Promotors trained as Productive Uses Advisors to support, expand and institutionalize in INDE the PER III Productive Uses Program described in Section III. This training will be provided by CARES in coordination with FUNDAP.

Those promotors trained in Productive Uses can be transferred to the Consumer Services Department of the Commercial Management Division when that Department becomes operational. The Productive Uses Specialist will then become Advisor to the Consumer Services Department.

c. Improved INDE Field Service Capability

Because INDE will substantially increase the number of direct sales customers under this Project, it will need to improve customer services, maintenance capability and other outreach programs in order to attend effectively these new users.

1. Improved Billing and Collection Producers

While INDE's collections of user charges have been good, there is room for improvement in both the percentages of charges collected and the timeliness of collection. Presently, collections data and meter readings are sent from regional field offices to the central office where they are processed by computer to record collections and calculate new charges. Bills are issued by headquarters and sent back to the field offices. The meter readers collect outstanding amounts for which they are paid on a commission basis. This procedure results in the largest users of electricity, where the highest commissions will be earned, being visited first by the collection agents. The meters of many of the smaller users are read irregularly and the users do not pay on a month-to-month basis because the collection agent simply does not appear at the house, and the nearest INDE office is too far away to justify a special trip. CARES management training will address this issue.

2. Improved Customer Service

Related to the problem of billing and collections are the customer services rendered by the regional field offices to their rural customers. Since the number of rural customers will increase, a greater demand for such service as connections and disconnections, special voltage installations, and other similar requests will be placed on INDE field services. This will improve with the establishment of a Distribution Department.

3. Improved Additional Connection Procedures

A better method should be established to facilitate the connection of additional customers after the initial connections in a community have been made. The process now is burdensome and discouraging to prospective consumers. The local offices should have the authority, as well as the materials, equipment and personnel to deal more directly with the people requesting service. A simpler process would save time for INDE personnel as well as the customer. CARES management training will address this issue.

d. Technical Assistance and Training

1. Needs

Successful implementation of PER III will require well-trained personnel with knowledge and skills related to rural electrification. Performance under PER II has demonstrated such attributes generally in both INDE's Construction Department and the Implementing Unit. However, there is a need for improvement in the management supervision, and coordination of all functions, especially in operations and customer services and productive uses.

The goals of training programs are more readily achieved in work activities involving practical skills such as construction and operation of equipment. On the other hand, disciplines requiring conceptual skills are more difficult to master. That this is true is reflected in the statements of the PER II Project Paper and reiterated in the mid-term evaluation of the Project. These findings are once more the case in assessing the technical assistance and training needs for PER III.

Training funds under PER II have not been fully utilized. As is often true, funds for training are limited and are the first to be cut when budgets are tight. In order to stretch the funds as far as possible, INDE should share facilities and programs with CARES, EEGSA, INTECAP and others when the opportunities arise.

INDE has a well-organized training center of 11 people under the Administrative Management Division. They prepare an annual program schedule according to a needs analysis. Progress is monitored monthly and year-to-date in regard to course completions and test results. Currently 1,500 of INDE's 7,500 personnel receive at least some training annually. However, the bulk of the training is general academic course work and lower level skills. There are good working relations with INTECAP which provides much of the training. The training center also coordinates a donor scholarship program for selected personnel in specific areas.

INDE's training personnel will cooperate with the CARES program and will fully utilize the training opportunities provided by CARES to meet PER III training needs.

Essential to the success of the training program is INDE's willingness to select appropriate personnel and to release them from their normal duties for participation in training activities. Personnel selected for training should be willing and able to share what they learn and thus effectively multiply the benefits.

The comprehensive program planned by CARES addresses many of the training needs identified in PER III. However, much of CARES five-year plan will be implemented on a regional basis, and so cannot directly meet all of INDE's needs. Thus, the "train the trainer" concept becomes very important. INDE can and should expand its training program and provide continuing education by replicating the CARES regional courses "in-house".

2. Coordination with CARES

The CARES Regional Program includes several activities which will provide technical assistance to INDE in direct support of the PER III Program. Specific funds from the Regional Program have been budgeted for activities to be carried out in Guatemala. Following is a detailed description of the TA activities planned for Guatemala under the CARES Regional Program, including funding levels and possible dates:

Description of CARES REGIONAL TA Activities

No. 3 - 34.5 kV Rural Distribution Standard

This program is to develop design standards and construction assembles and configurations that will lower the cost of rural electric distribution systems.

No. 4 - Transformer Evaluation and Management

Included in this program activity is the adaptation of an appropriate computerized load management system for transformers based on kWh usage. By associating each consumer with a particular transformer, the demand loading can be estimated. Likewise, by identifying each transformer by feeder line and by phase, the balance between phases can be determined, as well as feeder loading.

Instruction will be provided regarding overload capabilities and the economics regarding no-load versus load losses.

No. 6 - Monitoring Equipment

Field data is needed for correlation with estimates made by computer programs or other appropriate methodology. Instruments are used to test, measure and record various field data pertaining to current, voltage, line loss, power factor, phase balance, etc.

No. 8 - Publications/Information

CARES plans to translate into Spanish, publish and distribute manuals for improving the design, construction and operation of rural electric distribution systems, utilizing the best of U.S. and Central American technology and experience.

No. 9 - Linemen Training

The backbone of a utility's operation is the lineman. There are no comprehensive continuous linemen training courses in Central America. Most training is done in connection with a specific construction project or by inadequately trained staff demonstrating skills to new employees, often resulting in below per line work. This activity is to support training programs to improve the broad knowledge and the complex skills required of linemen - building lines, connecting transformers, maintaining energized lines, switching high voltage line, "trouble shooting" power outages, etc. - concentrating

on the training of local trainers to the extent possible. For example, from April 3 through April 14, 1989, a course was held in Guatemala to provide follow-up training for maintenance and upgrading of energized lines to approximately 15 persons who will become responsible for such training throughout INDE's seven construction districts. Efforts are also being made to develop training videotapes for linemen.

No.10 - Rural Electric Utility Management Training

CARES plan to conduct a series of short courses, seminars and workshops to improve management skills in the many facets of running a rural electric utility: customer services, design of retail rates, revenue collection, financial analysis, key operating ratios, and the principles of planning, coordinating and evaluating results.

No.11 - Operations Training for Rural Electric Utility Staff

This work plan component is of utmost importance in the support of rural electrification. Training activities will include materials management and inventory control, management of vehicles, meter testing and repair, coordination of system protection, work order procedures, pole inspection and maintenance programs, load and voltage surveys, reduction of line losses and control of outages. Each country, including Guatemala, will have at least 25 participants in this program, with a focus on the training of trainers.

No.12 - Local Manufacturing

Both line construction hardware and productive end-use equipment costs in the region are high. In order to reduce construction costs and increase the use of electrical equipment, NRECA/CARES intends to inventory the local manufacture of such equipment and develop an effective action plan to promote lower-cost products manufactured in Central America.

No.13- Alternative Financing

Central American utilities as a group are facing severe financial difficulties arising from large debt service burdens, high costs, and often up until now, lower than expected electricity sales. They also face continuing demand for rural electrification, and in some cases, rural electrification is an integral component of high-priority rural development initiatives. This activity is to increase funding for rural electrification from new and non-conventional sources, with a preliminary target of raising $20 million from such sources by 1992.

No.14 - Surplus equipment

CARES has begun to arrange for the donation of surplus but serviceable materials and equipment for rural distribution line construction from utilities in the United States. The receiving utility in Central America pays only the cost of transportation. So far, about 750 electric house meters have arrived in Guatemala through this activity, with the objective of decreasing the utility's cost of rural line construction through such donations.

With the only exception of the Publications/ Information activity where funds are only programmed on a regional basis, specific amounts have been programmed for Guatemala for all other TA activities. The CARES support for the PER III project will be formalized through a letter of understanding between the CARES Program and USAID/Guatemala. The programmed amounts and tentative dates for the activities are given below.

No.	Activity	Total	Fiscal Year and Amounts Programmed 1989	1990	1991	1992
13	Alternative Financing	7,500	2,500	2,500	2,500	0
3	34.5 kV Standards	12,000	3,000	3,000	4,000	2,000
4	Transformer Evaluation	11,500	5,500	5,500	500	0
14	Surplus Equipment	13,000	7,000	2,000	2,000	2,000
12	Local Manufacturing	5,200	5,200	0	0	0
6	Monitoring Equipment	1,800	1,000	400	200	200
9	Linemen Training	40,000	10,000	10,000	10,000	10,000
10	Management Training	40,000	10,000	10,000	10,000	10,000
11	Operations Training	26,000	10,000	6,000	5,000	5,000
	Total	$157,000	54,200	39,400	34,200	29,200

In addition to the Regional Program CARES will also finance the three following country-specific activities in Guatemala:

- Demand Assessment

  A methodology will be developed for selection of rural electrification sites based on the economic and financial benefit/cost analysis.

  The Model will be developed with help from INDE staff and applied in rural areas by INDE staff for selection of PER III communities for electrification.

Productive Uses

The goal of this activity is to increase the use of electricity in income-generating activities in rural areas of Guatemala.

This will be accomplished through the establishment and promotion of productive uses of electricity programs within INDE. By working directly with INDE staff from the Commercial and Rural Electrification Departments, coordination of such programs with other government and private-sector agencies will be accomplished as well as training INDE employees in basic marketing skills.

- Engineering Standards

This activity is a continuation of technical assistance and training initiated under PER II related to INDE's Engineering standards for Rural Electrification. A complete revision of INDE's rural electrification standards will be completed, and technicians from INDE's design department and construction personnel will be trained to use the revised standards.

These country-specific activities will be carried out according to the following timetable and budget:

		Fiscal Year			
Activity	Total	1988	1999	1991	1992
Demand Assessment	$107,000	107,000	0	0	0
Productive Uses	55,000	15,000	15,000	15,000	10,000
Engineering Standards	19,500	12,000	2,500	2,500	2,500
Total	$181,500	134,000	17,500	17,500	12,500

The PER II program has already financed the following training and technical assistance activities for INDE through a "buy-in" arrangement with NRECA.

a. Preliminary review of INDE Standards - November, 1987.

b. Energized Line Maintenance - 54 men received 2 weeks hot line training by U.S. Instructor in May and June, 1988.

c. Construction Practices - Training in how to read staking sheets and construction drawings, how to set poles, string and sag wire, make splices and connections, safety principles, first aid, etc. 20 foremen and linemen from INDE's Construction Department, 10 in each 2-week course, beginning August 8, 1988, conducted by two U. S. instructors.

IDENTIFIED TECHNICAL ASSISTANCE AND TRAINING NEEDS - PER III

	Needs Addressed by CARES	CARES WP No.
(1)	Distribution system management emphasizing the development of skills in planning, coordinating, supervising and controlling various areas of delegated responsibility and authority.	10, 11
(2)	Construction standards for lower cost rural electric systems.	3
(3)	Procedures for more efficient procurement, warehousing and inventory control.	10, 11
(4)	Engineering design techniques for quicker and simpler, and more practical, planning and designing of rural electric distribution systems.	October '88
(5)	Operations, maintenance and customer service practices - methods and systems for monitoring and improving voltage levels, reducing losses, and generally improving the quality of service.	6, 9, 11, 4
(6)	Publications - there is an extreme shortage of basic manuals, especially in Spanish, for reference and instruction in the various functions and activities related to rural electric distribution systems (This is partially addressed by CARES W.P. Component No. 8)	8

(7) Productive uses advisors - The productive uses pilot program initiated in the Project will be supported and expanded by training advisors from the Promotion Section of the R. E. Implementing Unit.

It is recommended that three to four Promotors from the Unit be assigned to work full time with the CARES team in adapting the CARES Demand Assessment Model to Guatemala for use as the community selection criteria. This training can be supplemented by their participating in the FUNDAP training in the application of various appliances and equipment in productive uses.

The Promotors would form the nucleus of Productive Uses Advisors in INDE and could train additional Productive Uses Advisors to expand the staff as needed.

NEEDS NOT ADEQUATELY ADDRESSED BY CARES

There are two technical assistance needs recognized by CARES, but not adequately dealt with due to funding limitations. These two needs should be funded to meet the goals of PER III:

1. Publications -

A three volume reference manual should be compiled, published in Spanish, and distributed in quantities so that each person will have ready access to information pertaining to their area of responsibility.

Volume I - Specifications and Drawings for Distribution Line Construction, similar to those produced by REA in the U.S. Included are the dimensions, material designations and instructions for proper assembly, forming and installation.

Volume II - Design standards handbook for application by technicians and engineers in the proper mechanical and electrical design of rural distribution systems: national code requirements for clearances and separations, structural safety factors, pole strength, maximum span guidelines, sag and tension data, guying tables, ruling spans and staking tables, voltage profile standards, conductor economics and mapping. All information should be in a format facilitating practical application without extensive calculations or theoretical knowledge.

Volume III - Operations and Maintenance Manual similar to REA Bulletin 160-1 dealing with preventive maintenance practices, pole inspection programs, correcting power factors, reducing losses, transformer and feeder load management, proper selection of fuses, metering applications, regulating voltage, methods for evaluating quality of service, and determination of cost/benefit ratios.

Funding Requirement

Consultant Services 6 week	$ 12,000
Travel	$ 1,000
Per Diem	$ 4,000
Compilation, Translation Editing and Publishing	$ 15,000
200 - copies of Volume I 50 - copies of Volume II 100 - copies of Volume III	
	$ 38,000

Three-ring, loose-leaf binders should be used to facilitate changes in the drawings, specifications and technical data from time to time.

2. Safety Program

A critical concern of any organization has to be the safety of its personnel. This is especially true for electric utilities given the hazards related to construction projects and the dangers associated with operating and maintaining high voltage lines.

An acceptable safety program will provide a safe working environment, including necessary tools and equipment, standard job procedures, and training to assure requisite knowledge and skills to perform the tasks safely. But, for a program to be effective, the concept of safety must permeate all work activities. It must be a line responsibility, accepted and supported by managers and supervisors at all levels. The performance evaluation of managers and supervisors should include job training and safety factors.

The various evaluations of PER II have noted good performance in terms of work accomplished, but have been critical of methodology, especially the lack of job training and safety practices. In recognition of this deficiency, CARES has included in its five-year program, seminars and workshops related to the subject of job training and safety. However, these efforts will not be sufficient to address the needs of INDE. It is recommended that technical assistance be provided to develop a thorough, yet realistic, training program.

The scope of work would include:

1. Assessment of present levels of job training and safety practices.

2. Policy development and approval.

3. Development of a safety manual of basic rules and job procedures.

4. Seminar for orientation of managers and supervisors.

5. Development of the outline for an ongoing safety program including regularly schedule training in job procedures and safety practices.

6. Initiation of a monitoring system for recording appropriate data related to safety and loss control, and for evaluating the results of the safety program.

Funding Required

Consultant Services-Six weeks	$ 12,000
Travel Round Trip	$ 1,000
Per Diem	$ 3,800
Secretarial, Copy, Printing etc.	$ 5,200
	$ 22,000

e. Future Institutional Considerations

It is understood that the World Bank has approved an Energy sector loan to Guatemala which is tied to policy reform aimed at improving INDE's efficiency. For example, the Bank is interested in decentralizing INDE's distribution management, reducing technical losses and increasing consumer/employee ratios.

The Mission supports this improvement and suggests consideration of the following methodology as one approach to achieving distribution decentralization.

Establish five operating districts in the Distribution Department. Appoint managers for each district and delegate the authority to manage and coordinate commercial, construction and operations personnel in the district, within the framework of policies established by the INDE central office.

The INDE Central Office, Distribution, Commercial, Financial, Planning and Projects Managements would each have personnel with the five district offices on a regular, periodic schedule to provide guidance, advice and assistance to each district manager and appropriate district personnel.

The INDE central office would continue to do the billing, however, duplicate individual customer ledgers should be maintained at each district office.

Each district office would maintain its own books and records including capital, inventory and operating accounts. Each would prepare and forward to INDE central office a monthly operating report and balance sheet together with a narrative summary of the district's progress and problems. The central office would consolidate the district reports into a system wide monthly report.

The Rural Electrification Unit has done a commendable job of promoting and coordinating connections. However, the promotion section must be expanded and promotors trained in productive uses as they will have the additional responsibility to train, then advise and assist the Consumer Services and Productive Uses Departments in the District Offices.

Additionally, the R.E. Unit will need to coordinate the PER III connections with the respective district office as well as the appropriate divisions in INDE's Central Office. District Engineering and Construction Departments should have the authority to design and construct up to 500 meters of distribution primary lines or secondary networks. Extensions

in excess of 500 meters would be designed and constructed by the respective central office divisions. These central divisions would continue to be responsible for overall system facilities planning design and the construction of substations and transmission lines. Figure 4 depicts a typical district office organization and lists the major functions of each department.

This decentralization can be accomplished without adding to INDE's staff. Personnel can be reassigned and retrained to new responsibilities making INDE a more effective and productive utility providing efficient, reliable service to its customers as well as continue to fulfill the GOG commitment to extend electric service to rural Guatemala.

It also is important to note that well-managed and operated R.E. distribution systems invariably attract other donors to provide "soft loans" to fund continuing R.E. Programs. This has been the case in Bangladesh, India, Indonesia, Pakistan and the Philippines.

In order to test the decentralization concept, the Project will finance equipment and technical assistance to strengthen and operate a pilot decentralized INDE Regional Office. This Regional Office will serve as a demonstration center which can later be replicated in other areas. The required funding will be distributed as follows:

1. Equipment

Computer	$ 10,000
Office Equipment	10,000
Maintenance Equipment	20,000
	$ 40,000

2. Technical Assistance & Training

Consultant Services (6 person-months)	$ 30,000
Personnel Training	30,000
	$ 60,000

Figure 1.1
National Electrification Institute (INDE)

Organizational Chart - 1987

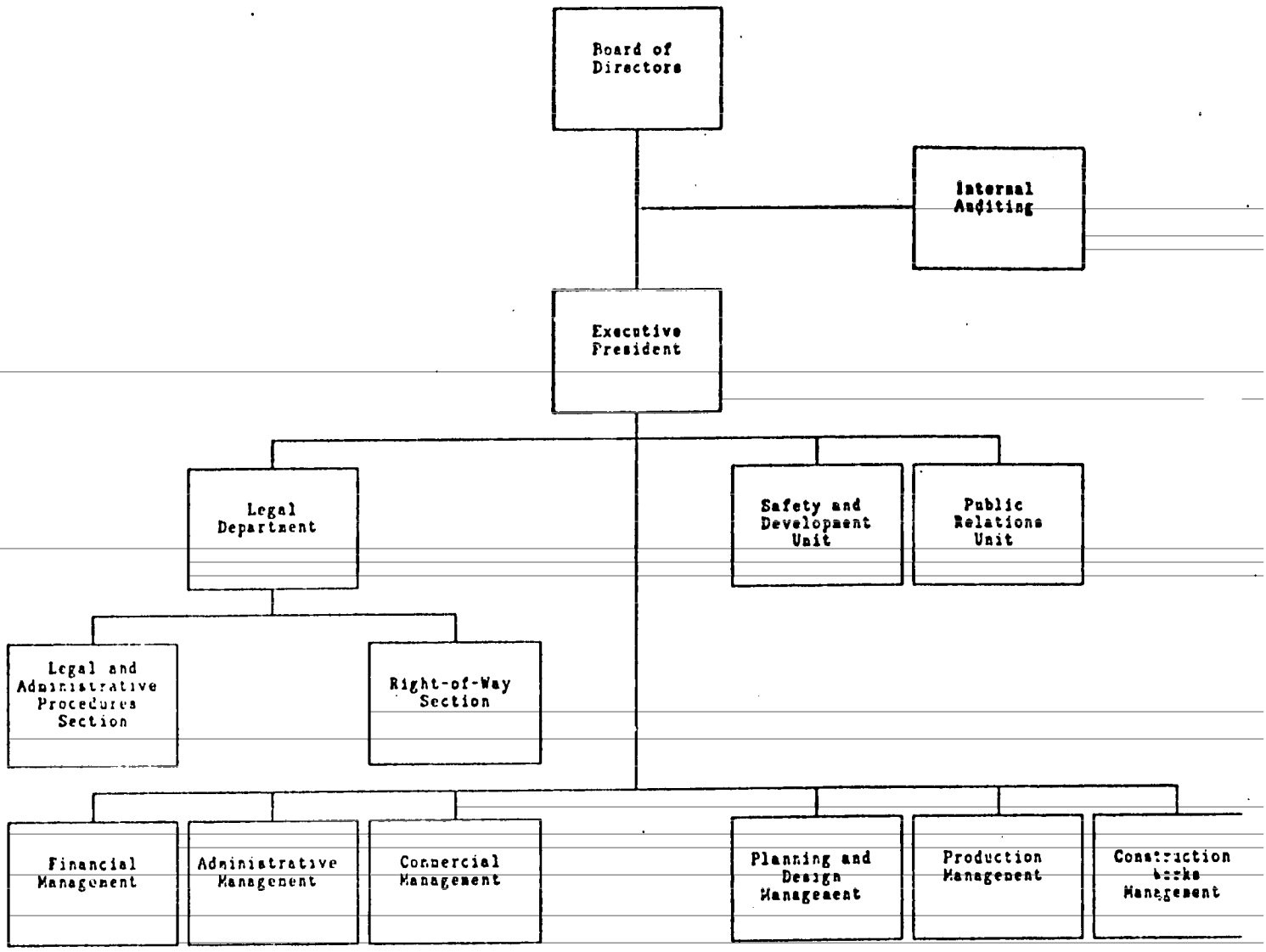


Figure 1.2
National Electrification Institute (INDE)
Financial Management
Organizational Chart - 1987

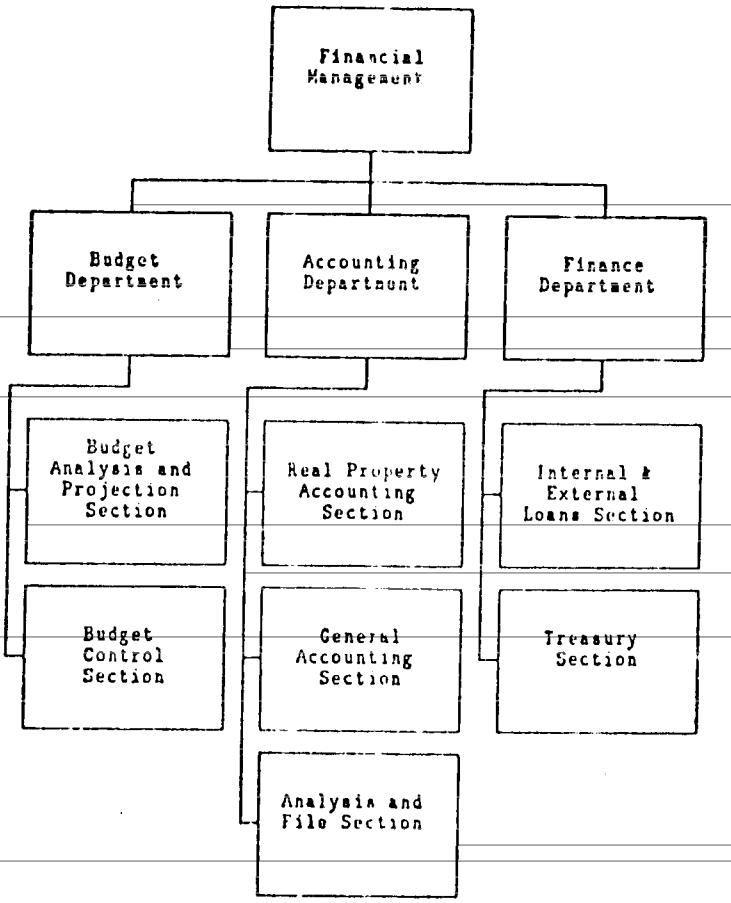


Figure 1.3
National Electrification Institute (INDE)
Administrative Management
Organizational Chart - 1987

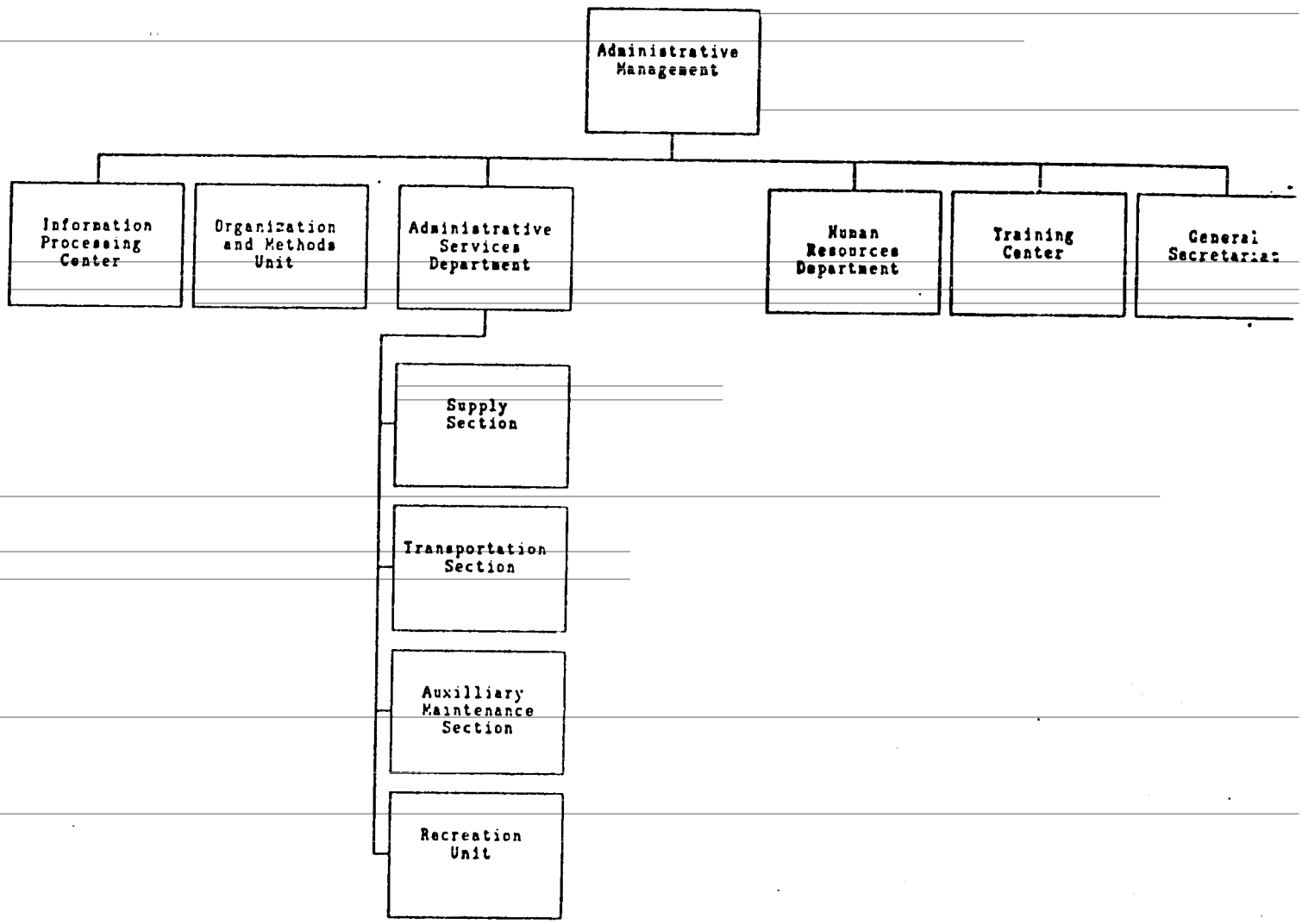
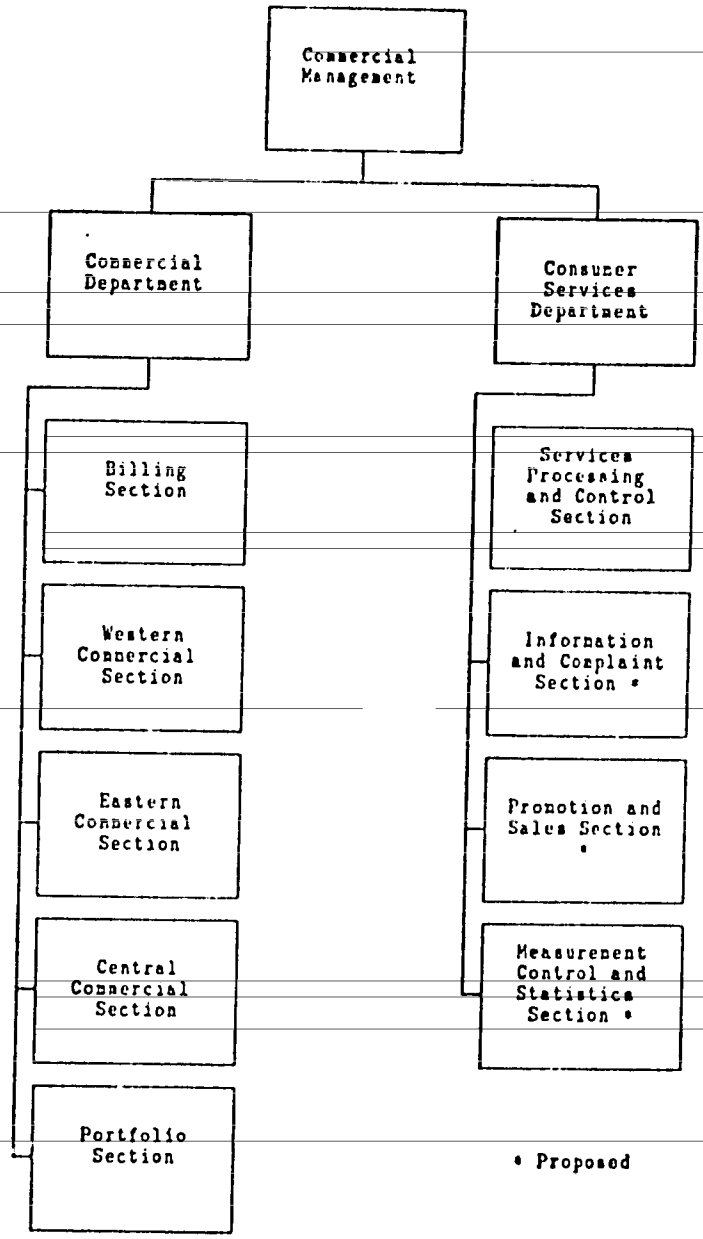


Figure 1.4
National Electrification Institute (INDE)
Commercial Management
Organizational Chart - 1987



* Proposed

Figure 1.5
National Electrification Institute (INDE)
Planning and Design Management
Organizational Chart - 1987

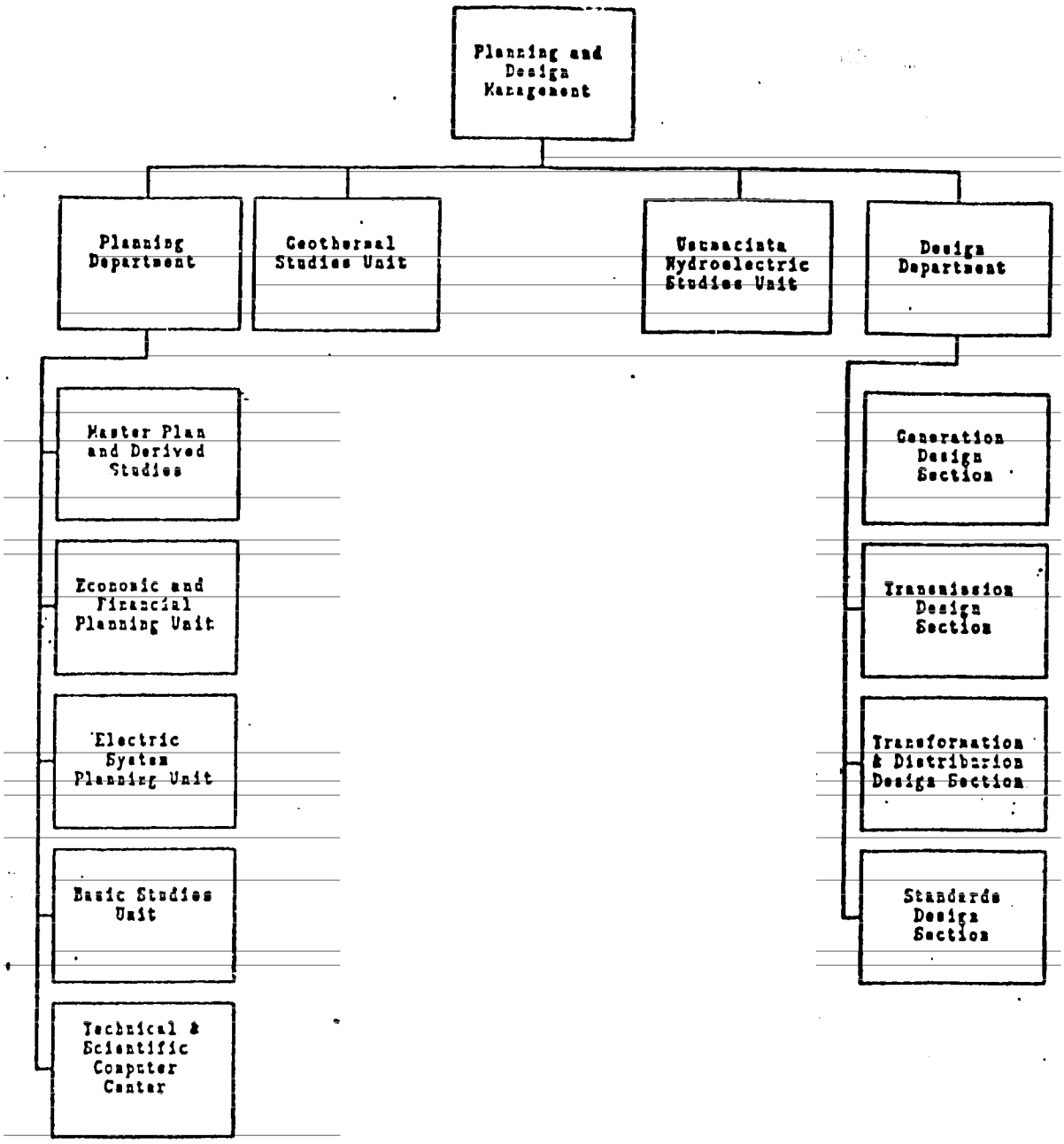


Figure 1.6
National Electrification Institute (INDE)
Production Management
Organizational Chart - 1987

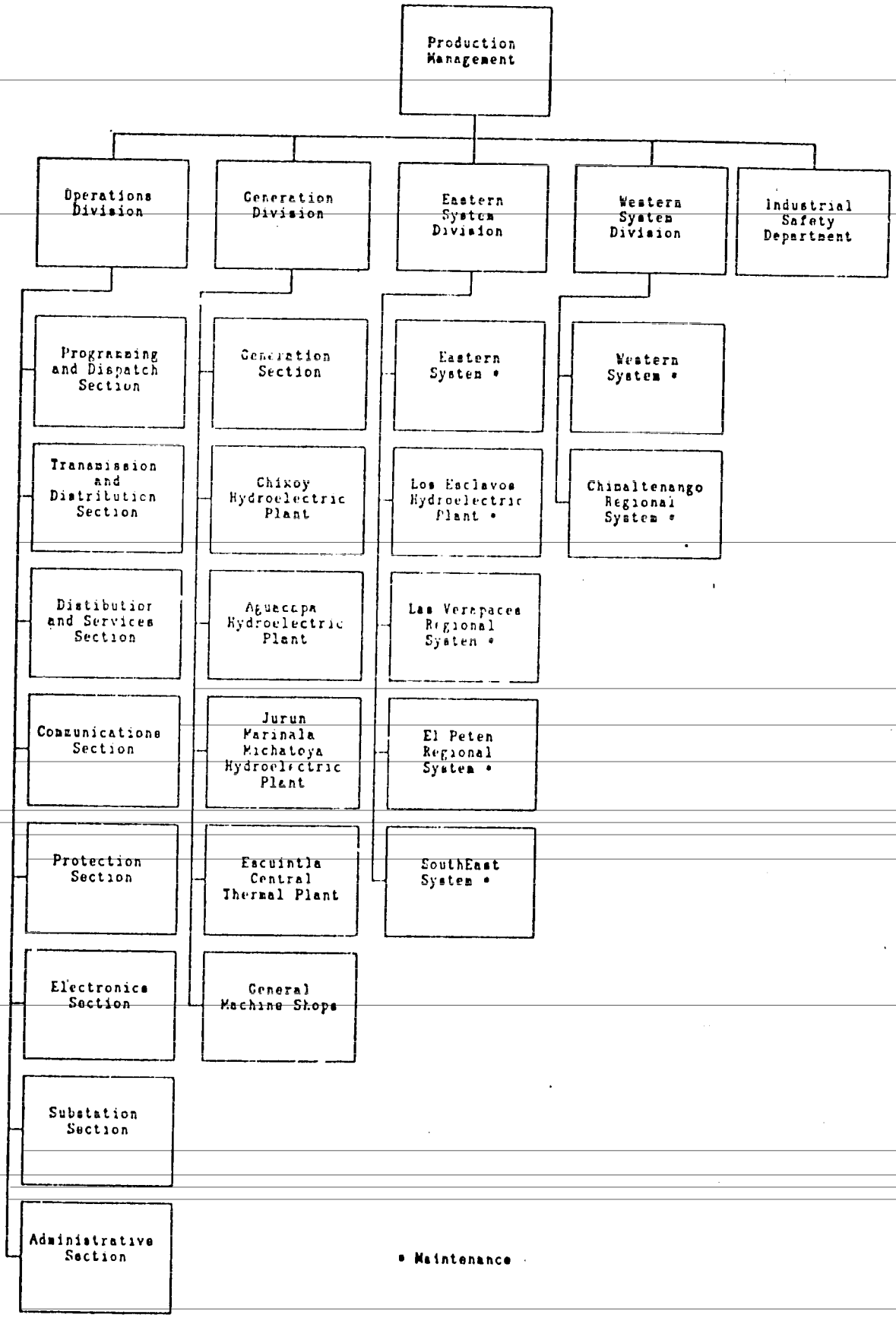


Figure 1.7
National Electrification Institute (INDE)
Construction Works Management
Organizational Chart - 1987

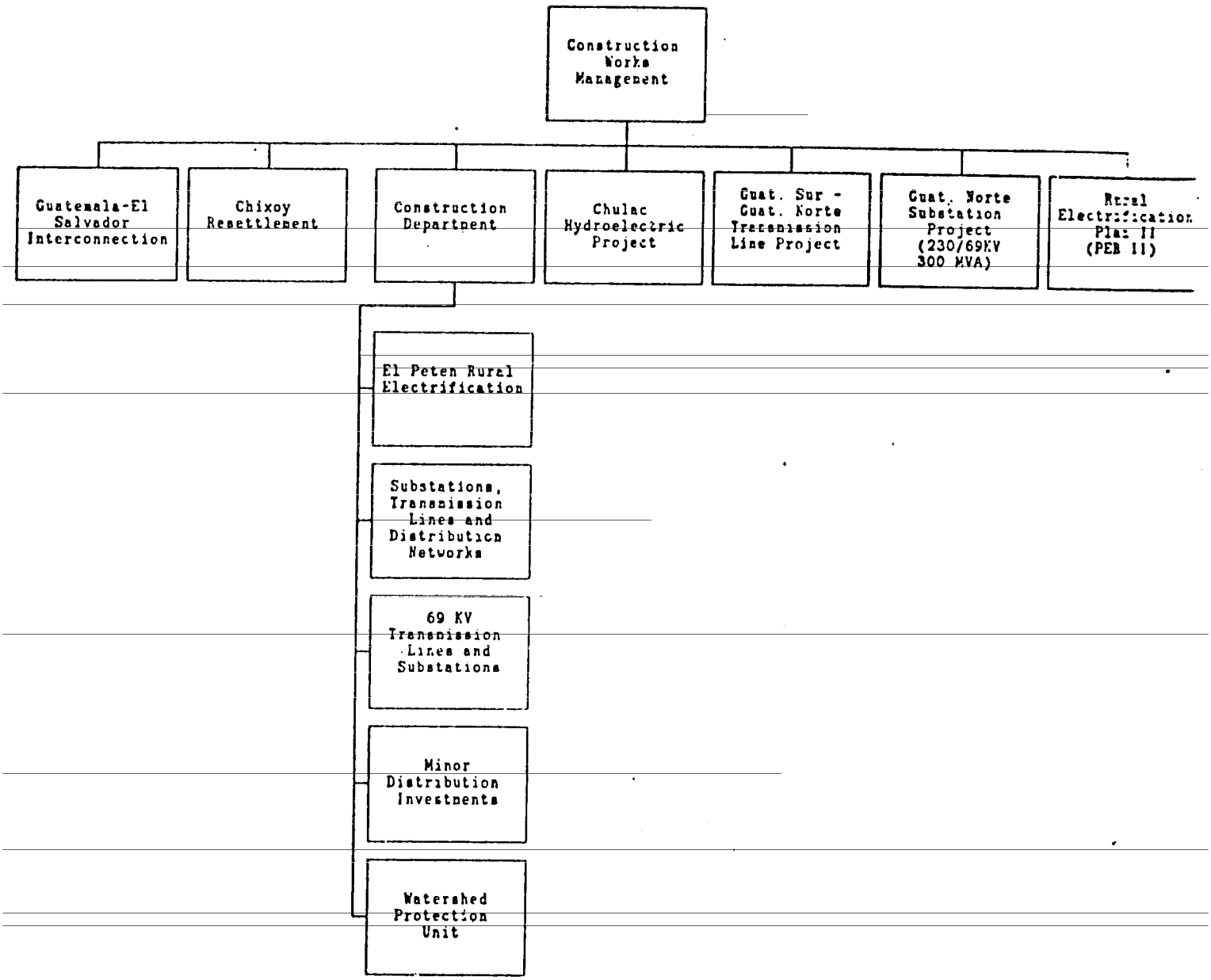


Figure 2
Organizational Chart
Rural Electrification Department - INDE

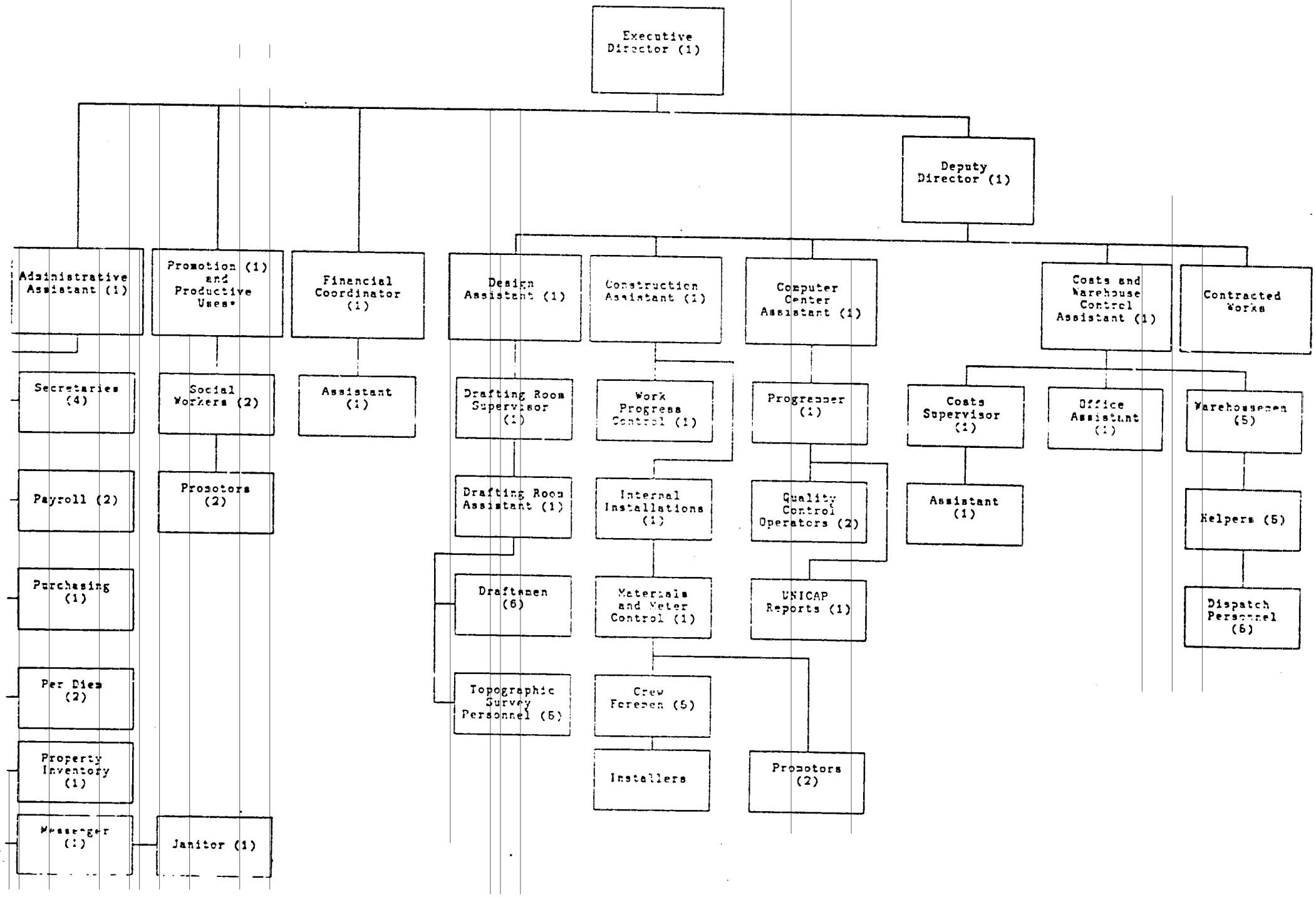


Figure 3
INDE Organizational Chart
(with recommended Distribution Division)

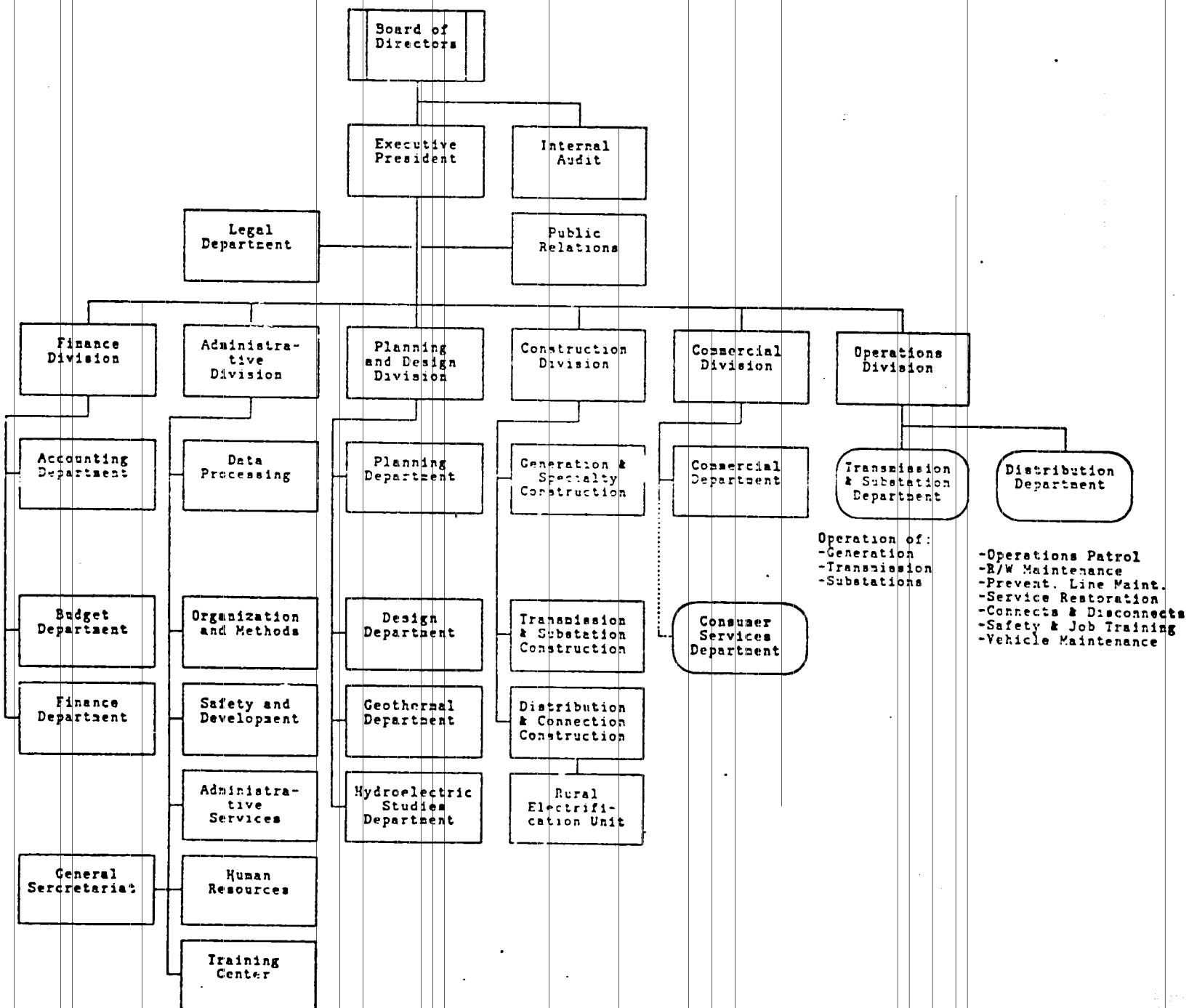
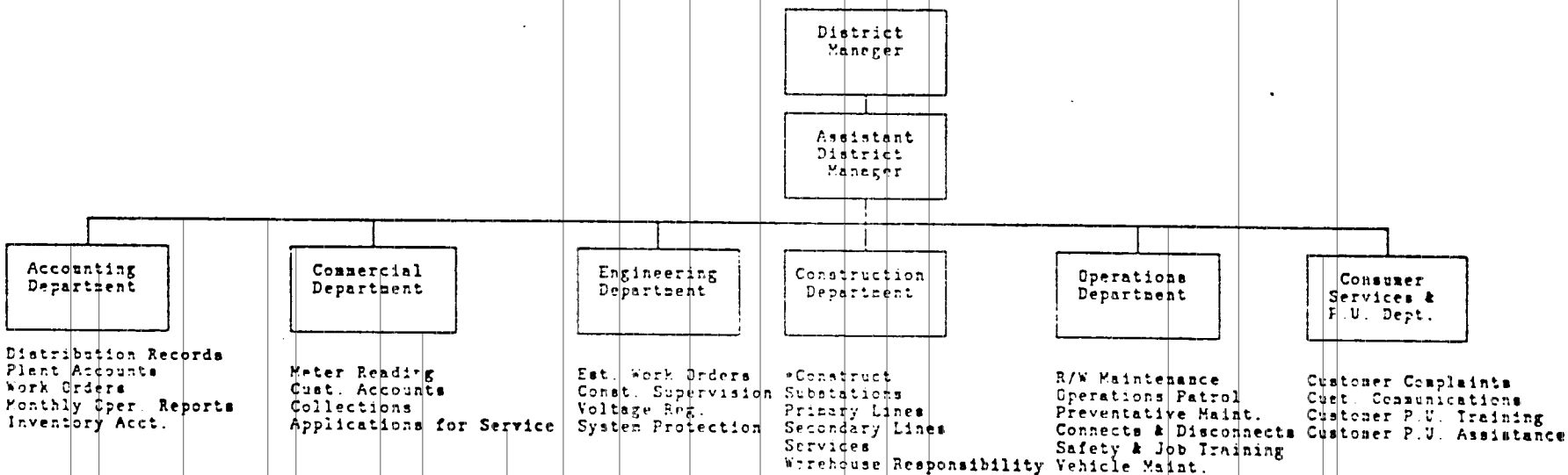


Figure 4
INDE District Office Organizational Chart



Note: The number of personnel in each District will vary according to the size of the District and the number of customers served.

POSITION DESCRIPTION:

PRODUCTIVE USES OF ELECTRICITY SPECIALIST

I. OBJECTIVES

A. Foster the more effective use of electric energy for increased agricultural production, the development of cottage industries and other rural industries and businesses, and the promotion of other rurally oriented economic activities.

B. Maximize the benefits to be derived from electric energy once it is introduced into a rural area.

C. Coordinate the above activities with government, private, and international agencies to assure maximum impact of utility effort.

II. REPORTING RELATIONSHIPS

A. Reports to: Director, Consumer Services Department

B. Directs: Productive Uses Advisors, Social Workers when assigned for surveys

III. RESPONSIBILITIES

Within the limits of established policies, budgets, and authority delegated by the Director of the Consumer Services Department, the Productive Uses Advisor will personally:

A. Supervise project area surveys

B. Implement and supervise application of demand assessment and site selection surveys related to rural electrification projects.

C. Analyze adequacy of project area infrastructure essential to the development of business and industry as related to rural electrification.

D. Provide technical services related to energy use matters to local business entrepreneurs, industrialists, and farmers who may want to develop new enterprises based on electric energy.

Conduct periodic programs designed to inform the general public of potential productive uses of electricity in the project area.

E. Assure project coordination with local, government and international agencies; university officials; trade and marketing groups; and suppliers and representatives of industry in order to mobilize and utilize professional support for new enterprises.

F. Counsel international development groups, agricultural leaders, technicians, university agricultural science and engineering professors, and other farm, business, and industry specialists on the development of productive uses of electricity by individuals, and on programs of training and instruction to assure their proper installation and use, to improve their production, processing, storage, and marketing operations.

G. Provide information and assist in the preparation of informative bulletins, news articles, and radio and television spots with reference to the productive uses of electricity on the farm, in business, in agro-industry, industry and in the home.

H. Prepare monthly reports of work accomplished for the Director of the Consumer Services Department.

I. Prepare input for annual work plans when and as requested.

J. Perform other duties as assigned by the Director of the Consumer Services Department.

IV. RELATIONSHIPS

The Productive Uses of Electricity Advisor maintains the contacts and relationships within INDE to include the Director of the Consumer Services Department, other Productive Use Advisors and INDE field and office personel.

Working relationships shall be developed by the Productive Uses Advisor with the following groups external to INDE: 1) actual and prospective consumers; 2) business and community leaders and organizations; 3) electrical equipment supply dealers; 4) news media as appropriate.

V. QUALIFICATIONS

A. Bachelor's Degree in:
   Agricultural Engineering
   Business Management
   Economics
   Engineering
   Agriculture
   Public Relations
   similar field of study

B. Training or experience in as many as possible of the following areas:

Electricity	Electric Utility Operations
Teaching/Training	Wiring & Electric Equipment
Agriculture	Salesmanship
Public Speaking	Audio-visual Equipment
Photography	Community Development
News Story Writing	Project Management
Economics	Business Administration

C. Personal Characteristics

- Preferably reared in a rural area.
- An interest in improving the life of rural people.
- Willing to live and work in rural areas and with rural people.
- Mechanical aptitude.
- Able to motivate people.
- Capacity to operate effectively within utility work environment.

ANNEX K

ENGINEERING ANALYSIS

I. PURPOSE

The technical analysis addresses specific issues and concerns related to technical aspects of the Project, evaluates resources and capabilities of the implementing institutions, considers possible alternatives, and recommends appropriate measures for the timely, cost-effective completion of the Project's technical component.

II. BACKGROUND

PER III is a continuation of the electrification of rural Guatemala presently being accomplished under PER II, but with an added emphasis on productive uses. The experience gained in PER II will be fully utilized to build on the successes of that Project and, at the same time, to correct the deficiencies that have been identified.

INDE is the institution assigned by law the authority and the responsibility for producing, transmitting and distributing electricity in Guatemala. Under this mandate, INDE is distributing power by block sales to EEGSA and eleven municipalities, and by direct sales to approximately 250,000 individual customers. Inasmuch as the more urban areas are served by block sales to EEGSA, INDE's distribution by direct sales is essentially the rural electrification program for Guatemala. PER II has constituted the major effort in recent years representing some 70% of the new rural connections annually.

III. BULK POWER SUPPLY EVALUATION

The facilities of the national power grid, i.e., generation, high voltage transmission lines and major substations required for PER III are already in place (see Exhibit 1). Limited funding is provided in this Project for additional substation capacity in three areas - San Marcos, Quetzaltenango and Huehuetenango.

INDE has prepared a ten-year plan for the orderly development of the national power supply capability, including the periodic addition of generation, transmission and substation components to meet the requirements for power and energy year by year. The plan addresses areas according to projected growth rates and identifies the specific facilities that will be required for each region.

INDE's plans and studies for future power production and transmission, including a potential interconnection with

Honduras, recognize an anticipated 6.5% annual growth in power and energy requirements. The national ten-year plan targets the connection of 40,000 new consumers annually, increasing from the 40% of the population with electricity up to 60%. The total system installed capacity is 700 MW, with an available capacity of 600 MW and a present maximum load of 375 MW. The estimated initial PER III load of 7 MW dispersed throughout rural Guatemala, will scarcely place a significant burden on the national power grid. Thus, there are no anticipated real constraints on the Project attributable to bulk power supply.

It should be pointed out that severe and extended drought conditions affecting INDE's hydro-generation capability would require future conservation measures and load management programs. It would be prudent to employ tariffs, such as interruptible service and seasonally differentiated pricing, to encourage only the beneficial and productive use of energy.

IV. CONSTRUCTION OF ELECTRIC FACILITIES

A. Location

The Project area encompasses 300 communities throughout the country, except for the department of El Petén, and excluding the more urban areas served by EEGSA and the eleven municipalities. Approximately 80% of the Project will be in the Western Highlands and 20% in the eastern part of the country.

B. Facilities to be Built

The electric facilities under this Project include 300 km of primary voltage distribution lines, 1,200 km of primary with secondary low voltage lines, installation of 1,857 transformers and 65,000 service connections and meters for new rural users. Also included are system changes in three areas (San Marcos, Quetzaltenango, and Huehuetenango) to provide adequate capacity in these areas of greatest potential for productive uses.

C. Cost Summary of Construction

Item	Qty	Unit Cost $ FX	Unit Cost $ LC	Cost $ FX	Cost $ LC
Primary line	300 km	1,134	6,311	340,200	1,893,300
Network	1,200 km	1,909	7,971	2,290,800	9,565,200
Transformer	1,857	450		835,650	
Service drop and meter	65,000	25	5.00	1,625,000	325,000
Interior wiring	65,000	16	8.33	1,040,000	541,450
SUB-TOTAL				6,131,650	12,324,950
Subtransmission/Transformation					
San Marcos				203,891	136,399
Huehuetenango				209,196	155,641
Quetzaltenango				103,712	10,222
SUB-TOTAL				516,799	302,262
Consulting Engineering					370,000
TOTAL				$6,648,449	$12,997,212

(1) Engineering and Administration Costs are included in each line item.

Criteria for Construction Cost Estimates

Because the design of the lines for the various communities has not been done, and thus the quantities of various units is unknown, the budgeted costs for the Project are based on the experience of PER II and certain assumptions regarding the different emphasis in PER III (see Exhibit 2):

1. All material purchases will be foreign exchange, except for poles, both wood and concrete, which will be local currency costs of INDE.

2. INDE will also provide all direct labor costs, engineering and administrative overheads (13%), transportation costs (12%), depreciation of construction equipment (5%) and right-of-way (3%). The direct labor costs include the base salaries plus bonus/benefits (100%) and travel per diem (21%). The labor figures are based on a typical 15-man crew building one km of line per month.

3. Lines are estimated to be entirely single phase, one-half 7.6 kV and one-half 19.9 kV. Sixty percent of the lines will use wood poles and forty percent will use concrete poles. Average number of poles per km will be 12 for primary lines and 22 per km for primary with secondary.

4. Transformer capacity is based on a demand factor of 0.15 kVA per consumer. Maximum number of 60 consumers per transformer. Average number of initial connections per new transformer is estimated at 35.

   Secondary lines are limited to a maximum of 500 meters in any direction from the transformer.

5. It is estimated that 25,000 consumers will be connected to existing networks, 15,000 will be connected to extensions of the networks in previously electrified villages and 25,000 will be connected to networks in newly electrified communities.

6. On the average, 30 meters of networks are required for each consumer, so 1,200 km of new networks will be required for the 40,000 consumers.

7. Experience has shown that primary lines are normally about 25% of networks. This produces an average of 2 km for each of the 150 newly electrified communities.

8. For the subtransmission and substation system improvements, the local currency costs were based on INDE's costs for comparable installations.

D. Design Standards

1. General

INDE has adopted design standards and construction specifications patterned after the four volume "Manual de Normas Eléctricas para el Istmo Centroamericano" (1976) and similar to the U.S. National Electric Safety Code. Further adaptations have been made based on rural electrification experience in the U.S., as well as in Central America and in the PER II Project in Guatemala. A complete set of standards for rural electrification are under final review and will be completed shortly for use in PER III. These standards recognize the unique characteristics of rural distribution systems which can be built at lower costs without impairing the capacity and the quality of service. Standardization of construction specifications will provide long-term benefits in expedited project design, improved quality and uniformity of construction, and cost savings in the procurement and management of inventory. This concept is especially important in assuring continuity of system development should other donors support rural electrification.

2. Appropriate Voltage Selection

Inherent in sound system design is the selection of voltage appropriate for the anticipated power and energy requirements, the densities of the service area, and the practical constraints of integration with existing systems. The 230, 138 and 69 kV transmission voltages are well chosen for the national grid. The distribution voltages presently employed are nominal 35 kV and 15 kV systems. The actual voltages are 19.9/34.5 and 7.6/13.2 kV grounded wye systems. These voltages likewise are appropriate for INDE's needs. The 34.5 kV system is appropriate for serving scattered loads over a broad area with acceptable voltage regulation and losses. The 13.2 kV system is appropriate for serving higher densities and shorter distances, employing 69 kV transmission and load center stepdown substations.

The standard secondary low voltage will be 120/240 volts single phase with most services being two-wire 120 volts.

3. Single Phase versus Three Phase

The main backbone feeder lines from the substation are routed through the heavy load centers, with single phase laterals, or branch lines, to the lighter load areas. This is the most significant concept in designing low-cost rural electric

distribution systems. Later, as loads increase, these single phase lines can be converted to three phase when economically justifiable, i.e., when the annual reduction in losses exceeds the annualized cost of conversion.

All the lines under PER II have been single phase and most of the lines under PER III will be single phase although three-phase lines will also be built depending on the technical characteristics of the installation, types of loads and number of customers. The potential productive uses identified under PER III can be adequately served by single phase power. Should large industrial customers require three phase service, they will be required to include such costs in their capital funding plan. The three phase service will be supplied either by a phase converter, or by a line extension from the nearest three phase feeder.

The phase converter is a transformer device that provides three phase service from a single phase source for loads of up to fifty horsepower. It was developed in the United States in the early 1960's and is in widespread use throughout the world where grounded wye systems are used. It is the most economical way to serve small, widely scattered three phase loads.

4. Other Specific Recommendations

- Distribution transformers should continue to be CSP, 10 and 25 kVA, without taps, directly pole mounted.

- Wood poles should be used whenever available. The initial cost is 30% lower, and with added transportation and installation costs, the differential is nearly 50%. Wood poles can be set much easier and more safely by hand than can concrete poles. Hand setting also minimizes damage to surrounding crops. Quality control is critical for the proper drying and preservative retention of wood poles. Concrete poles also must be subject to strict quality control.

- Treated wood crossarms should be used.

- Grounding should utilize galvanized rods and stranded galvanized wire for cost savings and for reduction of theft.

- Primary conductors of #4, #2, #1/0, #3/0 ACSR, presently in use, are adequate. Pole placements and span lengths should be varied as needed to suit the terrain and other characteristics of the line route in accordance with the selected ruling span. The initial sag should correspond to the temperature at the time of sagging. The conductor size should be selected according to the load and

distance, considering voltage regulation and energy losses. Reduced neutral size should be used to lower the cost.

- Guying should be determined according to the number and size of conductors, based on design tension, normally 50% of the ultimate strength of conductors.

  The guy lead should be sufficient to limit guy tension to 50% of its breaking strength. Guys should be bonded to the system neutral.

- Anchors, in the absence of augers for digging holes, should be concrete cones or steel plates installed and backfilled to provide holding power equal to the guy.

- Connections should be compression rather than split bolts to provide long term reliability as circuit loads increase.

- Stirrups or half armor rods should be used on all primary conductors where hot line clamps are used.

- Use of the neutral conductor as an overhead shield for lightning protection should be restricted to those areas of highest annual thunderstorm days, and only on three phase main feeders. To be effective much taller poles must be used, or shorter spans, to provide an effective cone of protection and, at the same time, maintain adequate ground clearance. Whenever there is secondary underbuild on the primary line, an additional neutral conductor is required if the primary neutral is used as an overhead shield. With the phase conductors in the lower position, ground clearance is of greater concern as is the safety of personnel working on the poles.

- A-base meters should continue to be used solely to reduce costs.

- Alternative specifications and guidelines should be prepared to deal with the various service drop attachment needs encountered in the field. Adequate structural extension, use of galvanized wire supports, and similar means should be employed to assure safe ground clearance and protection of the service drop conductors attached to the building.

- Basic standards for interior wiring, including typical diagrams and drawings, should be adopted to assure adequate and safe wiring for the customer.

V. TECHNICAL COMPONENT IMPLEMENTATION

A. Construction

1. Capability of INDE

The overall construction force of 2,000 people has an annual capability of 150 km of transmission lines and 500 km of distribution lines. It is recommended that INDE build the electric facilities for PER III. Experience under PER II has demonstrated INDE's ability to construct the lines, install the transformers, and make the connections. The number of connections for PER II will exceed the original goal by more than 25% (est. 90,000 vs original 70,000). INDE is presently building 9 km of primary lines, 20 km of secondary voltage lines, installing 25 transformers and connecting 960 services per month under PER II. The construction crews continue to gain experience and improve their skills and capabilities which will be further expanded by the equipment provided by the project. They will be entirely capable of building the facilities proposed in PER III. Further, this continuing experience will enhance INDE's ability to expand rural electrification in the future, as well as improve operational and maintenance skills.

The needs for additional training and for tools and equipment have been evaluated and lists of those items have been set forth in detail later in this analysis along with the related costs.

2. INDE Supervision and Inspection

A function that must be addressed in PER III is the matter of supervision and inspection of completed construction. It is important that work in progress be observed to assure that proper construction practices are being followed. It is obviously desirable to correct unacceptable practices before the work is completed. However, it is essential that all completed construction be inspected, "clean-up" notes prepared, and any deficient construction corrected. Observed deficient construction includes such items as occasional failure to bond the guy wires, incorrect sag of conductors, wrong placement of poles causing uplift on tangent structures, inadequate guy strength for the design tension, service wire attachments that rub against the metal roof or have inadequate ground clearance, failure to use stirrups or half armor rods for hot line clamp connections to the conductor, etc. Although constructed facilities with these defects may not cause a problem initially,

they do represent a potential source of power outages and added cost of operations and maintenance later on.

3. Construction Alternative

The use of private contracting firms is an alternative method for building PER III, but is not considered as viable. PER III is a relatively small Project, especially in terms of the broad area it will cover.

The uncertainty of future such projects would have to be closely evaluated by a potential private contractor in relation to the start-up and staging costs. Moreover, construction of rural electric distribution facilities requires special tools and equipment and work skills and knowledge not readily available to general contractors.

4. Local Community Labor

Voluntary local community labor represents a means to reduce the construction costs of the PER III Project. There are certain activities that can be adequately performed by unskilled labor, such as cutting and trimming trees, digging holes, and carrying materials. Such utilization of the local labor force, however, will continue to require close coordination with local committees and close supervision of inexperienced laborers. Other construction activities, such as framing the poles, sagging the wire, installing transformers and services and making connections should be done by trained line construction personnel of INDE.

The extent of voluntary local community labor could be considered in the capital recovery as a criterion for community selection.

B. Consulting Engineering Services

It is prudent project management to employ competent consulting services. This provides oversight of the Project from an objective and expert "outside" perspective not otherwise available. The private consultant to be retained by INDE for PER III will be charged with the following responsibilities:

- Review of all designs, and assuring conformance with previously adopted standards.

- Inspection of representative completed construction (at least 25% in each community) and certifying that the actual construction conforms to the design.

- In the course of inspection, the consultant will observe construction practices and will recommend changes to correct deficiencies, to increase productivity and to improve the quality of construction.

- The consultant will submit appropriate monthly reports reflecting progress of the Project and verifying the units of construction completed in relation to the Project schedule.

- Timely observation and comments shall be made by the consultant regarding any delays or deviations that may affect the successful completion of the Project. The reasons for such delays or deviations and recommended actions for correction shall be made promptly in writing.

- Copies of all reports and correspondence related to the Project shall be submitted to AID as well as INDE.

C. Rural Electrification Implementing Unit of INDE

Over the life of the current Project, the Implementing Unit has evolved from a modest coordinating unit to an effective organization achieving goals in excess of those originally established for the Project. The working relationships with other departments and divisions have been tenuous at times, but have been adequately resolved. Authorities and responsibilities have at times not been clearly defined, especially in regard to the design function. And finally, there have been some philosophical differences within INDE regarding the priority for rural electrification itself, given INDE's financial situation.

Relations with the Construction Department have been very supportive. It is recognized that rural electrification is a means through which materials for construction, and to a limited extent, tools and vehicles, are made available. The Operations and Commercial departments are less enthusiastic, perhaps due to the added work load of 70,000-plus consumers without a corresponding increase in resources to deal with them.

The Implementing Unit itself is a well-structured and effective organization of some 600 people. This includes the personnel devoted to interior house wiring and the crews assigned to construction, as well as the core staff for administration, field survey, design, and promotion. The Implementing Unit will be fully able to complete PER II and to accomplish the work proposed in PER III.

Participation by personnel from the Implementing Unit in the training programs available under PER II and III funding and through CARES is highly recommended.

VI. TECHNICAL ASSISTANCE AND TRAINING

A. Needs

The comprehensive program planned by CARES addresses most of the training needs identified for PER III. However, much of the CARES five-year plan will be implemented on a regional basis, and so cannot directly meet all of INDE's needs. Thus, the "train the trainer" concept becomes very important. INDE can and should expand its training program and provide continuing education by replicating the CARES regional courses "in-house".

There are two technical assistance needs recognized by CARES but not adequately dealt with due to funding limitations. These two needs should be funded to meet the goals of PER III.

1. Publications

A three volume reference manual should be compiled, published in Spanish and distributed to each group in their area of responsibility.

a. Volume I

Specifications and Drawing for Distribution Line Construction - Construction Crews.

b. Volume II

Design Standards Handbook - Design Engineers and Technicians.

c. Volume III

Operations and Maintenance Manual Operations - Supervisors and Crew Foremen.

Budget - Consultant for six weeks $38,000 (see Annex J)

2. Safety Program

A safety program should be developed for use throughout the organization. Consulting services will be needed to:

a. Assess present levels of job training and safety practices.

b. Policy development and approval.

c. Develop Safety Manual of basic rules and job procedures.

d. Conduct Seminar for orientation of Managers and supervisors.

e. Develop format for an ongoing safety program.

Budget - Consultant services for six weeks. $22,000 (see Annex J).

VII. VEHICLES, TOOLS AND EQUIPMENT

A. Needs

Funds are included in the Project budget for the purchase of vehicles, tools and equipment deemed necessary to successfully implement the Project. Each of the INDE institutional units involved in the Project were able to demonstrate needs, which in the aggregate, substantially exceed available funds. Therefore, needs were evaluated in relation to PER II experience, and the scope and focus of PER III. The new Project is somewhat smaller and so has a lesser requirement for construction resources. On the other hand, the focus on productive uses necessitates an improvement in the operation of the rural distribution systems. This includes preventive maintenance for more reliable electric service, as well as more responsive customer services. The recommendations for vehicles, tools and equipment are made in response to these needs.

The specific selection of equipment, both in terms of types and quantities, should be made in the light of a coordinated physical inventory. Disparities exist in the availability of such items from region to region and department to department in relation to their real needs. A proposed list of items and estimated costs is presented in the next section.

B. Cost List

Description of Item	Quantity	Unit Cost	Cost
Construction Department			
Heavy Duty Truck - 8T	3	$30,500	$ 91,500
Pickup Truck - 4WD	2	16,000	32,000
Pole Trailers	5	3,000	15,000
Operations Department			
Service Pickup Trucks - 4WD	5	19,000	95,000
Hot Line Trailer Complete	3	21,250	63,750
A-frame Truck	3	26,850	80,550
Tools	5 lots	9,500	47,500
Instruments	5 lots	6,500	32,500
Pole Trailer	5	3,000	15,000
Safety and Job Training	1 lot	12,000	12,000
Commercial Department			
Pick Trucks 4WD	2	16,000	32,000
Motorcycles	10	1,500	15,000
Implementing Unit Pickup Trucks (medium)	3	12,000	38,000
		Total	$567,800

NOTE:

Tools - (hoists, wire grips, ladders, block and tackle, transformer gin, stringing dollies, compression tools and dies, cable cutters, digging tools, grounding sets, hot sticks, etc.)

Instruments - (testing, measuring, recording - voltage, current, kw, power factor, etc.)

Safety and Job Training - (Hard hats, first aid kits, VCR's and TV sets for regional training, video camera for job site video recording of construction and operation activities for safety and job training)

VIII. INFRASTRUCTURE COMPONENT - BUDGET SUMMARY

Component/Activity	$ AID	$ INDE Funding	$ Total
A. Commodities for lines and electrical installations	6,131,650	3,884,100	10,015,750
B. Installation		7,328,150	7,328,150
C. Commodities for Subtransmission/ transformation	516,799	131,418	648,217
D. Installation		127,038	127,038
E. Vehicles, tools and equipment	567,800		567,800
F. Consulting engineering services		370,000	370,000
G. Engineering and administration		1,156,506	1,156,506
H. Training/technical assistance	240,000		240,000
I. Evaluations, studies and audits	200,000		200,000
J. Inflation*	382,812	1,414,244	1,797,057
K. Contingencies	1,060,938	649,861	1,710,799
Total	$ 9,100,000	15,061,317	24,161,317

* Inflation rates estimated at 5% FX and 3% LC.

Annex K - Exhibit 1

Generation Units

Substations

Transmission Lines

CAPACIDAD INSTALADA EN PLANTAS DE SERVICIO PUBLICO
(INDE EEGSA)

SISTEMA	No. DE UNIDAD	CAPACIDAD PLACA KVA	CAPACIDAD PLACA KW	CONFIABLE KW	VOLTAJE KV	FECHA DE INSTALACION	MUNICIPIO	DEPARTAMENTO
NACIONAL INTERCONECTADO			730920	645600				
HIDRAULICAS:			438080	404000				
CHIXOY	5	300000	250000	250000	13.8	1983	SAN CRISTOBAL	ALTA VERAPAZ
AGUACAPA	3	112500	90000	60000	10	22.02.82	PUEBLO NVO VIÑAS	SANTA ROSA
JORGE MARINALA	3	75000	60000	60000	13.8	12.02.70	PALIN	ESCUINTLA
ESCLAVOS	2	16875	13500	13000	6.9	17.08.66	COILAPA	SANTA ROSA
SAN LUIS	2	6250	5000	5000	2.4	15.07.54	ESCUINTLA	ESCUINTLA
EL SALTO	2	6875	5500	5000	2.3	15.10.27	ESCUINTLA	ESCUINTLA
PALIN	3	2275	1820	1000	2	01.09.27	PALIN	ESCUINTLA
RIO BONDO	2	3000	2400	1400	5	23.02.62	RIO BONDO	ZACAPA
SANTA MARIA	3	8600	6880	6000	2.3	25.06.66	ZUNIL	QUETZALTENANGO
EL FORTUNIO	1	2850	2280	2000	2.3	SEP 1968	SAN PABLO	SAN MARCOS
CHICHAIC	2	875	700	600	0.4	26.07.79	FINCA CHICHAIC	ALTA VERAPAZ
TERMICAS:			292840	241600				
VAPOR			116000	80000				
ESC. VAPOR I	1	41300	33000	0	13.8	27.05.72	ESCUINTLA	ESCUINTLA
ESC. VAPOR II	1	60000	53000	50000	13.8	22.04.77	ESCUINTLA	ESCUINTLA
LAGUNA VAPOR EEGSA	4	37500	30000	30000	13.8	1961	AMATITLAN	GUATEMALA
TURBINAS DE GAS			166400	153000				
ESCUINTLA GAS 1 Y 2	2	31250	25000	20000	13.8	07.05.69	ESCUINTLA	ESCUINTLA
ESCUINTLA GAS 3 Y 4	2	62500	50000	50000	13.8	03.03.76	ESCUINTLA	ESCUINTLA
ESCUINTLA GAS 5	1	40000	32000	32000	13.8	NOV 1985	ESCUINTLA	ESCUINTLA
LAGUNA GAS 1 EEGSA	1	15625	12500	11000	13.8	1964	AMATITLAN	GUATEMALA
LAGUNA GAS 2 Y 3 EEGSA	2	56000	46900	40000			AMATITLAN	GUATEMALA
DIESEL			10440	8600				
SAN FELIPE	1	1800	1440	1200	2.4	08.05.65	SAN FELIPE	RETALHULEU
LA CASTELLANA EEGSA	5	6250	5000	5000	2.4	1956	GUATEMALA	GUATEMALA
PUERTO BARRIOS	8	5000	4000	2400	2.4	1977	PTO. BARRIOS	IZABAL
OPERACION INDIVIDUAL			6200	4955				
ATLANTICO (MERCEDES)			1335	1080				
LIVINGSTON	6	540	430	360	0.2	1975	LIVINGSTON	IZABAL
EL ESTOR	4	1069	855	700	0.2	02.09.81	EL ESTOR	IZABAL
MELCHOR DE MENCOS (PETEN)	5	562	450	345	0.2	25.03.76	MELCHOR DE MENCOS	PETEN
SANTA ELENA (PETEN)	5	3375	2700	2590	0.2	1976	SANTA ELENA	PETEN
FORTUNA (PETEN)	3	893	715	440	0.2	15.12.80	FORTUNA	PETEN
SEBOLALTA VERAPAZ	6	750	600	500	0.2	ABR 1980	SAN BARTOLOME	ALTA VERAPAZ

NOTA: LA INTERCONEXION GUATE-EL SALVADOR FUE EL 19-09-1986

FUENTE: DEPARTAMENTO DE OPERACION INDE

[illegible] DE GENERACION	HIDRAULICA	VAPOR	GAS	DIESEL	TOTAL
[illegible]					
[illegible]	438640	85000	157000	[illegible]	[illegible]
[illegible]	0	33000	9400	5000	[illegible]
TOTAL SNI	438000	118000	166400	10440	732[illegible]
GENERACION INDIVIDUAL					
[illegible]	0	0	0	6000	[illegible]
[illegible] PLANTAS	4200	0	0	4235	[illegible]
TOTAL P.O.I	4200	0	0	10435	[illegible]
GRAN TOTAL REPUBLICA	442369	118000	166400	20875	745641

FUENTE: DEPARTAMENTO DE GENERACION

CAPACIDAD INSTALADA EN PLANTAS PROPIEDAD MUNICIPAL Y PRIVADAS DE SERVICIO PUBLICO

NOMBRE DE LA PLANTA	CAPACIDAD EN	TIPO HIDRO	TERMICO	MUNICIPIO	DEPARTAMENTO
TOTAL PAIS	8521	4288	4233		
ZONA OCCIDENTAL	6634	3209	3425		
SANTA CATARINA ISTAHUACAN	6	0	6	SANTA CATARINA [illegible]	SOLOLA
MAQUICHA	75	75	0	HUHUETENANGO	TOTONICAPAN
ZONIL	1000	1000	0	ZONIL	QUETZALTENANGO
CHIPRIZZ	1000	0	1000	QUETZALTENANGO	QUETZALTENANGO
HOCAYA	50	50	0	STA BARBARA	SOLOLA
VICENTE CASTILLO	149	149	0	HAZATENANGO	SOLOLA
FILADELFIA LOARCA	244	150	94	HAZATENANGO	SOLOLA
PATULUL	191	156	35	PATULUL	SOLOLA
OCOSITO	1473	693	780	RETALULEU	RETALULEU
SAN MARCOS	150	0	150	SAN MARCOS	SAN MARCOS
LA CASTALIA	265	265	0	SAN CRISTOBAL COCEC	SAN MARCOS
COMITANCILLO	12	12	0	COMITANCILLO	SAN MARCOS
CONCEPCION TUTUAPA	50	50	0	CONCEPCION TUTUAPA	SAN MARCOS
LOS BOLINOS	60	60	0	TEJUTLA	SAN MARCOS
EL TUMBADOR	138	138	0	EL TUMBADOR	SAN MARCOS
LA REFORMA	38	38	0	LA REFORMA	SAN MARCOS
ZACCALPA	45	45	0	ZACCALPA	QUICHE
JOYABAJ	118	118	0	JOYABAJ	QUICHE
CHICHICASTENANGO	226	226	0	CHICHICASTENANGO	QUICHE
SECOTT S.A	1360	0	1360	TIQUISATE	ESCUINTLA
ZONA ORIENTAL	290	290	0		
COBAJA	230	230	0	SN AGUSTIN ACASAG	GUASTATOYA
ZONA SUR OCCIDENTAL	1109	674	435		
SAN MIGUEL ESPANTAR	37	37	0	QUICHE	QUICHE
CATARINA	89	89	0	CATARINA	RETALULEU
BENTON	20	0	20	BENTON	RETALULEU
SANTA EULALIA	89	89	0	SANTA EULALIA	RETALULEU
RETALULEU	892	477	415	RETALULEU	RETALULEU
ZONA SUR ORIENTAL	338	205	133		
COCANJA	16	16	0	TACANA	ALTA VERAPAZ
PANZOS	36	36	0	TACANA	ALTA VERAPAZ
SEMUCU	83	0	83	SEMUCU	ALTA VERAPAZ
CARISOM	91	91	0	CARISOM	ALTA VERAPAZ
CAMPUCH	50	0	50	LANQUIN	ALTA VERAPAZ
SAN JOAQUIN	60	60	0	RCA SN JUAN SN CRISTOBAL	ALTA VERAPAZ
ZONA NORTE	249	0	249		
LA LIBERTAD	105	0	105	LA LIBERTAD	PETEN
DOLORES	25	0	25	DOLORES	PETEN
SAN LUIS	50	0	50	SAN LUIS	PETEN
SAYAXCHE	69	0	69	SAYAXCHE	PETEN

SUBESTACIONES DEL INDE
AGRUPADAS POR DEPARTAMENTO

CODIGO	NOMBRE	TENSION NOMINAL	POTENCIA	DEMANDA 1988
GUATEMALA				
001000	Guatemala Sur	230/69	3X50	122.9
	Guatemala Sur	138/69	3X25	38.7
	Guatemala Sur	138/69	3X25	38.7
029000	Guatemala Norte	230/69	3X50	67.3
	Guatemala Norte	230/69	3x50	67.3
	Guatemala Este	230	----	
ESCUINTLA				
003000	Escuintla	230/69	1X70	44.7
	Escuintla	230/138	1X70	30.9
	Escuintla	138/69	1X30	12.4
010000	Tiquisate (Noria)	69/13.8	1X5	1.2
SUCHITEPEQUEZ				
009000	Cocales	69/34.5	1X5	1.6
	Cocales	69/13.8	1X5	2.6
012000	Mazatenango I	50/13.8	1X2.5	0.7
012000	Mazatenango II	69/13.8	1X5	5.7
RETALHULEU				
014000	San Sebastián	69/13.8	1X5	3.0
015000	Retalhuleu	50/2.4	1X2.5	1.6
QUEZALTENANGO				
022000	Esperanza	69/34.5	1X5	5.2
	Esperanza	69/13.8	1x30	14.2
021000	Quezaltenango	50/22	1X2.5	1.6
	Quezaltenango	50/2.3	2X2.5	3.3
017000	Coatepeque	69/13.8	1X5	4.1
SAN MARCOS				
024000	San Marcos	34.5/13.8	1X2.5	1.2
016000	Melendres	69/13.8	1X1.5	1.3
018000	Malacatán	69/13.8	2X1	0.3
	Malacatán	50/13.8	1X2	1.5
019000	El Porvenir	2.3/13.8	1X3	0.5
HUEHUETENANGO				
025000	Huehuetenango	69/34.5	1X2.5	1.2
	Huehuetenango	69/13.8	1X5	3.4
	Sololá	34.5/13.8	1X1.5	
QUICHE				
023000	Quiche	34.5/13.8	1X1.5	1.3

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TOTONICAPAN				
050000	Totonicapán	22.5/2.4	1X0.5	0.5
CHIMALTENANGO				
026000	Chimaltenango	69/34.5	1x5	4.0
EL PROGRESO				
031000	Sanarate	69/34.5	1X5	5.4
	Sanarate	34.5/13.8	3X0.3	0.6
	Guastatoya	34.5/13.8	3X0.1	
035000	El Rancho	34.5/13.8	3X0.167	2.6
ZACAPA				
042000	Cabañas	34.5/13.8	1X2.5	0.4
043000	Panaluya	69/13.8	1X10	5.8
	Panaluya	13.8/34.5	1X5	1.7
045000	La Fragua	34.5/5	1X0.63	0.4
CHIQUIMULA				
046000	Chiquimula	34.5/4.16	1X0.75	0.9
	Chiquimula	34.5/4.16	3X0.25	0.9
038000	Vado Hondo	34.5/13.8	3X0.167	0.4
037000	Quezaltepeque	34.5/13.8	3X0.2	0.6
JUTIAPA				
041000	Progreso	69/34.5	1X5	2.3
	Progreso	69/13.8	1X5	4.8
JALAPA				
036000	Jalapa	34.5/13.8	3X0.167	1.3
SANTA ROSA				
040000	Los Esclavos	69/13.8	1X5	5.4
008000	Chiquimulilla	69/13.8	1X10	2.2
BAJA VERAPAZ				
032000	Santa Elena	69/13.8	1X2.5	1.5
ALTA VERAPAZ				
033000	San Julián	69/13.8	1X5	2.1
034000	Cobán	69/13.8	1X5	2.1
IZABAL				
301000	Puerto Barrios	69/13.8	1X5	4.1

CARACTERISTICAS DE LINEAS DE ALTA TENSION (230 Y 138 KV)

No.	NOMBRE	VOLTAJE (KV)	LONG. (KMS)	R (OHM/KM)	X (OHM/KM)	B (SIEMENS/KM)	CAPACIDAD MAXIMA	FLUJO DE POTENCIA
1	Aguacapa-Escuintla	230	24.4	0.0677	0.3575	4.7534×10^{-6}	320.0	61.30
2	Chixoy-Guate Norte 1	230	126.0	0.0666	0.3910	4.1439×10^{-6}	160.0	151.80
3	Chixoy-Guate Norte 2	230	126.0	0.0666	0.3910	4.1439×10^{-6}	160.0	151.80
4	Escuintla-Guatesur 1	230	44.7	0.0677	0.3961	4.4569×10^{-6}	320.0	9.80
5	Escuintla-Guatesur 2	230	44.7	0.0677	0.3961	4.4569×10^{-6}	320.0	99.80
6	Guate Este-Guate Sur	230	15.5	0.0655	0.3617	4.2929×10^{-6}	320.0	66.50
7	Guate Norte-Guate Sur	230	30.5	0.0666	0.3910	2.2268×10^{-6}	320.0	75.00
8	Guate Norte-Guate Este	230	15.0	0.0681	0.3805	4.6125×10^{-6}	320.0	86.50
9	Guate Este-Ahuachapán	230	112.0	0.0609	0.3641	4.4329×10^{-6}	188.4	27.30
10	Jurún Marinalá-Escuintla	138	13.1	0.1343	0.4787	3.3756×10^{-6}	95.3	19.10
11	Jurún Marinalá-Guate Sur 1	138	32.4	0.1345	0.4970	3.4618×10^{-6}	168	42.40
12	Jurún Marinalá-Guate Sur	138	32.4	0.1345	0.4970	3.4618×10^{-6}	168.0	42.40

CARACTERISTICAS DE LAS LINEAS DE 69 KV

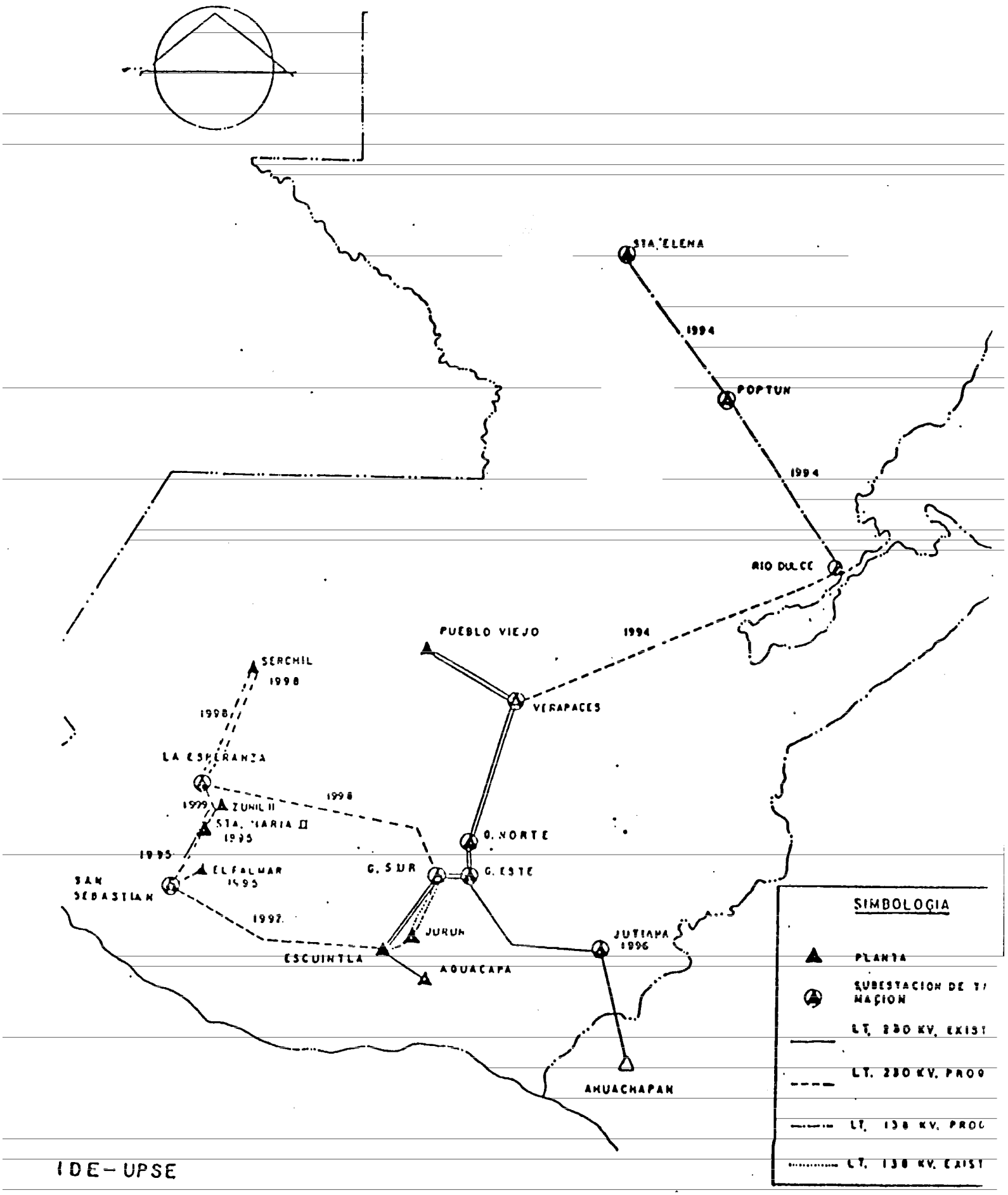
No.	NOMBRE	LONG (KM)	R (OHM/KM)	Y (OHM/KM)	B (SIEMENS/KM)	CAPACIDAD MAXIMA (MVA)	FLUJO DE POTENCIA
1	Centro-Amatitlán	15.9	0.2392	0.4670	2.9028E-G	48.0	14.7
2	Centro-Mixco	5.2	0.2392	0.4670	2.9028-G	48.0	36.0
3	Chimaltenango-Guate Sur	30.0	0.1343	0.4719	3.0807E-G	48.0	22.7
4	Chimaltenango-Esperanza	92.0	0.1343	0.4719	3.0807E-6	17.0	18.7
5	Coatepeque-Melendres	29.0	0.4494	0.5660	3.6517E-G	31.8	1.5
6	Coatepeque-Sn. Sebastián	33.1	0.1343	0.4719	3.1290E-G	48.0	4.8
7	Cocales-Mazatenango	45.4	0.1343	0.4719	3.1290E-G	48.0	21.3
8	Cocales-Escuintla	49.6	0.1343	0.4719	3.1290E-G	48.0	26.5
9	Sta. Elena-Samarate	30.0	0.1343	0.4719	3.1290E-G	48.8	5.1
10	Sta. Elera-San Julián	43.0	0.1343	0.4719	3.1290E-G	48.0	3.6
11	Escuintla-Modelo	6.7	0.1901	0.4496	3.1667E-G	43.3	21.2
12	Escuintla-Chiquimulilla	58.5	0.1343	0.4719	3.1290E-G	48.0	6.6
13	Progreso-Chiquimulilla	80.0	0.1343	0.4719	3.1290E-G	48.0	4.1
14	Esperanza-Huehuetenango	58.6	0.1343	0.4710	3.1290E-G	48.0	4.6
15	Guatenorte-Novella	23.0	0.1343	0.4719	3.1290E-G	48.0	29.1
16	Guatesur-Centro 1	7.3	0.1901	0.4496	3.1667E-G	48.0	48.8
17	Guatesur-Centro 2	7.3	0.1901	0.4496	3.1667E-G	48.0	52.2
18	Guatesur-Centro 3	7.3	0.1901	0.4496	3.1667E-G	48.0	52.2
19	Guatesur-Esclavos	48.2	0.1343	0.4662	3.0159E-G	38.0	2.5
20	Laguna-Centro	21.2	0.1343	0.4719	3.1290E-G	33.0	5.2
21	Laguna-Palín	19.0	0.2392	0.4464	3.2044E-G	33.0	4.2
22	Laguna-Amatitlán	5.3	0.1343	0.4719	3.1290E-G	31.2	1.2

23	Melendres-Malacatán	28.0	0.4494	0.5660	2.9782E-G	31.2	1.2
24	Mixco-San Lucas	8.4	0.2392	0.4670	2.9028E-G	31.2	8.3
25	Novela-Sanarate	5.4	0.1343	0.4719	3.1290E-G	43.3	21.1
26	Palín-San Luis	8.3	0.2392	0.4670	2.9028E-G	31.2	1.0
27	Palín-Antigua	21.0	0.2392	0.4670	2.9028E-G	31.2	6.5
28	Progreso-Esclavos	55.0	0.4494	0.5472	3.0159E-G	21.0	3.2
29	Sanarate-CELGUSA	33.0	0.1141	0.4010	2.9877E-G	31.0	10.7
30	CELGUSA-Panaluya	37.0	0.1199	0.4546	3.6682E-G	31.0	10.3
31	San Sebastián-Mazatenango	16.5	0.1343	0.4719	3.1290E-G	43.3	16.6
32	San Julian-Cobán	30.0	0.1343	0.4719	3.1290E-G	43.3	1.5
33	San Lucas-Antigua	10.2	0.2392	0.4670	2.9028E-G	31.2	0.4
34	San Luis-El Salto	1.0	0.2392	0.4670	2.9028E-G	31.2	1.0
35	Sta. María-Esperanza	17.4	0.1343	0.4719	3.1290E-G	43.4	6.4
36	Santa María-San Sebastián	23.4	0.1343	0.4719	3.1290E-G	43.3	5.1
37	Tiquisate-Cocales	21.0	0.1343	0.4719	3.1290E-G	43.3	1.3
38	Panaluya-Puerto Barrios a/	140.0	0.1343	0.4719	3.1290E-G	12.0	4.1

a/ Esta línea aún está en ejecución y se espera que entre a operar a inicios del año 1988.

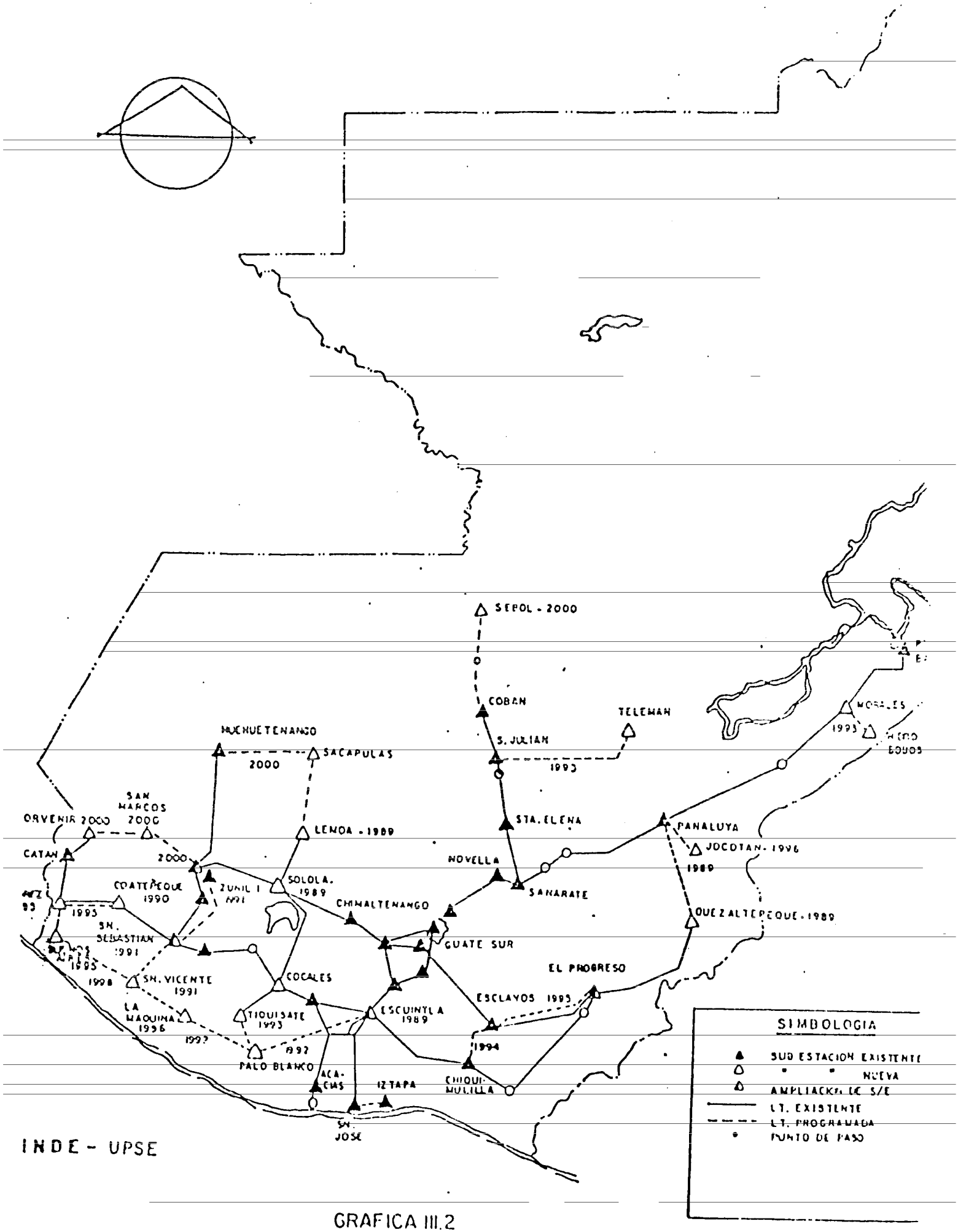
CARACTERISTICAS DE LAS LINEAS DE 50 KV

No.	NOMBRE	(KM)	(OHM/KM)	(OHM/KM)	(SIEMENES/KM)	CAPACIDAD MAXIMA (MVA)	FLUJO DE POTENCIA
1	Santa María-Quetzaltenango	16.0	0.4494	0.5660	2.9782E-G	15.0	1.6
2	Santa María-San Felipe	14.0	0.8538	0.5088	2.6766E-G	8.8	1.8
3	San Felipe-Mazatenango	14.0	0.8538	0.5088	2.6766E-G	8.8	0.7
4	Malacatán-Porvenir	18.0	0.4495	0.5472	3.0536E-G	15.0	1.7



GRAFICA III.1

TRANSMISION EN 138 KV Y 230 KV



GRAFICA III.2

TRANSMISION EN 69 KV

Annex K - Exhibit 2

Subtransmission and Distribution Construction Costs

Labor Costs Derivations

Overhead Calculations

COST PER KM OF SUBTRANSMISSION LINE
CONSTRUCTED BY THE PER II IMPLEMENTING UNIT - JULY 1988
(BASED UPON LAST USAID DIRECT PROCUREMENT)

ITEM	7.6 kV		19.9 kV	
	LC	FX	LC	FX
A. MATERIALS	Q.3,480	Q.2,456	Q.3,480	Q.3,669
Wood Posts	3,480		3,480	
Conductor		864		864
Miscellaneous (retainers, insulators, hardware, etc.)		1,592		2,805
B. LABOR	8,420*		8,420*	
C. MATERIALS & LABOR	11,900	2,456	11,900	3,669
D. ADMINISTRATION & ENGINEERING (13%)	1,547		1,547	
E. TRANSPORTATION (12%)	1,428		1,428	
F. AMORTIZATION & DEPRECIATION OF CONSTRUCTION EQUIPMENT (5%)	595		595	
G. RIGHT OF WAY (3%)	357		357	
TOTAL COST PER KM OF SUBTRANSMISSION LINE	15,827	2,456	15,827	3,669

Notes: 35-foot wood posts
2 ASCR No. 4 conductor
FX calculated at US$1.00 = Q.2 70

* INDE recurrent costs

COST PER KM OF SUBTRANSMISSION LINE
CONSTRUCTED BY THE PER II IMPLEMENTING UNIT - JULY 1988
(BASED UPON LAST USAID DIRECT PROCUREMENT)

ITEM	7.6 kV		19.9 kV	
	LC	FX	LC	FX
A. MATERIALS	Q.5,760	Q.2,456	Q.5,760	Q.3,669
Concrete Posts	5,760		5,760	
Conductor		864		864
Miscellaneous (retainers, insulators, hardware, etc.)		1,592		2,805
B. LABOR	8,420*		8,420*	
C. MATERIALS & LABOR	14,180	2,456	14,180	3,669
D. ADMINISTRATION & ENGINEERING (13%)	2,094		2,094	
E. TRANSPORTATION (12%)	1,933		1,933	
F. AMORTIZATION & DEPRECIATION OF CONSTRUCTION EQUIPMENT (5%)	805		805	
G. RIGHT OF WAY (3%)	483		483	
TOTAL COST PER KM OF SUBTRANSMISSION LINE	19,495	2,456	19,495	3,669

Notes: 10.6 m concrete posts
2 ASCR No. 4 conductor
FX calculated at US$1.00 = Q.2.70

* INDE recurrent costs.

COST PER KM OF DISTRIBUTION NETWORK
CONSTRUCTED BY THE PER II IMPLEMENTING UNIT - JULY 1988
(WITH PRIMARY AND SECONDARY UNDERBUILD)

ITEM	Primary 7.6 kV		Primary 19.9 kV	
	LC	FX	LC	FX
A. MATERIALS	Q.3,705	Q.3,547	Q.3,705	Q.4,058
Wooden Poles (9)	3,705		3,705	
Primary Conductor		432		432
Secondary Conductor		1,620		1,620
Miscellaneous (retainers, insulators, hardware, etc.)		1,495		2,006
B. LABOR	3,368*		3,368*	
C. MATERIALS & LABOR	7,073	3,547	7,073	4,058
D. ADMINISTRATION & ENGINEERING (13%)	919		919	
E. TRANSPORTATION (13%)	919		919	
F. AMORTIZATION & DEPRECIATION OF CONSTRUCTION EQUIPMENT (5%)	354		354	
G. RIGHT OF WAY (3%)	212		212	
TOTAL COST PER KM OF DISTRIBUTION NETWORK	9,478	3,547	9,951	4,058

Notes: FX calculated at US$1.00 = Q.2.70

* INDE recurrent costs.

COST PER KM OF DISTRIBUTION NETWORK
CONSTRUCTED BY THE FER II IMPLEMENTING UNIT - JULY 1988
(WITH PRIMARY AND SECONDARY UNDERBUILD)

ITEM	Primary 7.6 kV		Primary 19.9 kV	
	LC	FX	LC	FX
A. MATERIALS	Q.4,320	Q.3,547	Q.4,320	Q.4,058
Concrete Poles (9)	4,320		4,320	
Primary Conductor		432		432
Secondary Conductor		1,620		1,620
Miscellaneous (retainers, insulators, hardware, etc.)		1,495		2,006
B. LABOR	3,368*		3,368*	
C. MATERIALS & LABOR	7,688	3,547	7,688	4,058
D. ADMINISTRATION & ENGINEERING (13%)	999		999	
E. TRANSPORTATION (13%)	999		999	
F. AMORTIZATION & DEPRECIATION OF CONSTRUCTION EQUIPMENT (5%)	384		384	
G. RIGHT OF WAY (3%)	231		231	
TOTAL COST PER KM OF DISTRIBUTION NETWORK	10,302	3,547	10,302	4,058

Notes: FX calculated at US$1.00 = Q.2.70

* INDE recurrent costs.

COST PER KM OF DISTRIBUTION NETWORK
CONSTRUCTED BY THE PER II IMPLEMENTING UNIT - JULY 1988
(SECONDARY (240/120 V) DISTRIBUTION ONLY)

ITEM	LC	FX
A. MATERIALS	Q.3,375	Q.1,352
Wooden Poles (13)	3,375	
Secondary Conductor		972
Miscellaneous (retainers, insulators, hardware, etc.)		380
B. LABOR	5,052*	
C. MATERIALS & LABOR	8,427	1,352
D. ADMINISTRATION & ENGINEERING (13%)	1,095	
E. TRANSPORTATION (13%)	1,095	
F. AMORTIZATION & DEPRECIATION OF CONSTRUCTION EQUIPMENT (5%)	421	
G. RIGHT OF WAY (3%)	253	
TOTAL COST PER KM OF DISTRIBUTION NETWORK	11,292	1,351

Notes: FX calculated at US$1.00 = Q.2.70

* INDE recurrent costs

COST PER KM OF DISTRIBUTION NETWORK
CONSTRUCTED BY THE PER II IMPLEMENTING UNIT - JULY 1988
(SECONDARY (240/120 V) DISTRIBUTION ONLY)

ITEM	LC	FX
A. MATERIALS	Q.4,160	Q.1,352
Concrete Poles (13)	4,160	
Secondary Conductor		972
Miscellaneous (retainers, insulators, hardware, etc.)		380
B. LABOR	5,052 *	
C. MATERIALS & LABOR	9,212	1,352
D. ADMINISTRATION & ENGINEERING (13%)	1,198	
E. TRANSPORTATION (13%)	1,198	
F. AMORTIZATION & DEPRECIATION OF CONSTRUCTION EQUIPMENT (5%)	461	
G. RIGHT OF WAY (3%)	276	
TOTAL COST PER KM OF DISTRIBUTION NETWORK	12,344	1,351

Notes: FX calculated at US$1.00 = Q.2.70

* INDE recurrent costs

COST PER KM OF SUBTRANSMISSION LINES
FOR PER III, ASSUMING 50% 7.6 KV AND
50% 19.9 KV AND 60% WOODEN POLES
AND 40% CONCRETE POLES

	ITEM	LC	FX
A.	MATERIALS		
	Posts	4,392	
	Conductor		864
	Miscellaneous (retainers, insulators, hardware, etc.)		2,199
B.	LABOR	8,420	
C.	MATERIALS & LABOR	12,812	3,063
D.	ADMINISTRATION & ENGINEERING (13%)	1,666	
E.	TRANSPORTATION (12%)	1,537	
F.	AMORTIZATION & DEPRECIATION OF CONSTRUCTION EQUIPMENT (5%)	641	
G.	RIGHT OF WAY (3%)	384	
H.	TOTAL	17,040	3,063

COST PER KM OF DISTRIBUTION NETWORK
FOR PER III, ASSUMING 50% 7.6 KV AND 50% 19.9 KV
AND 60% WOODEN POLES AND 40% CONCRETE POLES
(WITH PRIMARY AND SECONDARY UNDERBUILT)

	ITEM	CC	FX
A.	MATERIALS		
	Poles (9)	3,951	
	Primary Conductor		432
	Secondary Conductor		1,620
	Miscellaneous (retainers, insulators, hardware, etc.)		1,751
B.	LABOR	3,368	
C.	MATERIALS & LABOR	7,319	3,803
D.	ADMINISTRATION & ENGINEERING (13%)	951	
E.	TRANSPORTATION (13%)	951	
F.	AMORTIZATION & DEPRECIATION OF CONSTRUCTION EQUIPMENT (5%)	366	
G.	RIGHT OF WAY (3%)	220	
H.	TOTAL	9,807	3,803

COST PER KM OF DISTRIBUTION NETWORK
FOR PER III, ASSUMING 50% 7.6 KV AND 50% 19.9 KV
AND 60% WOODEN POLES AND 40% CONCRETE POLES
(SECONDARY 240/120 V - DISTRIBUTION ONLY)

	ITEM	LC	FX
A.	MATERIALS		
	Poles (3)	3,689	
	Secondary Conductor		972
	Miscellaneous (retainers, insulators, hardware, etc.)		380
B.	LABOR	5,052	
C.	MATERIALS & LABOR	8,741	1,352
D.	ADMINISTRATION & ENGINEERING (13%)	1,136	
E.	TRANSPORTATION (13%)	1,136	
F.	AMORTIZATION & DEPRECIATION OF CONSTRUCTION EQUIPMENT (5%)	437	
G.	RIGHT OF WAY (3%)	262	
H.	TOTAL	11,712	1,352

260

COST PER KM OF DISTRIBUTION NETWORK
FOR PER III, ASSUMING 50% 7.6 KV AND 50% 19.9 KV
AND 60% WOODEN POLES AND 40% CONCRETE POLES
(PRIMARY AND SECONDARY 240/120)

	ITEM	LC	FX
A.	MATERIALS		
	Poles (22)	7,640	
	Primary Conductor		432
	Secondary Conductor		2,592
	Miscellaneous (retainers, insulators, hardware, etc.)		2,131
B.	LABOR	8,420	
C.	MATERIALS & LABOR	16,060	
D.	ADMINISTRATION & ENGINEERING (13%)	2,088	
E.	TRANSPORTATION (13%)	2,088	
F.	AMORTIZATION & DEPRECIATION OF CONSTRUCTION EQUIPMENT (5%)	803	
G.	RIGHT OF WAY (3%)	482	
H.	TOTAL	21,521	5,155

MATERIALS USED FOR SERVICE DROPS AND METERS

AMOUNT	DESCRIPTION	UNIT COST (Q)	TOTAL COST (Q)
25 mts.	Duplex cable No. 6	0.75	18.75
1 each	Hooks for service drop	2.58	2.58
2 each	Performed dead-end	1.83	3.66
2 each	Split bolt connectors	0.972	1.94
1 each	Meter	40.90	40.90
1 each	Seal	0.54	0.54
	TOTAL		68.37

MATERIALS USED FOR INTERIOR WIRING

AMOUNT	DESCRIPTION	UNIT COST (Q)	TOTAL COST (Q)
7 mts.	Electrical wire THW 2 x 14	0.675	4.73
5 mts.	Electrical tie wire, TWH 3 x 14	1.026	5.13
3 mts.	Wire, TW No. 10	0.459	1.38
1 each	Box for flip-on, single	10.00	10.00
1 each	15 amperes flip-on	7.00	7.00
2 each	Switch	2.50	5.00
2 each	Outlet	2.50	5.00
2 each	Ceiling receptacle	1.053	2.11
1 roll	Insulated tape	2.03	2.03
30 v.	Staples No. 1	0.0175	0.53
10	Wood screws, 1"	0.0024	0.02
	TOTAL		42.93

LABOR COSTS
INSTALLATION OF INTERIOR WIRING, SERVICE DROPS AND METERS

1,075 installations per month (PER III average)

Personnel: 5 crews of 15 workers each = 75 workers

Daily Salary: Q 5.27 x 30 days =	Q 158.10 / month
Bonus	175.00 / month
Per Diem, 10 days x Q 13.00/day	130.00 / month
Fringe Benefits (33% of salary)	51.70 / month
Net Salary per month per worker	Q 514.80 / month

Total Cost per month 75 x 514.80 = Q 38,610

Average cost per installation Q 38,610 / 1,075 = Q 235.92

Internal Wiring 63% = Q 22.63 = $ 3.33

Service Drops and Meter 37% = Q 13.29 = $ 5.00

LABOR COSTS CALCULATIONS PER KM OF SUB-TRANSMISSION LINE (QUETZALES)

It is assumed that a crew of 15 workers can construct one km of subtransmission line per month (optimal output).

COST ITEM	Foreman	Lineman	Helpers	Total
Quantity	1	5	9	15
Daily Wage	8.77	6.27	5.27	
Monthly Wage	263.10	188.10	158.10	
TOTAL WAGES	263.10	940.50	1,422.90	2,626.50
Monthly Bonus	175.00	175.00	175.00	
TOTAL BONUSES	175.00	875.00	1,575.00	2,625.00
Daily Per Diem	16.00	13.00	13.00	
16 Days	256.00	208.00	208.00	
TOTAL PER DIEM	256.00	1,040.00	1,872.00	3,168.00
TOTAL COSTS	694.10	2,855.50	4,869.90	8,419.50

Note: Labor costs for distribution networks are calculated separately, based upon past experience of the Construction Department.

ADMINISTRATION, ENGINEERING AND TRANSPORTATION OVERHEAD CALCULATIONS

Real costs of these categories was taken as of December 31, 1987, and divided by the km of line and distribution network built as of this date.

ITEM	COST	KM DISTRIB.	KM LINE	KM TOTAL	COST/KM
ENGINEERING & ADMINISTRATION	1,598,956	1,102	329	1,431	1,117
TRANSPORTATION	1,485,959	1,102	329	1,431	1,038

The division of the costs/km by materials costs provides the following overhead percentages:

Engineering & Administration: Q.1,117/Q.8,478 = 13%

Transportation: Q.1,038/Q.8,478 = 12%

Annex K - Exhibit 3

Subtransmission and Transformation Improvements

BUDGET FOR THE REQUIRED SYSTEM IMPROVEMENTS
TO THE WESTERN SYSTEM (IN QUETZALES)

DEPARTMENT OF SAN MARCOS

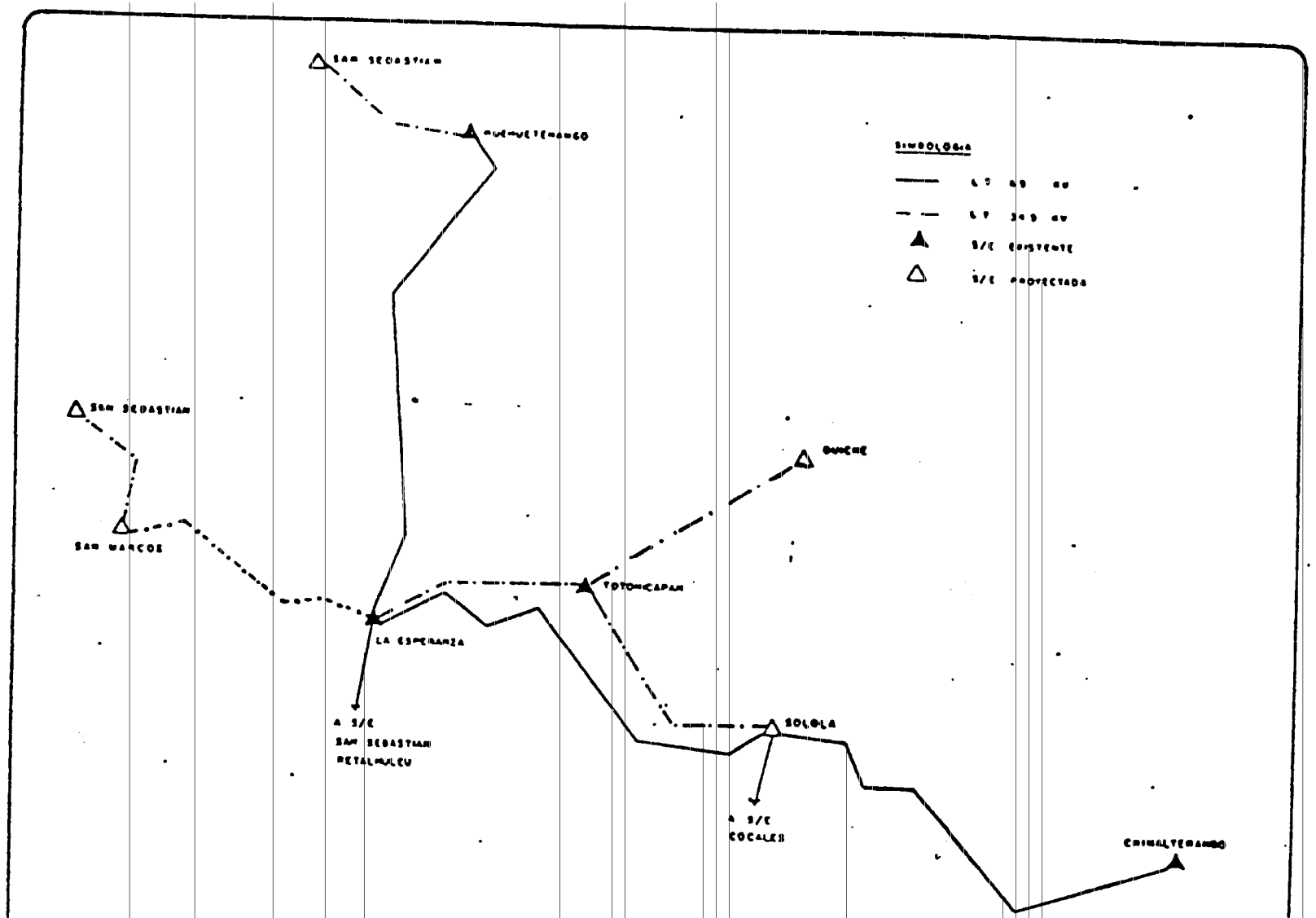
QUANTITY	UNITS	DESCRIPTION	LC	FX	TOTAL
14	Kms	34.5 KV Lines	181,839.28	50,136.38	231,975.66
1	Unit	S/S 34.5/13.2 KV, of 3x0.5 MVA (according to attached description)	186,438.57	500,368.45	686,807.02
		TOTAL	368,277.85	550,504.83	918,782.68

DEPARTMENT OF QUETZALTENANGO

QUANTITY	UNITS	DESCRIPTION	LC	FX	TOTAL
1	Unit	Transformer 69/34.5 KV 10-14 MVA for the S/S of La Esperanza	27,600	280,022.40	307,622.40
		TOTAL		280,022.40	307,622.40

DEPARTMENT OF HUEHUETENANGO

QUANTITY	UNITS	DESCRIPTION	LC	FX	TOTAL
18	Kms	34.5 KV Line	233,793.36	64,461.06	298,254.42
1	Unit	S/S 34.5/13.2 KV of 3x0.5 MVA (according to attached description)	186,438.57	500,368.45	686,807.02
		TOTAL	420,231.93	564,829.51	985,061.44

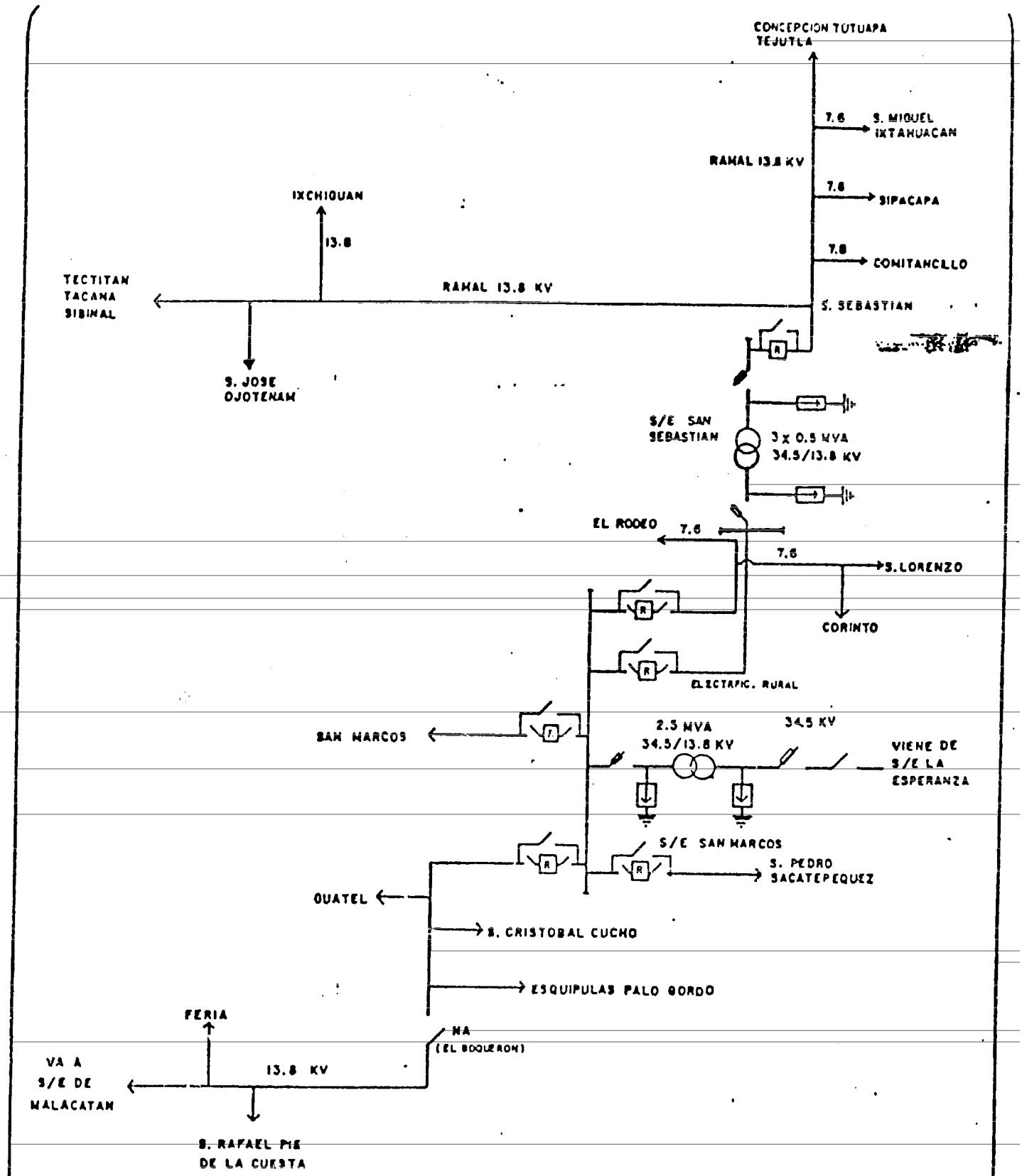


DEPARTAMENTO DE PLANIFICACION

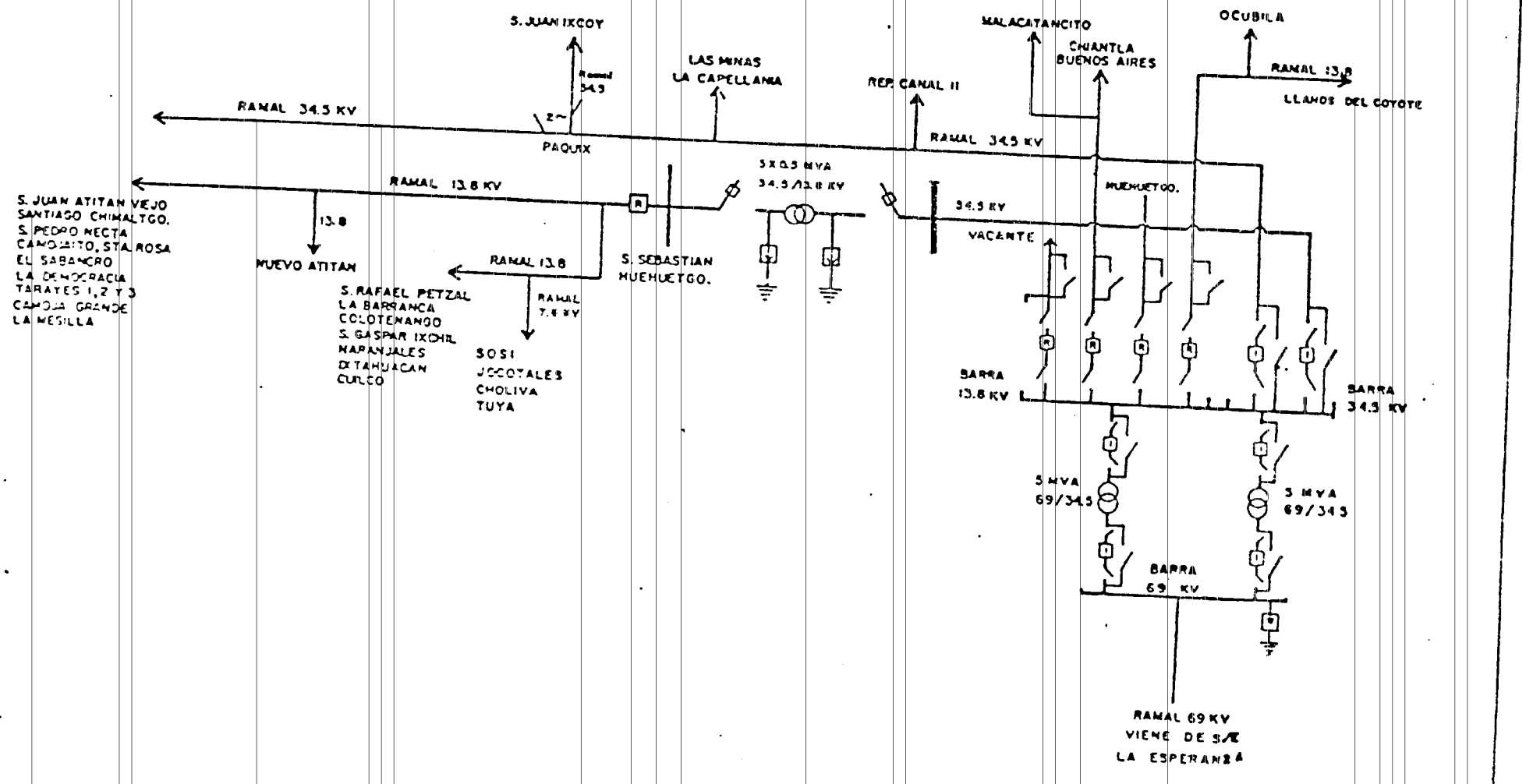
UNIDAD DE PLANIFICACION DEL SISTEMA ELECTRICO

ELABORO	DIBUJO	FECHA
ING. J. P. PASTOR	S.G.S.	31-I-86
		CODIGO

SISTEMA PROPUESTO PARA EL ABASTECIMIENTO DE ENERGIA ELECTRICA, REGION OCCIDENTAL



INDE UNIDAD DE PLANIFICACION DEL SISTEMA ELECTRICO	DIBUJO W.M.G.	INSTITUTO NACIONAL DE ELECTRIFICACION	FECHA AGOSTO 1988
	REVISO ING. J.P.P.C.	S/E S.SEBASTIAN S.MARCOS	ESCALA
	APROBO	34.5/13.8 KV 3X0.5 MVA.	



INDE DEPARTAMENTO DE PLANIFICACION

UNIDAD DE PLANIFICACION DEL SISTEMA ELECTRICO

TRABAJO ING JUAN PABLO PASTOR	DIBUJO W.M.G.	FECHA AGOSTO 1988 CODIGO

SUB ESTACION SAN SEBASTIAN

HUEHUETENANGO 3X0.5 MVA 34.5/13.8 KV

EQUIPO REQUERIDO PARA CADA COMPONENTE DE LA S/E 34.5/13.2 KV

1. SALIDA DE 34.5 KV

1 Restaurador trifásico
6 Desconectadores monopolares
1 Desconectador tripolar acción en grupo
3 Pararrayos con 1 contador de descarga
1 Tablero de medición, mando, control y protección

2. BARRA DE 34.5 KV

3 Transformadores de potencial

3. CAMPO DE TRANSFORMACION 34.5 KV

1 Restaurador trifásico, incluye CT'S
3 Desconectadores tripolares
3 Transformadores de potencial
3 Cortacircuitos con fusible

4. BARRA DE 13.8 KV

3 Transformadores de potencial
3 Cortacircuitos con fusible

5. EQUIPO REQUERIDO PARA IMPLEMENTAR LOS SERVICIOS PROPIOS

3 Pararrayos
3 Cortacircuitos

6. EQUIPO REQUERIDO PARA IMPLEMENTAR UNA SALIDA DE 13.2 KV

1 Restaurador trifásico
6 Desconectadores monopolares
1 Desconectador tripolar acción en grupo
3 Pararrayos con 1 contador de descarga
1 Tablero de medición, mando, control y protección

7. CAMPO DE TRANSFORMACION 13.2 KV

1 Restaurador trifásico, incluye 13.2 KV

3 Desconectadores tripolares

3 Transformadores de potencial

3 Cortacircuitos con fusible

CUADRO 4A

COSTO DE LINEAS DE SUBTRANSMISION POR KM CONSTRUIDAS POR ADMINISTRACION DEL INDE

PRECIOS A 1988

DESCRIPCION	DE 7.6 KV M.L.	DE 7.6 KV M.E.	DE 13.2 KV M.L.	DE 13.2 KV M.E.	DE 19.9 KV M.L.	DE 19.9 KV M.E.	DE 34.5 KV M.L.	DE 34.5 KV M.E.
A. MATERIALES								
-Postes de concreto reforzado 1/	2879		4024		3148		4520	
-Conductor 2/		387.72		1163.16		387.72		1163.16
-Cable de Guarda 3/		245.16		245.16		245.16		245.16
-Materiales diversos (retenidas, aisladores,herrajes,etc.)		594		1150.20		993.60		2002.32
SUB TOTAL DE MATERIALES	2879	1226.88	4024	2558.52	3148	1626.48	4520	3410.64
B. MANO DE OBRA	2322		4398		2322		4398	
C. MATERIALES + MANO DE OBRA 5/	5201	1226.88	8422	2558.52	5470	1626.48	8918	3410.64
D. ADMINISTRACION E INGENIERIA (15% DE C)	964.18		1647.08		1064.47		1849.30	
E. TRANSPORTES (5% DE C)	321.39		549.03		354.82		616.43	
F. AMORTIZACION Y DEPRECIACION DE EQUIPO DE CONSTRUCCION (5% DE C)	321.39		549.03		354.82		616.43	
G. DERECHOS DE VIA (3% DE C)	192.84		329.42		212.89		369.86	
H. SUMA (C+D+E+F+G)	7000.81	1226.88	11496.55	2558.52	7457.01	1626.48	12370.02	3410.64
I. IMPREVISTOS (5% DE H)	350.04	61.34	574.83	127.93	372.85	81.32	618.50	170.53
VALOR TOTAL POR KM. DE LINEA DE SUBTRANSMISION	7350.85	1288.22	12071.37	2686.45	7829.87	1707.80	12988.52	3581.17

OBSERVACIONES

1/ Postes	5.758 de 10 m	8.049 de 10 m	5.291 de 12 m	7.597 de 12 m
2/ Conductor	1050 m ACSR No.2	3150 m ACSR No.2	1050 m ACSR No.2	3150 m ACSR No.2
3/ Cable de guarda	1050 m ACSR No.4	1050 m ACSR No.4	1050 m ACSR No.4	1050 m ACSR No.4

4/ Los costos en moneda externa (M.E.) se dan en Quetzales

5/ $ 1.00 = Q 2.70

NOTA: Costos por km de linea,con materiales de AID.

PRODUCTIVE USES ANALYSIS

A. Institutional Considerations

The productive uses component contemplates the provision of credit to individuals and small groups for the acquisition of electrical equipment and machinery. INDE cannot act as a lending institution, according to its internal operating procedures and by law (Reglamento Interno). Therefore, another institution must be selected for the productive uses component of PER III.

In November, 1987, the consulting firm of Molina, Woolford and Associates (MWA) presented a report to USAID on an investigation carried out for the purpose of identifying what entity or entities could carry out the component. The study took into consideration state and private banks, state and private financing institutions (financieras), cooperative associations and private voluntary organizations (PVO's). The conclusion of the study was that BANDESA (the state Agricultural Development Bank), initially proposed as a candidate due to its extensive rural infrastructure and coverage, is too inefficient in promoting its own credit line and in collecting on its outstanding portfolio. MWA concluded that a PVO should implement the productive uses component. However, the study recommended that the Asociación Desarrollo para Todos (ASODESPT) be awarded the role, despite the fact that this institution has no credit and training experience whatsoever.

On the other hand, USAID has financed (Grant Agreement 520-0377-G-00-7043-00) an assistance program to urban micro-enterprises through Acción International (AITEC) and the Fundación para el Desarrollo Integral de Proyectos Socio-económicos (FUNDAP), a U.S. and Guatemalan PVO, respectively. The objectives of the micro-enterprise Project are similar to those of the productive uses component of PER III, and the experience to date has been satisfactory. The geographical coverage for both Projects is the Western Highlands of Guatemala, although the first focuses on urban micro-enterprises, while PER III is geared towards the rural population. Furthermore, AITEC and FUNDAP have already established an infrastructure in the region of interest which, through a small expansion in equipment and personnel, can be used in the PER III productive uses component. The Projects can thus be judged to be complementary to each other, and therefore the two PVO's have been selected to carry out the credit and training portions of this component.

B. Description of the Entities Involved in the Productive Uses Component and Project Administration

AITEC and FUNDAP are non-profit private voluntary organizations with sufficient experience in development programs both in Guatemala and abroad.

Acción AITEC is based in Cambridge, Massachusetts, and has ample experience in the region, from Colombia to Guatemala, in designing and developing projects focused towards the improvement of living conditions, both in urban and rural areas as well. Presently, AITEC is executing the assistance program for urban micro-entrepreneurs funded by USAID, in association with two local PVO's, including FUNDAP.

AITEC's role in the proposed Project will be to administer and control the grant funds, and to supervise the execution of the community training, provision of loans, and technical assistance efforts by the executing agency, FUNDAP. In order to carry out these overseeing tasks, AITEC has determined it will require a full-time Project coordinator/administrator and an accounting assistance in Guatemala, as well as part-time effort from a grant officer and accounting aide in its headquarters.

FUNDAP is a local PVO with its headquarters in the city of Quetzaltenango, in the Western Highlands of Guatemala. As stated before, it participates with AITEC in the urban micro-entrepreneur credit and technical assistance program, covering the Highlands region. Furthermore, the foundation currently has several other projects whose purposes are to develop and fully exploit the productive potential of the Western Highlands, including carpentry and woodworking in Nahualá, and sheep raising, wool production and knitting in Momostenango.

FUNDAP employs a matrix organizational structure in order to have the ability to attend and service its different projects. In this sense, the addition of the PER III productive uses component to its structure will not be a burden for the foundation. The two major sub-components are community productive uses training, and credit and technical assistance. FUNDAP and AITEC have decided to sub-contract all training and technical assistance in order to decrease the cost of such services and to incorporate people in the target areas to the process, particularly in the provision of technical assistance. The additional personnel will thus be limited to a

general Project coordinator and a field supervisor. All other activities necessary for the proper control of the Project, including accounting, legal assistance and others, will be provided by their service departments already in existence.

In regards to the credit activities for the purchase of electrical equipment and machinery, FUNDAP has programmed the need for a credit supervisor and credit promoters who will carry a workload of 80 to 100 credits each, which will result in the employment of up to 8 promoters during the latter portion of the life of the Project.

Institutional Support for Productive Use Activities within INDE

The productive uses promotion requires utility counterpart participation. The responsibility for long-terms success of a productive uses program must eventually rest with the utility. INDE is prohibited by law from handling the funding, but must become involved in the training and technical assistance portions of the proposed activity to ensure Project replicability and sustainability.

To accomplish this involvement, INDE will appoint, subject to AID approval, a project-funded Productive Uses Specialist within INDE. The Specialist will provide AITEC and FUNDAP the needed technical support for the promotion of specific productive use activities and will supervise and train INDE's Productive Uses Advisors, as well as maintain linkages with FUNDAP.

INDE will create, within the Rural Electrification Department, the permanent position of Productive Uses Specialist to work as counterpart of the Grant-Financed Productive Uses Specialist. INDE will also increase the number of promoters in the Rural Electrification Department to 10. These promoters will be trained by the Productive Uses Specialist and will be responsible for providing information and assistance to new consumers.

The following diagram describes the relationships that will exist between FUNDAP and INDE for the coordination and institutionalization within INDE of the productive uses component.

FUNDAP - INDE Relationships/Responsibilities

FUNDAP (Pilot Project)	INDE (Broad-based, long-term)
Funding Community Training Develop Training Material Promotion Provide T/A in - Care and Use of Equipment & Machinery - Business management	Inform about: Financing options Productive Use options Training options Advise in - Installation requirements - Safety instruction - Rates, appropriate to use - Estimates of energy use

NRECA/CARES On-Going Productive Uses Program

The Central American Rural Electrification Support (CARES) Program, funded under USAID/ROCAP with the National Rural Electric Cooperative Association (NRECA), is working in the promotion of productive uses of electricity in Guatemala. This effort began with a "Productive Uses of Electricity in Rural Areas Planning" seminar, held in March 1988. A representative of AITEC attended this seminar as well as representatives from over 20 other entities interested in the concept. The CARES program has now formed a follow-up committee (Comité de Acción para los Usos Productivos de la Electricidad - CAUPE) with liaison support from approximately 20 entities to develop a productive uses program for rural Guatemala. The need for coordination of effort between the CARES program and the productive uses credit activity of this project is essential. The Productive Uses Specialist will establish and maintain an ongoing working relationship with CARES and CAUPE. The input which INDE and AITEC/FUNDAP will receive from CAUPE through the Productive Uses Specialist will be used to improve the community selection process for both the infrastructure and productive uses of electricity components.

C. Target Beneficiary Population

1. By Regional Coverage

As stated in the PER III Project Identification Document, the productive uses component will be applied principally to communities electrified through PER II and, to

smaller scale, to those electrified through PER III. Obviously, beneficiaries must reside in rural areas in these regions, so the urban areas such as Quetzaltenango, Totonicapán, and Zacapa will not be included.

In December 1987 and August 1988, the firm of Stewart, Alvarez and Associates presented the results of sociological surveys and studies performed in the Western Highlands and the Eastern regions of the country, with the purpose of identifying the geographical zones with the highest productive uses potential. The initial conclusion was to limit the area of interest to the Western Highlands, as its potential surpasses by far that of the East. This would favor the selection of AITEC/FUNDAP, since the latter institution's sphere of influence is precisely the Highlands, and takes advantage of already established offices and other facilities.

The second step in refining the start-up geographical area was performed by FUNDAP based on the Stewart Alvarez studies and the official PER II community listings as of June 1988, focusing on those with more than 100 users. This resulted in the definition of a tentative initial list of communities in three departments, Quetzaltenango, Sololá and Totonicapán, to be extended to Quiché, San Marcos, Chimaltenango and Huehuetenango in the future. The communities preliminarily selected by FUNDAP are listed below. However, the foundation should perform on-site evaluations before Project start-up in order to focus their effort in valid communities.

Initial Target Communities:

- Department of Quetzaltenango, communities in the municipalities of:

  - Zunil
  - Cantel
  - Almolonga
  - Olintepeque
  - Palestina de los Altos
  - San Juan Ostuncalco
  - Salcajá
  - San Carlos Sijá
  - San Francisco La Unión
  - Cajolá

- Department of Sololá, communities in the municipalities of:

  - Nahualá
  - Santa Catarina Ixtahuacán
  - Santa Lucía Utatlán
  - Sololá

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- Department of Totonicapán, communities in the municipalities of:

  - Momostenango
  - Totonicapán
  - San Cristóbal
  - San Francisco El Alto
  - Santa María Chiquimula

2. By Productive Use

The emphasis of the Project is to expand the use of electricity in applications which improve the target population's level of income and general living conditions. The relevant range of productive uses can be from agricultural to industrial applications of electrical equipment. By emphasizing the following activities, the productive uses component will seek to diversify the target population's productive endeavors.

- Garment manufacturing: sewing, knitting and similar activities.
- Wood products: carpentry, furniture manufacturing.
- Miscellaneous equipment: compressors, motors, pumps, hand-held soldering, industrial hand-held sewing machines, etc.
- Production or processing of food: bakery, milling, other processing.
- Leather goods: shoe-making, belts, luggage.
- Metal working: cutting, forming, polishing, soldering.
- Milking operations and storage.
- Water pumping.
- Poultry laying and brooding operations.
- Grain grinding, drying and crop storage.
- Vegetable storing and processing.
- Feed processing.
- Fruit storage and processing.

The Ministry of Agriculture, via DIGESA/DIRYA, has completed a study on the potential for irrigated agriculture in the Western Highlands of Guatemala. This agency is now placing demonstration plots in these areas. Close coordination with this Project will be encouraged as water pumping for irrigation or municipal uses is a prime productive use activity that should be promoted. Likewise, coordination with other AID-financed projects in agriculture and micro-enterprise will be sought to improve project impact.

3. Potential Credit Recipients

The final consideration in this sub-section is who can apply for benefits under the productive uses component of PER III. The Project calls for improvements to benefit the rural population of Guatemala. The Project, and in particular, the credit and technical assistance sub-component, should be geared towards the inhabitants of rural communities in the selected municipalities who demonstrate:

- That their permanent residence is in a selected community in the area of interest (Western Highlands).
- That they employ a maximum of 10 people in the case of individual enterprises, and 100 people in the case of cooperatives and other communal organizations.
- That they are willing to accept technical assistance as needed, as well as supervision from the executory institutions.
- That they are willing to accept the conditions imposed as a part of the credit sub-component.

D. Description of the Grant Sub-Components

The productive uses component is divided into a community training portion, a credit and technical assistance portion, and an amount set up for the execution of required evaluations, studies and audits.

1. Community Training

Exhibit 1 at the end of this section details community training figures and costs. Over the life of the Project, FUNDAP will attempt to reach almost 100 communities in the Western Highlands, working progressively from 4 in the first semester to almost 30 during the fifth year. Community training is expected to end in the fifth year, as the goal of 100 communities will have been reached. However, and depending

on the identifications of new communities, it will be necessary in the future to schedule further training by INDE's Consumer Services Department.

The elements which should be addressed in the community training seminars include:

- General considerations regarding electricity. The local population should be instructed as to the benefits of electrification, safety considerations, and similar aspects. INDE promoters should be invited to participate in this activity, since the Commercial Department and, in particular, its Consumer Services Office are concerned with the expansion of the use of electrical energy.

- Productive uses of electricity. The second stage of the community awareness programs will familiarize the target population with the concept of productive uses. The examples presented in each community will reflect the principal activities carried out in the vicinity, be they carpentry, textiles, etc.

- Credit for the purchase of electrical equipment and machinery. The presentations should orient the target population as to the use of credit to purchase said machinery, and to the different financing alternatives at their disposal.

FUNDAP will contract the services of specialized firms to carry out these activities in order to minimize costs and speed up the training process. The total expected cost per presentation is estimated at $315, and it is estimated that an average number of three visits per community will be sufficient to educate and motivate the local population. Furthermore, FUNDAP will develop audiovisual aids for the presentations, at an estimated expense of approximately $3,700.

There are a number of training programs currently directed toward the small business operator in the Western Highlands. Many of these programs are related to a productive use of electricity. FUNDAP will be encouraged to coordinate efforts with these training groups to assure that the productive use activity is thoroughly presented, including a summary of the credit available for such equipment. Special coordination with USAID/PSPO office's efforts in micro-enterprise promotion should be pursued by FUNDAP.

2. Credit and Technical Assistance

An important part of the grant is the credit portion. Through this section, the target population will be able to purchase desired equipment and machinery, and INDE will be able to build load on its rural systems. The funds destined for loans must be seen as seed money on which a permanent revolving credit fund is to be established. Interest received on outstanding loans and capital recoveries will replenish the fund and provide for additional lending. However, the target population needs to be educated not only in the use of credit, which is to be addressed in the community training programs, but also on the use and maintenance of the purchased electrical equipment, on the management of their small enterprises, and on the marketing of the goods produced.

FUNDAP will apply a comprehensive services package similar to the one offered under the urban micro-entrepreneur Project, providing credit for asset purchases and working capital, and technical assistance in production, management and marketing.

a. Elements of the Credit Package

FUNDAP will receive funds from USAID through Acción AITEC gradually over the first five years of the life of the Project, in the following way:

Funds received in 1989 (6 mo.)	$ 71,111	17.6%
Funds received in 1990	77,778	19.3%
Funds received in 1991	115,000	28.5%
Funds received in 1992	106,667	26.4%
Funds received in 1993	33,333	8.2%
	$403,889	100.0%

i. Interest Rate and Method of Payment

FUNDAP charges 2.5% per month interest on the urban micro-enterprise assistance program. Such a rate is deemed high for a development project in a rural area. Market (bank) rates are approximately 16% per year, nominal, but the target population for this Project cannot make use of these loans due to their lack of collateral, of credit references, and even physical access to bank offices. The tentative interest rate to apply in this Project is 20% per year, effective, reflecting the fact that the potential beneficiaries are among the poorest in Guatemala, but at the same time being slightly over bank rates in an effort to offset possible high default rates.

As shown in the Component Budget - Exhibit 4, the 20% per year effective interest rate will be sufficient to cover the credit administration and technical assistance costs and will enable ACCION/AITEC-FUNDAP to continue the credit program without AID assistance after the sixth year of the project. Although another urban credit program also managed by ACCION/AITEC-FUNDAP, is charging interest of approximately 30%, it is considered that the PER III Productive Uses Component, which is directly targeted to small rural populations and small rural enterprises with the specific objective of promoting the productive uses of electricity should charge the minimum interest that is feasible to support administrative and TA costs and allows for continuation of the program without AID assistance. The target areas and target users of the urban project and PER III are completely different so there is no possible interference between both projects. In addition, since most of the productive uses component loans will be for fixed asset financing (93%) the risk factor is lower than in the urban project, where most of the credits are for working capital. The proposed interest rate was discussed at length and approved by ACCION/AITEC- FUNDAP and by the Project Design Committee.

The 20% interest rate, as stated above, is being proposed as a tentative interest rate considering that the Productive Uses Component is a pilot effort. This interest rate will be annually reviewed by AID and ACCION/AITEC-FUNDAP, and adjustments will be made if necessary.

Interest will be paid on the outstanding balance, while payment on principal will be collected on equal monthly payments. No grace period will be offered.

ii. Loan Terms and Amounts

FUNDAP's experience in the Western Highlands, including the micro-enterprise Project, is that loan duration terms average six months for working capital and eighteen months for fixed assets. Similarly, the estimates for average loan amounts are under $600 for individual loans, which are expected to account for 75% of the total loans over the six-year period, and $3,700 for group loans. This results in a maximum rotation of twelve and four times for working capital and fixed assets, respectively, over the life of the Project. The range of the loans has been set, initially, at:

- Individual loans: $75 minimum, $1850 maximum
- Group loans: $370 minimum, $3700 maximum

iii. Loan Use and Distribution over Time

The loans will be applied primarily to asset financing (roughly 93%), with the remaining portion for working capital. Using a 75% efficiency in rotation for the purpose of conservatism, and considering the interest rate mentioned above, the expected inflow from credit operations is the following:

Year	Total Loans placed	Funds from USAID	Collections	Interest Received
1989	$ 71,111	$ 71,111	$ 0	$ 7,111
1990	208,889	77,778	131,111	31,200
1991	398,889	115,000	283,889	59,019
1992	584,444	106,667	477,777	85,915
1993	663,333	33,333	630,000	89,630
1994	685,556	0	660,556	90,370

As can be observed from the figures above, the credit agency will not require funding from USAID by 1994.

iv. Loan Guarantee

In terms of collateral, as mentioned previously, the target population is among the poorest in Guatemala, which limits the options on mechanisms to employ to guarantee the loans. FUNDAP will have to secure the credit granted with the same assets financed for purchase, complemented with the personal endorsement of the borrowers.

v. Authorization and Formalization of Loans

Credit applications will be initially weighed and reviewed by a credit promoter and the credit supervisor. The final decision as to the approval and disbursement of funds will be responsibility of a credit review and policy committee integrated by FUNDAP's PER III Project manager, the Project coordinator, and the credit supervisor, counting with the AITEC assistance.

Since the Project is directed towards the rural poor, AITEC/FUNDAP and USAID should formally request to the Government of Guatemala that the recipients of these loans be exempt from the payment of the fiscal stamp law (timbres and papel sellado).

vi. Technical Assistance Sub-Component

The technical assistance to be provided to the credit recipients will be sub-contracted outside by FUNDAP just as the community training seminars. The reason for this is that the total number of financed equipment may be high, so that it will be either difficult or expensive to have full-time experts on the payroll.

FUNDAP estimates that 50% of the individual borrowers will be visited twice during the life of their loan for technical assistance purposes, a start-up visit and a supervisory and maintenance visit. On the other hand, and since the group loans will involve higher amounts, all of the recipient groups will be visited three times on average. The visits will not be longer than 5 hours, so the estimated total cost is $18.51 per visit. Exhibit 3 summarizes the total expected cost for the technical assistance sub-component.

vii. Credit Management Cost Component

The $900,000 grant will be disbursed between 1989 and 1993, with one major exception: the cost of the final evaluation, occurring in 1994. The distribution of the funds calls for $403,889 in credit funds; $170,778 in community training and technical assistance; $272,924 in overall Project administration; and $52,409 for inflation and contingency purposes. Exhibit 4 details the distribution of resources for the life of the Project, and Exhibit 5 describes the yearly disbursements by USAID.

E. Implementation Plan

The training and credit sub-components are scheduled to begin in the second semester of 1989. Prior to the start-up date, the involved institutions must formalize their respective agreements. The tentative implementation plan is detailed below.

- Formalization of the contractual agreement between USAID and AITEC — May 1989
- USAID revision and approval of the AITEC/FUNDAP agreement, credit policies and regulations, and other relevant documents — June 1989
- Formalization of the contractual agreement between AITEC and FUNDAP — June 1989

- Drafting of the credit policies, regulations and other documents governing the operations relative to the productive uses component — July - August 1989
- Initial disbursement to AITEC — August 1989
- Procurement of vehicles, office equipment and supplies, hiring the necessary personnel, and other preparatory activities — July - August 1989
- Initiation of the Project — September 1989

F. Economic Benefits

Based on the experience from Productive Uses programs in other developing countries, Exhibits 6, 7 and 8 reflect what is considered to be a conservative estimate of electricity use and economic benefits that will be derived from the program in Guatemala. Exhibit 6 estimates kWh usage for typical applications for both individual and group loans. Exhibit 7 estimates kWh usage over the life of the Project, and Exhibit 8 reflects the benefit/cost analysis of the activities funded under the program.

EXHIBIT 1: COMMUNITY TRAINING FIGURES AND COSTS

YEAR	NUMBER OF COMMUNITIES	VISITS PER COMMUNITY	COST PER VISIT	TOTAL COST
1989 (6 mos.)	4	3	$315	$3,778
1990	12	3	315	11,333
1991	20	3	315	18,889
1992	27	3	315	25,500
1993	27	3	315	25,500
1994	NONE			
SUB-TOTAL				$85,000

YEAR	GROUPS PER COMMUNITY	GROUPS REQUIRING TRAINING	COST PER VISIT	TOTAL COST
1989 (6 mos.)	6	0.5	$315	$944
1990	18	0.5	315	2,833
1991	30	0.5	315	4,722
1992	40.5	0.5	315	6,375
1993	40.5	0.5	315	6,375
1994	NONE			
SUB-TOTAL				$21,250

YEAR	COMMUNITY COST	GROUP COST	TOTAL COST
1989 (6 mos.)	$3,778	$944	$4,722
1990	11,333	2,833	14,167
1991	18,889	4,722	23,611
1992	25,500	6,375	31,875
1993	25,500	6,375	31,875
1994	0	0	0
TOTAL PROJECT COST			$106,250

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EXHIBIT 2: LOANS GRANTED THROUGHOUT THE LIFE OF THE PROJECT

NUMBER OF LOANS:

YEAR	INDIVIDUAL LOANS	GROUP LOANS	TOTAL LOANS
1989 (6 mo.)	80	6	86
1990	260	14	274
1991	480	29	509
1992	720	39	759
1993	720	39	759
1994	720	39	759
TOTAL			3,145

VALUE OF LOANS:

YEAR	INDIVIDUAL LOANS	GROUP LOANS	TOTAL LOANS	FUNDS PROVIDED BY US AID
1989 (6 mo.)	$48,889	$22,222	$71,111	$71,111
1990	158,889	50,000	208,889	77,778
1991	293,333	105,556	398,889	115,000
1992	440,000	144,444	584,444	106,667
1993	440,000	144,444	584,444	33,333
1994	440,000	144,444	584,444	
TOTAL			$2,432,222	$403,889

EXHIBIT 3: TECHNICAL ASSISTANCE FIGURES AND COSTS

TECHNICAL ASSISTANCE FOR INDIVIDUAL LOANS:

YEAR	NUMBER OF LOANS	PERCENTAGE REQUIRING VISITS	VISITS PER LOAN	TOTAL VISITS
1989 (6 mo.)	80	50%	2	80
1990	260	50%	2	260
1991	480	50%	2	480
1992	720	50%	2	720
1993	720	50%	2	720
1994 **	720	50%	2	720
SUB-TOTAL				2,980

TECHNICAL ASSISTANCE FOR GROUP LOANS:

YEAR	NUMBER OF LOANS	PERCENTAGE REQUIRING VISITS	VISITS PER LOAN	TOTAL VISITS
1989 (6 mo.)	6	100%	3	18
1990	14	100%	3	41
1991	29	100%	3	86
1992	39	100%	3	117
1993	39	100%	3	117
1994 **	39	100%	3	117
SUB-TOTAL				495

COST FOR THE TECHNICAL ASSISTANCE COMPONENT:

YEAR	INDIVIDUAL LOAN VISITS	GROUP LOAN VISITS	TOTAL VISITS	COST PER VISIT	TOTAL COST
1989 (6 mo.)	80	18	98	$19	$1,615
1990	260	41	301	19	5,565
1991	480	86	566	19	10,472
1992	720	117	837	19	15,500
1993	720	117	837	19	15,500
1994 **	720	117	837	19	15,500
TOTAL COST OF THE TECHNICAL ASSISTANCE SUB-COMPONENT					64,352

** NOT FUNDED BY US AID

EXHIBIT 4: BUDGET -- PER III CREDIT AND TRAINING COMPONENT

	1989	1990	1991	1992	1993	TOTAL US AID FUNDING	1994	TOTAL
ADMINISTRATIVE EXPENSES FUNDAP:								
Wages, salaries, benefits:								
Coordinator	$2,083	$4,167	$4,167	$4,167	$4,167	$18,750	$4,167	[illegible]
Field supervisor	1,111	2,222	2,222	2,222	2,222	10,000	2,222	[illegible]
Per diems	315	648	648	665	741	3,037	741	[illegible]
Fuel, maintenance & related	324	648	648	648	648	2,917	648	[illegible]
Forms, formats, etc.	370	741	741	833	833	3,519	926	[illegible]
Overhead	3,704	7,407	7,407	7,407	7,407	33,333	8,519	[illegible]
Investments:								
Pick up (4WD)	12,963					12,963		[illegible]
Motorcycles	2,963	2,963	4,630	1,852		12,407		[illegible]
Office Equipment	1,481					1,481		[illegible]
SUB-TOTAL	$25,315	$18,796	$20,463	$17,815	$16,079	$98,407	$17,222	$115,[illegible]
ADMINISTRATIVE EXP ACCION-AITEC:								
Local salaries, benefits, etc:								
Assitant coordinator	3,148	6,481	7,037	7,222	7,222	31,111	7,407	38,[illegible]
Accounting assistant	276	694	741	741	741	3,194	741	3,[illegible]
AITEC USA salaries, benefits:								
Grant officer	1,600	3,600	3,600	3,600	3,600	16,200	3,600	19,[illegible]
Accounting assistant	600	1,200	1,200	1,200	1,200	5,400	1,200	5,[illegible]
Office Equipment	556					556		[illegible]
Local overhead expense	741	1,481	1,481	1,481	1,481	6,667	1,778	8,[illegible]
USA overhead expense	1,481	2,667	2,778	2,870	2,963	12,759	3,036	15,[illegible]
SUB-TOTAL	$8,604	$16,124	$16,837	$17,115	$17,207	$75,887	$17,761	$93,[illegible]
COMMUNITY TRAINING:								
Contracted professional fees	5,000	14,250	24,750	33,500	38,000	115,500	0	115,[illegible]
Audiovisual aids	3,704					3,704		3,[illegible]
SUB-TOTAL	$8,704	$14,250	$24,750	$33,500	$38,000	$119,204	$0	$119,[illegible]
CREDIT/TECHNICAL ASSISTANCE:								
Wages, salaries, benefits:								
Credit supervisor		3,889	3,889	3,889	3,889	15,556	4,074	19,[illegible]
Credit promoters	1,222	7,037	13,889	21,111	21,111	64,370	21,667	86,[illegible]
Per Diems	185	1,296	2,407	2,593	2,778	9,259	2,963	12,[illegible]
Fuel, maintenance & related	185	556	741	1,111	1,111	3,704	1,111	4,[illegible]
Office Equipment	1,296					1,296		1,[illegible]
Forms, formats, etc.	556	926	926	1,019	1,019	4,444	1,111	5,[illegible]
Credit fund	71,111	77,778	115,000	106,667	33,333	403,889		403,[illegible]
Technical assistance fees (contracted)	1,815	5,565	10,472	15,500	18,222	51,574	18,222	69,[illegible]
SUB-TOTAL	$76,370	$97,046	$147,325	$151,889	$81,463	$554,093	$49,148	$603,[illegible]
INFLATION AND CONTINGENCIES:	7,091	12,070	12,070	11,144	10,033	52,409		52,[illegible]
TOTAL PRODUCTIVE USES COMPONENT:	$126,084	$158,287	$221,444	$231,463	$162,722	$900,000	$84,132	$984,[illegible]

EXHIBIT 5: PRODUCTIVE USES OF ELECTRICITY COMPONENT
US AID DISBURSEMENTS BY YEAR (IN US DOLLARS)

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	TOTAL FUNDING
Community Training	$8,704	$14,250	$24,750	$33,500	$38,000		$119,204
Technical Assistance	1,815	5,565	10,472	15,500	18,222		51,574
Credit Funds	71,111	77,778	115,000	106,667	33,333		403,889
Credit Management Funds	37,363	48,623	59,152	64,652	63,134		272,924
Inflation, Contingencies	7,091	12,070	12,070	11,144	10,034		52,409
TOTAL FUNDING	$126,084	$158,286	$221,444	$231,463	$162,723		$900,000

INDIVIDUAL LOANS

$600 - AVERAGE AMOUNT
$75 - MINIMUM
$1,850 -- MAXIMUM

In an attempt to determine the kWh usage for the productive use activities to be funded under this credit line, the following information was prepared.

A review of locally available productive use equipment shows that the HP range for equipment consisting under $1,850 is from fractional HP sizes (small sewing machines) up to 5 HP (corn grinding equipment).

Estimated kWh usage for selected HP ranges are presented below:

ESTIMATED KWH USAGE FOR SELECTED APPLICATIONS
UNDER THE "INDIVIDUAL" CREDIT LINE

kWh/month	HP	Hours use per Day	kWh use per Year	cost per kWh (Q)
150	.5	8.7	1,800	.154
	1	5		
	2	2.5		
	5	1.1		
300	.5	17.4	3,600	.133
	1	10		
	2	5		
	5	2.2		
500	.5	(29)	6,000	.130
	1	16.7		
	2	8.3		
	5	3.7		

Assumptions: varying motor efficiency, 30 days use/month, 12 months/year, cost based on C14 rate as presented in Annex H.

Using a 5 HP corn grinder 2.2 hours per day to provide nixtamal (corn paste for tortillas) for a neighborhood seems a reasonable estimate. With this as a guide, 300 kWh per month might be expected. Since this activity occurs every day of the year, the basic assumptions stated above are valid and 3,600 kWh/year is a reasonable estimate of energy use for productive use activities funded under this credit line.

ESTIMATED KWH USAGE FOR SELECTED APPLICATIONS UNDER THE "GROUP" CREDIT LINE

kWh/month	HP	Hours use per Day	kWh use per Year	Cost per kWh [Q]
400	2	6.7	4,800	.131
	5	3		
	7.5	1.9		
800	2	13.3	9,600	.128
	5	5.9		
	7.5	3.8		
1000	2	16	12,000	.127
	5	7.4		
	7.5	4.8		
1500	2	(25)	18,000	.127
	5	11		
	7.5	7.1		

Assumptions: varying motor efficiency, 30 days use/month, 12 months/year, cost calculated using C14 rate as presented in Annex H.

Since these equipment will be operated by a cooperative or similar group to meet needs of the membership, higher usage levels might be expected than individually owned equipment. Seasonal use of some of the equipment should also be considered in estimating annual use figures. Energy use of compressors for refrigeration varies depending on amount of product in storage.

For estimation purposes, an annual energy use figure of 9,600 kWh is suggested to represent average energy use for productive uses activities funded under the "group" credit line proposed in the PER III Project paper.

Exhibit 7

ENERGY USE ESTIMATE FOR EQUIPMENT FINANCED THROUGH THE CREDIT PROGRAM

3600 KWH/YR FOR INDIVIDUAL P.U. ACTIVITIES
9600 KWH/YR FOR GROUP P.U. ACTIVITIES
93% OF LOANS APPLICABLE TO ASSET FINANCING
10 YEARS LIFE OF INDIVIDUAL EQUIP.
15 YEARS LIFE OF GROUP EQUIP.

YEAR	----- TOTAL ----- # IND. LOANS	# GROUP LOANS	KWH/YR INDIV.	KWH/YR GROUP	--CUMM. KW/YR-- INDIV.	GROUP	TOTAL KWH PER YR.
0							
1	80	6	267840	53568	267840	53568	321,408
2	260	14	870480	124992	1138320	178560	1,316,880
3	480	29	1607040	258912	2745360	437472	3,182,832
4	720	39	2410560	348192	5155920	785664	5,941,584
5	720	39	2410560	348192	7566480	1133856	8,700,336
6	720	39	2410560	348192	9977040	1482048	11,459,088
7	720	39	2410560	348192	12387600	1830240	14,217,840
8	720	39	2410560	348192	14798160	2178432	16,976,592
9	720	39	2410560	348192	17208720	2526624	19,735,344
10	720	39	2410560	348192	19619280	2874816	22,494,096
11	720	39	2410560	348192	21762000	3223008	24,985,008
12	720	39	2410560	348192	23302080	3571200	26,873,280
13	720	39	2410560	348192	24105600	3919392	28,024,992
14	720	39	2410560	348192	24105600	4267584	28,373,184
15	720	39	2410560	348192	24105600	4615776	28,721,376
16	720	39	2410560	348192	24105600	4615776	28,721,376
17	720	39	2410560	348192	24105600	4615776	28,721,376
18	720	39	2410560	348192	24105600	4615776	28,721,376
19	720	39	2410560	348192	24105600	4615776	28,721,376
20	720	39	2410560	348192	24105600	4615776	28,721,376
21	720	39	2410560	348192	24105600	4615776	28,721,376
22	720	39	2410560	348192	24105600	4615776	28,721,376
23	720	39	2410560	348192	24105600	4615776	28,721,376
24	720	39	2410560	348192	24105600	4615776	28,721,376
25	720	39	2410560	348192	24105600	4615776	28,721,376
26	720	39	2410560	348192	24105600	4615776	28,721,376
27	720	39	2410560	348192	24105600	4615776	28,721,376
28	720	39	2410560	348192	24105600	4615776	28,721,376
29	720	39	2410560	348192	24105600	4615776	28,721,376
30	720	39	2410560	348192	24105600	4615776	28,721,376

Exhibit 8

BENEFIT/COST ANALYSIS OF PRODUCTIVE USE ACTIVITIES FUNDED UNDER THE CREDIT PROGRAM

SHADOW COEF.	1.59
REVENUE/KWH IND.	0.12
REVENUE/KWH GROUP	0.12
COST/CONNECTION	12.00
COST/KWH	0.183
DISCOUNT RATE	15%
CONST. COST/CONNECT	0

YR	ACT. # CONNS	SALES [MWH]	BENEFIT	COST OF SALES	COST CONSTR	NET BENEFIT	NET CASH FLOW
0	0				0		0
1	80	321	61,325	58,818	0	2,507	2,507
2	255	1,317	251,261	241,949	0	9,312	9,312
3	473	3,183	607,284	585,516	0	21,768	21,768
4	706	5,942	1,133,654	1,092,990	0	40,664	40,664
5	706	8,700	1,660,024	1,600,632	0	59,392	59,392
6	706	11,459	2,186,394	2,105,484	0	80,910	80,910
7	706	14,218	2,712,764	2,610,335	0	102,429	102,429
8	706	16,977	3,239,134	3,115,187	0	123,947	123,947
9	706	19,735	3,765,504	3,620,038	0	145,465	145,465
10	706	22,494	4,291,874	4,124,890	0	166,984	166,984
11	706	24,985	4,767,140	4,580,727	0	186,413	186,413
12	706	26,873	5,127,422	4,926,281	0	201,141	201,141
13	706	28,025	5,347,168	5,137,044	0	210,124	210,124
14	706	28,373	5,413,604	5,200,763	0	212,840	212,840
15	706	28,721	5,480,039	5,264,482	0	215,556	215,556
16	706	28,721	5,480,039	5,264,482	0	215,556	215,556
17	706	28,721	5,480,039	5,264,482	0	215,556	215,556
18	706	28,721	5,480,039	5,264,482	0	215,556	215,556
19	706	28,721	5,480,039	5,264,482	0	215,556	215,556
20	706	28,721	5,480,039	5,264,482	0	215,556	215,556
21	706	28,721	5,480,039	5,264,482	0	215,556	215,556
22	706	28,721	5,480,039	5,264,482	0	215,556	215,556
23	706	28,721	5,480,039	5,264,482	0	215,556	215,556
24	706	28,721	5,480,039	5,264,482	0	215,556	215,556
25	706	28,721	5,480,039	5,264,482	0	215,556	215,556
26	706	28,721	5,480,039	5,264,482	0	215,556	215,556
27	706	28,721	5,480,039	5,264,482	0	215,556	215,556
28	706	28,721	5,480,039	5,264,482	0	215,556	215,556
29	706	28,721	5,480,039	5,264,482	0	215,556	215,556
30	706	28,721	5,480,039	5,264,482	0	215,556	215,556
NPV			15,499,985	14,903,755	0	518,460	

ANNEX M

SOCIAL SOUNDNESS ASSESSMENT

SOCIAL SOUNDNESS ASSESSMENT

I. Background

Electrical service to Guatemala's rural areas is still the second lowest in Central America, and just 7% of the rural population has access to electricity. In response to this problem, the Government of Guatemala considers electrification of the rural areas to be one of its more important infrastructure investment priorities. In order to realize its objectives, the Government has requested that USAID/Guatemala continue its assistance to the rural electrification effort.

USAID/Guatemala has begun the design of the Rural Electrification III (PER III) Project as a follow-on to the ongoing PER II Project and the earlier PER I, which represent USAID's effort in this area since 1972. The goal of the new Project is to increase the productivity, incomes, and employment of the rural poor in Guatemala, and the purpose of the Project is to expand electrification in rural areas where the introduction of electricity will complement and maximize the productive potential of existing infrastructure and resources.

PER III has been programmed as a six-year project with three basic components: (1) the construction of lines and electrical installations, (2) training of community members in productive uses of electricity, and (3) a credit program for small enterprises. Construction will be directed toward communities with the highest potential for productive use, and electricity will specifically be made available for commercial and small industrial uses.

Training will be crucial in making the beneficiary communities conscious of the appropriate and productive use of electric service as well as in the operation of electrical equipment installed in small productive enterprises. The credit program will make it possible for existing small enterprises to convert to electricity and for the establishment of new small businesses for which electricity is the main source of energy.

II. Sociocultural context

A. Historical context

By way of introduction to the beneficiary group, a short history and analysis of ethnic differences is presented below. The population of Guatemala at the time of the Spanish Conquest has been estimated at about one million people divided

into several ethnic groups, mostly varied groups of Highland Mayan in speech and heritage. The native population of Guatemala dropped to perhaps ten or twenty percent of what it had been in the years just after the Conquest as the European diseases decimated the people, and estimates for the year 1650 put the total population of Guatemala at no more than 200,000, still nearly all Indian. By 1778, this figure had increased to just about 380,000. The present population is estimated to be about 8 million, about half of whom are Indian.

In most cases, the Indians continued to occupy the same areas after the Conquest as they had previously. Because of the low and very slowly growing population, the Indian situation changed little in the centuries of the Spanish colony and not much more in the first hundred years of Guatemala's independence. The Spanish presence in much of the Indian area was token, usually a priest and a small detachment of soldiers, with the priest wielding the greatest influence. Under these circumstances a Guatemalan Indian culture grew up which represented the confluence of three basic elements: the autochthonous preconquest Mayan culture with roots in the general Mesoamerican civilization, the Spanish Catholic culture of the 16th to 18th centuries, and the subsistence base of the Indians.

This subsistence agricultural base of corn, beans, and other crops grown on plentiful land was ample enough to comfortably maintain the Indian populace, produce grain surpluses, and incidentally, maintain civil tranquility for the most part among the colonized Indians. The Spanish colonial contribution was found primarily in a religio-civic social organization based on obligatory service in the cofradias, religious brotherhoods taken from the Spanish but elaborated to fulfill the civic needs of a town's population. The religious forms which grew up in this context represented a syncretism of Spanish Catholicism and autochthonous religious beliefs and practices. At the same time the Indian population maintained and developed their own cultural traits through the stubborn retention of elements of their own cultural heritage, although at times it was at the insistence of the Spanish that distinguishing cultural traits were established and conserved. In sum, the Mayan Indians acquired an ethnic identity both then and now that distinguishes them from the Ladinos, the ethnic group represented by the descendants of the Spanish colonizers.

Ladinos are the cultural descendants of the Spanish colonialists and today share a common heritage. The Ladino population, however, is anything but racially homogeneous, as there has been considerable mixture of European and Indian populations for centuries, and the offspring of most of these

unions have opted for a non-Indian identity. In addition, there have been cases of racially pure Indians converting ethnically to Ladino, either individually or occasionally as whole villages or towns. The result is a racially heterogenous Ladino population whose common bond is cultural, not racial. This cultural identity, though occasionally colored by reference to an Indian heritage, is basically Hispanic and Latin, in most ways little different from the rest of the general Latin American people.

Ladino society is complex, including modern urban elements as well as traditional rural ways of life. As regards the rural agricultural Ladino society, it resembles the Indian society in that many of the same circumstances have operated in both areas. The traditional Ladino farmer was dedicated in general to subsistence agricultural and to many of the same crops as the Indian. Corn and beans supplemented by a variety of other cultigens characterized the Ladino farmer as it did the Indian. Population growth and the subdivision of land into smaller and smaller plots has forced some farmers to look to new, more productive crops and others to leave their home areas in search of new opportunities.

B. Ethnic context

Ethnic groups can be defined and described using a variety of criteria, such as beliefs, rituals, economic base, dress, food, and so forth, and the Indian-Ladino situation in Guatemala is no exception. One of the more obvious and important elements of this ethnic culture in Guatemala is language. Nearly all Indians speak languages of the Mayan family as their first and sometimes only language, and very few Ladinos can speak or understand these languages. Thus, speaking a Mayan language is a strong factor in the ethnic identity of Indians.

Dress is another indicator of Indian identity. Nearly all Indian women wear distinctive Indian dress, while Ladino women use current Euro-American clothing styles. The fact that Indian dress is of intricate design and fabrication and is virtually all hand-made by the Indians themselves may have important implications for the productive uses component, since this means that many rural Indians have highly developed manual abilities which allow them to adapt to other manufacturing activities, especially textiles, which require such abilities.

World-view is another cultural area in which the Indian culture differs strongly from that of the Ladinos. The traditional Indian orientation toward the world is one of adjustment, adaptation, and coming to terms with the physical

and human reality found there. On the other hand, the Ladino approach is aggressive in an effort to control and dominate his universe, and destructive force is a legitimate means to this control.

One of the most important aspects of Indian culture is the relation of the individual to the group. In contrast to the Ladino emphasis on individualism, the Indian culture stresses that the individual exists as a member of the group and that the individual prospers as the group prospers. The function of the individual is thus to promote the group and not his own personal interests. This tends to produce communities with less social conflict than the those in which the individual is supreme. The traditional Indian society is usually unstratified, while the Ladino society is stratified.

Leadership is considered in Indian culture, usually within the confines of the cofradia, obligatory but temporary and open to all who follow the patterns and precepts which regulate Indian society. Leadership in Ladino society stems from individual and personal leadership qualities. Group decisions in Indian society are arrived at through consensus rather than fiat or majority vote. This contrasts with the strong individual leadership of Ladino culture based on personal characteristics coupled with loyal, subordinate followers. If decisions are taken by the group, it will more likely be through majority vote than by consensus.

One element of Indian culture that should be noted is a strong attachment on the part of Indians to their traditional towns and villages. This should not be construed as mystical or romantic, nor is it strictly limited to Indians and not Ladinos. But Ladinos, faced with ever increasing limitations in traditional farming, are more likely to permanently move away from rural homelands to seek opportunities elsewhere, while Indians tend to look for income producing activities other than farming that will allow them to remain at home or at least maintain their traditional homes as a base of operations.

This has important implications for Indians in a productive uses program in rural electrification, since Indians should tend to realize the implications of such programs to allow them to improve their productive economic position while staying at home. Those Ladinos who remain in their traditional homes in rural areas are often those who inherit the family lands and who are thus able to make a living farming, while their siblings end up emigrating, usually to urban areas.

These and other cultural characteristics combine to define the boundary between the two ethnic groups. This

boundary is well established, much of the cultural content is firmly set and subject only to limited change, and the identity of members of both groups is well understood and accepted by both.

C. Economic context

The economic situation of the target population is a difficult one. The centuries old agricultural economic base of both Indians and Ladinos, while still important, cannot sustain the present population on their existing landholdings. The average farmer has seen his real income reduced constantly and has been forced to make up the difference either by working as a laborer part of the year on the agribusiness plantations on the south coast plains, by engaging in some sort of small scale business or industry in or near his home, or by engaging in itinerant commerce away from home.

One of the responses to this situation has been the introduction of new crops and technology in both Indian and Ladino areas. Export crops like broccoli, brussels sprouts, and mango have made it possible to link small farmers with agroexporters. Irrigation systems, including those requiring electric or diesel motors, can have a dramatic effect in converting semi-arid lands into crop land.

Agricultural labor as a source of income is precarious, as it depends on the vagaries of the international market for the plantation products, and it is dangerous, due to the climate, living conditions, and biocide use on these plantations. In addition, it is extremely low paying, seasonal work through which the laborer can expect at best to survive at a minimal level and pay his debts but never be comfortable or secure with. The ostensible minimum wage of $3.20 per day has not always been paid in recent years as plantation owners have been hit with falling demand and lowered world market prices.

Other economic activities have been sought which would allow them to remain closer to home. The highland area of Guatemala, where the different Indian groups are contiguous, has been linked through trade for centuries as individual towns have come to specialize in the production of certain articles, such as pottery, baskets, wool, mats, furniture, candles, charcoal, and other articles. This craft production, now often oriented to the tourist trade, can supplement the income of selected groups or individuals. But these too are subject to the fluctuations of the world economy: during the recent recession few tourists came to Guatemala and their purchases were smaller. Also, the devaluation of the Mexican peso caused similar crafts from that country to compete much more favorably

in the international markets. In addition, traditional craft production is capable of supporting or helping to support only selected portions of the population, such as those who produce the more sought after craft articles or those dedicated to selling selected articles from a variety of towns.

But handcraft ability presents an opportunity for artisans to diversify production in response to new market demands. Handcrafts competitive on the market today are not the traditional blouses and so on, but rather items with design, materials, dying, and other input from individuals with access to the demands of today's international market. Traditional crafts are giving way to cottage industries and the production in small villages to items destined for sale in fine shops in Los Angeles or New York. The entrepreneurs in this business often provide traditional crafts people with all raw materials, check regularly on quality and design, and then provide all transport from the village to the foreign markets.

This business may mean adapting to new machinery and techniques, and it should be pointed out that Indians are not averse to laying aside their traditional crafts to produce new materials using new techniques on new machines. There are numerous cases of this in the Indian Highlands. For example, assembly of clothing for sale in store in the United States is an activity which has grown 150% during the last year, according to a recent local magazine article.

Another area of Indian economic activity has been small scale commerce where products, usually craft or agricultural, are purchased wholesale and transported for resale elsewhere. Fifty years goods and foodstuffs was carried on foot to be traded in large regional markets as far as 11 days journey from one's home. Now, of course, transport is by truck or bus, and many traditional articles, such as pottery, have been replaced by plastic articles made in Guatemala City. The goods are sold in markets, in plazas, on street corners, or even door to door. The returns on this type of economic activity are low but may represent enough income for the individual's family to get through the year.

Still, Indian culture in the Highlands, especially in the larger towns but not limited to them, has been characterized by an entrepreneurial spirit which seems to contrast with the more traditional attitudes of the peasant agriculturalist. The Indian population in a few cases has also competed directly and successfully at economic levels usually dominated by Ladinos, such as larger scale manufacturing and transport. In some areas, such as San Pedro Sacatepequez, San Marcos, this change has been sweeping. Modern trucks have

replaced the traditional mule teams to transport the textiles made in San Pedro, and the goods now are destined for international as well as regional or national markets. The close-knit family structure and the avoidance of conspicuous consumption have often made these Indian industrialists and traders more competitive when compared with their Ladino counterparts.

However, the San Pedro case is exceptional in the Guatemalan Highlands. Some of the major problems in entering this market include the lack of sufficient start-up capital, sophistication in the management of larger scale commercial operations, and the difficulties of attempting to operate in an environment dominated by Ladinos. Where the Indian has been successful in operating successfully in competition with Ladinos certain preconditions have been present, such as access to an urban environment and the existence of good educational facilities, the latter often a result of the former.

D. Income levels

Income varies widely in the target area. An example of this can be found in tabulated data for communities soliciting rural roads. Since the communities to be served by rural roads are similar in many ways to those applying for electrification, these data will be presented here. They are taken from three regions: eastern, central highlands, and western highlands.

The first item of note in these data is the fact that virtually all of these farmers maintain a certain level of subsistence agriculture in that all plant at least a moderate amount of corn, much of which is consumed by the farmers and their families, and most plant beans as well. In all cases the farmers are able to sell some corn, but in only one case, which involves the Xaabaj-Chuacacay road with the lowest average income in the sample, was corn the principle producer of cash income.

Besides corn and beans, virtually all other crops mentioned are produced for cash income according to the tabulated data. However, many homes undoubtedly contain small vegetable gardens cared for by the women of the family. It is probable that these are not mentioned by the men interviewed, because vegetable gardens are often not considered culturally in the same category as corn, beans, and the cash crops. In Comalapa, for example, it is up to the wife to provide the non-corn complement for family meals, either through gardening or through craft production or other small business activity, while the men provide the corn and income for other expenses. It may be that the men interviewed in some cases ignored or

'forgot' about their wives' contribution in this area, since the data have almost no references to it.

The importance of cattle, principally cows but also including goats, sheep, and horses, is notable as a source of income, both for the poorer villages as well as the more well off communities. In the three poorest villages income from cattle represented 14.6%, 39.3%, and 18.4% of the total average income. In the three richest villages cattle represented the principle source of income in one village and the second most important source in the other two.

The other really productive cash crop is coffee, which is by far the principle source of income for two of the three most well-off villages, the beneficiaries of the Río Ocho-Agua Blanca and Caserío Esquipulas-Los Planes roads, both in Huehuetenango. In these cases coffee represents 86.7% and 76.9% respectively of the total cash income of the two villages.

As regards total average income, there are startling differences between these 13 villages, as will be noted from the table below.

Population area	Average Annual Income
1) Xaabaj-Chuacacay	Q.393.00
2) Parajbey-Xepanil	468.04
3) Interamericana-Pueblo Viejo	556.27
4) Los Magueyes-Los Lavaderos	643.40
5) Malacatancito-Chocal	687.10
6) Cushapa-Granada	692.69
7) Los Magueyes-Sn. J. Las Canoas	916.06
8) Interamerican-La Cumbre	1271.25
9) Los Magueyes-Canajal	2169.48
10) Llano Las Tejas-Piaché	4818.54
11) Río Ocho-Agua Blanca	5438.95
12) Jalapa-La Ventura	5469.55
13) Caserío Esquipulas-Los Planes	5494.55

In the first six villages, two each from the eastern, central, and western regions, the incomes are extremely modest. It is to be understood that this income is used to by very little food, since they consume corn that they themselves have grown. It should also be emphasized, particularly in the central and western regions, that corn represents a very high percentage of their diet. For example, the Parajbey-Xepanil beneficiary population sample of 14 families included 72 persons of all ages, which consumed 41,400 lbs. of their own corn, or 1.6 lbs. per person per day. This figure appears reasonable in that other studies have estimated from 1.4 to 2.0

lbs per person per day (see, for example, William Carter, New Lands and Old Traditions: Kekchi Cultivators in the Guatemalan Lowlands, U Florida Press, 1969).

But in the latter four villages, it will be noted that the average income of the sample is reasonably high and provides a comfortable living for the population. These are communities which have land either in coffee or in cattle, and the land is sufficiently ample to produce adequate income. It is assumed that PER III will place communities with similar characteristics at a low priority since, with or without electricity, they are already sufficiently productive.

It may be that the introduction of electric irrigation facilities will be able to transform communities with a low average income with traditional, low-income crops into highly productive ones by opening up marginally productive land to intensive agriculture.

III. Project impact

The impact of the Project should be almost universally positive, particularly as regards the productive uses component. The Project will address one of the principle felt needs of the target population, the Highlands Indians, which is how to make a living while resident in their traditional homelands given the fact that available farm land is unable to satisfy the needs of an expanding population.

As was noted above, Highlands Indians are willing to go to great lengths to stay home, and they have not limited themselves by refusing to learn new income-producing activities. Instead, the problem has been that they have not had sufficient access to knowledge about these kinds of activities, nor have they had access to credit, however small, which would provide the initial impetus for these activities.

It is precisely in these two areas the productive uses component proposes to work, and the only non-variable factor is electricity use. The productive use component will begin with a campaign of informati[illegible] [illegible]r the 63 communities in the three departments where it wi[illegible] [illegible]nitiate activities. This campaign will bring together repre[illegible]entatives of the electrified houses for presentations on the productive use of electricity.

While the campaigns will concentrate on productive uses involving present, known activities in the community, it will also present other available options. In this way, the members of the community who are looking for a new or improved way of making a living while maintaining residence in their

traditional communities will learn of a whole range of such possibilities. Two or three such meetings per community are planned to give the beneficiary population a chance to absorb as much information as possible, and the presentations will need to be presented in the local language with question and answer periods carried out the same languages.

While these educational campaigns are general in focus, they are intended to stimulate interest in the beneficiary population to decide to participate, either individually or in group. It is expected that the beneficiaries will be able to visit one of the offices set up by the implementing agency to express their interest in one or another of the productive uses presented during the previous sessions--or suggest some other project involving productive uses that had not been discussed before.

At this point the productive use component begins to address the second problem: credit. The two studies of demand carried out previous to the design of this Project found that, while many people had had negative experiences with credit in the past, in the majority of cases it was simply a situation of applying for credit and being turned down. There were fewer cases where the individual had been granted credit and considered the experience to be negative for other reasons, such as being unable to repay the loan or losing collateral.

The productive use component thus targets a population which has been unable to get credit in the past, usually because the individuals simply had no way of providing security for credit for conservative lending agencies. The advantage of the present Project is that one of the implementing agencies, AITEC, has specialized in working with this type of situation in a number of countries and has a well thought out methodology for assuring success in such first-time borrowers among the rural poor.

There are thus three elements virtually guaranteeing high impact for the Project:

1) it develops in an area where people are looking hard for economically viable, income enhancing activities in their traditional homelands;

2) it provides information on the kinds of activities which the beneficiary population can either begin or upgrade to improve their economic position; and

3) it provides the essential credit to permit the acquisition of the electric machinery necessary to carry out the productive use activities.

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IV. Beneficiaries

The beneficiaries in this Project must be divided into two groups: those who benefit from the introduction of electricity and those who benefit from the productive uses component.

A. Direct beneficiaries: productive uses

This Project should produce both direct and indirect beneficiaries. The direct beneficiaries are of course the participants in the productive uses component who acquire electrical machinery and receive training in how to use it correctly and productively. In virtually all cases, the entire family will benefit directly, since many of the craft operations which exist at present and which will be converted to electricity are family operations. For example, in one family in Sololá interviewed in the Preliminary Demand Study, all the family members were involved in textile production in one way or another.

The group of direct beneficiaries should probably include other members of the community who possess the necessary skills to work with the new machinery who do not themselves acquire machinery and training but rather work as employees or doing piece work for the program participants. In many cases these will be relatives, but they might be neighbors as well.

This latter group is important. Smith's study of San pedro Sacatepéquez, San Marcos, noted that entrepreneurs in San Pedro tended to bring in many new family members and friends into the production of non-traditional textiles, which meant that the economic benefit spread far beyond the individual entrepreneur. What is more, these entrepreneurs were not so heavily oriented toward personal gain as for example the Ladinos. They undersold the Ladinos, and they distributed their profits in a reasonably generous way, with the effect that they themselves had quite good incomes and the people under them as well.

The number of individuals in the first four years who will benefit directly from the education aspect of the productive uses component is 6300 individuals, calculated at 100 persons in each of 63 communities, and it is calculated that by EOP this number will reach 10,000. These individuals will learn about productive uses, the types of electric machinery available, the economic advantages of using electricity, and so on. These beneficiaries will also receive

information on the credit and training packages offered as part of this component.

The number of direct beneficiaries of the credit and training part of the productive uses component is calculated to be 1260 owner-operators of small productive use businesses or industries, or 20 beneficiaries in each of 63 communities electrified during PER II in the departments of Sololá, Totonicapán, and Quetzaltenango. This is a rough calculation, since there will certainly be communities which fail to take full advantage of the program while in other communities the total number of individual credits will be more than 20. The average credit per beneficiary will be Q.1650, for a total of Q.2,079,000 in available credits.

In addition, an average of 1.5 groups per community will be included among the beneficiaries. These groups, which may include cooperatives, women's groups, and so on, will solicit and receive up to Q.10,000 per group for purchases to benefit the entire group. Estimating the number of members in these groups at an average of 20, the total number group direct beneficiaries will be 1890. The total amount available in credits for groups will be Q.945,000.

Together, the individual and group direct beneficiaries total 3150 direct beneficiaries, and the total amount of credit available to them for productive uses is Q.3,024,000, of a total of US$ 1,120,000.

B. Indirect beneficiaries: productive uses component

The indirect beneficiaries is composed of the members of the local community who benefit from the increased circulation of money in the community from the increased income of the direct beneficiaries. As the beneficiaries acquire greater spending power, it is expected that they will benefit other members of the community by purchasing more goods from local stores and from nearby towns. Greater income will also allow the direct beneficiaries to play a greater part in community improvement.

The minimum number of users in a community to be eligible to participate in the productive uses component is 100, but the total will often be higher. If the average number of houses in a community is just 150, and if there is an average of 5 persons per household, the indirect beneficiaries per community will be 750 people. Assuming that all 63 communities participate in the program, the number of indirect beneficiaries will total 47,250.

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C. Direct beneficiaries: electrification

Electrical connections will be provided to 65,000 new rural homes in 400 communities, so that some 325,000 rural inhabitants will be directly benefitted by the introduction of electricity. Approximately half of these will be extensions of existing grids, while the other half will be reserved for new communities. The number of communities benefitting from extensions is 200, while the new beneficiary communities make up the other 200.

The 400 communities will be selected using the Demand Assessment Model to assure that the newly electrified communities will be those best able to put electricity to productive use. Thus the direct beneficiaries of electrification will benefit not just from the possibility of domestic and community lighting but also from the possibility of increasing their incomes through the productive use of electricity.

D. Indirect beneficiaries: electrification

The indirect beneficiaries of rural electrification, particularly given the productive uses orientation of the new Project, can be said to include much or all of the areas surrounding the newly electrified community but particularly the market towns which serve these communities. Increased income in a neighboring community means increased purchasing power in the market towns where the direct beneficiaries buy products, which means that the vendors in these market towns are indirect beneficiaries.

In other cases, the market town functions as a center for piecework, such as in the case of the still non-electrified community of San Antonio Sija. Electrification in communities like San Antonio, where much of the population sews together clothes farmed out to them by an entrepreneur in San Francisco El Alto and where houses sometimes have three or four pedal sewing machines, increase the incomes of the market town entrepreneurs who work with the people in the community.

V. Impact on women

A. Importance of women in domestic economy

As was mentioned above in the section on the sociocultural context, women are often responsible for providing that part of the family diet not covered by basic grains, typically corn and beans. While it should be stressed that the Indian diet is extremely weighted toward these grains,

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vegetables, fruit, eggs, meat, and so on are extremely important as complements providing important vitamins and minerals. Thus, the direct role of women in the family economy cannot be underestimated.

Women typically maintain vegetable gardens and keep farm animals to provide a part of the dietary complement. In addition, they often participate in local and regional markets to market domestic produce, both their own and as small market sellers of others' produce.

However, another important source of income for women in the Highlands comes from craft production, especially textiles. As is well-known, nearly all Indian women in Guatemala wear distinctive 'Indian' dress which includes a skirt and blouse. The skirt may occasionally be unique to a particular town or village, and the blouse nearly always is, and although Indian women more and more are varying their wardrobes with blouses from other towns, the blouses themselves are nearly always authentic representations of a particular town and they are invariably hand made.

While the skirts are often made on large looms by men or even on mechanized looms, it is safe to say that nearly all women's blouses are made by women and that most women are skilled at making blouses. These skills may vary from one town to another. In one village, the entire blouse may be hand-woven on a backstrap loom, while in another, the blouses are made of industrially produced cotton cloth but elaborately embroidered by local women. What is certain is that nearly all Indian women have some skill and often considerable skill in weaving, sewing, embroidery, and so on.

B. Assuring productive use impact on women

The productive uses component must look for ways to exploit this knowledge and skill for the benefit of groups of Indian women. This will require a commitment on the part of FUNDAP to closely scrutinize the skills of women to identify ways in which electricity can be adapted to their skills.

In order to focus the attention of the implementing agencies on assuring impact on women, quotas based on 40% of both individual credits should be established. This translates into 504 individual women beneficiaries and 38 women's groups.

This quota is based on world-wide USAID policy to orient 40% of AID projects toward women in development. More importantly, unlike other Projects the productive uses component of PER III easily lends itself to being carried out

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within the framework of this quota. The importance of women in supplementing the domestic household economy has been noted above, and the widespread textile and sewing skills of most Indian women has been demonstrated. It may require some extra effort on the part of the implementing agencies to comply with the quota, but this effort will be justified in the contribution to development for Indian women in the Guatemalan context.

VI. Participation

The participation of the beneficiary communities is of crucial importance to this Project, since the success of the Project will be determined in part by selecting communities which show demonstrable capacity to use electricity productively and not simply as a lighting substitute. One way of assuring community participation is through careful study of each of the communities seeking electrification, and this has been done through two demand studies carried out in areas electrified in PER II and those included in PER III.

A. The Preliminary Demand Survey (PLDS)

In order to determine the possibilities of community participation, USAID/Guatemala contracted a Preliminary Demand Survey (DBS) in late 1987. Sample populations were selected from four Highlands and two Oriente departments, and roughly half were already electrified while the other half were on the list of communities to electrify. All were communities with at least 50 families.

The survey instrument included components on the individual informants, community infrastructure, access, economy, credit experience, social organization, community attitudes about electricity, and training institutions in the community. The respondents were selected by looking for persons in each community who appeared to be most economically active in one sense or another.

Of immediate interest to the productive uses component of the Project is the fact that a high percentage of individuals interviewed in the Highlands are artisans who dedicate at least part of their time to craft production. The PLDS stated:

> While they are most at home producing traditional products, they are usually more than willing to attempt textiles for modern markets if given the opportunity. Guatemalan artisans, for example, are currently producing napkins for fine shops where the materials,

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the colors, the designs, and the quality of the products are determined and controlled by persons with a close relationship to these markets. The same artisans might well, on their own time, continue to produce traditional blouses for domestic use. The point is that they are capable of adapting to modern innovations, including modern machinery.

What is required, to effect the connection of these artisans with the productive use of electricity, is to present them with new electric machinery for the production of textiles, introduce them to the market for the finished product, train them in the use of the machine, and provide them with the loan credit for purchasing the machine.

The social soundness of the Project may also be affected by the distance of electrified populations from small urban centers. The communities involved in electrification are not always the most distant, rural ones, nor is it the case that the electrification program works out from urban centers, covering these first and working progressively into more rural areas. There are therefore communities which are virtually suburbs of departmental capitals, such as one suburb of Jalapa in the survey, and there are also communities which are only accessible by motorized transport during the dry season.

The productive uses component of PER III needs to decide whether to concentrate on the more distant, truly rural villages or to focus its efforts on those recently electrified populations closer to, or virtually part of, rural towns. It seems clear that the latter present greater opportunities for productive use simply because people closer to towns acquire and accept new ideas and new ways of doing things more readily than those in distant villages. As an example, not related to electrification, in the municipality of Totonicapán a study has shown that rural stores closer to the town showed more willingness to sell new products than those farther from town, seemingly because these new products could already be found in the town itself.

The PLDS, in looking more toward the industrial uses of electricity, felt that the Project would function more effectively in the Highlands than in the Oriente, due to the predisposition and 'preadaptation' of people in the latter area toward manufacturing because of their textile production. The Oriente, it was reasoned, would be less able to readily adapt electricity to their activities, since agriculture is nearly the only productive activity found there. The PER III productive uses component has taken the above into account in

choosing to focus its activities in the western Highlands in the departments of Sololá, Totonicapán, and Quetzaltenango.

The PLDS found that illiteracy rates were high and the level of formal education low in the target area. The high level of illiteracy in many cases, along with the low level of formal education in others, is important in determining the low development level in the communities surveyed, since this low level of preparation impedes access to new techniques and knowledge which would tend to effect improvements in a number of ways. The low educational levels and high incidence of illiteracy represent a serious obstacle for training programs, requiring training techniques which require little or no reading on the part of the trainees.

As regards credit, the PLDS found that the majority of individuals in the communities surveyed know about credit assistance, but it is also true that they have a very imperfect understanding about the mechanisms, requirements, end results, and benefits which these loans represent. This has occurred in part due to the lack of projection and coverage on the part of rural credit institutions, but it is also true that most of the credits available are focused on agriculture and ignore other possible applications. Even more important is the fear on the part of small farmers and rural residents that high interest rates on loans will sink them little by little into an indebtedness which will eventually cause them to lose their small landholdings or craft workshops.

B. The In-Depth Demand Survey (IDDS)

In May, 1988, AID/Guatemala contracted another survey to provide a more in-depth look at potential beneficiaries of the PER III productive uses component. The objectives of the In-Depth Demand Survey (IDDS) were to identify both types of communities as well as specific communities which will participate in the productive uses component of PER III, and to identify specific businesses, enterprises, and other activities which might utilize electric energy for productive purposes.

During PER II, information on communities applying for electrification as been gathered using a short survey form (see section VI.B, below, for more information). Using this information, plus information provided by the social workers who carried out the actual socioeconomic surveys and the written requests sent in to the utility by rural communities, 100 communities were selected for inclusion in the demand survey.

For the demand survey itself, 25 randomly selected communities were researched as to existing infrastructure and level of economic activity. New information was collected on existing small industries, shops, crafts, commerce, and agroindustrial activities. 50 small enterprises from the 25 communities were selected for intensive study involving general, financial, and socioeconomic information about the owner, a general description of the operations involved in the enterprise, and the credit history of the owner.

As regards the communities in general, and taking into account the information generated through both instruments, a priority listing of the communities surveyed was prepared using five basic criteria. These were:

1. Community organization. This refers to the existence of a dominant, centralized organization of some kind, such as a cooperative, committee, or other group. The existence of such an organization helps local people better visualize how assistance can be funneled and greatly facilitates the organizational process for productive uses.

2. Productive activities. This refers to the economic activities in the community which have the potential of being used with electric energy, such as sewing shops, carpentry shops, and so on.

3. Credit and technical assistance. This item refers to the attitude of people in the community toward receiving credit and technical assistance for productive uses. Some communities simply do not wish to get involved with credit, technical assistance, and training programs.

4. Productive use awareness. This refers to the awareness of the potential for the productive use of electricity. In some cases, communities recognize clearly the possibilities for productive use, while in others, in spite of activities which might be converted to electricity, the local people are unaware of the possibilities or deny that they exist.

5. Community interest and attitude. This refers to the general attitude perceived by the surveyors of the community to outsiders, new programs, and so on directed at the well-being of the community as a whole. This item refers to what could almost be called the social psychological profile of the community.

Each community was graded as positive or negative in each category, and a community which graded positive in all five categories was ranked as top priority. In succession, the other communities were ranked as second, third, or low, the latter grading out positive in two categories or less.

The study noted that three-quarters of the communities from the Oriente were found in the lowest priority category in spite of the fact that every attempt was made to preselect communities that might have potential for productive uses. In contrast, all eight communities ranked in the highest priority category are Indian towns from the Highlands. This confirms the earlier study's recommendation and supports the decision to locate the PER III productive uses component in the Highlands.

The explanation given was that Indians for the most part would prefer to remain in their home area if at all possible, and they thus are more energetic in looking for ways of doing so. The Ladinos of the Oriente are more apt to emigrate to other parts of the country to look for economic opportunities when they are unable to successfully practice traditional agriculture and related activities.

Another notable result was that municipalities like Aguacatán and Estanzuela tend to offer more possibilities than villages, which is not surprising considering the concentration of population, infrastructure, and other resources normally found in municipalities. Related to this is the fact that some of the "rural communities" recently electrified are actually outlying neighborhoods of municipalities, so they also enjoy many of the socioeconomic advantages of municipalities.

Certain elements characterized the higher priority towns. Aguacatán is a town which appears to have everything necessary for success in a productive uses program. First, as regards productive activities, Aguacatán is the garlic capital of Guatemala and exports to Mexico, El Salvador, Honduras, and Panama. Community organization is strong: two production organizations complement each other, a savings and loan cooperative federated with FENACOAC for agricultural production credit, and a 500-member farmers association to market crops.

Their awareness of productive use potential is shown in their interest in acquiring machinery to process their garlic in town. Examples of machinery include that necessary for making garlic salt, dried garlic, and soups using garlic. They are highly motivated as regards improved technology, have carried out improvement in the quality of seed used, and are planning to install wells with electric pumps to irrigate their plots.

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Another advantage is that Aguacatán is a municipality, not a village, with a high density town-urban population of 21,000 people, plus some 80 small stores and four pharmacies. Local schools go through high school. Government development agencies such as BANDESA, DIGESA, and ICTA have offices there. There is indoor potable water in all houses, most have indoor plumbing, and there are sewers for waste water. There are four buses daily to Huehuetenango, the departmental capital. Thus the support infrastructure for productive uses is extensive.

Another high priority community is Chicuá I, a "cantón" or village of 2000 people in the municipality of Chichicastenango. Chicuá I ranks high because of the successful operation of a PVO in the community: the technical and credit assistance of the Rafael Landivar University CAPS program. The local people recognize that their success with a 70-member cooperative which markets local produce, functions as a general store, contains a bakery, and provides medical attention has depended heavily on this relationship, since the CAPS program not only provided credit but also training.

Chicuá hopes to use electricity to store apples between the production period in July-August and the high demand period around Christmas, and to extend its bakery operations for markets outside the local boundaries, at the same time replacing firewood in the baking process.

Barreneché, a village (2300 people) in Totonicapán has strong local organization in the form of a community improvement committee but one which not only works on projects to improve community infrastructure but also in productive activities. This system is not the usual one but is also not completely unknown or ineffective. The principal activity of the community is carpentry, and many men are at least part-time carpenters. They have no electric machinery as yet but are keenly interested in acquiring it, using credit to do so, and receiving relevant training.

San Antonio Sija, a village of 2200 persons in San Francisco El Alto, demonstrates great potential for productive uses through the fact that some 500 men work in cottage production of clothing. They receive the cloth cut-outs in San Francisco, take them home to sew together, and return with the finished product. They have not thought much about the productive use of electricity, since this PER III village has not yet been electrified, but the possibilities are obviously very attractive. They are interested in taking a more direct role in clothing manufacture and bypass the middlemen who provide them with raw materials and market the clothing. For example, when one individual was asked what he would like to

learn, he replied that he would like to learn how to cut cloth for trousers.

The relatively high ranking (second priority) given a community in the eastern region was that of Estanzuela, a municipality (5000 persons) just six kilometers from the departmental capital of Zacapa. Estanzuela is attractive for productive uses in some ways and unattractive in others. Positive features are its standing as a municipality, its high population and population density, two businesses which make cement block, and the production of embroidered clothing by women. On the negative side, there is just one community-wide social organization, which is primarily a charity organization and has little impact. Also, the women making embroidered clothing are convinced that this activity must be done by hand, and they see little possibility for converting to electric sewing machines to embroider.

The low-ranking communities are those which showed the least promise as regards the productive uses of electricity. Racantacaj has little to offer with the exception of just one carpenter who is interested in productive uses. El Maguey simply had no activities which appeared to fit with electricity use, since the principal activity there is hand-rolling cigars. The people surveyed in Santa Catarina Palopó were adamant that their production of Indian textiles was only possible by hand, social organization was poor, and the community seemed unreceptive to new development activities. Santa Marta, near Esquipulas, has very little activity to offer that could be electrified, Chuarché near Sololá had even less, and all respondents were negative in general and about productive use in particular.

C. Participation in on-going development

The Project as designed is oriented toward extensive community participation. All communities will participate in the educational campaign on the productive uses of electricity, and the expected number of participants is expected to include nearly all the users in the community.

Following the educational sessions, the beneficiary participation depends on the desire on the part of individuals and groups to participate in the credit and technical training aspect of the component. Of particular importance is the fact that the beneficiaries are not limited to productive uses as defined by the implementing agencies but are free to suggest other uses that occur to them.

VII. Sociocultural feasibility

A. Lack of organization in INDE's social work area

The In-Depth Demand Survey noted that the study itself was made difficult by the lack of organization in the social work area, where all information concerning applications for electrification is concentrated. Several factors were identified as contributing to the lack of organization, the most obvious being the work area, which is too small and lacks the minimum conditions for attending groups of people who come to deliver their applications.

None of the social workers possessed the minimum equipment necessary to organize their material. Two persons with different activities shared the same desk, there was general lack of files, chairs, and shelves. Information received is lost due to the lack of even a rudimentary information management system where each person who produces basic information for the program would be able to enter and retrieve information.

There was no logical or organized relationship between the initial requests for electrification and the collection of data in the field. In addition, in spite of the national or near national scope of the program, field workers were unable to program and carry out field activities in an organized manner since there is no transport system accessible to this unit of INDE.

The social work unit in INDE's rural electrification program must be improved during PER III. Additional space must be acquired, and office furnishings and materials must be made readily available. Most important, the office information system must be revamped and designed to permit the logical storage and easy retrieval of information.

B. Information problems: data gathering and processing

1. INDE's infrastructure and economic questionnaire

INDE has been using a two-page questionnaire, called the PER II Community Infrastructure Questionnaire (Encuesta Informativa de Infraestructura Existente en las Poblaciones del Per-2), to gather information on infrastructure and economic activity in the communities which apply for electrification.

Two formulas were devised using the information provided in the questionnaire, one to produce an index of community infrastructure and another to produce an index of

economic activity. Each was organized so that communities with an index of between five and ten would be those targeted for electrification.

Infrastructure factors include transitable road, potable water, health post, human waste disposal in latrines, percentage of formal housing, number of schools, number of schoolrooms, and level of school instruction by grade. Economic factors include cooperative, market, number of "first class" and "second class" businesses, craft activity, diversified agricultural, and land tenure.

The formulas used to produce the indexes are based primarily on the presence or absence of the above factors, so that there are no gradations in the data. The profile produced is thus poorly defined, and the index is of little or no use in determining where electrification and certainly of no use if productive uses is an important criterion for selection.

INDE has acknowledged verbally that it has not in fact used the indexes in PER II but rather has concentrated exclusively on cost factors in selecting sites for electrification. The questionnaire has been useful to INDE in that it includes the total electrifiable population and the dispersion of house sites, both key factors in determining the cost of electrifying the community. House site dispersion is important in that houses more than a certain distance apart require an extra post.

INDE has used the questionnaire to survey a tremendous number of communities--somewhere between 1500 and 2400 in all--but the quality of the data gathered is in many cases suspect. Untrained persons have carried out some surveys, and there has been no control of the survey process.

In conclusion, the instrument and the indexes it produces are inadequate and need to be replaced.

2. Relation to NRECA Demand Assessment Model (DAM)

The National Rural Electrification Cooperative Association (NRECA) has been preparing a Demand Assessment Model for the evaluation of rural electrification projects in Central America as part of its regional effort funded by ROCAP. This Model should be adopted by INDE in future surveying of sites.

a. Summary of DAM

The DAM methodology is intended to provide additional guidance to utilities in project selection and to increase the focus on possibilities for productive use of electricity in rural areas. The DAM attempts to balance the need for reasonable data collection and analysis requirements with the need for credible preliminary evaluation calculations.

The DAM methodology projects a five-stage process which can be conceptualized as screens to reduce to number of sites under consideration. The first stage, which essentially requires no utility-supplied information or field visits, consists of the identification of broad geographic or socio-economic target groups. A particular area of the country or a particular subset of populations selected for social, economic, or political reasons is designated as having priority.

The second stage is a preliminary cost screening to quickly identify those projects preselected in the first stage which appear the most attractive from a cost or demand standpoint so that limited evaluation resources can be focused on these. This stage eliminates potential projects with clearly identifiable very high cost features while at the same time producing a rough, preliminary ranking of candidate projects based on several easily identifiable features.

This stage require some reconnaissance in the field to determine at a minimum the following: the distance from transmission lines to the proposed site; the distance between houses expressed in percentiles, since scattered houses means greater post requirements; the number of houses it should be possible to electrify; and perhaps one or two other factors. For those communities which have already applied for electrification, the INDE questionnaire has provided this information.

The third stage is a cost-benefit accounting system to analyze each candidate project as regards its financial viability from the utility's point of view. The analysis must be general enough to be applicable under conditions of limited data and available analytic expertise but accurate enough to provide a credible ranking in monetary terms among alternative candidate projects.

This stage requires field work in two steps, the first to establish financial benefit guidelines for the model and the second to actually apply the model. The first step must be done in already electrified communities to acquire data on how communities using electricity productively have

developed, while the second step involves the analysis of the candidate communities to project how their electricity use will grow given the productive use parameters already in place in the community. The new and very specific nature of this stage's activities would require new field activities on the part of INDE for their application.

The fourth stage involves socio-economic adjustments to the strict cost-benefit ranking of the previous stage. The purpose of this step is to provide guidelines for the incorporation of available information on factors which are expected to significantly influence demand, but whose impacts at the moment cannot be directly quantified in monetary terms. This stage also requires field activities of sufficient detail to allow the utility to modify the stage three cost-benefit ranking--either upgrade communities with a low ranking or downgrade others with a relatively high position--in the final selection of sites for electrification.

The fifth stage is a final detailed feasibility study, which is an engineering cost analysis carried out by the utility as a final step in project evaluation and design prior to implementation. In this stage, technical people study the problems in actually introducing the electric poles and wiring into the community.

b. Incorporation of the DAM into INDE: a new infrastructure and economic questionnaire

In light of the development of the DAM methodology, it would seem logical that the new questionnaire be one that not only fulfills INDE's requirements for improved information but also can be incorporated into the above outlined DAM. To do so, such an instrument would need to provide the same skeletal information for stage two above that the present questionnaire does, but more importantly, the new instrument should also produce the information required by the DAM for the socioeconomic adjustments of stage four.

The new system (presented in detail in Annex I) should attempt to take into account factors which impinge in both a general way on community development and the community socio-economic situation while also focusing on factors which have a direct or indirect effect in the role of electrification in rural communities.

The proposed system is one in which a survey instrument is designed to provide information used in assessing point totals. The system is based on a possible 1000 points. Once the information is processed, it should be possible to

rank communities from high to low based on their point totals. The system combines information on cost and demography, community infrastructure, economics, community organization, and community attitudes and awareness, thus integrating both material and social factors in the system.

The system is summarized below, while explanations justifying the inclusion of individual items as well as how the point totals for each item should be determined are found in Annex I. It does not include as yet an actual survey instrument, since the system itself should be discussed and critiqued before beginning the instrument design.

Chart I: Summary of priority system

Infrastructure and demography: 350 points

Population density:	50 points
Health Services near by:	50 points
Communications:	50 points
Distance to communications media: 15 points	
Fluency in spoken Spanish: 20 points	
Water/sewage:	50 points
Waste water disposal: 10 points	
Human waste disposal: 20 points	
Potable water: 20 points	
Highest educational level in or near the community:	50 points
Percentage of formal housing:	50 Points
Description of roads/access to transport:	50 Points

Economics: 150 points

Percentage families dedicated to crafts:	50 points
Percentage women dedicated to crafts:	50 points
Agricultural projects in the community:	50 points

Community organization: 300 points

Number of Improvement Committees in the community:	50 points
Number years electrification committee existed:	50 points
Number different government orgs in the community:	50 points
Number different non-government orgs in the community:	50 points
Organizational viability of government organizations:	50 points
Organizational viability of non-government orgs:	50 points

Community attitude: 200 points

Community organizational cohesion:	50 points
Community attitude toward development activities:	50 points
Community awareness of possible productive use:	50 points
Community attitude toward credit and credit insts:	50 points
TOTAL POINTS POSSIBLE FOR A COMMUNITY:	1000 points

VIII. EVALUATION ARRANGEMENTS

The fact that the PER III Project has two independent components means that the collection of baseline data and the plan for later evaluation must be carried out separately. The following sections detail the two parts of the baseline and evaluation plans.

A. Infrastructure Component

PER III electrification is to be carried out in communities which demonstrate potential for productive uses as demonstrated through the application of the Demand Assessment Model. This Model will select and rank communities first on the basis of cost-benefit (the NPV). This ranking will be subject to adjustment on the basis of the socioeconomic questionnaire. As a result, the final ranking of communities should represent the best possible determination of the potential of each community for productive uses.

The baseline survey will be carried out in a sample of these communities. The sampling process should include 10% of the communities selected randomly to be statistically valid. Thus, the baseline will be carried out in 30 of the approximately 300 communities selected for electrification through the Demand Assessment Model. Within each community a similar sample percentage should be taken. Assuming an average of 100 users per electrified community, the baseline will include 300 individuals.

The baseline should focus on family income from all sources and including all persons resident in the homes to be electrified, as well as a detailed study of household expenses. The final evaluation will be based on the same data collection instrument but will include questions on productive use of electricity following electrification.

The cost of this baseline study should be around $28,000. It is difficult to calculate the cost of repeating the study at EOP, but funds for the evaluation should be sufficient for replication of the baseline as well as for analysis.

B. Productive Uses of Electricity Component

The productive uses program will not use the same sort of baseline as the electrification component. For this component it will be necessary to develop a simpler baseline instrument to survey present use of electricity for productive

purposes (i.e. for other than purely domestic uses). It should be possible to survey each of the 63 communities in the three departments to determine what machinery is presently in use. Data collection will be the responsibility of the implementing agencies, although the survey itself will probably be supervised by an specialized outside person or agency.

The instrument will be complemented by the information gathered in the socioeconomic questionnaire that forms part of the Demand Assessment Model. This questionnaire should be applied to each of the communities at the end of the Project to detect changes in the socioeconomic situation, some of which will have been brought on by participation in the productive use component. In addition, the actual amount of electric machinery in use in these communities must be tallied to compare with the situation at the beginning of the project.

If possible, the evaluation will include data on actual electricity consumption gathered by INDE, and this information will be compared with other communities, perhaps from other but similar areas of the country, which have electricity but which were not included in the productive use component.

The EOP evaluation will require the presence of a field team of three in each community for one day. If the evaluation were carried out today, it would cost around $25,000, excluding a comparative study of actual consumption in participating and non-participating communities. In conclusion, at least $50,000 revised upward for inflation to EOP should be set aside for Project evaluation.

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PROCUREMENT PLAN

I. COMMODITIES

AID grant funds will finance all the imported construction materials and equipment required for the construction of lines, networks, service drops and internal house wiring. Likewise, all the imported materials and equipment required for improvements in subtransmission lines and transformation facilities will be financed with AID Grant funds. The detailed integration of costs for electrical materials and equipment are presented in Exhibits 2 and 3 of Annex K, Engineering Analysis. Since the construction of lines, networks and internal wiring involves more than 300 separate items, it is not considered practical to give a detailed list of the commodities to be procured. The lists, however, were used for the derivation of costs presented in Annex K. A summary of construction costs is presented in page 3 of Annex K. The total estimated cost of imported materials and equipment for construction of primary lines, networks and household installations is $6,131,650 and the estimated cost of imported materials and equipment for subtransmission and transformation improvements is $516,799.

In addition, AID funds will finance vehicles, tools, instruments and safety equipment for the Construction, Operations, Commercial and Rural Electrification Departments with a total approximate cost of $567,800. A detailed list of these commodities is given in the next page.

Description of Item	Quantity	Unit Cost	Cost
Construction Department			
Heavy Duty Truck - 8T	3	$30,500	$ 91,500
Pickup Truck - 4WD	2	16,000	32,000
Pole Trailers	5	3,000	15,000
Operations Department			
Service Pickup Trucks - 4WD	5	19,000	95,000
Hot Line Trailer Complete	3	21,250	63,750
A-frame Truck	3	26,850	80,550
Tools	5 lots	9,500	47,500
Instruments	5 lots	6,500	32,500
Pole Trailer	5	3,000	15,000
Safety and Job Training	1 lot	12,000	12,000
Commercial Department			
Pick Trucks 4WD	2	16,000	32,000
Motorcycles	10	1,500	15,000
Implementing Unit			
Pickup Trucks (medium)	3	12,000	38,000
Total			$567,800

NOTE:

Tools - (hoists, wire grips, ladders, block and tackle, transformer gin, stringing dollies, compression tools and dies, cable cutters, digging tools, grounding sets, hot sticks, etc.)

Instruments - (testing, measuring, recording - voltage, current, kw, power factor, etc.)

Safety and Job Training - (Hard hats, first aid kits, VCR's and TV sets for regional training, video camera for job site video recording of construction and operation activities for safety and job training)

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A detailed schedule of the procurement process for the commodities described above is provided in the following table:

PROCUREMENT PLAN FOR COMMODITIES

Description of Commodities	Total Estimated lost ($)	Method of Procurement	Procurement Initiated	Contract signed	Commodities delivered
40% of materials and equipment for lines, networks and household installations	2,452,660	AID Direct	7/89	9/89	2/90
Computer, Office and Maintenance Equipment for Pilot INDE Regional Office	40,000	AID Direct	7/89	9/89	2/90
Materials and Equipment for subtransmission/transportation improvements	516,800	AID Direct	9/89	11/89	4/90
Vehicles, tools and safety equipment	567,800	AID Direct	9/89	11/89	4/90
30% of materials and equipment for lines, networks and household installation	1,839,495	AID Direct	8/90	10/89	2/91
30% of materials and equipment for lines, networks and household installations	1,830,495	AID Direct	3/92	5/92	8/92

II. SERVICES

AID Grant funds will finance training, technical assistance, studies, evaluations and audits under the infrastructure component. Under the Productive Uses Component AID Grant funds will be used to finance community training and technical assistance.

A detailed schedule of the procurement process for the services described above is provided in the following table:

PROCUREMENT PLAN FOR SERVICES

Description of Services	Total Estimated lost ($)	Method of Procurement	Procurement Initiated	Contract signed	Service completed
TA for design Standards Preparation	38,000	AID Direct	9/89	12/89	3/90
TA for INDE Safety Program	22,000	AID Direct	10/89	1/90	4/90
Productive Uses Advisor	80,000	Host country contract	7/89	10/89	10/91
TA for establishment of INDE pilot Decentralized Regional Office.	60,000	AID Direct	9/89	12/89	12/90
TA for Productive uses of Electricity Training	70,000	PVO Contract	9/89	on-going	10/94
Management Audit of INDE Commercial Department	27,000	AID Direct	10/89	12/89	4/90
Baseline study	28,000	AID Direct	7/89	9/89	12/89
Mid-term Evaluation	25,000	AID Direct	10/91	12/91	3/92
Final Evaluation	30,000	AID Direct	12/94	2/95	5/95
Three Biannual Audits	90,000	AID Direct	6/91	on-going	5/95