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

PROJECT PAPER

Proposal and Recommendations  
For the Review of the  
Development Loan Committee

GUATEMALA - RURAL ELECTRIFICATION (REVISED) (June 12, 1978)

AID-DLC/P-2269

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RURAL ELECTRIFICATION (REVISED)

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\* in LA/DR Files

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I. SUMMARY AND RECOMMENDATIONS

AGENCY FOR INTERNATIONAL DEVELOPMENT		1. TRANSACTION CODE <b>A</b> A - ADD C - CHANGE D - DELETE		PP
<b>A. PROJECT PAPER FACESHEET</b>				2. DOCUMENT CODE <b>3</b>
3. COUNTRY/ENTITY <b>Guatemala</b>		4. DOCUMENT REVISION NUMBER <b>1</b>		
5. PROJECT NUMBER (7 digits) <b>520-0248</b>		6. BUREAU/OFFICE A. SYMBDL <b>LA</b> B. CODE <b>05</b>		7. PROJECT TITLE (Maximum 40 characters) <b>RURAL ELECTRIFICATION</b>
8. ESTIMATED FY OF PROJECT COMPLETION FY <b>83</b>		9. ESTIMATED DATE OF OBLIGATION A. INITIAL FY <b>78</b> B. QUARTER <b>4</b> C. FINAL FY <b>78</b> (Enter 1, 2, 3, or 4)		

10. ESTIMATED COSTS (\$000 OR EQUIVALENT \$1 - )						
A. FUNDING SOURCE	FIRST FY			LIFE OF PROJECT		
	B. FX	C. L/C	D. TOTAL	E. FX	F. L/C	G. TOTAL
AID APPROPRIATED TOTAL						
(GRANT)						
(LDAN)	( 4,200 )	( 4,400 )	( 8,600 )	( 4,200 )	( 4,400 )	( 8,600 )
OTHER U.S.	1.					
	2.					
HOST COUNTRY		6,400	6,400		6,400	6,400
OTHER DONOR(S)						
<b>TOTALS</b>	<b>4,200</b>	<b>10,800</b>	<b>15,000</b>	<b>4,200</b>	<b>10,200</b>	<b>15,000</b>

11. PROPOSED BUDGET APPROPRIATED FUNDS (\$000)									
A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE		FIRST FY <u>78</u>		SECOND FY <u>79</u>		THIRD FY <u>80</u>	
		C. GRANT	D. LOAN	E. GRANT	F. LOAN	G. GRANT	H. LOAN	I. GRANT	J. LOAN
(1) F - N	749		062		8,600		-0-		-0-
(2)									
(3)									
(4)									
<b>TOTALS</b>					<b>8,600</b>				

A. APPROPRIATION	N. 4TH FY <u>81</u>		O. 5TH FY <u>82</u>		LIFE OF PROJECT		12. IN FISCAL YEAR SCHEDULED  MM   DD   YY <b>01   81</b>
	P. GRANT	Q. LOAN	R. GRANT	S. LOAN	T. GRANT	U. LOAN	
(1)						8,600	
(2)							
(3)							
(4)							
<b>TOTALS</b>						<b>8,600</b>	

13. DATA CHANGE INDICATOR. WERE CHANGES MADE IN THE PID FACESHEET DATA, BLOCKS 12, 13, 14, OR 15 OR IN PRP FACESHEET DATA, BLOCK 12? IF YES, ATTACH CHANGED PID FACESHEET

1 - NO  
 2 - YES

14. ORIGINATING OFFICE CLEARANCE		15. DATE DOCUMENT RECEIVED IN AID W. OR FOR AID W. DOCUMENTS, DATE OF DISTRIBUTION	
SIGNATURE <i>[Signature]</i>			
TITLE <b>Director</b>		DATE SIGNED MM   DD   YY <b>05   24   78</b>	

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B. Recommendations

The following recommendations are submitted for approval:

(Loan Terms: 20 years with 10 years grace period on amortization; 2% interest during the grace period and 3% thereafter.)	\$ 8,600,000
GOG Counterpart	<u>6,400,000</u>
Total Project	\$ <u>15,000,000</u>
Disbursement Period	<u>4 years</u>

C. Description of Project

1. Borrower

The Government of Guatemala will be the Borrower. Loan proceeds and the Borrower's counterpart contribution will be provided on a non-reimbursable basis to the implementing agency, the Instituto Nacional de Electrificación (INDE). INDE is a government owned autonomous agency responsible for electric power generation and distribution through bulk (block) electricity sales and direct retail distribution.

2. Project Summary

This project will contribute to a balanced power development program for Guatemala by assuring the participation of low income rural populations in INDE's energy investment program. The project will finance approximately 70,000 new rural residential and commercial users in villages in the Western and

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Central Highlands, Eastern and South Coast Regions of Guatemala. This figure includes new users located in partially electrified villages which are now served by INDE as well as those in villages which will be newly electrified under this project. The new villages included in the project have been selected on the basis of their relative stage of development and capacity to utilize electric power for productive purposes without extended delays. Electrification will compliment other infrastructure investments for development now in place. The project areas and distribution of new users is shown in the following table and map. Technical assistance, training, maintenance equipment and vehicles will also be financed to strengthen INDE's administrative and outreach capability for servicing the 70,000 additional new customers.

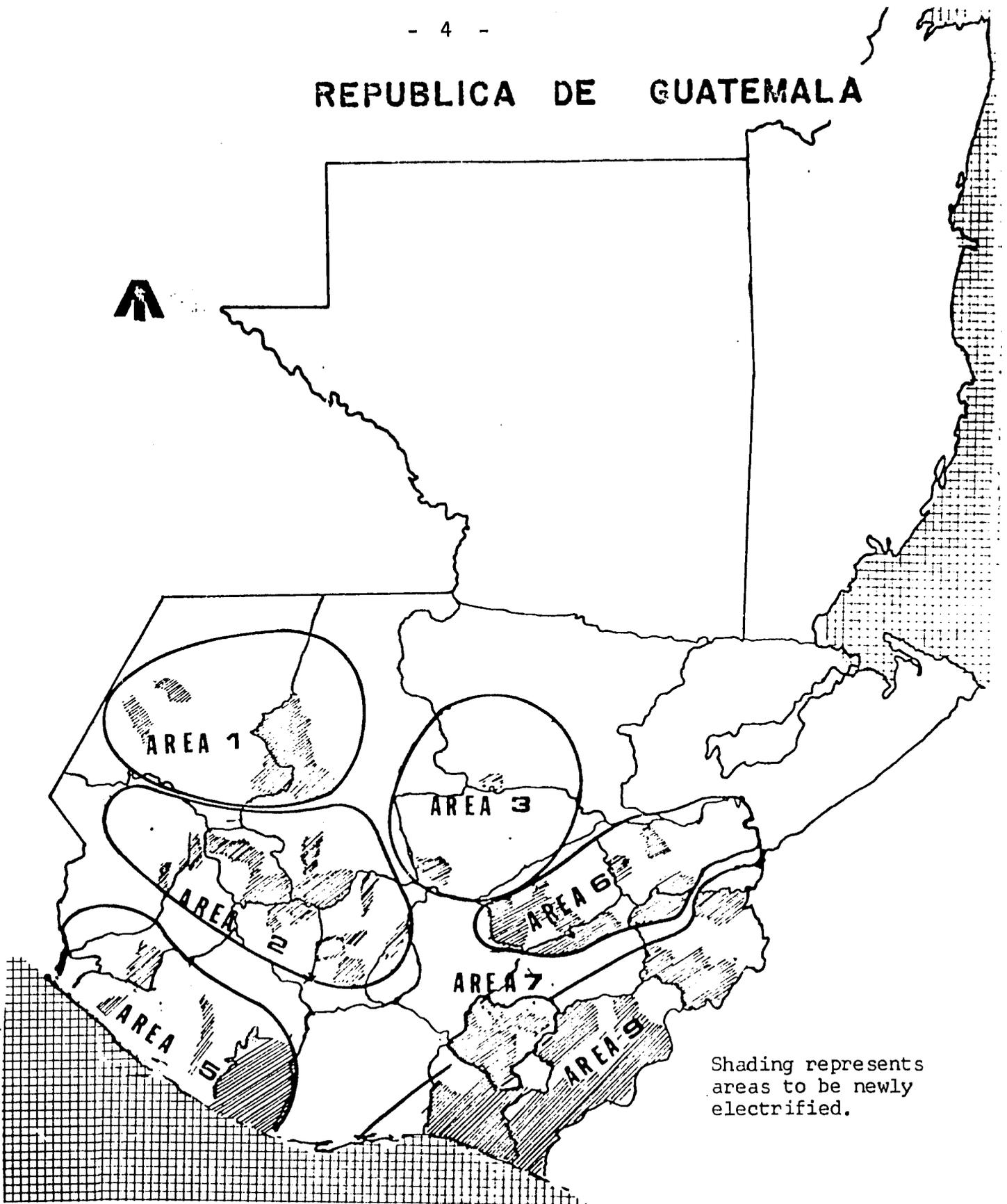
Distribution of New Users

(Number of Villages are Shown in Parenthesis)

Region	Villages Partially Electrified	Villages to Be Newly Electrified	Total
Eastern (Areas 6, 7 and 9)	13,000 (186)	20,000 (222)	33,000 (408)
Western and Central Highlands (Areas 1, 2 and 3)	16,000 (114)	11,000 ( 69)	27,000 (183)
South Coast (Area 5)	<u>8,000 ( 33)</u>	<u>2,000 ( 18)</u>	<u>10,000 ( 51)</u>
Total	<u>37,000 (333)</u>	<u>33,000 (309)</u>	<u>70,000 (642)</u>

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# REPUBLICA DE GUATEMALA



RURAL ELECTRIFICATION SYSTEM

PROYECTED AREAS

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Approximately 95% of all connections will be residential and 5% will be commercial.

To ensure minimal acceptable quality of service in the areas where distribution systems are to be extended and expanded, 150 Kms. of 69 KV subtransmission lines will be financed to avoid unacceptable voltage fluctuations and energy losses which would otherwise occur due to the increased demand being placed on existing systems. One sub-station is also required to provide transformation of voltage and protection for the new distribution lines.

The new and expanded distribution systems will require a total of approximately 1080 Kms. of primary and secondary lines to serve a total of 70,000 customers. Service drops, meters, and customer-owned housewiring will be installed. Funds to finance house wiring, which will be repaid by customers through monthly charges to their bills over a four year period, are included in the project. An impact evaluation which measures the rate of adoption of electricity for productive purposes by low income rural families will be carried out during the last years of the project.

A key element of the project is INDE's agreement to remove its present requirement for payment in advance of connection charges. This "front-end charge" is a major obstacle preventing low income families from obtaining electric service.

After the four year project has terminated, INDE will continue to connect a minimum of 10,000 new low income users annually in rural areas of Guatemala. Financing for these hook-ups will come from INDE's own resources.

The project complements other activities underway for large scale development of the country's hydroelectric resources which are being financed through IBRD, IDB, CABEI, and Venezuelan Development Fund loans totalling about \$292.2 million. It builds on transmission investments made under AID's previous rural electrification loan (019, authorized in 1971 for \$7

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million and fully disbursed in 1976). This investment will allow INDE to serve a large number of low income families who otherwise would not receive service for many years to come.

### 3. Primary Beneficiaries

The primary beneficiaries of the project will be the 70,000 new consumers in 642 selected villages which will receive electrical power service from INDE. Since the effective demand for expansion of electric service far exceeds that which can be accomplished over the four year life of the project, an effort was made to target the project towards those users which could make the most immediate productive use of electricity. On this basis, 222 new villages and 186 partially electrified villages located in the Eastern Region were selected because of the relatively more advanced development status of this region. This represents almost two-thirds of all the villages to be benefited by the project. In the Highlands Region 114 already partially electrified villages were selected by virtue of their demonstrated ability to utilize and pay for electricity. Based on a survey of infrastructure, services and economic activity in 180 non-electrified Highland villages, an additional 69 villages which demonstrated the greatest potential for the productive use of electricity were selected to be newly electrified. On the South Coast 18 villages located in 2 large land settlement schemes financed by an AID predecessor agency were selected to be newly electrified. Farm size, type of agriculture, economic activity and the existence of diesel powered generators in these settlements indicated a development status appropriate for electrification. Finally 33 of the poorer partially electrified small villages in the South Coast were also selected to benefit from the project.

It is estimated that 80% of the new residential customers in the selected villages which will receive electricity service as a result of the project had annual family incomes of less than \$400 in 1969 dollars (\$754 in 1976 dollars). Average per capita incomes in these households was less than \$65 in 1969 dollars. Data on education and health status in these households show significantly lower literacy levels and greater health problems than the higher income groups.

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The potential beneficial impact of electrical service on rural incomes and quality of life are described in this Project Paper in Section IV. Of significance is the extent to which the target group is aware of these benefits. A Village Electricity Utilization Survey conducted by the USAID and INDE concluded that a significant demand for electrical services exists within the target group. The relative value and priority placed on the service is clearly reflected in the fact that the target group indicated willingness to pay up to 13% of their average total annual income for electricity (based on non-users surveyed).

An unknown number of secondary benefits will accrue to consumers whose living standards improve due to the availability of electricity. Additional secondary benefits will arise through increased employment created in the target areas by investments which will be induced by the availability of reliable electric power. Other qualitative benefits will arise, such as those made possible because of improved health services and expanded educational programs resulting from the availability of electricity.

Of the 33,000 new connections proposed for towns which have never had electricity, over 6,000 will be in towns of fewer than 500 inhabitants. An additional 12,000 will

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be in towns of less than 1,000 inhabitants. Therefore, more than half of all new connections in villages without electricity will be made in villages of 1,000 people or less. In the already electrified villages, more than 6,700 connections will be made in towns of fewer than 1,000 people. Thus a total of 40% of all new connections financed by this project will be made in villages of less than 1,000 people. Almost 100% of the population of villages of this size consist of target group families.

The project involves a substantial redirection of GOG resources towards the target group. As a result of the project, INDE will adopt new operational policies which will eliminate present financial barriers to serving the target group, will hook-up an estimated 70,000 new rural customers, and will develop the financial and operational base for continuing target group family hook-ups after the end of the project.

4. Summary Findings

The Project Committee has reviewed the technical, economic, social and financial aspects of the proposed project. On the basis of this review and the investigations of specialized consultants the Committee recommends that a loan be authorized. The availability of electricity to the target group will complement and reinforce many other developmental projects directed towards these low-income rural families. The Committee believes that all technical and administrative barriers to successful implementation of this project have been addressed.

The project meets all applicable statutory criteria (See Annex D). The Mission Director's 611(e) Certification is included as Annex E. Per State 016547 dated January 25, 1977, paragraph 7 the Mission IEE Recommendation for a Negative Determination has been approved by the Assistant Administrator.

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5. Project Issue

A key constraint to the expansion of electric service to AID's target group is INDE's current practice of requiring prepayment by customers of construction costs required to serve a new customer or group of customers. Historically, the front-end, lump-sum contribution has ranged from 30% to almost 100% of the costs of new installations, or \$50 to more than \$500 per user. This requirement has effectively prevented low income families from obtaining electric service. Accordingly, one of the primary objectives of the loan has been to obtain INDE's agreement to eliminate this front-end charge requirement, which accords with modern utility practices generally accepted by INDE.

With respect to the cost of electricity, INDE did not negotiate a specific monthly rate for the service which will be connected under the Project. The affordability of the target group to pay for electric service is a key concern in view of their low incomes. INDE is currently in the process of carrying out a water rate review as a condition to a \$55 million World Bank loan to help pay for the Aguacapa Hydro-electric project. INDE must, by June, 1978, establish a system-wide earnings adequate to provide a reasonable return of 9% on assets.

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This World Bank condition will undoubtedly be included as well in their proposed \$65 million loan for the Chixoy Hydro-electric project which is already under construction. Thus INDE could not commit itself to specific rates at this time.

Analysis of INDE's current rate structure indicates that rates for block customers (certain municipalities as well as the electric company serving Guatemala City) and industrial users may be below cost. Rates to direct customers (which include AID's target group), are substantially higher. During project discussions, INDE staff made it clear that large increases for direct customers were not contemplated. (They currently constitute only 9% of total INDE power sales anyway). To develop projected financial and economic returns for the project, high, base, and low assumptions were made for possible rate changes. These financial analyses demonstrate that it will be feasible to establish a rate within this range which will satisfy the IBRD minimum return requirement, be affordable by AID's target group, and provide sufficient cash flow to continue the expansion of the rural electrification program.

A condition precedent to disbursement of the loan has been included which requires AID concurrence with the new rate which will be adopted as required by the World Bank loan. In view of the large stakes involved for INDE with the two hydro-electric projects (total construction cost is \$568 million) we do not feel that the AID loan represents a great deal of leverage in setting rates. However, the condition ensures that the project will not go ahead in the absence of an affordable rate for the project's target group.

The criteria by which the Mission will evaluate the rate structure adopted by INDE are:

1. The total charges (electricity, house wiring repayment, public lighting, etc.) for the average low income user are within the target group's ability to pay; and
2. The contribution to construction requirement (front-end charges) is eliminated and if a deposit or prepayment from a customer is required prior to connection, it will not exceed a minimum bill for six months or \$15.00, whichever is less.

The current rate structure is highly skewed, as evidenced by the fact that 9% of KWH sales to INDE's direct customers provides 19% of INDE's revenues. The new rates must provide more equitable treatment for the low income customers. Currently, INDE rates for residential and rural customers discriminate against the small user because the highest charge per KWH is in the first block with progressively lower rates in successive blocks. This rate structure also promotes greater but possibly wasteful use of electricity. The Mission's preferred alternative to the present rate schedule is to make the charges in successive blocks the same or higher

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than the first block.<sup>1/</sup> This would favor the small user and encourage the conservation of energy.

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<sup>1/</sup> Rural Electrification Rate Study - Guatemala, March 31, 1977,  
Sanderson & Porter, Inc., N.Y. p. 5.

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## II. PROJECT BACKGROUND

### A. AID Rural Development Strategy

The USAID's current program has been developed in close coordination with the GOG's 1975-79 development plan which emphasizes development of effective government programs for meeting the needs of the rural poor. It has been based on: (1) growing knowledge of the target group and its problems; (2) stated GOG priorities which have coincided with AID-mandate requirements; (3) considerations of other IFI activities, and (4) existence of institutional capacity for implementing programs. The Mission's program objectives and proposed response to target groups constraints as now contemplated are outlined below:

#### 1. Program Objectives

The Mission in defining its rural development program objectives has sought first to identify accurately the target population in economic, social, and geographic terms and, second, to identify the priority needs of this population in terms of those resources, services and basic infrastructure required to improve its own economic and social well-being. The analytical basis for identification of the target group and its priority needs includes the recently completed Tri-Partite (IBRD, IDB and AID) Agricultural Sector Assessment and the soon to be completed Health and Education Sector Assessments. These and prior studies have provided significant knowledge about the rural population of Guatemala.

Guatemala's total rural population in 1970 consisted of approximately 661,000 farm and landless worker families. Of

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these, 596,000 or 90%, were landless workers or small farmers (less than seven hectares) whose annual family incomes averaged \$232 or \$42 per capita in 1970 dollars. The table on a following page provides a breakdown of the rural population by farm size and income.

Further information on the geographic dispersion of the poorest farm families and landless laborers is also available. As can be seen in the maps of the following pages (poverty and unemployment), although members of each of these sub-groups live throughout rural Guatemala, they are heavily concentrated in the Western Highlands and Eastern region. Further indication of the concentration of rural poverty in these two areas can be seen in the index of gross value of agricultural production per rural inhabitants by municipality. Of the 166 municipalities in the Highland Departments more than 80% fall below the national average index while only 44% of the municipalities outside the Highland Departments fall below the national average, most of those in the poor Eastern region. Data on education and health developed through sector assessments in those areas show that the residents of these departments have lower literacy levels and greater health problems than residents of the rest of the country.

Based on the Tri-Partite and other studies <sup>1/</sup>, the most serious problems and needs of the target group which constrain their potential for increased income and an improved quality of life have been identified as follows:

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1/ Some of the more significant are: (a) Guatemala's Economic Development The Role of Agriculture, Fletcher et al; ISU press, 1970; (b) Long-Run Prospects for Increasing Income Levels in Guatemala's Highlands, William C. Merrill, CNPE, Guatemala, Jan. 1974; (c) Evaluation of Prior Assistance - AID Loan 520-L-024, USAID/Guatemala, October 1975; (d) Guatemala National Development Plan, 1975-79, CNPE, Guatemala, June 1970 and May 1975; (e) Agricultural and Rural Development in Guatemala, Tri-Partite Study (General Report, Vols. I & II), June 1976.

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a. Limited Farm Size and Land Availability

The 1964 Agricultural Census disclosed that the average farm size in Guatemala was 8.3 hectares or less. Over 75% of the farms were 3.5 hectares or less. In the areas inhabited by the target group, average farm size was far smaller than the national mean. In the nine Western Highland departments, for example, average farm size was 6.2 hectares. Furthermore, since the 1964 census, the mean farm size has decreased as population has increased. There is limited potential for expanding farm area and availability of rental lands is limited. At present, it is estimated that cultivable land per person in the target area is less than one hectare per person.

b. Lack of Productive Resources and Services

Compounding the land constraint are the limited availability of resources and services which could stimulate increased farm productivity and incomes in the region. Although since 1970 there have been various GOG efforts (some AID-financed) to address this constraint, coverage is still limited in the following areas:

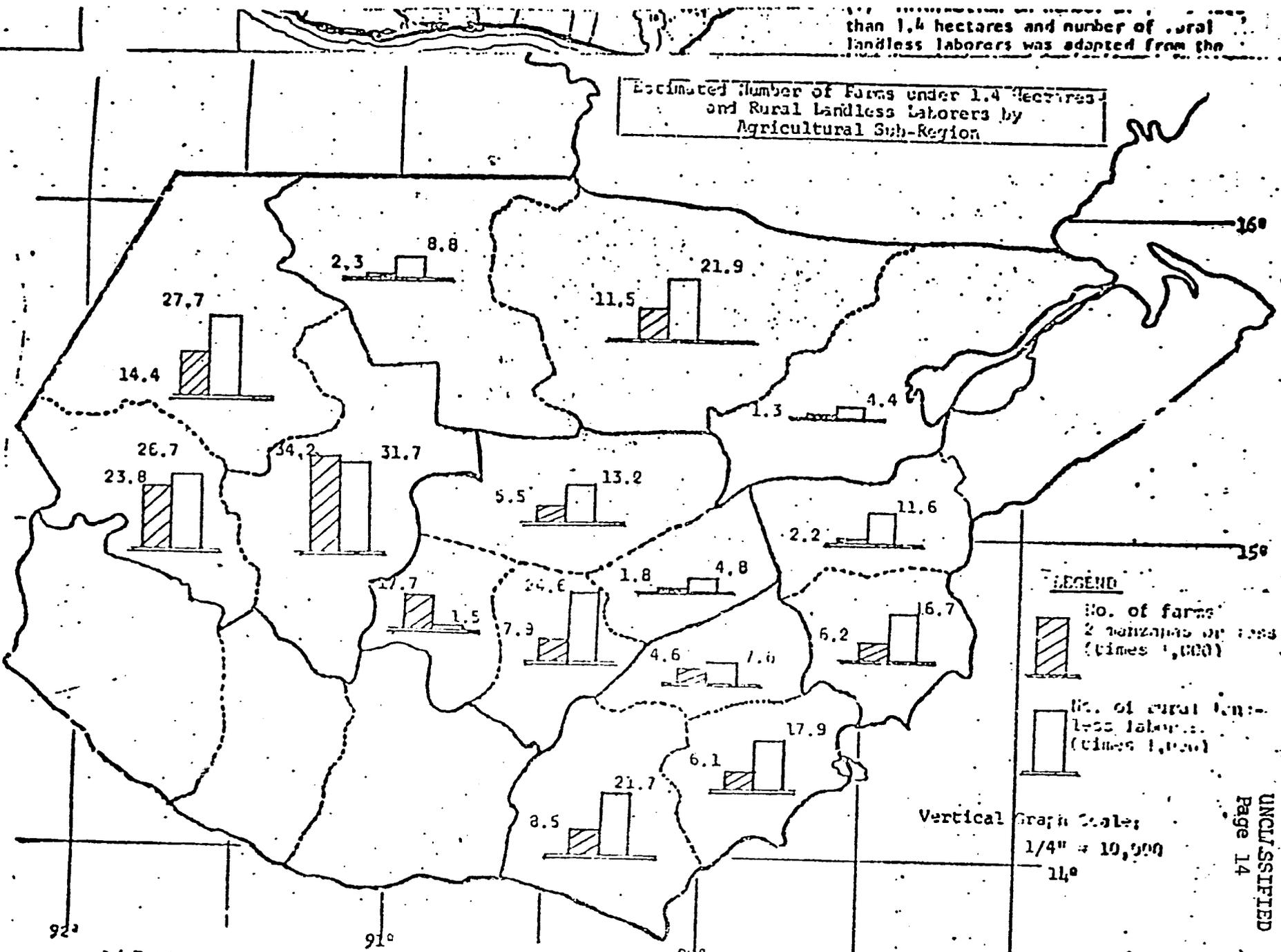
- (i) Production credit
- (ii) Farm improvement credit
- (iii) Improved production inputs
- (iv) Improved appropriate farming technologies
- (v) Extension services

Population pressures have also brought under cultivation land unsuited for intensive use which contributes to low productivity and severe soil erosion problems. Production of alternative, higher value crops is hampered by lack of knowledge about appropriate technology and inefficient marketing systems for non traditional crops. Moreover,

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than 1.4 hectares and number of rural landless laborers was adapted from the

Estimated Number of Farms under 1.4 Hectares and Rural Landless Laborers by Agricultural Sub-Region



**LEGEND**

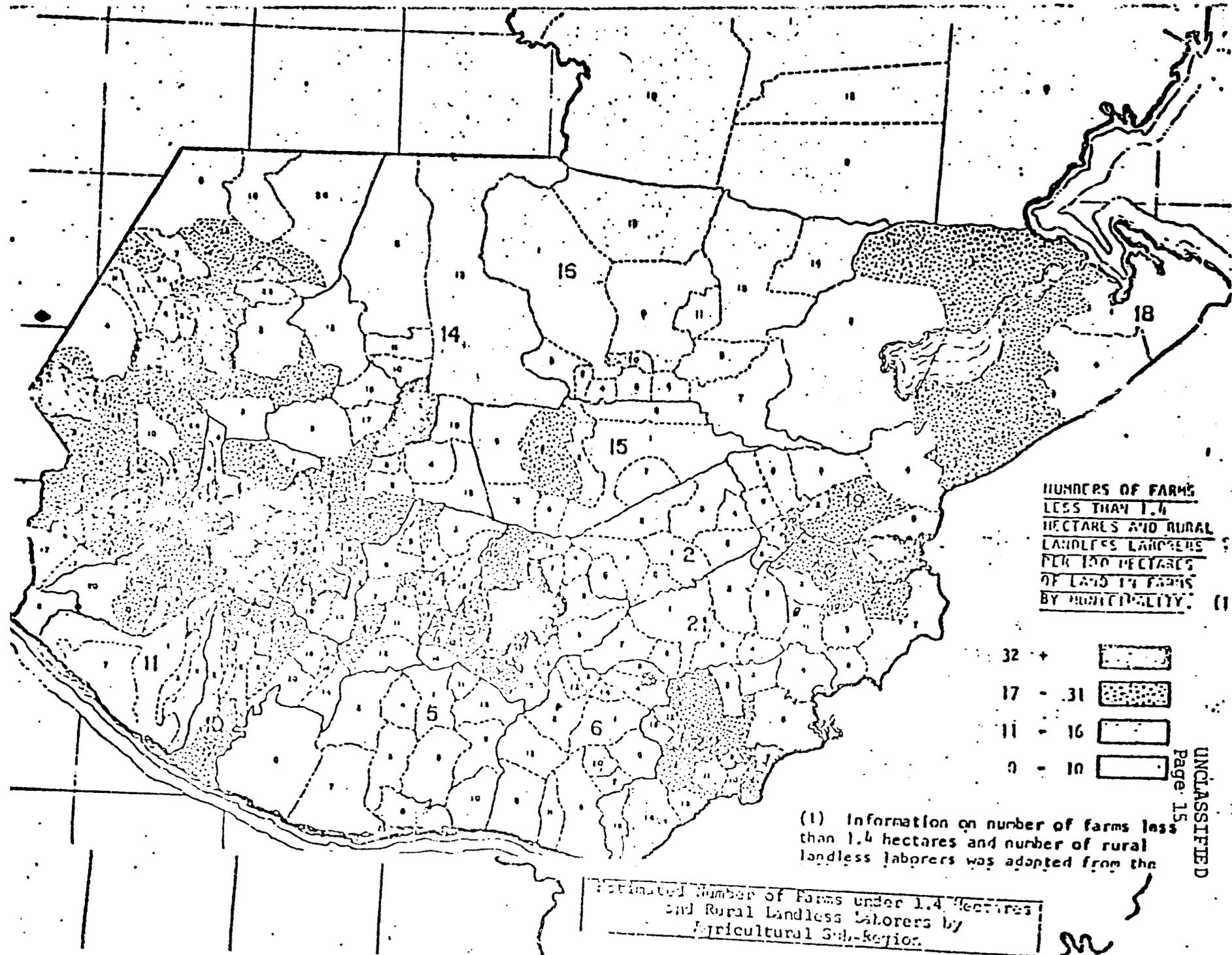
No. of farms  
2 hectares or less  
(times 1,000)

No. of rural landless laborers  
(times 1,000)

Vertical Graph Scale:  
1/4" = 10,000  
14°

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1/ Estimates based on 1964 Population and Agricultural Census Data.



HUNDREDS OF FARMS  
 LESS THAN 1.4  
 HECTARES AND RURAL  
 LANDLESS LABORERS  
 PER 100 HECTARES  
 OF LAND BY FARMS  
 BY MUNICIPALITY. (1)

- 32 +
- 17 - 31
- 11 - 16
- 0 - 10

(1) Information on number of farms less than 1.4 hectares and number of rural landless laborers was adapted from the

Estimated Number of Farms under 1.4 Hectares and Rural Landless Laborers by Agricultural Sub-region.

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ESTIMATED AGRICULTURAL INCOME DISTRIBUTION BY TYPE OF FARM, 1970

Farms & Families	Area (thou- sands hects.)	No. of Farms & Families (thou- sands)	Rural Popula- tion (thou- sands)	Income		Income Distribution	
				Total (Thousands Q) <sup>2</sup>	Per Capita (Q)	Population %	Income %
Landless workers	---	174.9	976	64.3 <sup>a</sup>			
Microfarms (under 0.7) Has.	36	98.2	540	3.4	35 <sup>b</sup>	83.3	34.8
Small Subfamily Farms (0.7-4.0)	427	277.9	1528	39.6			
Medium Subfamily Farms (4.0-7.0)	235	45.0	248	31.1	125	6.8	10.1
Family Farms (7-35)	568	48.5	267	36.2	136	7.3	11.7
Multifamily Farms (35-350)	896	9.5	52	72.3	1390	1.4	23.5
Large Multifamily Farms (over 350)	1590	2.5	14	53.1	3793	0.4	17.2
Administrators	---	5.4	30	8.2	273	0.8	2.7
Total	3752	661.9	3655	308.2		100.0	100.0

<sup>1</sup>Average family size : 5.5 persons

<sup>2</sup>Corresponds to the domestic product of  
crops and livestock.

<sup>a</sup>Includes all type of income earnings.

<sup>b</sup>Forestry and fishing salaries excluded.

Source: SIECA-FAO Perspectivas para el Desarrollo y la Integración de la Agricultura  
Centro América Vol. II, Table C-4, Guatemala, 1974.

NUMBER AND AREA OF FARMS IN GUATEMALA BY SIZE: 1964

Size (hectares)	No. of Farms	%	Total Area (Hectares)	%
0.7	85.083	20.4	32.678	0.9
0.7-1.4	98.658	23.6	95.427	2.8
1.4-3.5	129.115	30.9	270.692	7.8
3.5-7.0	52.023	12.5	242.832	7.1
7.2-22.4	37.025	8.9	446.563	13.0
22.4-44.8	6.631	1.6	203.508	5.9
45-450	7.859	1.9	915.078	26.5
450-900	561		345.739	10.0
900-2.250	294	0.2	387.093	11.2
2.250-4.500	56		169.747	4.9
4.500-9.000	30		178.448	5.2
9.000-and above	9		160.927	4.7
	<u>417.344</u>	<u>100.</u>	<u>3.448.736</u> Has.	<u>100.0</u>

Source: Second Agricultural Census, 1964, Volume IV

PROJECTED FARM SIZE IN WESTERN HIGHLANDS 1970 - 2000

MEDIUM PROJECTIONS

	NINE HIGHLAND DEPARTMENTS		
	Number of Farms(1000) <u>1/</u>	Average Farm Size (ha.) <u>2/</u>	Farm Land per Person in Ru- ral Population (ha./person) <u>3/</u>
<u>CENSUS</u>			
1950	203	8.1	1.35
1964	256	6.2	1.03
<u>PROJECTIONS</u>			
1970	279	5.6	0.92
1975	298	5.3	0.86
1980	317	5.0	0.81
1990	355	4.5	0.70
2000	392	4.0	0.61

Notes:

- 1/ Projected number of farms based on the average annual increase in the number of farms between 1950 and 1964.
- 2/ Projections based on the assumption that total land in farms remains equal to the 1964 value of 1,581,600 hectares.
- 3/ Projections based on the assumptions that population will increase at the 1950-1964 rates, and total land area in farms remains constant at 1,581,600 hectares. Highland departments are: Chimaltenango, Sololá, Totonicapán, Quezaltenango, San Marcos, Huehuetenango, Quiché, Baja Verapaz, and Alta Verapaz.

POTENTIAL FOR EXPANDING FARM AREA IN HIGHLAND DEPARTMENTS

DEPARTMENT	LAND AREA IN FARMS 1964 (%)	POTENTIAL ARABLE LAND (%)	ESTIMATED ARABLE LAND NOT IN FARMS	
			1964 (ha.)	1974 (ha.)
Chimaltenango	60	65	9,895	--
Sololá	36	41	5,305	1,657
Totonicapán	35	46	11,671	5,895
Quezaltenango	65	67	3,902	--
San Marcos	53	49	--	--
Huehuetenango	34	37	22,200	--
Quiché	29	36	58,646	8,336
Baja Verapaz	43	46	9,372	--
Alta Verapaz	<u>50</u>	<u>59</u>	<u>78,174</u>	<u>8,676</u>
HIGHLAND SUB-TOTAL	42	47	199,165	24,564
Percent of Total Area in Highland Departments:			5	0.7
Location of Arable Land Not Farmed:				
a. Percent in Highlands			32	33
b. Percent on Pacific Coast Slopes			4	2
c. Percent in Tropical Areas			64	65

small farmers generally have no alternative to selling their crops at harvest due to lack of proper storage facilities and the need for immediate income.

c. Limited Off-Farm Employment Opportunities

For those target group members who have no land of their own, or small farmers whose actual and potential income limits them to a subsistence level existence, attaining a better standard of living depends on full, or at least part-time, off-farm employment. The Tri-Partite Study found that there is sufficient agricultural land in the Western and Central Highlands to provide employment for 256,000 persons out of a labor force of 556,000. <sup>1/</sup> The remaining 300,000 persons need full, part-time or seasonal employment to attain even a minimal standard of living for their families. For most of these persons, opportunities at present are limited to seasonal jobs of from 1-4 months on farms in the Pacific Coastal Plain. Additional family income is often provided through the sale of artisanal products made in the home. Perhaps 50,000 people are employed at least part-time in such crafts. While existing agro-industries offer some full-time employment (estimated at 14,000 jobs in 1971), they are largely located outside the target group area and process products of the modern sector (sugar, beef, cotton, etc.).

The GOG has placed increasing emphasis on expanding off-farm employment in the target group area. In view of the constraints to increasing income from agriculture discussed previously, the importance of expanding rural, off-farm employment opportunities is clearly evident.

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<sup>1/</sup> These figures are based on 1964 data. The target group size would seem to indicate a much larger labor force at present -- perhaps on the order of 800,000/900,000 persons, including the target group in the Eastern Region.

d. Lack of Basic Infrastructure

The quality of life in the target areas is significantly affected by the lack of basic infrastructure. Historically, the flow of public investment in both economic and social infrastructure has favored the urban areas. Thus, in the rural areas, such basic requirements as access roads, power, water (for drinking and irrigation) and improved education and health facilities, fall short of needs. Considerable public investment is needed to provide minimum levels of services to rural areas especially in the Western Highlands. Past governmental neglect of rural areas has left a legacy of unmet needs, and despite attempts in recent years by the public sector to address these deficiencies, much of the target group is inadequately served. The situation is aggravated by inadequate budgets, inefficient and overcentralized administration, poor coordination at the national and local levels in the public sector, and inadequate planning. Much of the stock of physical infrastructure in the zones affected by the February 4, 1976, earthquake was damaged or destroyed, further aggravating the lack of services to target group members in these areas.

e. Educational Opportunity

The high rate of illiteracy, especially among the Indian population, is a result of lack of access to the formal education system due to a variety of factors: inadequate physical educational infrastructure, language impediments (classes are taught only in Spanish), overcrowding, inappropriate curriculum, and economic need for services of children on the farm. Until recently, non-formal educational programs were operated only by private groups with most concentrating on literacy programs for adults.

f. Health Conditions

Poor distribution of public health infrastructure in rural areas has resulted in high infant

mortality indices, low average life spans, and incidence of illness arising from easily preventable diseases. Lack of potable water and sanitary conditions, and poor nutritional practices, are the major factors limiting the general health levels of the rural population.

g. Population Growth

Guatemala's population is increasing at about 2.9% annually, which adds one million people every 25 years. Although the country has extensive unused land resources, the population is concentrated in certain areas, particularly in the highlands. This results in intense pressure on land resources which has caused significant drops in average farm size over the past 25 years. The growing population has increased the demand for government services, such as schools, health facilities, and out-reach programs of the public agricultural extension, which are increasingly difficult to establish. The provision of such services was inadequate under previous administrations.

2. USAID Response

To address the development needs of the rural population, USAID has developed and is pursuing a development loan rural development program designed to improve the income and general well-being of the rural population.

a. Rural Development

With rural areas still unsettled, and a result of the pressure on land resources, the major problem is the development of an effective program of rural extension. COG efforts to resettle the population have had limited success due to a heavily deteriorated economy and budgetary limitations. In 1974, the Government of Guatemala funded a pilot colonization program (see attached report for FY 1976) whereby 3,000 families were resettled in rural areas.

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resettled in the Northern Transversal Strip. A key objective of this project is to demonstrate an alternative approach to colonization, using cooperatives as the vehicle for organizing and selecting participating families and for channeling necessary inputs. Government control is minimized, and because self-help activities are encouraged, heavy GOG investment in infrastructure is not required. The loan is also financing land use and cadastral studies for the remaining area of the Northern Transversal Strip so that colonization can continue after the initial pilot program is underway.

In terms of dealing with the land constraint in the target group area itself, the USAID is exploring a possible FY 1979 project which would be designed to facilitate the transfer of farm property to the poor. While experience is limited to date, three PVO project which are financing the sale of fairly large farms to groups of campesinos have demonstrated the strong interest on the part of the rural poor in obtaining land and their willingness to repay mortgages. Expropriation and redistribution of large land holdings does not appear to be politically feasible.

b. Farm Productivity

The constraints bearing on small farm productivity have received much attention from the USAID and other international donors. Approximately \$12 million from Loan 018 (authorized in 1970 and fully disbursed in 1976) was allocated for small farmer credit. Of this amount, \$2 million was channeled through cooperatives with the remainder being lent directly by BANDESA, the GOG's agricultural credit bank. An additional \$4.5 million was made available to the cooperatives for credit under Loan 024, now fully disbursed. In 1976, the IDB lent \$25 million to the GOG for small and medium farmer credit through BANDESA, and the IBRD is considering a loan for \$10 million in 1978 for the same purpose.

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Loan 018 also financed the expansion of the GOG's ag extension capability, with the number of extensionists increasing from about 90 in 1970 to 450 in 1975. Agricultural research is being supported through an AID grant to ICTA (the GOG's research institute), which also received funds under Loan 018 for equipment. The Rockefeller Foundation is providing two technicians to complement those contracted under the USAID grant, and the IDB has made a grant to ICTA for seed multiplication facilities. The USAID financed research is concentrating on basic grains (corn and beans) with emphasis on adapting high-lysine corn varieties to highland conditions. As part of its FY 1979 ABS, the USAID included a PID for a project to develop an applied research, extension and intermediate credit program for farm diversification in the Western Highlands which will concentrate on increased production of temperate climate vegetables and fruits and small farm animals.

To improve the existing land base, funds from Loan 026 will finance pilot programs in small-scale irrigation and improved soil and water conservation practices. This activity complements a reforestation project being developed by the Canadian International Development Agency (CIDA), and will form the basis for a possible USAID loan for erosion control on small farms in 1980.

A nationwide system of public storage facilities for basic grains was financed through a CASSEI loan (using IDB funds), and USAID Loan 018 provided financing for private grain storage facilities.

Finally, to develop alternate marketing channels for fruits and vegetables which will return higher prices to small farmer producers, the USAID prepared and submitted to AID/W a loan and grant PP for FY 1977 authorization which will finance a cooperative-owned marketing facility for these products. The loan agreement was signed on May 18, 1978.

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c. Employment Opportunities

As one alternative for increasing off-farm employment opportunities in rural areas, the USAID is developing a combined grant and loan project for FY 1978 funding which will provide credit, technical assistance and training for small rural enterprises. Small businesses eligible for assistance under the loan will include those involved in processing of locally available raw materials, provision of supplies and services for the surrounding farm population and small-scale cottage industry and handicrafts production. The IDB has authorized a loan to CORFINA for \$7 million for larger rural industries.

The increased USAID emphasis on assisting farmers to switch into more labor intensive, higher value crops is also expected to have significant impact on increasing on-farm employment opportunities for landless laborers.

USAID Loan 026 is also assisting the GOG in a pilot effort in labor-intensive construction of minimum standard, all-weather roads in areas with the highest un- and under-employment.

d. Rural Infrastructure and Government Services

The USAID has provided assistance for construction of small infrastructure projects in rural areas through Loan 017 (\$2.1 million which is fully disbursed) to the GOG's Municipal Development Institute (INFORM). The loan financed the construction of water and sewer systems, market places and slaughter houses in the cabeceras municipales (equivalent to a small U.S. county seat). Following the February, 1976, earthquake, the USAID authorized a loan to the GOG for reconstruction activities in the earthquake devastated area (Municipal Earthquake Recovery Loan 027 - \$8.0 million) which is administered by INFORM for the 100 plus

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municipalities destroyed or severely damaged by the earthquake. Funds are included in the loan for improving INFOM planning and management capacity, as well as the administrative and financial capacity of the participating municipalities. It is contemplated that the experience gained by INFOM in implementing this loan will enable it to undertake an integrated rural infrastructure development program financed by a projected FY 1979 USAID loan. To support development of this loan, USAID is preparing an FY 1978 area studies grant project to assist the GOG in the design of an analytical framework for rationalizing rural investments made by INFOM and other government agencies. Based on projected agricultural productivity and population data for rural towns and villages, and an inventory of the existing economic and social infrastructure base, rural investment requirements and optimal locations for future investments can be derived. This will serve as a basis for coordinating GOG and other donor investments. At this time major infrastructure investments are being financed by IDB and IBRD in primary and secondary highway construction, water and sewerage systems for larger towns, and large scale power generation and transmission systems.

A related objective (apart from impact on the target group) of the projects already financed, or projected for financing by the USAID, has been the strengthening of public sector agencies to facilitate follow-through once AID financing is disbursed. To accomplish this, conditions have been included requiring increased personnel and budget, and technicians have been provided to assist implementing agencies when new programs are being introduced. The USAID has also financed training costs for GOG personnel to attend courses developed by AID in project management and public administration. Technical assistance is also being financed for a new GOG office charged with monitoring internationally financed projects. Project control systems are being established by this office within implementing agencies. Finally, a major effort is being undertaken with Loan 026 funding to up-grade in-service training capabilities within the Ministry

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of Agriculture (both in administrative and technical skills), and to create an effective sector planning capability within the Ministry.

e. Educational Opportunity

The USAID is currently providing assistance for both formal and non-formal education programs. A recent loan (025 for \$7 million) will extend qualitative improvements and teacher training programs throughout the rural primary education system. These improvements were developed under an earlier AID loan and grant. Construction of rural primary schools is included as well. A recently approved loan (029) will finance reconstruction of primary schools damaged or destroyed in the earthquake of February, 1976. In FY 1975, the USAID signed a grant to provide technical assistance to a new GOG non-formal education agency. UNICEF and UNDP are also providing technical assistance and commodities. The program is based on AID's regionally funded Basic Village Education project which was implemented in Guatemala and which sought to test a number of communication approaches to supplying relevant information to rural adults. A combination of radio and audio-visual techniques are being utilized along with local monitors. Information basically deals with agricultural matters and is developed from baseline data collected through surveys of the target group. A second stage of the program will be providing primary level educational inputs to children and adults not reached by the formal system. The USAID is submitting a PID for a proposed FY 1979 grant to assist the Ministry of Education in developing an experimental bilingual education program.

f. Health Conditions

As is true with many developing countries, Guatemala's health system heavily emphasizes curative services, with the great majority of doctors being concentrated in the capital. In an effort to extend the outreach of the

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public health system, as well as address many of the conditions which cause a high percentage of illnesses and deaths (mainly gastro-intestinal disorders and communicable diseases), the USAID financed (with two loans, 020 and 021) the initiation of a paramedic program within the Ministry of Health. Under this program, candidates from rural areas receive two years of training as Rural Health Technicians (TSR's), and are then assigned to rural health posts and health centers. While they practice limited forms of curative medicine, the TSR's are expected to concentrate on mobilizing community support for preventive health measures such as proper sanitary procedures, safe disposal of garbage, and ensuring safe drinking water sources. In order to give impetus to this key aspect of TSR activities, the USAID will develop a PP for a loan in FY 1978 which will provide financing for these village projects. The loan will also provide assistance for up-grading the Ministry of Health's administrative capacity. A current grant is financing a program for creating a capability within the Ministry for evaluating the impact of rural health programs in order to provide feedback for planning and program management.

g. Population Growth

Since 1968 the USAID has been supporting family planning activities in Guatemala. Until the end of CY 1976, the program worked with the Ministry of Health as well as with a private family planning organization (APROFAM). Because of disappointing results with the public sector program, stemming in large measure from lack of top-level policy support, the USAID withdrew assistance from the Ministry's program and concentrated, instead, on expanding APROFAM's activities to rural areas. (APROFAM's program had been concentrated in Guatemala City.) APROFAM is now responsible for supplying contraceptives to Ministry of Health facilities in rural areas (with the Ministry's authorization), and is conducting promotional programs through radio and printed materials. Family planning instruction is also being

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conducted through local campesino leagues, cooperatives, and community based distribution programs:

B. Role of Rural Electrification in the USAID Program

The goal of USAID rural development programs is to increase the income and quality of life of rural families. Programs being carried out by the GOG, the USAID and other donors, as described above, have been designed to achieve these ends. Of necessity, many of these are innovative programs which during their initial implementation periods will affect relatively limited numbers of people. Fullest achievement of their potential for modernizing the rural sector will be dependent in many instances on the availability of electric power. It is difficult to see how broad scale development of rural areas will occur over time in the absence of this basic resource.

Present GOG policies seriously limit the expansion of electric power service to AID's target group with the result that only a small percentage are currently being served. Even so, the USAID is not asserting that lack of electric power in rural areas is a major constraint at this time to increasing incomes (although levels of well being would certainly be improved); the justification for the program essentially lies in providing a very basic element of rural infrastructure at a favorable cost which will complement and reinforce many developmental efforts directed toward the target group. In so doing, ultimate effectiveness of these programs will be enhanced, thereby improving prospects for significant levels of goal achievement.

The anticipated links between ongoing and planned programs and the availability of electric power are described below:

## 1. Agricultural Diversification

A major USAID program objective is to improve the incomes of poor rural families with limited land holdings by diversifying their production from basic grains to higher value crops, including small animals. In addition to the development and extension of agronomic technology, intermediate credit for increased production inputs, and training of farmeres, a number of ancillary constraints are being addressed. Among these are: (a) the need for irrigation to maximize production possibilities from fruits and vegetables; (b) the need to organize more sophisticated marketing channels including product storage capacity for perishable products; and (c) the need to control the environment necessary for the survival of small farm animals and the storage of animal products.

Much of the infrastructure required to support a continued expansion of the agricultural diversification program depends on the availability of affordable electric power. For example:

### a. Irrigation

Under Loan 520-T-026, the USAID is financing a pilot program to develop small scale irrigation systems on some 5,000 hectares in the Western and Eastern Highlands. While it is anticipated that the majority of the systems which would be financed under the loan will be gravity fed, there are a number of irrigation sites where such systems are not feasible and where pumping would be required. The initial purchase price and operating and maintenance costs for electric pumps are considerably lower than for diesel or gasoline operated pumps, which make them an attractive and affordable alternative for expanding the amount of small farmer land area under irrigation. Thus, the rural electrification project would directly complement the implementation and replication of the on-going small scale

irrigation project by : (1) allowing greater latitude in selecting sites for irrigated crop production; and (2) improving the returns for farmers where only pump irrigation is feasible.

b. Small Farm Animals

On-going and planned AID, IBRD, and IDB programs are funding credit and services to small farmers through the cooperative movement. At present most of this assistance is directed towards increased crop production. However, some local level cooperatives are beginning to sponsor and finance diversified activities such as poultry and livestock production. 1/

The proposed USAID FY 1979 project for agricultural diversification will further this initiative by improving technology and providing intermediate term credit for small farm animal production. The extension of rural electrification will contribute directly to this effort by enabling small farmers to store vaccines and other medicines under refrigeration, improve poultry production by using modern incubation procedures, and facilitate temporary retention of milk and other animal products.

c. Produce Storage and Processing

The planned FY 77 Small Farmer Marketing Loan will finance a system of storage facilities for fruits and vegetables through small farmer cooperatives. These facilities will need electric power for cold storage and efficient grading, sorting and weighing operations. Over time, additional operations, such as drying, slicing, blanching, crushing and juicing may be added to these cooperatively run ventures. Expansion of the rural electrification system will facilitate the establishment of these and other produce storage and processing facilities in the target group area.

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1/ Tripartite Study, p. 43.

## 2. Increased Employment Opportunities in Rural Areas

As described in the previous section, a major focus of the USAID strategy is to assist in creating conditions which will foster increased employment opportunities in the rural areas. The planned FY 1978 Rural Enterprises Loan is expected to provide financing for some 6,000 artisans, 700 small agro-industrial enterprises and 1,300 other businesses providing services to the rural population. This financing is expected to create directly 3,000 full time jobs for target group members. The multiplier effect is expected to generate at least as many additional jobs. Moreover, it is anticipated that IDB financed lines of credit for larger scale agro-industry in CORFINA and BANDESA will provide substantial additional new employment in the rural areas.

The Rural Electrification Loan will directly complement these programs by: (1) facilitating the establishment in the target area of new enterprises which require electric power for efficient production; and (2) permitting increases in efficiency of existing enterprises. Increases in efficiency will permit these rural enterprises to maintain or increase their competitiveness and increase their sales and employment over time.

## 3. Quality of Life

An important aspect of improved quality of life is the availability of an assured source of water for human consumption and other essential uses. Current and planned USAID programs for small town development provide for financing, through INFCOM, of water systems for residential, commercial and industrial uses.

Most of the existing water systems in the target area are gravity-fed. However, terrain considerations limit the

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number of unserved populations which will be able to use this type of water system in the future. A number of towns are now using, or are planning to install, diesel or electric pumps for their water supply systems. To date, INFOM has financed 59 water systems which utilize pumps, 42 of which are electric. Due to their lower initial cost, operating efficiency, reliability, and lower maintenance costs, electric pumps are the most efficient, cost/effective way of providing water where pumping is necessary. Expansion of rural electrification distribution systems will allow the conversion of existing diesel pumps to electric service and the installation of additional electric powered water systems in towns which are not presently served.

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C. The Power Sector - INDE Past and Future Investments.

1. Generation and Transmission

While INDE's present installed generating capacity is still higher than demand, there is little excess capacity for accomodating further demand increases at this time. Thus significant expansion in generating capacity is planned to accomodate the steady growth in demand arising from overall economic development.

Prior to 1973, when generation costs per KWH of thermal units were comparable to the cost of hydroelectric generation, surges in demand could be easily met by the installation of additional thermal generators -- a process which required little advance planning. While this solution is still technically feasible, the rapid rise in oil prices over the last few years has not made it economically feasible. The rapid increase in demand coupled with rapidly rising costs from its existing facilities caused INDE to look for alternative generation solutions. A key step in the process was the preparation of a Master Plan for power generation which was financed by the West German Government in 1975. Related feasibility studies for major hydroelectric generating facilities were completed, and loans were approved by the IBRD, IDB and other sources to finance the most viable generation projects -- Aguacapa and Chixoy. These facilities are expected to come on stream between 1979 and 1982 and provide sufficient generation capacity until the early 1990's.

2. Planned Generation Projects

a. Aguacapa Hydroelectric Complex

This project involves construction of a three stage hydroelectric plant and connection to the

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national grid at a total cost of \$100 million. The World Bank has approved a \$55 million loan for the project. The loan agreement has been signed and is in the process of being ratified by the GOG. A construction firm has been selected to build the dam and work is underway. Additional financing for the project was authorized and approved by CABEI (\$2.2 million) and the Venezuelan Investment Fund (\$30.0 million) which is administered by the IDB. The project will increase the interconnected system's <sup>1/</sup> generating capacity by 90 MW by 1979, an increase of 25% over its 1977 capacity of 352 MW. (See Table in Section IV. A. Technical Analysis.)

b. Chixoy Hydroelectric Project

Feasibility studies for this 300 MW generating plant and related transmission lines have been completed and the World Bank has programmed a \$65 million loan in Cy 1978 for this \$350 million project. Additional financing has already been authorized by the IDB (\$105 million including \$35 million from the Venezuelan Trust Fund).

The project consists of the construction of a rockfill dam on the Chixoy River, a spillway, and a power tunnel approximately 16 miles in length; a powerhouse at Quixal with 300 MW generating capacity, and a 230 KV transmission line approximately 75 miles in length from the power plant to the grid load center near Guatemala City. The tunnel and spillway are already under construction by Italian and German companies. The project is projected to be completed in 1982, and will increase the interconnected system's generating capacity by an additional 66% over the planned 1979 level.

In summary INDE expects to invest \$558 million in generation and transmission during the 1977-1982 period.

1/ The interconnected system includes INDE, Empresa Electric (which serves Guatemala City and environs) and several municipally owned generating plants.

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Significant additional investment in generation and transmission will not be needed until the 1980's.

### 3. Rural Electrification

INDE's approach to rural electrification in the past was to extend subtransmission and distribution lines to larger towns and villages. Because many of these were already partially served by diesel generators, minimal investment in local distribution systems was needed. For newly electrified towns, INDE funds were used to pay the high contribution to construction costs for the required distribution system. The rural system until now has largely bypassed the smaller villages, because they were either too poor to pay the front-end charge and too small for INDE to make funds available to cover the construction costs or they were simply too far from existing subtransmission lines to make it cost effective for INDE to serve them. However, INDE serves directly some 7,000 customers in 1,000 small villages and towns (see tables on following pages). Because these customers amount to less than 1% of the country's total rural population.

The subtransmission and distribution lines that serve these customers were largely paid under the program of a financed rural electrification program. Under this program, INDE constructed 479.4 kms of 110 KV and 230 KV transmission lines and built 400 subtransmission stations. Distribution lines for connections to 10,000 small villages benefiting approximately 33,000 customers. Two substations and two warehouses were also constructed. These lines and related substations were located in the Northern and Central Highland Departments of San Marcos, Huehuetenango, Quiché, Baja Verapaz and Alta Verapaz. Available, full-time power in many cases replaced the piecemeal systems which were typically run only a few hours per day in these areas. The \$7 million loan was fully disbursed on September 30, 1977. INDE has invested approximately \$2.5 million in additional funds (over its \$4 million loan counterpart funding) to

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construct transmission lines, substations, and distribution networks in the Eastern Region, thereby laying the foundation for further expansion in this area.

Under AID Loan 520-W-027, Municipal Earthquake Reconstruction, approximately \$900,000 of loan funds have been allocated for repair of earthquake damaged distribution systems in the Department of Chimaltenango. This area had previously been served by a privately owned company which was bought out by the GOG after the earthquake. Under this project, INDE will construct approximately 130 kilometers of subtransmission and distribution lines with its own funds, while INFOM (the Municipal Development Bank and Implementing Agency under Loan 027) will fund the cost of repair and reconstruction of the existing system.

The proposed project builds on previous and on-going efforts. Subtransmission and distribution lines built under previous AID supported efforts will be the physical base from which the new distribution system expansion will be built and the new hook-ups made under the proposed project.

Due to the anticipated increase in generation capacity which now makes it feasible and desirable to seek additional customers, INDE now places a higher priority on its rural electrification program. However, the massive new investments in generating and transmission capacity will absorb the bulk of INDE's financial resources until 1982 and will leave few resources for investing in an expanded rural electrification program. The AID loan and GOG counterpart contribution will make this expansion possible thereby serving villages which otherwise would not receive electricity for many years.

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TABLE OF SALES AND GROWTH DATA BY CLASS OF CONSUMERS RURAL AREAS  
(INDE Direct Customers)

	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>% Increase 1972-1976</u>
<b>1. Total Sales (in GWH)</b>						
- Residential	10.3	12.8	16.1	20.2	23.9	132
- Commercial	7.6	9.4	10.7	12.3	14.2	87
- Industrial (a)	6.1	6.5	10.0	11.7	29.2	379
- Government	1.7	2.4	3.2	4.4	5.7	235
- Municipal	.8	1.0	1.2	1.0	1.7	113
- Public Lighting	4.4	4.0	5.3	4.8	6.3 (b)	43 (b)
<b>T O T A L</b>	<u>30.0</u>	<u>37.0</u>	<u>46.5</u>	<u>55.0</u>	<u>81.0 (c)</u>	<u>162 (c)</u>
<b>2. Number of Customers (as of 12/31, year indicated)</b>						
- Residential	31,135	38,134	44,960	50,061	58,832	89
- Commercial	5,003	5,420	5,973	6,277	7,019	40
- Industrial (a)	186	196	235	236	289	55
- Government	413	431	525	608	717	74
- Municipal	512	544	638	696	732	43
- Public Lighting	213	265	351	190 (b)	203 (b)	-5 (b)
<b>T O T A L</b>	<u>37,462</u>	<u>44,990</u>	<u>52,682</u>	<u>58,066 (c)</u>	<u>67,792 (c)</u>	<u>81 (c)</u>
<b>3. Average KWH/Customers</b>						
- Residential	336	337	357	404	407	31
- Commercial	1,512	1,734	1,789	1,962	2,016	33
- Industrial (a)	33,120	32,966	42,525	49,500	100,884	205
- Government	4,188	5,658	6,103	7,254	7,881	88
- Municipal	1,524	1,832	1,942	2,353	2,270	49
- Public Lighting	20,448	18,382	15,154	25,148 (b)	31,192 (b)	53 (b)
<b>O V E R A L L</b>	<u>828</u>	<u>828</u>	<u>883</u>	<u>948 (c)</u>	<u>1,195 (c)</u>	<u>44 (c)</u>
<b>4. Number of Cities, Towns and Villages Served</b>	273	320	379	416	462	69

(a) Cementos Novella, S.A., the biggest industrial customer of INDE, consumes approximately 25% of all of INDE's direct sales and is excluded to avoid distortion of these general sales data.

(b) Apparent error in number of customers and average KWH/Customer.

(c) Slight error introduced by error explained in Note (b) above.



### III. PROJECT DESCRIPTION

#### A. Introduction

The proposed project is designed to contribute to AID's ultimate program objectives, i.e., increased incomes and improved quality of life for Guatemala's rural poor, by providing the target group with access to electricity. This service heretofore either has not been available or, if available, was provided at a cost which effectively precluded their participation. The potential beneficial impact of electrical service on rural incomes and quality of life are described in other sections of this paper. It is important to note the extent to which the target group is aware of these benefits. The INDE-AID Village Electricity Utilization Survey described a significant demand for electrical services on the part of the target group. The relative value and priority they place on the service is also clearly reflected in the fact that they are willing to pay up to 13% of their average total annual income for electricity (based on non-users surveyed). The project thus provides AID with the opportunity to assist the GOG in providing a basic public service to the target group, a service which they themselves perceive as a high priority need.

The project has been designed around three fundamental concerns related to targeting: first, that the expansion of the subtransmission/distribution systems be in areas of high target group concentration; second, that priority be given to those members of the target group which can make productive use of electricity; and third, that the rate structure be

within the limits of the target group's ability to pay. All of these conditions are essential to assure that the maximum possible project benefits flow to the target group.

The first concern, that of geographic area, is addressed in the context of both those participating villages already partially electrified and those without electricity. Because of the existing rate structure -- i.e. the front-end charge -- the vast majority of hook-ups in partially electrified villages are now commercial/industrial and the better-off residential users, who were able to afford the high front-end charge. Thus, the unmet demand in these villages is almost entirely the poorer households. The project investment in distribution lines in these electrified villages will therefore primarily benefit the poorer households. Those villages to be newly electrified under the program are smaller or poorer or more isolated than the villages already electrified, which is the primary reason they have not had access to electricity in the past.

The second concern, that of ensuring the productive use of electricity, was addressed in the process of selecting participating villages. Partially electrified villages selected have already demonstrated that they have reached a development status sufficient to productively use and to pay for electricity. In selecting villages to be newly electrified, particularly in the Highlands Region which is generally less developed than the other regions, priority was given to those villages which, in light of their infrastructure base and level of economic activity, demonstrated the greatest potential for using electricity

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productively. Through this process 111 of the 180 highlands villates considered were eliminated from the project.

The third major concern, the rate structure, is addressed through a significant change in INDE's existing tariff schedule. INDE has agreed to discontinue the requirement for a cash contribution and instead establish nation-wide rates which generate sufficient earnings to finance continued system expansion. The rate structure will be determined when a rate study required by the IBRD has been completed. The financial analysis carried out for this project demonstrates that it is possible to establish such a rate within the limits of the target group's capacity and willingness to pay. Based on these efforts in targeting, it is anticipated that 80% of the new customers will be target group families and an additional 5% will be commercial users.

In developing the project, the Mission dealt with one other major issue, i.e., replicability. The feasibility of continuing the process of rural electrification begun under the project at an acceptable rate is dependent on both the cost per beneficiary and a source of post project financing. The rural electrification project, because it builds on the heavy infrastructure investments in generation and transmission already in place or programmed by other donors (i.e., IBRD and IDB), is able to extend electrical service to a large number of target group consumers at a relatively low incremental cost. The average total incremental investment (including T. A. and training) per customer under the AID project is about \$214 per household, or approximately \$33 per capita. The subtrans-

mission and distribution systems to be financed under this project are thus analogous to AID financed feeder road systems which begin at the point where the higher cost primary and secondary road system ends.

With respect to a continued source of financing for the rural electrification program, the projected cash flow for the project demonstrates that sufficient funds will be generated to cover the cost of future investment requirements. Thus, after the project period the rural electrification program will be on a self-financing basis.

#### B. Goal

This project supports the overall rural development sector goal of improving the quality life of rural Guatemalans by increasing small farmer incomes and increasing employment in the rural areas. The project will complement AID and other donor financed activities aimed at assisting small farmers and landless laborers in Guatemala. Goal achievement will be verified by the fact that average incomes of users increase more rapidly than the incomes of non-users.

#### C. Purpose

The purpose of the project is to increase the number of electric connections in low-income rural areas and improve INDE's capacity for continuing the extension of local power services to additional low-income rural areas. Achievement of the project purpose will be measured by the connection of 70,000 users in low income areas to INDE's distribution system by 1982 and a plan for financing the connection of at least 10,000 additional low income users in each year thereafter.

The project area is defined by the departmental boundaries of the seven Highland Departments of Totonicapán, El Quiché, Huehuetenango, Sololá, Chimaltenango, Alta Verapaz, and Baja Verapaz, and the natural boundaries formed by the mountain range cutting across the Highland Departments of San Marcos and Quezaltenango. The project area in these two Departments is determined by altitude; the project area will be 5,000 feet and above. Below that elevation are large coffee plantations which clearly do not include the target group. In the Eastern Region the project will operate in all the Departments of Jutiapa, Jalapa, El Progreso, Chiquimula, and Santa Rosa. In the Department of Zacapa, only the area south of the Motagua River Valley will be included in the project. On the South Coast the project will include villages in the departments of Suchitepequez, Retalhuleu, and Escuintla.

Reliable, affordable electric power will enable the low-income rural families of AID's target group to improve their incomes and living standards by making productive use of electricity in the home, on the farm and in small enterprises and workshops. Target group families will benefit from improved living conditions and a reduction of household drudgery (with the addition of small appliances, such as irons). In addition, rural enterprises and other industry will be attracted to the project area, thereby generating additional employment for low-income families.

D. Project Outputs

The loan and GOG counterpart will finance the following activities:

1. Rural Electric Distribution Systems

a. New Connections

A total of 591 Kms. of primary distribution lines (34.5 KV, 19.1 KV, 13.2 KV, and 7.6 KV) and 489 Kms. of secondary (120/240 V) lines will be needed to connect low income families to INDE's system. An estimated 911 transformers will be installed on primary lines for 33,000 hook-ups in towns which have never had electricity and 37,000 hook-ups in already electrified villages. Finally, service drops, meters, and customer-owned house wiring will be installed in order to connect 70,000 new users.

**b. House Wiring**

House wiring is included in the construction plan. The cost incurred for this element will be recovered from each customer over a four year period by affixing a special charge to the user's monthly utility bill. For purposes of the financial and economic analyses the house wiring cost was estimated at \$20 per customer amortized over four years plus a 3% fee to INDE for administrative costs. On a monthly basis this charge was estimated to be 44 ¢ per user. These recuperations for house wiring will create a source of funds in INDE for continuing the house wiring program after the loan is disbursed, i.e., for the 6,000 connections to be made annually in the geographic area of the project. Income from the house wiring payments will eventually exceed the amount required for wiring houses for the 6,000 annual new connections. Any additional such income will be earmarked to finance the construction costs for new hookups in the geographic area of the project.

Independent construction crews will be employed to perform house wiring throughout the areas to be served, and timing will coincide with construction of the distribution systems. Selected residents of the villages will form part of the house wiring crews. These people will be trained in house wiring techniques in order to assure that there will be indigenous people in the villages with capacity to continue this service in the future. Only houses that fit the standard plan of about three light fixtures and two outlets will be wired in this manner. All wiring will be inspected by INDE before meters are installed. Larger houses that require additional services and special wiring will not be eligible for this service.

c. Subtransmission Lines and Distribution Substations

To make the above connections and additional hook ups possible, 69 KV subtransmission lines will be needed in two parts of the project area. A 94 kms. line will be built to provide additional capacity to the subtransmission system primarily to reduce the burden on the existing South coast subtransmission line which is now loaded above capacity. This line will also serve to meet eventual increases in demand in the Western Highlands.

In the Eastern Region a 69 KV line extending for 56 kms. from El Progreso, Department of Jutiapa to Quezaltepeque, Department of Chiquimula will be constructed. One 5 MVA substation to transform 69 KV to 34.5 KV will be constructed in Quezaltepeque.

2. Improved INDE Field Service Capability

INDE's field service capability will be improved in three ways: first, by strengthening the capacity of INDE's regional field offices to maintain the system and provide customer services; secondly, the Commercial Department will receive training in promotion of electricity in the rural areas and will develop programs of customer education in power uses and safety; and lastly, the accounting and billing services of the Commercial Department will be expanded to serve the increased number of customers.

In addition, INDE personnel will be trained on the job as local managers, linesmen, maintenance persons and meter readers. Local electricians will receive on-the-job training in house wiring from INDE or contract personnel. The marked increase in the number of customers to be attended, lines to be maintained, and meters to be tested, will require the purchase of additional special tools, test equipment, and approximately 13 standard line maintenance vehicles so that quality of service can be maintained at reasonable cost.

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3. Improved INDE Management and Technical Capacity

INDE's ability to implement and expand its rural electrification program will depend in part upon strengthening certain management and technical capabilities. Five areas for assistance have been identified for loan financing:

a. INDE Technical Practices

Technical assistance will be provided to review, with the assistance of INDE personnel, certain technical practices and standards with the purpose of recommending lower cost solutions. Specific areas of interest are:

(i) Sub-station design in terms of reducing costs while still complying with acceptable standards; and

(ii) Distribution system design (trade-offs between economics of various distribution voltages) and development of standard unit costs.

Required are four person months of consultant services.

b. Rate Analysis

Provide INDE with expertise in analyzing its current procedures for determining rates so as to ensure all factors bearing on development of equitable rates are considered. Required are two person months of consultant services.

c. Commercial Operations

Provide technical assistance to INDE's Commercial Department so as to prepare it to handle the

greatly expanded workload represented by the increased number of new customers which will be financed under this project. Specific areas where assistance will be provided are:

(1) Billing and collection procedures including computer applications;

(ii) Promotional and education programs in power use for rural customers; and

(iii) Customer services such as connections and disconnections, responding to special voltage requests, etc. Required are 10 person months of consultant services.

d. Contract Personnel for Evaluation

Local contract personnel (enumerators) to carry out baseline surveys and the impact evaluation survey at the end of the project will be hired by INDE and will be under the direction of the Planning Department. Survey instrument printing and processing and data tabulation will also be financed by the loan, for a total estimated cost of \$30,000. Non-loan funds will be used to finance the consultant(s) who will design the evaluation and analyze the results of the impact survey.

e. Other short-term consulting services

Other consultant services may be identified during project implementation. Estimated are six person months.

f. Participant Training

Training for INDE management and technical personnel will also be loan financed. Five members of INDE's management staff will be sent to the United States for

four weeks' training in special courses arranged by REA, NRECA, and Michigan State in all aspects of utility company management and practices. In addition 8 lower level personnel will receive short term training in rural electrification in Nicaragua and Costa Rica. Three people will be selected from the technical departments to receive academic and specialized training for periods of one year in the U.S. Study will be in such areas as rate analysis, systems planning, project design and customer relations for the power sector. (See Section 5 for detailed cost estimates for technical assistance and training.)

4. Evaluation System

An evaluation to measure the rate of adoption of electricity for productive purposes by low income rural families and assess the impact on their productivity will be undertaken.

The impact evaluation methodology and plan of implementation will be designed by the end of the first year of the project by a consultant contracted by TAR/Office of Rural Development in AID/W, who will work closely with INDE staff. Baseline data gathering activities, which will be designed to fit into INDE's normal operations to the extent possible, will begin sometime during the first year of the project. In the final year of the project, USAID will obtain services contracted to study the project's impact. Loan funds will pay for personnel hired by INDE as enumerators and analysts for the evaluation. In addition, annual progress evaluations (country level) will be conducted by INDE and the USAID in January of each year of project implementation beginning in CY 1983.

#### IV. PROJECT ANALYSIS

##### A. Technical Analysis

##### 1. Description of INDE System

In the eighteen years since its creation INDE has grown to be the dominant electric power entity of the country supplying electrical energy to approximately 250,000 users. Approximately 70,000 of these users are served directly by INDE while the remainder are served through block sales to municipalities and the Empresa Eléctrica (the electric power company which serves Guatemala City and nearby towns). There are approximately 6,000 employees on its payroll.

As of December 31, 1976, INDE's system had total assets of \$175,420,000 of which \$70,963,000 was net property, plant and equipment. INDE's average rate base for 1976 was \$61,780,544 on which it earned a rate of return of 6.69%. A recent analysis indicates that this low return is caused by the fact that current block sales and industrial user rates do not appear to cover the cost of generation.

At the end of 1976 INDE owned 77% of the in-service generation capacity in the country with a mix of hydroelectric, steam, gas turbine and diesel plants. The remaining capacity is owned by Empresa Eléctrica and isolated municipalities. Another 390 MW will be added by 1982 when Chixoy and Aguacapa are completed.

Approximately 91% of INDE's kWh sales are to block customers including the government owned Empresa Eléctrica de Guatemala and other municipalities. As a result, INDE's transmission, substation and line requirements for providing services to these entities are minimal. The major generating plants are located in Palin and Escuintla, near

Guatemala City and are tied together with 138 KV transmission lines.

Substations outside the Guatemala City complex serve distribution systems which are tied together by subtransmission lines. To these substations are connected INDE's own distribution systems and 13 municipal block customers. With the exception of small isolated plants in the Peten and Izabal, all of INDE's system is interconnected.

INDE's subtransmission and distribution system is very modern and well built generally following REA Standards. It is a mix of five different voltages as indicated in the table below:

69	KV (3 $\phi$ )	693.3 Kms.
34.5	KV (3 $\phi$ )	513.8 Kms.
19.1	KV (1 $\phi$ )	9.0 Kms.
13.2	KV (3 $\phi$ )	1,587.04 Kms.
7.6	KV (1 $\phi$ )	143.32 Kms.

Detailed information on INDE's existing and planned facilities is provided in Annex J.

Present and projected generating capacity is shown in the table on the following page. Present firm capacity 1/ is about 354 MW and projected to reach about 693 MW in 1983. Projected demand in 1978 is estimated at 250 MW and is estimated to reach 412 MW in 1983. Demand for energizing new customers connected by this project is estimated to reach about 12 MW in 1983. This represents less than two percent of the projected firm generating

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1/ Firm capacity is the installed capacity less the largest single generating unit in service.

GUATEMALAN INTERCONNECTED SYSTEM CAPACITY AND DEMAND

<u>YEAR</u>	<u>CAPACITY - MW</u>			<u>DEMAND - MW</u>		
	<u>Installed Capacity</u>	<u>Largest Unit</u>	<u>Firm Capacity</u>	<u>Total Real</u>	<u>Total Projected</u>	<u>Projected for This Project</u>
1974	209.5	33	176.5	163.1	-	-
1975	209.5	33	176.5	185.0	-	-
1976	259.5	33	226.5	199.5	-	-
1977	362.5	53	309.5	227.0	-	-
1978	362.5	53	309.5	-	250	-
1979	452.5	53	399.3	-	275	1.1
1980	452.5	53	399.3	-	304	3.3
1981	452.5	53	399.5	-	336	5.9
1982	752.5	60	692.5	-	371	8.5
1983	752.5	60	692.5	-	412	10.2

capacity and about three percent of projected demand. In the period following 1983, demand created by this project is projected to increase at seven percent annually. Therefore, it is evident that even though large numbers of rural inhabitants will receive electrical services, the project will have in significant impact on the overall generation and transmission system. Furthermore, the rural electric system expansion does not require additional high voltage transmission. The incremental costs for delivering this service are limited to expansion of the distribution system and construction of three subtransmission lines and two substations.

2. Technical Description - Construction Activities

This project will finance subtransmission lines, distribution substations, primary and secondary distribution lines, distribution transformers, meters, and service drops for 70,000 customers. Essential equipment, technical assistance, and house wiring for 70,000 customers will also be financed. The total estimated cost is \$15 million.

The project will serve 33,000 new customers in approximately 309 villages presently without electricity and connect an additional 37,000 customers in 333 already electrified villages. The total estimated population to be served is about 430,000.

a. Subtransmission Lines (See map on following page)

Under the project two 69 KV subtransmission lines totaling 150 Kms., will be constructed. These three subtransmission lines are designed to bring power from transfer points in the system to load centers; existing 138 KV transmission lines bring the power from generation stations to the system transfer points.

Because of the topography of the land and the distances involved, 69 KV subtransmission is appropriate for reaching the remote areas of this project. The alternative to building 69 KV subtransmission system which will supply sufficient power for rural distribution is to replicate the past pattern of isolated diesel generators. Experience has shown that this alternative is not very practical in view of logistic problems, the training required, fuel quality and supply, maintenance, and spare parts. In addition, the cost would frequently be greater, and the probable useful life of the equipment might be in the range of 10-20 years (depending on the quality of maintenance); whereas the useful life of 69 KV lines and substations could be 40-50 years or more.

- Zaragoza-Quezaltenango Line

This line will extend from a substation being built by INDE in Zaragoza to Quezaltenango in the Western Highlands where it will connect to an existing substation. These substations and others financed under loan 019 in the Western Highland area which are connected into an existing 69 KV network would be the foci for distribution expansion in this AID geographic target area. The distance covered by this line is approximately 94 Kms.

The Quezaltenango substation is presently served by a 69 KV subtransmission line from Escuintla, a distance of about 200 Kms., with a 12 MW capacity on 477 MCM aluminium conductor which is standard. There is an additional distance of 100 Kms. to Huehuetenango which is also served by this line.

The actual loading on the existing 69 KV line between Escuintla and Quezaltenango in recent months has been as follows:

<u>1978</u>	<u>Peak Loading</u> <u>1/</u>
January	29.0 MW
February	30.0 MW
March	30.0 MW
April	31.0 MW

As can be seen from the above this line is grossly overloaded during peak periods. The new line by completing a loop from Antigua, Zaragoza, Quezaltenango, South Coast, and Escuintla will add considerably to INDE's capacity to provide quality service by reducing outages and maintaining stable voltage.

- El Progreso-Quezaltepeque Line

The second line will be built in the Eastern target group area from El Progreso, Department of Jutiapa to a new substation, which will be financed under the loan, in Quezaltepeque, Department of Chiquimula. With a length of 56 Kms. this line will make it possible to serve about 40 villages that cannot be served from the substation in Quezaltepeque because of the distances involved. The small substation (0.6 MW) presently located in Quezaltepeque and fed by an overloaded 34.5 KV line from Zacapa is providing poor quality services for only three towns. Larger volumes of power must be introduced in order to adequately serve the area.

Subtransmission (69 KV) Lines - Estimated Costs

	<u>Qty.</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total Cost</u>
			\$	\$
a. Zaragoza-Quezaltepeque	94	Kms.	17,574	1,652,000
b. El Progreso-Quezaltepeque	56	Kms.	17,589	985,000
				<u>\$2,637,000</u>

1/ Calculated on a power factor of 80%

b. Substations

One substation for reducing line voltage with a capacity of 5 MVA will be constructed in Quezaltepeque. REA standards and specifications are to be used. Cost is estimated at \$290,000.

c. Distribution Systems

1) Primary Distribution Lines

About 591 Kms. of primary line of different voltages will be built to relay power from substations to line transformers in population groupings. REA standards for spacing and insulation on the lines will be followed. Aluminium conductor will be used for the lines and compression-type connectors will be used to the maximum extent possible. The breakdown of the lines by voltage and costs is shown at the end of this section.

2) Secondary Distribution Lines

A total of 489 Kms. of secondary distribution lines (120/240 V), will be built to extend the electric service from the line transformers in the villages to the customer service drops. These lines will also follow REA design standards. Aluminium conductor will be used for the lines and compression-type connectors will be generally used.

3) Distribution Transformers

Distribution transformers will be installed to reduce primary distribution line voltage to 120/240 V for secondary distribution. An estimated 900 (10 KVA 706 KV/120-240V) transformers will be required.

DISTRIBUTION SYSTEM ESTIMATED COSTS -

<u>Item</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Total Cost</u>
<u>1. Primary Distribution Lines</u>			
a. 34.5 KV (3 ϕ)	7.6 Km.	\$7.250/Km.	55,100
b. 19.1 KV (1 ϕ)	101.0 Km.	5,011/Km.	506,131
c. 13.2 KV (3 ϕ)	95.0 Km.	6,345/Km.	603,408
d. 7.6 KV (1 ϕ)	387.2 Km.	3,910/Km.	1,514,074
<u>2. Secondary Distribution Lines</u>			
a. 120/240 V new villages	402.6 Km.	5,680/Km.	2,286,725
b. 120/240 V electrified villages	86.0	5,670/Km.	487,656
<u>3. Distribution Transformers</u> (10 KVA 7.6 KV/120-240 V)			
a. New villages	845	363.21	306,912
b. Electrified villages	66	359.77	23,745
<u>4. Meters and Service Drops</u> (meters at \$16.00 and service drops at \$15.00)			
a. New villages	33,287	\$31.04	1,033,369
b. Electrified villages	37,394	31.19	1,166,199
<u>5. House Wiring</u>	70,000	20.00	626,285 <u>1/</u>

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1/ This represents the net cost outlay for house wiring assuming that the total cost will be recuperated in four years at the rate of \$0.44 per month per customer. Collections will start upon receipt of electrical service.

#### 4) Meters and Service Drops

In order to deliver power from the secondary distribution lines to the customers, meters and service drops will be installed. These installations will be made in conjunction with construction of the primary and secondary lines in order to reduce cost and time lag in provision of service.

#### 5) House Wiring

Independent construction crews will be contracted to install house wiring with work to be timed with construction on distribution systems. A standard house wiring plan will be used consisting of about three light sockets and two outlets. Owners of houses and businesses that require more extensive wiring will make their own arrangements for the work. House owners will be billed for the cost of wiring as a component of the monthly service bill over a four year period. Based on an estimated \$20 per house this will add 44 ¢ per month which includes a 3% service fee. Local labor will be hired as part of the wiring crews so as to provide training for villagers who will continue to be available to users for repairs (internal wiring is considered to be property of the house owner). Over the life of the project part of the house wiring costs will be financed through repayments received from customers hooked up in the initial years of the project.

d. Method of Construction and Supervision.

INDE has decided that all new works, subtransmission lines, substations and distribution systems in areas not presently served will be built by contract. Additional services in areas where distribution systems exist will be installed directly by INDE.

INDE is examining two alternative plans for materials procurement: Direct INDE procurement of total construction material needs for the project; or inclusion of material requirements in construction contracts (in which case INDE would procure directly only for force account construction). The first approach which was used in the prior rural electrification project, offers potential savings through quantity procurement. However, it also requires greater administrative and logistics effort on INDE's part to ensure that delivery of materials to contractors coincides with their construction schedules. The final determination of the preferred procurement method will be made prior to the first disbursement of loan funds and incorporated into the project procurement plan which INDE is required to submit as a condition precedent. For both contract and force account work INDE will contract for consulting services to review plans, specifications, cost estimates, and bid documents. Consulting firm will also be required to certify construction payments, both contract and force account and to assist with meeting reporting requirements. (See Section V.B. for the procurement plan).

e. Service and Maintenance

As service is extended to increasing numbers of customers, INDE must expand its capacity to maintain and service the system. INDE and the USAID have reviewed regional office and warehouse requirements and believe that physical facilities in place are adequate to meet project needs. There is, however, a requirement for additional testing and line maintenance equipment. There is also a requirement that additional linemen and maintenance personnel be trained. INDE will undertake to train and add staff to perform the linesmen and maintenance function. Since this training is all on-the-job, there are basically no costs to be financed. INDE will expand its cadre of linesmen and maintenance personnel, if required, and finance it from its own operational budget. Essential equipment requirements are estimated to cost \$300,000. A list of equipment is shown in Annex J.

3. Technical Description - Training and Technical Assistance.

The project will double the number of INDE direct customers in rural areas. INDE will hookup as many new rural customers during project implementation as it has hooked up since its creation. Further-

more, elimination of the front end charges is likely to create a large effective demand for a continued high level of hookups in rural areas after the project implementation period. This expansion of rural electrification services requires that INDE not only correct some minor deficiencies in its present administrative capability, but also enhance its capability to provide customer services and develop a promotional program for the use of electricity in the rural areas.

a. Improved INDE Management and Technical Capacity

Several consultants have studied INDE's administrative capability and have made observations on areas in which INDE's management, planning and operations need improvement.

A World Bank analysis prepared for the Aguacapa Project Appraisal Report detected weaknesses in financial management, rate analysis and asset evaluation. Funds were provided under the loan for the Aguacapa project to provide technical assistance to INDE in financial management. Funds were also made available to support a rate study and to reevaluate assets.

USAID personnel and consultants have detected certain weaknesses that may constrain INDE from providing efficient rural electrification services.

Training and technical assistance will be financed to strengthen INDE's capacity in:

(i) Development of Comprehensive Program for Extension of Rural Electrification. Many of the technical and non-technical problems INDE faces in rapidly expanding rural electrification have been

faced by other developing countries. INDE has competent technicians at all levels of management who can rapidly adapt solutions that have proven effective elsewhere to technical problems in INDE's system. INDE's technicians and executives can also quickly adopt techniques used elsewhere to improve comprehensive planning for Guatemala's rural electrification expansion program. INDE and the Mission have agreed that the most effective way to develop INDE's comprehensive programming capability is through participant training.

Executive level managers from INDE will receive short-term training in utility company management and practices in order to strengthen and reinforce INDE's overall capability in providing effective service to 70,000 additional customers. These courses sponsored by REA, NRECA, Michigan State and other institutions experienced in utility management will be beneficial. Such courses are specifically oriented to utility system managers from developing countries. Participation of INDE executives will allow ample opportunity for discussion of common problems and development of practical solutions. In addition, technical personnel from INDE will be sent to other Central American countries, such as Nicaragua and Costa Rica, to observe the technical practices of on-going rural electrification programs. These countries have had a long experience with rural electrification and resemble the Guatemalan environment. They should be able to further demonstrate practical ways of extending electrification to low income rural areas.

The ideas developed through participant training will help INDE prepare, during the third and fourth years of the project, a program for extending rural electrification services to additional rural consumers after the end of the project. This program will be a major exercise for INDE due to its long term focus (20 years).

(ii) Simplification of INDE's System Components. INDE's substations in its existing rural electrification network are costly and over-designed. Consultants have estimated that the cost of substations could be reduced by 20 - 25% without endangering other system components by simpler, more functional designs. Furthermore, with INDE's patchwork of different voltage lines, the Institute may be incurring discontinuity in operation due to the need for more frequent and costly high voltage transformation. INDE and the Mission have agreed that improvements in these areas could be most effectively achieved by assistance to INDE's technical staff. The technical advisors will help INDE to: design simpler substations without reducing design standards or system capability; improve distribution system design, including the development of unit cost data for lines of different voltages and analysis of economic trade-offs between them. Other areas where technical assistance will be required to help INDE achieve greater efficiency in rural electrification systems have been identified in consultant reports.<sup>1/</sup> INDE is studying its needs and will submit a list of the areas in which technical assistance is most needed as a technical assistance plan to be submitted as a condition precedent to initial disbursement.

(iii) Developing an In-house Capability in Rate Analysis and Rural Electrification Systems Planning. Because INDE will be required to review periodically the rate structure, after the IBRD-financed rate study has been completed, an increased capability for undertaking rate analysis is essential to INDE's institutional development. INDE does not have this in-house capability and has placed heavy reliance on foreign consultants who specialize

<sup>1/</sup> Rural Electrification Rate Study Guatemala, March 31, 1977, Sanderson & Porter, Inc. N.Y., and Review of Proposed Rural Electrification Plan for Guatemala and Recommendations for Technical Assistance to INDE, July 20, 1977, Alf Carrell, Little Valley, New York.

in power rates. INDE technicians will receive training in power rate analysis. In addition, one of the loan's objectives is the institutionalization of the rural electrification program within INDE's overall power development program. In furtherance of this objective training in overall planning, including rural electrification distribution systems will be provided under the loan.

b. Improved INDE Field Service Capability

Because INDE will double the number of direct 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.

(i) Improved Maintenance Capability.

The capacity of INDE's regional field offices to maintain the rural electrification distribution system will be strengthened by the training of additional linesmen and maintenance personnel. Where required, additional staff to perform these functions will be hired. Because the training will be on-the-job, there are basically no costs to be financed over and above the labor costs for construction. Added staff will be financed out of INDE's own operating budget.

(ii) Improved Billing and Collection Procedures. While INDE's collections of user charges have been good, there is room for improvement in both the percentage of charges collected and the timeliness of collections. Technical assistance will help INDE improve and expand its billing and collections system in rural areas. 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 emitted 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. The technical assistance will help to conduct a systematic analysis of the entire process and develop a more efficient and effective billing and collection system. Alternatives to the system of paying collection agents on a commission basis, as well as the more innovative and effective use of the new computer system INDE has ordered, will be studied in developing a billing and collection system which takes into account both INDE's need for prompt collections and the payment capacities of low income rural users. The loan will finance technical assistance to improve the prevailing situation.

(iii) 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 services as connections and disconnections, special voltage installations, and other similar requests will be placed on INDE field services. In order to improve outreach capability, technical assistance has been provided for under the loan.

(iv) Development of an Education/Promotional Program for the Rural Areas. At present, INDE does not have sufficient generating capacity to provide regular and reliable service to all of its customers. Consequently, it has not developed a pro-

gram to increase the sale and use of electricity in rural areas. Two new hydrogeneration projects are now under construction and by 1979 (when this program is starting to connect new users), INDE will have excess generating capacity and will need to increase sales. INDE wishes to promote the productive use of electricity for two reasons: increased profitability for the Institute, and a recognition that low income users can increase their incomes by employing electricity in productive activities. INDE also recognizes that most new users will need to be educated to ensure safety in the use of electricity. Consequently, INDE will design, test, and implement a promotional and educational program for potential new customers in rural areas. Technical services to develop instructional materials and demonstration programs and train INDE field promoters to carry out a promotional and educational campaign in power use for rural users is contemplated.

A breakdown of all technical assistance and training estimated costs is included on the following pages.

COST ESTIMATES FOR TECHNICAL ASSISTANCE AND  
TRAINING FOR INDE MANAGEMENT AND TECHNICAL PERSONNEL

I.	<u>TECHNICAL ASSISTANCE</u>		<u>\$227,000</u>
1.	Technical Practices		<u>\$35,760</u>
	4 months x \$7,560/month (includes salary, overhead \$ fee)	= \$30,240	
	Travel 1 x \$600/r.t.	= 600	
	Per Diem 120 days x \$41	= 4,920	
2.	Rate Analysis		<u>\$18,180</u>
	2 months x \$7,560/month	= \$15,120	
	Travel 1 x \$600/r.t.	= 600	
	Per Diem 60 days x \$41	= 2,460	
3.	Commercial Operations		<u>\$89,100</u>
	10 months x \$7,560/month	= \$75,600	
	Travel 2 x \$600/r.t.	= 1,200	
	Per Diem 300 x \$41	= 12,300	
4.	Other Consultants		<u>\$53,340</u>
	6 months x \$7,560/month	= \$45,360	
	Travel 1 x \$600/r.t.	= 600	
	Per Diem 180 days x \$41	= 7,380	
5.	INDE Contract Personnel and Evaluation Local Costs		<u>\$30,620</u>
II.	<u>TRAINING</u>		<u>\$ 73,000</u>
1.	One month course in rural electrification in Nicaragua and Costa Rica for 8 persons		<u>\$10,900</u>
	Travel	= \$ 800	
	Per Diem	= 9,600	
	Other	= 500	

2. Five INDE Executives to special courses in U.S. for 30 days		<u>\$20,400</u>
Travel	=	\$ 3,000
Per Diem	=	5,400
Course expenses	=	10,000
Travel in U.S.	=	2,000
3. Equivalent of Three Technicians for one-year training in U.S. at \$13,900 each		<u>\$41,700</u>

B. Financial Analysis

1. Financial Plan

The total estimated cost of the project is \$15.0 million of which \$8.6 million, or 57% will be financed by AID. The Government of Guatemala will provide the remaining \$6.4 million.

The AID contribution is projected as follows:

a. All of the foreign exchange costs of off-shore procurement of equipment, materials and services required for the construction of the subtransmission/distribution system and related maintenance and service equipment. (\$3,400,000).

b. 42% of the local currency costs of construction of the subtransmission/distribution system (\$3,570,000).

c. The total cost (including local currency) of the consulting engineers and technical assistance and training. (\$600,000).

d. Contingency and Inflation factors. (\$1,030,000).

The GOG contribution is projected as follows:

(a) 58% of the local currency costs of installation and local materials related to the

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construction of the subtransmission/distribution system (\$4,870,000).

(b) The total costs of INDE engineering and administrative expense related to the project (\$760,000).

(c) Inflation and contingency - (\$770,000).

The source and uses of funds, disbursement schedule and costing of project outputs are shown in the following tables. A more detailed cost breakdown for the subtransmission/distribution systems is contained in Section IV.A., Technical Analysis.

TABLE  
Source and Use of Funds  
(in 000)

	AID		GOG	Total
	<u>\$</u>	<u>Q</u>	<u>Q</u>	<u>\$ Equiv.</u>
1. Construction of Sub-Transmission/Distribution <sup>1/</sup>				
- Oriente	1,560	1,790	2,450	5,800
- Highlands	1,250	1,440	1,960	4,650
- South Coast	<u>290</u>	<u>340</u>	<u>460</u>	<u>1,090</u>
Subtotal	3,100	3,570	4,870	11,540
2. Consulting Engineer	240	60	-	300
3. INDE Engineering & Administration	-	-	760	760
4. Maintenance & Service Equipment	300	-	-	300
5. Technical Assistance & Training	250	50	-	300
6. Inflation <sup>2/</sup>	440	500	700	1,640
7. Contingency	<u>40</u>	<u>50</u>	<u>70</u>	<u>160</u>
Total	<u>4,370</u>	<u>4,230</u>	<u>6,400</u>	<u>15,000</u>

<sup>1/</sup> Based on actual cost data gathered under prior AID loan No. 520-L-019 with allowance for inflation from the time 019 construction was completed.

<sup>2/</sup> Provides for 10% annual inflation rate applied against projected disbursements for construction.

TABLE

Disbursement Schedule  
(in 000)

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Total</u>
1. Construction					
- Materials	2,460	5,745			8,205
- Labor	840	900	770	825	3,335
2. Consulting					
- Engineer	75	75	75	75	300
3. INDE Admin. & Engineering	215	210	155	180	760
4. Maintenance & Service Equip.	75	75	90	60	300
5. Technical Assistance & Training	75	75	90	60	300
6. Inflation	165	995	190	290	1,640
7. Contingency	<u>15</u>	<u>95</u>	<u>20</u>	<u>30</u>	<u>160</u>
Total	<u>3,920</u>	<u>8,170</u>	<u>1,390</u>	<u>1,520</u>	<u>15,000</u>

TABLE

Costing of Project Outputs  
(in 000)

<u>Project Inputs</u>	<u>Project Outputs</u>			
	<u>No. 1</u>	<u>No. 2</u>	<u>No. 3</u>	<u>TOTAL</u>
1. Construction	11,540	-	-	11,540
2. Consulting Engineer	300	-	-	300
3. INDE Engineering and Administration	440	160	160	760
4. Equipment	300	-	-	300
5. Technical Assistance & Training	-	150	150	300
6. Inflation	1,560	40	40	1,640
7. Contingency	<u>150</u>	<u>5</u>	<u>5</u>	<u>160</u>
Total	<u>14,290</u>	<u>355</u>	<u>355</u>	<u>15,000</u>

No. 1 -- Subtransmission/Distribution system installed and operating.

No. 2 -- Trained personnel.

No. 3 -- INDE administrative procedures improved.

## 2. Financial Viability

### a. Rates of Return

Financial rates of return were calculated for the project using both the internal rate of return (IRR) method and the World Bank utility rate of return method (annual rate of return on average value of net fixed assets). The financial IRR was calculated using a base case projection and high and low option projections. The utility rate of return was calculated on the high and low option projections. The results are as follows:

	<u>Financial Returns</u>	
	<u>IRR</u>	<u>Utility</u> <sup>1/</sup>
Base Case	8.8%	-
High Option	10.5%	21.1%
Low Option	7.0%	16.7%

The IRR for the low option compares favorably with the current cost of borrowing money through government bonds (7 to 8%). The project is thus considered to be financially viable.

The utility return method yields higher rates since it is more an accounting measure and does not consider the time value of cash flows, i.e., it does not discount cash flows. The utility returns reach the stipulated IBRD minimum of 9% in the eleventh year of the project for the low option and in the fifth year of the project for the high option.

<sup>1/</sup> Utility rates of return are calculated on an annual basis. The figures shown here thus represent the average annual rate of return over a 30 year period.

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b. Basis for Financial Projections

Base Case and High/Low Projections

Because INDE's revised system-wide rate structure is yet to be determined it is necessary to make certain assumptions in order to arrive at the cash flow to be derived from INDE sales. The new rate structure will have to consider the elimination of the front-end charge which is a fundamental objective of this project. Therefore, some increase of the monthly rate is anticipated in order to, in effect, amortize the construction cost.

The current minimum monthly bill is \$1.00 which covers 12 KWH of use. In a recent AID-INDE survey, the most frequently cited monthly amount which could be afforded by the respondents was \$2.00. To provide a lower limit for the likely range into which a new minimum rate would fall, it was assumed that the rate would have to be increased by \$0.50. The financial analysis is therefore calculated on the basis of three different minimum monthly rates.

(i) Base Case: \$0.75/month (for a total minimum bill of \$1.75)\* This represents the best estimate at this time of what the fee may likely be.

(ii) High Option: \$1.00/month (for a total minimum bill of \$2.00)\* This is the most frequently cited figure which survey respondents said was affordable.

(iii) Low Option: \$0.50/month (for a total minimum bill of \$1.50)\* This represents the estimated minimum rate increase which is anticipated.

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\* Excludes house wiring.

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Sales and Cost of Sales :

The annual new connections projected over the period of the project (30 years) are comprised of the 70,000 new residential and commercial hook ups during the disbursement period plus the continuation of hook ups at the rate of least 6000 per year after the disbursement period. Residential connections were assumed to comprise 95% and commercial 5% of total new connections.

The average rate of consumption of residential users was estimated initially at 200 KWH/household/year, increasing at the rate of 3.2%/year until the seventh year and at 4.5%/year thereafter. The average annual consumption per household thus reaches 604 KWH by the end of the 30 year period.

The annual consumption rate for commercial users was estimated initially at 600 KWH, increasing at the rate of 5% through the seventh year, and 3% thereafter, to a high of 1511 KWH.

Public lighting and government municipal consumption rates were estimated at the rate of 40 KWH per year and 8 KWH per year, respectively, per new residential and commercial connection in the newly electrified villages (on the assumption that already electrified villages already had these services).

Industrial consumption was estimated at 1.5% of residential consumption.

All of these projections were arrived at jointly between AID and INDE and are essentially conservative estimates based on an analysis of INDE historical data. A comparison of INDE's historical experience and the estimates used in the financial analysis is included in Section IV.C., Economic Analysis, along with a discussion of the underlying rationale for the figures that were selected.

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The cost per KWH over the period covered by INDE's projections (See table next page) includes adjustments for both expected unusual increases in the price of fuel (already the largest single cost component in the generation of electricity) and the phased changeover to the use of less expensive hydroelectric generation. Average cost per KWH fluctuate slightly until 1982 at which time there is a significant reduction in per KWH production cost, beginning with the introduction of INDE's largest hydro-electric generating facility. From 1983 on INDE's generating facilities will be almost entirely hydro-electric. Fuel cost per KWH beyond 1983 was therefore held constant since any fluctuations in fuel cost would have only minimal impact on INDE's overall generation costs.

The sales price per KWH electricity used for the projections is the current sales price (\$1.00 for 12 KWH) for the target group in the areas covered by this project. This price was kept constant as no unusual increase in price is projected (other than normal inflationary increases). The three amortization fee assumptions and other revenues have been set forth separately as a function of the number of users rather than the KWH consumption.

IRR Cash Flows

The cash flow projections for purposes of the Financial IRR consists of the following (See tables on the next pages):

- Net sales and cost of sales calculated in the manner described above.
- Projected rate increase for three monthly amortization fees (low option, high option and base case).
- Reflows from amortization of housewiring costs.
- Consumer Deposits (\$2.00 per new hook up).

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TOTAL ADMIN., OPERATIONS, AND MAINT. COST PROJECTIONS

	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>
1. Average Cost w/o Int. and Depreciation (¢ 1 Kwh)	5.85	4.86	5.19	5.50	2.49	2.21
2. Average Cost Incl. Interest (¢ 1 Kwh)	6.85	6.38	6.65	6.85	4.55	4.05
3. Average Cost Incl. Depreciation (¢1 Kwh)	6.83	6.10	6.45	6.76	4.53	4.03
4. Average Cost Incl. Int. & Depreciation (¢ 1 Kwh)	7.83	7.63	7.90	8.10	6.59	5.86

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- Total project investments.
- Interest charges on AID loan.

(Supporting financial tables are shown in Annex K.)

Utility Rate of Return

To ensure that this project would not prejudice INDE's position relative to the IBRD requirement that INDE maintain at least a 9% annual utility rate of return on its total investments, the utility rate of return for the AID project was calculated. This required adjustment of certain figures in the financial IRR calculation. Cumulative fixed investment was adjusted to reflect accumulated depreciation at the rate of 3%/year. Net income was also adjusted to reflect the annual depreciation charge and to exclude interest payments. The utility rate of return was calculated for both the high and low options. The results are shown in the table on the following page.

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ANNUAL UTILITY RATE OF RETURN ON AVERAGE ANNUAL VALUE OF FIXED ASSETS  
(Computed in Accordance with ICRD Method)

Year	Annual Fixed Investment	Cumulative Fixed Investment	Annual Depreciation at 3%	Cumulative Depreciation	Net Fixed Assets 1/	Annual Average Net Fixed Assets	Net Income at Current Rates 2/	Annual Depreciation Charges at 3%	Increment Due to Rate Increase		Total Net Income		Rate of Return on Average Fixed Assets	
									Low	High	Low	High	Low	High
1	3,925	3,925	118	118	3,807	1,904	41	118	51	102	(26)	25	(1.4)	1.3
2	8,174	12,099	363	481	11,618	7,712	101	363	154	308	(108)	46	(1.4)	0.6
3	1,388	13,487	405	886	12,601	12,109	143	405	261	522	(1)	260	(0.0)	2.1
4	1,513	15,000	450	1,336	13,664	13,132	692	50	370	739	612	981	4.7	7.5
5	1,327	16,327	490	1,826	14,501	14,082	910	490	442	884	862	1,304	6.1	9.3
6	1,318	17,645	529	2,355	15,290	14,895	1,019	529	478	956	968	1,446	6.5	9.7
7	1,309	18,954	569	2,924	16,030	16,660	1,133	569	514	1,028	1,078	1,592	6.9	10.2
8	1,299	20,253	607	3,531	16,722	16,376	1,269	607	550	1,100	1,212	1,762	7.4	10.8
9	1,290	21,543	646	4,177	17,366	17,044	1,406	646	586	1,172	1,346	1,932	7.9	11.3
10	1,280	22,823	684	4,861	17,962	17,664	1,557	684	622	1,244	1,495	2,117	8.5	12.0
11	1,270	24,093	722	5,583	18,510	18,236	1,716	722	658	1,316	1,652	2,310	9.1	12.7
12	1,260	25,353	760	6,343	19,010	18,760	1,888	760	694	1,388	1,822	2,516	9.7	13.4
13	1,250	26,603	798	7,141	19,462	19,236	2,071	798	730	1,460	2,003	2,733	10.4	14.2
14	1,239	27,842	835	7,976	19,866	19,664	2,264	835	766	1,532	2,195	2,961	11.2	15.1
15	1,228	29,070	872	8,848	20,222	20,044	2,473	872	802	1,604	2,403	3,205	12.0	16.0
16	1,216	30,285	908	9,756	20,530	20,376	2,694	908	838	1,676	2,624	3,462	12.9	17.0
17	1,205	31,491	944	10,700	20,791	20,660	2,928	944	874	1,748	2,858	3,732	13.8	18.1
18	1,193	32,684	981	11,681	21,003	20,897	3,179	981	910	1,820	3,108	4,018	14.9	19.2
19	1,181	33,865	1,016	12,697	21,168	21,085	3,446	1,016	946	1,892	3,376	4,322	16.0	20.5
20	1,168	35,033	1,051	13,748	21,285	21,226	3,730	1,051	982	1,964	3,661	4,643	17.2	21.9
21	1,155	36,188	1,086	14,834	21,354	21,319	4,032	1,086	1,018	2,035	3,964	4,982	18.6	23.4
22	1,142	37,330	1,120	15,954	21,376	21,365	4,293	1,120	1,054	2,108	4,217	5,281	19.7	24.7
23	1,129	38,459	1,154	17,100	21,359	21,367	4,632	1,154	1,090	2,180	4,568	5,658	21.4	26.5
24	1,115	39,574	1,187	18,295	21,279	21,319	5,055	1,187	1,126	2,252	4,994	6,120	23.4	28.7
25	1,101	40,675	1,220	19,415	21,260	21,269	5,440	1,220	1,162	2,324	5,482	6,644	25.8	31.2
26	1,086	41,761	1,253	20,668	21,093	21,176	5,718	1,253	1,198	2,396	5,663	6,861	26.7	32.4
27	1,072	42,833	1,285	21,953	20,880	20,987	6,283	1,285	1,234	2,468	6,232	7,466	29.7	35.6
28	1,056	43,889	1,317	23,270	20,619	20,749	6,745	1,317	1,270	2,540	6,698	7,968	32.3	38.4
29	1,041	44,330	1,330	24,000	19,730	20,174	7,235	1,330	1,306	2,672	7,211	8,577	35.7	42.5
30	1,025	45,955	1,379	25,979	19,976	19,853	7,756	1,379	1,342	2,684	7,719	9,061	38.9	45.6
						<u>19,853</u>					<u>7,719</u>	<u>9,061</u>	<u>38.9</u>	<u>45.6</u>
						x*18,011					x*3,007	x*3,801	x*16.7	x*21.1

1/ End of year  
2/ Excluding Interest and Depreciation Charges

NET CASH FLOW - FINANCIAL RATE OF RETURN 1/

Year	Base Case Economic Net Cash Flow	(Interest Adj)	Base Case Net Financial Cash Flow	(Low Option) Adjustment)	Low Option Flow	High Option + Adjustm.	High Option Flow
1	3729	32	3761	25	3786	26	3735
2	7671	91	7762	77	7839	77	7685
3	588	148	736	130	866	131	605
4	94	329	235	184	419	185	50
5	602	364	238	221	17	221	459
6	715	408	307	239	68	239	546
7	830	455	375	257	118	257	632
8	962	507	455	275	180	275	780
9	1134	563	571	293	278	293	864
10	1349	622	727	311	416	311	1038
11	1572	686	886	329	557	329	1215
12	1808	753	1055	347	708	347	1402
13	2055	824	1231	365	866	365	1596
14	2313	900	1413	383	1030	383	1796
15	2587	980	1607	401	1206	401	2008
16	2874	1066	1808	419	1389	419	2227
17	3173	1157	2016	437	1579	437	2453
18	3490	1254	2236	455	1781	455	2691
19	3823	1357	2466	473	1993	473	2939
20	4204	1466	2738	491	2247	491	3229
21	4543	1582	2961	509	2452	509	3470
22	4871	1683	3188	527	2661	527	3715
23	5277	1812	3465	545	2920	545	4010
24	5768	1973	3795	563	3232	563	4358
25	6221	2119	4102	581	3521	581	4683
26	6568	2386	4182	599	3583	599	4781
27	7201	2440	4761	617	4144	617	5378
28	7730	2615	5115	635	4480	635	5750
29	8290	2801	5489	653	4836	653	6142
30	8883	2995	5888	671	5217	671	6559

INTERNAL RATE OF RETURN

8.78%

7.00%

10.46%

### 3. Analysis of INDE's Financial Statements

INDE's comparative Balance Sheets, Income Statements and Statements of Changes in Financial Position for the years ending December 31, 1973 through 1976, along with certain financial indicators shown in the lower margin of the Balance Sheets and Income Statements are shown in Annex K, Exhibits 8, 9, 10 and 11. All financial information was extracted from statements on which unqualified opinions were given by external auditors.

The Financial Statements reflect growth in total assets of 230% (\$76.3 million in 1973 to \$175.4 million in 1976) and an increase in net income of 196% (\$1.3 million in 1973 to \$2.5 million in 1976).

In 1975 the historical growth of net income was reversed, falling from \$2.0 million in 1974 to \$28,600 in 1975. The 1975 drop in net income was primarily due to the increase in petroleum prices combined with general inflation. Profitability recovered in 1976 as a result of rate increases to INDE's customers.

Financial indicators shown on the Balance Sheets reflect an excellent current position. Current ratios of 1.68:1.00; 1.85:1.00; 2.35:1.00; and 2.0:1.00 in 1973, 1974, 1975 and 1976 respectively, combined with debt equity ratios of 0.6:1.0 in 1973; 0.6:1.0 in 1974; 0.7:1.0 in 1975 and 0.6:1.0 in 1976 indicate a solid current position financed principally by government contributions to equity. These contributions accounted for over 54% of total available resources between 1973 and 1976.

The Table of Breakdown of INDE's Capital Account reflects an increase in Government contributions of \$60.2 million over the four year period 1973-1976 which represents 71% of the total Capital Account.

Comparative Income Statements for the years 1973 and 1976 show an increase in net income of \$1.2 million. This increase is attributed mostly to an increase in block sales from \$8.2 million in 1973 to \$20.4 million in 1976. Block sales in 1976 accounted for 91% of total KWH sold. Such sales account for 81% of dollar sales. INDE's largest block customer is the Empresa Eléctrica de Guatemala, which accounted for 92% of total block sales.

Direct Sales which have also shown an increase in volume from \$1.8 million in 1973 to \$4.8 million in 1976, accounted for 19% of total sales in 1976. Income from direct sales was generated through the following classes of services:

<u>Services</u>	<u>TOTAL INCOME</u> (in US \$000's)	
	<u>Amount \$</u>	<u>Amount %</u>
Residential	1,829.3	38.1
Commercial	833.2	17.4
Industrial	1,467.8	30.6
Public Lighting	269.3	5.6
Municipal Lighting	85.6	1.8
Government Lighting	271.2	5.6
Other	44.7	.9
Total	<u>4,801.1</u>	<u>100.0</u>

Operating costs and General and Administrative Expenses increased by \$14.3 million, or 156% during the four-year period. Fuel prices increased \$11.3 million and accounted for 78.8% of the total increase in costs.

The Comparative Statements of Changes in Financial Position disclose that 75.8% (41.4 million) of INDE's 1976 resources were applied to expanding services through cons-

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truction and purchase of property plant and equipment, and \$2.4 million (4.4%) to debt servicing. In 1976 INDE had net income of \$2.5 million. It is significant to note that such income would have enabled INDE to service the principal portion of their external debt and retire bonds even if they had received no GOG assistance. The lack of GOG subsidies would, of course, have prevented any significant expansion of INDE's operations. Only a dramatic increase in rates would enable INDE to continue its growth at past levels if GOG contributions are not available in future years.

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C. Economic Analysis

1. Summary and Conclusions

Evidence from benefit/cost analysis and consumer surveys that will be reviewed here shows that many rural villages are ready for rural electrification. Constraining the rural electrification process are two major factors: the high front end charge for connections which is prohibitive for most rural families and the physical lack of distribution lines in many areas. The loan strategy is designed to overcome both constraints by using loan funds to build additional lines and cause the rate reform to occur. However, since GOG and AID loan funds are not sufficient to do all the distribution work required, the immediate line construction will be targeted on those villages and areas in which an immediate and productive use can be made of the electricity. The GOG will covenant to continue the hookup process at a rate of 10,000 houses annually thereafter.

There is considerable evidence that the great majority of rural households are now economically ready to become electric power consumers for household and productive uses. Household survey data (which is discussed in depth in the following chapter) shows that 95% of rural village households want to hook up now. This is supported by a high rate of application for services (which is subsequently frustrated by the high front-end hook up charge).

The survey data gives economic evidence as well as consumer desire information. Potential rural electric customers are now paying an average of \$1.54 per month for non-electric lighting costs (candles, kerosene lamps, etc.). They also indicated that they would be willing to pay \$2.00 per month for electricity. This projection of the new users is reasonable when compared with present user survey results of \$3.23 per month. The willingness to pay for electricity is shown dramatically in the following table.

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Ratio of Prices of Selected Municipal Distribution  
Systems to INDE's Direct Sales Prices, 1970

C o m p a n i e s	Consumption in HWH per month					
	10	20	40	60	80	100
	Price Ratios					
INDE	100	100	100	100	100	100
Empresa Servicios del Sur (Tiquisate) <sup>1/</sup>	198	106	103	113	118	141
Retalhuleu <sup>1/</sup>	370	199	120	115	120	121
San José <sup>1/</sup>	296	159	158	174	179	226
Sanarate <sup>2/</sup>	124	149	146	160	173	229
San Lucas Tolimán <sup>3/</sup>	124	116	117	128	138	
Malacatán <sup>3/</sup>	100	119	117	128	139	
Joyabaj <sup>3/</sup>	154	123	105	109	111	
Unweighted Average	163	134	121	128	135	163

<sup>1/</sup> South Coast<sup>2/</sup> Oriente<sup>3/</sup> Western Highlands

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## 2. Development Status of Project Regions

### a. Oriente

The eastern region or "oriente", is relatively more developed than the Western highlands. The inhabitants are almost entirely westernized and integrated into the money economy.

The relatively greater level of development in this region is a result of several factors. The area is on the main routes to El Salvador, Honduras and Guatemala's Caribbean port, Puerto Barrios and thus generally well served by transportation infrastructure. Rainfall is however, low (average of 600 mm, about 24 inches, per year) and concentrated into a rainy season of five months duration. Therefore, the land is not so crowded because it will not bear the intense agriculture of the more traditional Western highlands. The low rainfall disadvantage is at once an advantage in that the severe overcrowding seen elsewhere is not a negative factor here. The combination of low rainfall and lack of crowding (plus the prevalent good soil) gives ample opportunity for irrigation to provide large increments in yields. Deeply eroded river canyons, however, makes the usual river diversion-gravity flow irrigation systems prohibitively expensive in many cases. Pump irrigation, using river or well water is increasingly converting the medium sized plots of this low income region from one of single planting dry agriculture (basic grains) to double cropping of more tropical climate fruits and vegetables (as well as basic grains) for the Guatemala City and San Salvador (export) markets.

### b. South Coast

The area to be newly electrified on the South Coast is known as the area of "Parcelamientos". These Parcelamientos were large tracts of rich coastal land that were subdivided in the mid 1950's into 50 acre parcels for resettling by farmers under a GOG colonization program. An AID predecessor agency provided substantial assistance for this programs, including land clearing, construction of penetration roads, schools,

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technical assistance and the like. Electricity from the overloaded 69 KW subtransmission line from Escuintla to Quetzaltenango serves larger villages close to the main Coastal highway, but does not get down to the Parcelamientos which are closer to the Pacific Ocean.

The area has a productive agriculture base of corn, sorghum, cotton, sugarcane and cattle. Roads reaching the settlements have been paved. Throughout the area homes are being upgraded and the prevalence of trucks, motorbikes, tractors and farm implements indicates a prosperous progressive small farm culture. Occasionally, a small private generating plant is in evidence, and it is reported that owners of such plants will sell electricity to their immediate neighbors for \$1.00 per month per 40 watt light bulb for evening lighting service.

There appears to be ample availability of ground water in the area, and electric pump application for irrigation is anticipated given the otherwise suitable conditions for double cropping.

c. Western and Central Highlands

In the western and central highlands, INDE has undertaken a detailed survey of 180 villages to determine their individual readiness for productive application of electricity. In an econometric analysis of already electrified villages, thirteen variables were determined to be statistically significant in predicting a newly electrified village's power demand. Another three variables did not have coefficients significantly different from zero. A limited number of the villages surveyed, 69, were determined to be immediately ready for electrification under the project.

The survey questionnaire for this analysis of potential power use for electrification is reproduced as Annex M. The six most significant variables for predicting demand were determined to be:

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- (1) The existence of health post;
- (2) The existence of a school of 3 or more classrooms;
- (3) The existence of a functioning cooperative;
- (4) The existence of part-time private or municipal diesel generator plants, generally in operation only 2-3 hours per day;
- (5) The number of class 1 commercial establishments; and
- (6) Access to the community by an all-weather road.

The analysis is methodologically and conceptually adequate, and the variables determined to be most significant accord with a priori reasoning as well as theoretical suggestions in the literature. The coefficients derived for use in the estimating equation are shown in handwriting on the sample questionnaire.

These six major factors cover the necessary pre-conditions for the next stage of economic development in this region which is small-scale labor-using industry. Such industry typically emerges in towns where social and commercial services are in place. Not every highland village can be expected to advance to the small industry stage; thus the selection criteria applied in the INDE study has provided a sensible rationale for rural electrification investment.

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3. Micro-Economic Impact

a. Target Group Benefits

The beneficiaries of this project are the low income families living in the Western and Central Highlands, Eastern and South Coast regions of Guatemala. The project will provide electrical services to approximately 70,000 consumers. Of these, it is estimated that 66,500 or 95% are residences and 3,500 or 5% are commercial establishments. Of the 66,500 residential users, it is estimated that 5,000 residences are the work place for artisans, as well as family living space.

Approximately 37,000 of the new users live in towns that are electrified but, because of the previous INDE requirement of customer contributions to the cost of construction, are not at present receiving electrical services. Another 33,000 users live in areas that are not yet electrified.

Of the 33,000 new connections proposed for towns which have never had electricity, 6,000 will be in towns of fewer than 500 inhabitants. An additional 17,000 will be in towns of less than 1,000 inhabitants. Therefore, more than half of all new connections in villages without electricity will be made in villages of 1,000 people or less. In addition, in the already electrified villages, more than 6,300

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connections will be made in towns of fewer than 1,000 people. Thus, a total of 40% of all connections in this project will be in villages of less than 1,000 people.

The project involves a substantial redirection of GOG resources towards the target group. Over the past five years INDE has hooked up an average of about 7,500 new direct customers per year countrywide. Almost all of these customers are higher income rural residents. As a result of the project, INDE will: adopt new operational policies which will eliminate the present financial barriers to serving the target group; hook-up an estimated 70,000 new consumers, the large majority of which will be target group members; and develop the financial and operational base for reaching a continued high level of target group families after the end of the project.

There are several factors that provide assurances that the project resources will primarily serve the target group. First, the richest towns in the area already have their own municipal systems. Second, the higher income residents of areas where INDE provides service are already hooked up. Third, the criterion for determining the towns which will be electrified will be investment cost per customer rather than maximization of sales. This criterion helps to avoid undue bias in favor of serving richer areas. Fourth, while economic and practical considerations preclude an approach that would focus exclusively on the poorest of the poor, regardless of where they live, the geographic concentration of project investments in the

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poorest rural areas ensures that most of the beneficiaries will be part of the AID target group. Although townsfolk on the average have higher incomes than residents of isolated villages, the majority of small town dwellers form part of the target group. A common pattern in these areas is for families to live together, but depend on their surrounding agricultural plots for their livelihood. As distribution lines are brought in to serve larger towns, it also becomes more feasible to serve smaller, nearby villages. As these villages are electrified, it becomes more feasible to extend service even farther into the hinterland, thereby benefitting additional target group members.

b. Intangible Benefits and Impact on Women

There are benefits which arise from electrification which improve the quality of life of the rural poor and contribute to a heightened perception that living standards have improved, but which do not lend themselves well to quantification. These benefits occur at both the household and community levels within the target group.

At the household level, electricity will lengthen the time available for productive work. Because cultural mores require that Indian women spend the major portion of their daylight hours on such tasks as food preparation and child care, they have little time for income-producing activities such as weaving and other handicrafts. With electricity, women will be able to weave in the evenings with reduced eye strain. Weavers report<sup>1/</sup> that an embroidered blouse (hüipil) valued at \$25 or \$30, requires between three to six weeks to complete. With electric lighting, production time will be reduced and, by extension, household incomes

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<sup>1/</sup> Information supplied by Dr. James Converse, Department of Rural Sociology, Cornell University, based on personal interviews.

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increased. Electric irons will decrease the drudgery of rural women. Electrically powered corn grinders, which are likely to be installed in the community, can save women as much as three hours a day in labor time. Radios will add a source of entertainment, news, and education, and children will be able to study their lessons at night.

At the community level, electricity will make a contribution to improved health of the target group by making feasible low-cost pumping of potable water, refrigeration of medicines and certain foods, and sterilization of medical instruments in health posts. Adult education courses can be offered in the evenings, thereby affording people education without the cost and separation from family involved in attending schools in urban areas.

The decreasing demand for charcoal due to the introduction of electric irons will lead to less cutting of scarce trees, which will save an economic resource for future, profitable exploitation, as well as help reduce erosion. Street lighting will contribute to the safety of residents. Electricity will facilitate the organization of recreation, entertainment, and civic and religious activities after dark.

The target group will also benefit from the opening of new employment possibilities; especially general store operators. In electrified towns, a large number of these stores are run by women, and there is no reason to assume that the pattern will not be the same in the villages affected by this project. The same result can be predicted for the tailor and seamstress occupations. Economically, therefore, women will benefit from these new employment opportunities. Perhaps the greatest potential impact on women of this project depends on the hypothesis that birth rates will decline with the introduction of electricity because of increased employment opportunities that are created.

In summary, target group members will benefit from this project by adopting electricity for productive uses. The Village Electricity Utilization Study showed that 15% of low income users claim to use electricity in their work. The non-user responses indicate that target group members recognize the potential for applying electricity to work uses. This high rate of adoption for productive purposes by the target group (compared to productive uses found in evaluations of rural electrification projects elsewhere in Latin America) may be partially explained by the high level of artisan activity and cottage industries found among Guatemalan's poor rural residents.

4. Macro-Economic Impact

a. Rates of Return

Economic internal rates of return (EIRR) for the project were first calculated using the base case projections of project revenues and the high and low options projections without consideration of consumer surplus benefits. The set of assumptions for these projections are the same as those used for the financial analysis with the exception that interest on investment in generation is excluded and the investment in generation is considered sunk cost with no alternative use in the short or medium term. The costs of electricity are thus the variable costs rather than marginal costs.

This treatment is fairly standard, however, it may also be argued that, in this case, a charge for the fixed investment in generation should be included in view of the fact that INDE is concurrently investing over \$350 million to double its generating capacity. Accordingly, a sensitivity analysis was performed on the base case to determine the effect on returns if generation investment costs (depreciation and interest) are considered.

Additional calculations were made adding consumer surplus benefits to the base case projections with

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and without consideration of the cost of investment in generating capacity. Estimated surplus benefits, as calculated in the following section, are 42%. To test the sensitivity to variation of surplus benefits, the rates of return were also calculated using a more conservative estimate of 25%.

The results of all of these calculations are as follows:

Economic Returns <sup>1/</sup>

	Base Case	High Option	Low Option
<u>1. Without Cost of Generation:</u>			
(a) Without Surplus Benefits	12.5%	14.0%	11.0%
(b) With 25% Surplus Benefits	15.3%		
(c) With 42% Surplus Benefits	17.1%		
<u>2. With Cost of Generation:</u>			
(a) Without Surplus Benefits	3.6%	5.9%	0.9%
(b) With 25% Surplus Benefits	8.5%		
(c) With 42% Surplus Benefits	11.0%		

<sup>1/</sup> See following tables.

In all cases the EIRR rates calculated without the cost of generation exceed the opportunity cost of capital in Guatemala. Including depreciation and interest in the calculations reduces the economic rates of return significantly.

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CASH FLOWS WITHOUT INTEREST & DEPRECIATION

CASH FLOWS WITH INTEREST & DEPRECIATION

Net Sales,	Cost of Sales w/o Interest or Depreciation	Cash Sources					Cash Use (Investment)	Base Case Economic Cash Flow	Cost of Sales with Interest & Depreciation	Base Case Economic Cash Flow
		Net Income	House Wiring Receipts	Rate Increase	Consumer Deposits					
141	100	41	45	76	34	3925	( 3729)	157	(3786)	
426	325	101	136	231	35	8174	( 7671)	495	(7841)	
745	602	143	230	391	36	1388	( 588)	886	( 872)	
1091	399	692	325	554	36	1513	94	1055	( 562)	
1348	438	910	344	663	12	1327	602	1161	( 121)	
1510	491	1019	285	717	"	1318	715	1301	( 95)	
1679	546	1133	223	771	"	1309	830	1448	( 72)	
1874	609	1265	159	825	"	1299	962	1615	( 44)	
2082	676	1406	127	879	"	1290	1134	1793	17	
2305	748	1557	"	933	"	1280	1349	1982	115	
2539	823	1716	"	987	"	1270	1572	2183	212	
2792	904	1888	"	1041	"	1260	1808	2397	315	
3061	990	2071	"	1095	"	1250	2055	2624	421	
3345	1081	2264	"	1149	"	1239	2313	2866	526	
3651	1178	2473	"	1203	"	1228	2587	3123	642	
3975	1281	2694	"	1257	"	1216	2874	3395	760	
4318	1390	2928	"	1311	"	1205	3173	3685	878	
4685	1506	3179	"	1365	"	1193	3490	3993	1003	
5075	1629	3446	"	1419	"	1181	3823	4320	1132	
5490	1760	3730	"	1473	"	1168	4204	4667	1267	
5931	1899	4032	"	1527	"	1155	4543	5036	1406	
6314	2021	4293	"	1581	"	1142	4871	5360	1532	
6809	2177	4632	"	1635	"	1129	5277	5772	1682	
7424	2369	5055	"	1689	"	1115	5768	6283	1854	
7986	2546	5440	"	1743	"	1101	6221	6750	2017	
8583	2733	5850	"	1797	"	1086	6700	7597	1836	
9214	2931	6283	"	1851	"	1072	7201	7771	2361	
9886	3141	6745	"	1905	"	1056	7730	8328	2654	
10598	3363	7235	"	1959	"	1041	8292	8919	2736	
11353	3597	7756	"	2013	"	1025	8883	9539	2941	

ECONOMIC RATES OF RETURN

<u>WITHOUT COST OF GENERATION</u>					<u>WITH COST OF GENERATION</u>				
<u>A D J U S T M E N T S</u>					<u>A D J U S T M E N T S</u>				
Base Case	Low Option	High Option	25% Surplus Benefits	42% Surplus Benefits	Base Case	Low Option	High Option	25% Surplus Benefits	42% Surplus Benefits
3729	3754	3703	3695	3672	(3786)	(3811)	(3761)	(3752)	(3729)
7671	7748	7594	7568	7498	(7841)	(7918)	(7764)	(7738)	(7668)
588	718	451	408	286	( 872)	(1002)	( 742)	( 692)	( 570)
94	90	279	358	537	( 562)	( 746)	( 378)	( 298)	( 119)
602	381	823	928	1149	( 121)	( 342)	100	205	426
715	476	954	1079	1327	( 95)	( 334)	144	269	517
830	573	1087	1235	1510	( 72)	( 329)	185	333	608
962	687	1237	1414	1721	( 44)	( 319)	231	408	715
1134	841	1427	1636	1978	17	( 276)	310	519	861
1349	1038	1660	1906	2284	115	( 196)	426	672	1050
1572	1243	1901	2186	2604	212	( 117)	541	826	1244
1808	1461	2155	2484	2944	315	( 32)	662	991	1451
2055	1690	2420	2797	3302	421	56	786	1163	1668
2313	1930	2696	3125	3678	526	143	909	1338	1891
2587	2186	2988	3475	4078	642	241	1043	1530	2133
2874	2455	3293	3842	4500	760	341	1179	1728	2386
3173	2736	3610	4226	4942	878	441	1315	1931	2647
3420	3035	3945	4634	5412	1003	548	1458	2147	2925
3823	3350	4296	5064	5908	1132	659	1605	2373	3217
4204	3713	4695	5549	6461	1267	776	1758	2612	3526
4543	4034	5052	5998	6987	1406	897	1915	2861	3850
4871	4344	5398	6421	7475	1532	1005	2059	3082	4136
5277	4732	5822	6951	8089	1682	1137	2227	3356	4494
5768	5205	6331	7597	8840	1854	1291	2417	3683	4926
6221	5640	6802	8191	9530	2017	1436	2598	3987	5326
6700	6101	7299	8820	10261	2187	1588	2786	4307	5748
7201	6584	7818	9480	11029	2361	1744	2978	4640	6189
7730	7095	8365	10178	11842	2654	2019	3289	5102	6766
8292	7639	8945	10119	12705	2736	2083	3389	5363	7149
8883	8212	9554	11701	13567	2941	2270	3612	5759	7675
<b>EIRR 12.5%</b>	<b>11.0%</b>	<b>14.0%</b>	<b>15.3%</b>	<b>17.1%</b>	<b>3.6%</b>	<b>0.9%</b>	<b>5.9%</b>	<b>8.5%</b>	<b>11.0%</b>

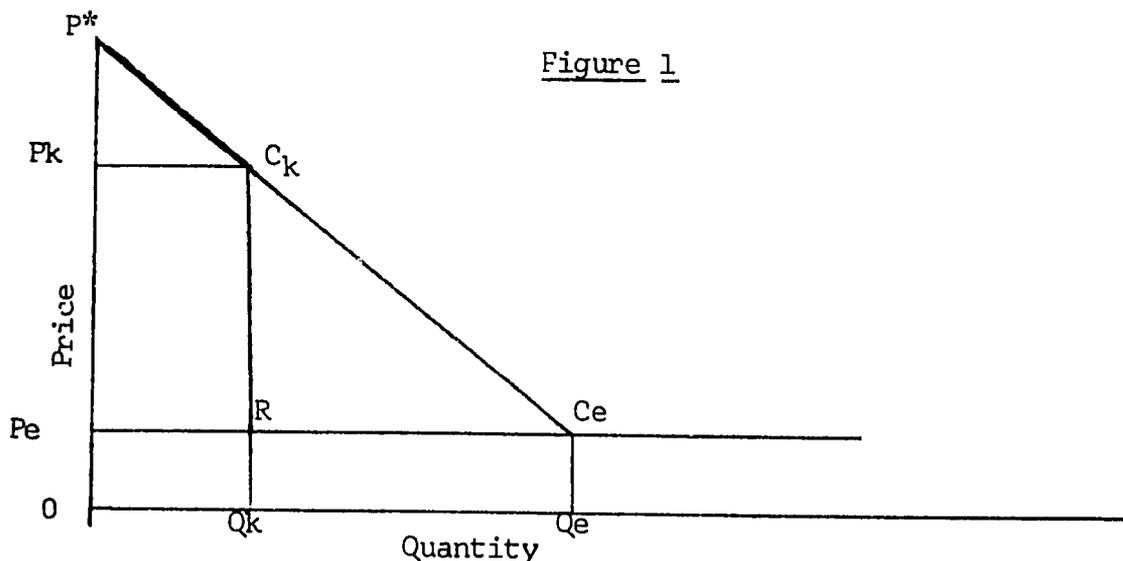
However, the most representative case is the base case projection with 42% surplus benefits. Calculated without cost of generation and with cost of generation this case yields EIRR's of 17.1% and 11.0% respectively. Both of these rates exceed the opportunity cost of capital in Guatemala.

b. Benefits

The definitive work on the subject by Marcelo Selowsky\* shows that the economic benefits of rural electrification projects consist of resource savings from primarily the cheaper provision of the present amount of lighting and other substitutable energy services consumed plus the consumer surplus resulting from the customers' increased use of energy due to the lower price now available to him/her.

Since lighting demand is by far the predominant projected use, the benefit scale analysis will be done in terms of lighting use.

Figure 1 presents a graphical portrayal of the benefit calculus.



\* Notes on the Appraisal of Rural Electrification Projects (mimeo, IBRD).

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According to household survey data, average expenditure on kerosene and candles for lighting is \$1.54 per month. This expenditure is represented by the rectangle (Pk, Ck, Qk, 0). (Kerosene lighting also yields the consumer a surplus benefit measured by the triangle (P\*, Pk, Ck). With the shift to central station electricity, the resource cost of the present amount of lighting consumption is reduced to the rectangle (Pe, R, Qk, 0) and thus the resources represented by the rectangle (Pk, Ck, R, Pe) are no longer a cost to the household. Surveys and present rural electrification project experience indicate that newly electrified households will spend at least this amount on increased consumption of energy primarily for lighting. In the case where total household expenditure remains the same, i.e. where the elasticity of demand equals unity (-1), the amount of light and energy services from the same resources is now Qe. Assuming a linear demand curve, the benefit of the increased consumption is the triangle (Ck, Ce, R). The general expression for this benefit is (from Selowsky, op. cit.)

$$B = \sum K_t (G_t + \frac{1}{2} G_t^2 t M)$$

where

$K_t$  = Expenditure on kerosene/candles that would be used in years.

$G_t$  = Percentage difference between the cost of the equivalent amount of kerosene lighting and one KWH of electric light.

$M$  = The elasticity of demand for electric lighting, in absolute value.

$t$  = Life of project in years.

Since present rural electric customers do, and surveyed potential customers indicate they will, spend more

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\* This does not include the factor for electricity demand for electric specific services.

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for electricity than the present household kerosene expenditure, we can be very confident that the elasticity of demand  $M$  is greater than unity (in absolute value). Thus an underestimate of true level of benefits will result if we assume that the elasticity,  $M$ , is equal to unity. In this special case, the amount that would be spent on kerosene  $K_t$  is equal to the amount that will be spent on electricity. That is  $K_t =$  the annual electric utility bill of the new customer ( $S_t$ ). Thus we have a link to the financial analysis, and a simple benefit expression for the unitary elasticity case:

$$B = \sum_{t=1}^n G_t (G_t + \frac{1}{2} G_t^2)$$

The cost reduction factor,  $S$ , results from engineering calculations that relates the cost of kerosene required to produce a "footlambert" of light with the cost of that amount of electric light. (See 511-L-046 Annex IV. A. - Exhibit 3) At present prices (\$0.60 per gal.) in Guatemala, it costs the kerosene lighting household \$1.54 per KWH equivalent of light. Thus,  $G$  is equal to 0.96. Evaluating the benefit formula, we have that:

$$B = \sum_{t=1}^n G_t (1.42)$$

That is, in the unitary elasticity case, economic benefits from rural electrification are equal to 142 percent of the present value of the flow of electricity sales over the life of the project.

It bears emphasis that the surplus benefit calculation has yielded a distinct and deliberate underestimate. By examining the general formula, above, we can see that when the elasticity has an absolute value above unity, the  $(\frac{1}{2} S_t^2)$  expression will become larger, as will the amount spent on energy. In the long run, and considering other uses of

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electricity than lighting, we expect that the elasticity may well be above 3. Thus, a surplus benefit of an 100% of the amount paid to INDE would not appear to be too high. This additional percentage was in fact the estimate for a group of rural villages in nearby El Salvador, which resulted from an intensive study by the World Bank.<sup>1/</sup>

c. Costs

The basic economic concept of cost for evaluating rural electrification is the present value of all cost outlays to provide the project specific increment in electric service, thus, all direct costs of subtransmission, distribution, hookup, administration, and generation must be included. The financial analysis herein provides a cost concept somewhat broader than the correct economic concept in that it includes an apportionment of generation capital costs for the large hydro-electric projects whose size is greatly in excess of current system-wide capacity requirements. For computational convenience we will use the financial concept inasmuch as it again gives the B/C analysis a conservative bias.

Shadow pricing concepts should be applied to the cost analysis; these fall in four main categories:

(1) Net tax revenue are in effect a reduction in the investment cost of the project, taxes and import duties on project-induced purchases of electrical appliances, etc. are likely to be small in the early years of the project. Accordingly, we will ignore the small downward adjustment called for by this factor.

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<sup>1/</sup> The title is Costs and Benefits of Rural Electrification - A Case Study in El Salvador. IBRD, Central Projects Staff Public Utilities Department. The study is an internal document, not for distribution.

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(2 and 3) Foreign exchange and capital rationing adjustments are not applicable in the case of Guatemala, where there is a free foreign exchange market and unimpeded access to capital.

(4) Unskilled labor should be priced at a shadow wage somewhat below the legal minimum wage, as long as the unskilled labor can be programmed for use during slack periods in the agricultural cycle. Unskilled labor is estimated to account for 25% of the total investment cost. During about half the year we estimate the opportunity cost of this labor to the economy to be about 60% of its observed financial cost. Thus, the investment cost should be adjusted downward by 5%. This adjustment is a fairly substantial one, coming as it does in the early years of the discount flow. We have not performed the calculations but estimate that this effect would raise the base case EIRR by less than one percentage point.

d. Basis for Economic Projections

(i) Power Demand

The three areas to be served by the project are among the poorest in the country. Within this area the villages to be newly electrified are primarily the smaller towns which contain the highest concentrations of Guatemala's poor. Furthermore the customers to be added in already electrified villages are expected to be the poorer segments of these population centers which have not been able to afford electricity under INDE's current tariff structure. The projections of power demand used in the financial and economic projections are thus based on a predominance of low income consumers. The following table provides a comparison of demand assumptions used for the project with actual INDE experience on a nationwide basis; these assumptions all tend to bias the EIRR calculations downward.

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Selected Comparisons: Project with INDE, Actual  
Direct Sales for 1976

	National Averages	Project Area Assumptions
- Annual per Household Consumption <sup>1/</sup>	440 KWH	200 KW
- Rate of Increase of Average Household Domestic Consumption	23%	3.2%-4.5%
- Commercial Sector as Percent of Connections and Consumption	10% & 18%	5% & 12%
- Industrial Sector as Percent of Total Consumption	36%	1-1½%
- Government and Municipal Sector as Percent of Total Consumption	11%	1-2%
- Public Lighting as Percent of Total Consumption	9%	4-8%

<sup>1/</sup> A selective review of per household consumption in aldeas similar to those in project area indicated an annual average of 230 KWH.

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These assumptions essentially reflect a view of slowly improving economic conditions in the region, and moderately increasing commercial and industrial activity starting from a very low base. They are considered conservative in view of the stated intentions of the international lending institutions and the GOG of assigning higher priority to the social and economic development of the area. For instance, the Master Plan for National Electrification prepared by personnel from INDE and a technical assistance team provided by the Federal Republic of Germany in 1974-1976 was far more optimistic about the region's future growth. The general magnitude of these projections were similar to the ones used by the IBRD in its AGUACAPA appraisal study. Electricity consumption for the nation as a whole is projected to increase at a rate of about 11-12% p.a. through the balance of the century. For the 15 Departments in the project region, the Master Plan projects a growth in demand of about 18% p.a. ranging from about 14% in Zacapa and El Progreso to about 30% in Alta Verapaz and Huehuetenango.<sup>1/</sup>

(ii) Factors That May Increase Power Demand

The implicit assumption underlying the projections is that public policy to improve economic conditions in the project area will be moderately successful, but will not result in any major increases in industrial and commercial activities. This outlook is more likely a short-run situation. The following plans and policies may significantly improve the longer run situation to the extent they are implemented and successful.

- The National Industrial Development Plan 1976-1979 states that industrial decentralization is one of the plan's fundamental strategies.

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<sup>1/</sup> Pgs. 4-50 to 4-59 of SYNOPSIS, Master Plan for National Electrification

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- The Draft Law for Industrial Decentralization Incentives declares as a national necessity and priority the establishment of industrial enterprises outside of the Department of Guatemala.

- The Decree of June 22, 1976 established a commission to plan industrial projects in Chimaltenango and Baja Verapaz, Departments that were severely affected by the earthquake. Industrial parks are now being planned for these two Departments and also for Quezaltenango.

Irrigation is another potential use of electric power. A number of diesel powered irrigation systems are located near Aguacatán, Santiago, and along the banks of Lake Atitlán. Also a number of gravity systems exist, which indicate opportunities for using electric pumps. The AID financed pilot project to put 5,000 hectares into irrigated agriculture in 4 years will emphasize gravity systems simply because electricity is not available in most of the areas to be irrigated. The project will extend the areas serviced and make it possible to provide electricity for electric pumps to perhaps 10% of the irrigation systems - 500 hectares.

The USAID financed Small Farm Marketing Project will expand the marketing infrastructure for buying, assembling, storing, grading, sorting, washing, producing and selling of fruits and vegetables. Cooling plants, cold storage, and many types of electrically operated machinery and equipment will present a significant consumption of electricity.

The potential additional demand for electricity described above for industrial and agricultural uses that possibly would be served by the project were not considered in the projections of demand. They are treated here as a reserve that provides additional assurance that the projected demand estimates will be realized.

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5. Economic Significance of Rate Reform

The rate reform agreed to by the GOG in conjunction with this loan project is of particular economic significance. Rural electrification in Guatemala has been choked off by a system of high front-end charges. Such charges defeat the very purpose of a public utility, which is to supply services which are capital intensive in production but which offer large economies of scale. These economies of scale occur, in the case of electricity, in production (central station, whether it be thermal or hydro), in distribution, and in finance. It is the last-cited economy of scale that is especially relevant in a LDC rural electrification project because the opportunity cost of capital facing the poor rural family is incredibly higher than that facing the utility. As we have seen, the economic returns to rural electrification occur more or less gradually over a period of years following the start-up of service. This slow pay-off for the utility is the major reason that utility companies, their eyes on the cash flow projections, are reluctant to sink their capital into slow payoff assets. (This, also, is why donor lending with long grace periods is so appropriate for rural electrification.) However, the utility can borrow capital, in the case of INDE in Guatemala at 8-9% in financial costs from GOG guaranteed internal bond issues or IBRD/IDB loans. Inclusion of an appropriate risk factor would raise this figure to, say 12% as an economic opportunity cost of capital.

For the poor rural resident, the opportunity cost of capital in the amount needed to hook up to the INDE system at present is extraordinarily high, perhaps 50 - 100% per annum. While lower rates may be obtained by rural consumers, such rates are only available for small amounts of capital. Larger amounts are available from money lenders but only on a short term basis at rates in the order of 5-10% per month. Given these rates and the fact that the payoff for the small rural user of electricity who has to finance his portion of the utility's capital comes as slowly as that perceived by the utility, the investment is no longer feasible.

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Thus, the benefit of rural electrification is realizable for the small rural resident only if the utility raises capital at low, wholesale, guaranteed rates and provides access thereto for the target group. The role of a utility in making generalized access to capital at its economy-wide opportunity cost is a powerful one, and projects that require substantial capital contributions by the intended beneficiaries miss this important benefit and indeed may fail because of the difference between the capital costs faced by the beneficiary and the capital cost assumed in the project analysis.

However, the rate reform does not lower the opportunity cost of capital to the small farmer or artisan beyond the direct impact on energy cost. That is, the rural resident still does not have access to credit in general at the economy's opportunity cost of capital. Programs to improve the capital market for small farms and rural enterprises are presently being developed by the GOG and the international donors, and there should be substantial complementarity which will result in increased benefits for the several cooperating projects.

Thus, it is the rate reform that converts the high theoretical internal economic rate of return into a feasible opportunity for redistributive economic growth. Economists are wont to say that "good" project analysis is not a substitute for "good" economic policy. The electric rate reform will make it possible for the rural residents to hoop up in accordance with the project analysis because lighting will not require further household recurrence to the capital market. Expansion of electric use in productive uses will be slowed if the rural sector does not get improved access to the capital needed to finance investments complementary to electricity.

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#### D. Social Analysis

##### 1. Target Group Description

A description of the socio-economic characteristics of the target group to be served by this project is found in Annex L.

##### 2. Socio - Cultural Feasibility

USAID/Guatemala and INDE designed and conducted a survey in April, 1977, to obtain data on the demand for and anticipated benefits of rural electricity. In addition, a social anthropologist conducted a series of field visits to complement the survey data. The survey was conducted over a two-week period in 378 households in 22 randomly selected rural villages in the Western and Central Highlands and the Eastern part of the country.

The seven villages surveyed in the Eastern part of Guatemala had populations which were virtually all Ladino (non-Indian). Of these, only three were not at least partially electrified. Of the 15 villages surveyed in the Western and Central Highlands, five, which had almost exclusively indigenous populations, were without electricity. Five other villages with majority indigenous populations had 30% or less of their households electrified. (See Table on next page.) These ten highland villages had an average population of 1,300, a size large enough to permit the delivery of electrical services with reasonable efficiency.

The survey defined households of low income as those with annual incomes of less than \$800. The average family income among these low-income electricity users was \$400; among non-users, approximately \$340.

Neither the survey nor the field visits identified social or cultural mores which precluded the use of electricity among the indigenous population groups.

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TABLE OF VILLAGES SURVEYED

<u>Village</u>	<u>Department</u>	<u>Popula- tion *</u>	<u>Percent of Population which is Indigenous</u>	<u>Per cent Electrified</u>
San Juan Ixcoy	Huehuetenango	982	87	27.8
Soloma	Huehuetenango	2,116	58	47.6
San Marcos Huista	Huehuetenango	1,935	100	0.0
Tzisbaj	Huehuetenango	1,017	100	0.0
Nahualá	Sololá	1,742	99	22.1
Chirijox	Sololá	831	100	0.0
Los Encuentros	Sololá	1,935	99	0.0
Sacapulas	El Quiché	1,439	65	49.7
Cunén	El Quiché	1,369	68	30.7
Uspantán	El Quiché	1,898	54	-**-
Chicamán	El Quiché	1,069	3.6	0.0
Chisón	Alta Verapaz	500	99	0.0
Tactic	Alta Verapaz	2,260	62	61.6
Tamahú	Alta Verapaz	633	73	40.6
Senahú	Alta Verapaz	1,444	69	- + -
Pasaco	Jutiapa	1,364	0	52.4
Conguaco	Jutiapa	723	0	37.0
El Salamar	Jutiapa	473	0	0.0
San José Mogollón	Escuintla	743	3.2	0.0
Nueva Concepción	Escuintla	6,115	2.5	45.5
Sanarate	El Progreso	5,228	32	74.8
San Antonio La Paz	El Progreso	923	0	0.0

\* 1973 Population Census.

\*\* Municipal Plant of 37 KW capacity.

+ Municipal plant of 32 KW capacity. Percentage electrified unknown but presumed to be minimal in view of low generating capacity.

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### 3. Demand for Electricity

#### a. Survey Results

More than 95 percent of the families interviewed expressed a strong desire for electrical services. Survey interviewers felt that even more wanted electricity, but that a few families feared that a positive expression of interest would mean an on-the-spot commitment to pay some unknown charge. In addition, those who expressed a desire for electricity indicated a willingness and ability to pay for monthly service charges. Moreover, low-income families who did have electricity indicated that they had no difficulty in meeting monthly payments.

An important conclusion of the survey was that the major constraint to effective demand among all non-users surveyed was the existence of heavy installation costs. Under current INDE practices, these "front-end" or "hook-up" charges must be paid by the consumer before service can begin. The elimination of this bottleneck under the project and thereafter will greatly increase the effective demand for electricity among AID's target group.

#### b. Observed Uses of Electricity

Survey respondents were asked about intended or actual uses of electricity. Although there were some differences exhibited between actual uses and desired uses, the overall consistency was quite high. The three most frequently cited uses of electricity were: (1) lighting; (2) household appliances (principally radios and irons); and (3) work related uses. Other general uses of electricity included recreation, refrigeration, security and hygiene. The table on the next page shows the comparison between the actual use made of electricity by low income families in the survey with the desired use of electricity by low income families without electrical power.

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USES OF ELECTRICITY

<u>Use Category</u>	<u>Frequency Among Users</u>	<u>Frequency Among Non-users</u>
Lighting	126	163
Household Appliance	92	127
Work	21	36
Recreation	40	15
Refrigeration	11	20
Hygiene	0	9
Security	6	2

Approximately 48% of the survey questionnaires were reviewed to ascertain the types of work applications mentioned by respondents. Thirty-eight of the 183 questionnaires which were reviewed mentioned work applications.

LIST OF WORK APPLICATIONS AMONG USERS AND

NON-USERS OF ELECTRICITY

(From Village Electricity Utilization Survey)

- Weaving (6)
- Operation of Dental-Medical Devices (1)
- Sewing (3)
- Carpentry (4)
- Radio Repair (2)
- Store (Tienda) (7)
- Blacksmith (1)
- Gasoline Station - Cage (1)
- Bar (Cantina) (1)
- Corn Mill (2)
- Unspecified I/ (10)
- Total (38)

I/ General responses as : "to work", or "to work at night".  
(Trabajos Nocturnos).

c. Profile of Users and Non-Users

On-site field observations by the social anthropologist in the Western Highlands revealed that existing INDE services do not reach many of AID's target group.<sup>1/</sup> Currently, electricity is being provided in most instances to those towns and villages which are nearest to major transportation and communication routes. In these towns, the typical pattern is for the electric service to exist in the town center which corresponds to the neighborhoods generally inhabited by higher income Ladino families and Transitional Indians. Outlying neighborhoods and adjacent villages, areas inhabited almost exclusively by Indian peasants, are generally without service.

The survey and field visits confirmed that users generally enjoy a better standard of living. Their sources of income are varied, ranging from practicing a profession, operating a modest scale commercial or service enterprise, or owning a medium sized farm with a strong market orientation. For non-users, major sources of income are day labor wages, the output from their small farms, and revenue generated by the manufacture and sale of handicrafts.<sup>2/</sup>

Concerning income generation and recreation activities, the contrast between electrified and non-electrified communities is dramatic. From the survey it was noted that villages with extensive electrification had a more varied set of occupations. Villages with more than 40% of houses electrified showed an average of 10 occupations among heads of households interviewed, those with less than 40% elec-

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<sup>1/</sup> See Annex L for description of characteristics of target sub-groups.

<sup>2/</sup> For an additional description of users and non-users see USAID/Guatemala's Interim Report, pp. 28-31, June, 1977.

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trified showed an average of only 7 occupations. In villages without electricity less than four occupations were noted, on the average.

The survey results were supported by the findings of the social anthropologist that the range of employment opportunities was considerably wider in villages with electrical services; in large degree as a direct result of electrical power. For example, new jobs have been created in such fields as repair of electrical appliances, wire installation service, and ice making. Working conditions have been improved for tailors and dress makers and auto mechanics. Saw mill operators and corn and coffee mill owners claim that their businesses are more profitable because of the use of electrically operated machines and the ability to work after dusk. In a similar manner, managers of plaza kiosks, local general stores, and restaurant owners state that business has improved because they can now provide service after dark. Store and restaurant owners also report that electrically operated refrigerators enable them to preserve perishable foodstuffs for much longer periods of time. In non-electrified villages such conditions and supplementary employment opportunities do not exist.

In summary, the on-site field observations and the Village Electricity Utilization Survey have shown initial indications that there are observable differences in the quality of life of users and non-users of electricity. However, it has not been possible to attribute a cause-and-effect relationship between the presence of electricity and indicators of economic, educational, or health status.

4. Target Group Demand Constraints and Affordability of Electric Services

The ability of low-income rural families to afford electrical services depends upon two factors: the initial installation costs; and the recurring monthly cost for services.

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a. Prepayable Costs to Obtain Electricity

At present anyone wishing to obtain electrical services from INDE must pay the following costs in advance:

- (1) A cash contribution to cover all or part of the costs of the lines, transformers, service drop and meter required to serve the house;
- (2) The cost of internal house wiring; and
- (3) A deposit totaling no less than the estimated amount of the electric service bill for two months.

The construction contribution charge is the most significant of the three charges. INDE's regulations require the payment of amounts ranging from 30 dollars for only the meter and service drop to thousands of dollars if primary distribution lines, transformers, and secondary lines are required in addition to the meter and service drop. Minimal house wiring costs an average of \$20. Finally, a deposit equivalent to no less than two months' bills is required which amounts to approximately \$2.00 for the target group households.

The majority of low income, non-users surveyed indicated that they cannot afford to pay such a large hook-up fee in one installment. Confirming data from INDE reveals that eleven out of twelve (or 92%) applications for service are subsequently withdrawn once installation charges are known.

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b. Affordability

The survey disclosed that low income families who have electricity are currently paying an average of \$3.23 per month, <sup>1/</sup> and are having no difficulty in meeting this obligation. The families that do not have electricity indicated in the survey that they could pay an average of \$2.00 per month for the service.

As indicated in the Table on the next page, minimum charges for families who will receive electricity under the loan have been tentatively estimated at three levels using rate increases ranging from a low of 50¢ to a maximum of \$1.00 over and above the basic charge. These increases are sufficient to amortize the full cost of INDE's investment in the distribution system over a period of 20 to 30 years, depending on the level of increase, e.g. a 50¢ rate increase will amortize the average investment per customer of \$157 over approximately 25 years. This minimum charge will provide 12 KWH.

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<sup>1/</sup> Average charges were calculated by examining a respondent's most recent electric bill receipt. It is possible that more than one month's cost was inadvertently included for some respondents and that the average is somewhat less than this figure.

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An average bill has also been figured utilizing the 3 levels of rate increases. As the reader can see, minimum users of electricity will be below the \$2.00 they said they could pay, including housewiring, if rate increases do not surpass 50¢. Minimum bills will be 10¢ above the \$2.00 maximum if a 75¢ rate increase is imposed and 44¢ above with a \$1.00 increase which is very unlikely. Of course, all bills will be reduced by 44¢ per month after the four years when the housewiring has been fully paid for. (See Tables on the following pages.)

While it is evident that the target group families could afford the basic monthly charge, the major constraint to demand for electricity is the INDE requirement that the consumer contribute a sizeable percentage (20-80%) of the cost of construction of the line, poles, and transformer involved in taking the electricity from the nearest secondary distribution line to the dwelling.

INDE has agreed to eliminate the front-end construction charge and instead establish a nation-wide, minimum standard rate which will amortize most of the front-end costs for continuing expansion of the distribution system.

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Table of Estimated User Charges Under  
AID Project Using Three Possible Rates  
Increases of Low, Medium, and High

I. Minimum Monthly Bill (12 KWH)

	<u>Low</u>	<u>Medium</u>	<u>High</u>
Basic Charge (12 KWH)	\$1.00	\$1.00	\$1.00
Rate Increase	.50	.75	1.00
Housewiring*	<u>.44</u>	<u>.44</u>	<u>.44</u>
Total	\$1.94	\$2.19	\$2.44

II. Average Monthly Bill (17 KWH)

	<u>Low</u>	<u>Medium</u>	<u>High</u>
Basic Charge (12 KWH)	\$1.00	\$1.00	\$1.00
Additional Consumption of 5 KWH at .07 KWH	.35	.35	.35
Rate Increase	.50	.75	1.00
Housewiring*	<u>.44</u>	<u>.44</u>	<u>.44</u>
Total	\$2.29	\$2.54	\$2.79

\* Is dropped from monthly bill after 4 years

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Without Housewiring, After 4 Years

I. Minimum Monthly Bill (12 KWH)

	<u>Low</u>	<u>Medium</u>	<u>High</u>
Basic Charge (12 KWH)	\$1.00	\$1.00	\$1.00
Rate Increase	<u>50</u>	<u>.75</u>	<u>1.00</u>
Total	\$1.50	\$1.75	\$2.00

II. Average Monthly Bill (17 KWH)

	<u>Low</u>	<u>Medium</u>	<u>High</u>
Basic Charge (12 KWH)	\$1.00	\$1.00	\$1.00
Additional Consumption of 5 KWH (at 7¢ KWH)	.35	.35	.35
Rate Increase	<u>.50</u>	<u>.75</u>	<u>1.00</u>
Total	\$1.85	\$2.10	\$2.35

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The Village Electricity Utilization Survey respondents indicated that they could pay an initial lump sum connection fee of \$8.00 and monthly amortization payments of \$1.00 in addition to an estimated \$2.00 monthly bill for electrical use. This would make a total of \$3.00 per month. In no case with a rate increase of either 50¢, 75¢, or \$1.00, and including housewiring, does the monthly bill, under the project, exceed this \$3.00 maximum limit. The initial lump sum fee for connection proposed by the project is a \$2.00 deposit on one month's bill, well below the \$8.00 maximum cited by survey respondents for the connection fee. Housewiring costs remain an average of \$20.00 but will be spread out over a period of 4 years and only total 44¢ per month, also affordable by the target group.

The affordability of the monthly outlay was confirmed by the survey's comparison of expenditures for electricity made by users with the expenditures for other lighting sources (mostly kerosene and candles) made by low income people without electricity. Both users and non-users were spending an average of 10%, ranging from 8 to 13%, of their annual incomes on lighting, a yearly average of \$40 for users, \$34 for non-users.

Consequently, the Mission has concluded that target group families can afford electricity. Although it is difficult to determine the magnitude of suppressed demand because of the high front-end charge, the Master Plan for Electricity Supply written by the German Agency for Technical Cooperation has estimated such demand to be between 20% and 25% of present consumption. In addition to assessing the suppressed demand among customers whom it would be profitable for INDE to serve, the Master Plan noted that many individual applications have been withdrawn due to the high customer contribution for construction costs required by INDE. The table below summarizes the low number of connections made as a proportion of applications received by INDE.

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TABLE OF ELECTRICITY SUPPLY  
ANNUAL APPLICATIONS AND CONNECTIONS  
INDE - 1973/1975

<u>YEAR</u>	<u>APPLICATIONS</u>	<u>CONNECTIONS</u>	<u>PERCENTAGE OF CONNECTIONS MADE</u>
1973	7,611	610	8.0%
1974	9,600	769	8.0%
1975 *	6,605	331	5.0%

USAID's examination of annual rural connection applications confirms that at the present time about one out of 12 applications results in electric service connection. As a result, the USAID is confident that there is more than sufficient demand for the number of connections programmed under this project.

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\* Only part of 1975.

Source: INDE, Department of Planning, August 1975

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V. IMPLEMENTATION

A. Project Implementation Agency

1. INDE Creation and Growth

The creation of INDE in 1959 provided the GOG with an institutional framework for undertaking nationwide electric power planning, investment and operation. At that time, Guatemala City (and its surrounding industrial base) was served by a U.S.-owned private power company, (Empresa Eléctrica), while outside the City a few privately and municipally-owned systems generated and distributed power to other selected areas of the country relying on small hydro and diesel generators. Except for the Guatemala City system, service was of poor quality and unreliable.

INDE has grown rapidly since its creation. It has invested in new generation facilities (primarily thermal plants) and has extended electric service to 14 block customers (who serve approximately 180,000 consumers in the country's urban areas) and to approximately 70,000 rural consumers (who are direct INDE customers). Total sales have increased from \$1.8 million in 1966 to \$25.2 million in 1976 -- a fourteen fold increase. While some of this increase is due to rate adjustments, sales in GWH increased from 79.0 to 611.0 over the same period - an eightfold increase. Key indicators of INDE's growth are shown in the table on the next page.

In order to accommodate this extraordinary growth, INDE has had to improvise. Many small systems of diverse designs and capabilities have been absorbed or joined into the national grid as block customers. New generation facilities and transmission lines have been added to keep up with the rapidly increasing demand. The national grid - a patchwork of different voltage lines serves, the more populated areas of the country. Despite the shortcomings caused by its ad hoc

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INDE GROWTH INDICATORS\*

Concept	Unit Measurement	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
<b>1. Production</b>											
Installed Capacity 1/ Hydraulic	MW	20.4	33.4	35.6	55.6	95.7	96.3	95.7	95.7	95.7	95.7
Thermal		14.9	15.4	28.4	28.4	28.6	32.4	66.1	65.8	67.5	67.5
Total		35.3	48.8	64.0	84.0	124.3	128.7	161.8	161.5	163.2	163.2
Gross Generation	GWH										
Hydraulic		39.4	79.8	133.3	159.2	312.6	319.8	283.6	295.9	318.6	283.1
Thermal		45.4	53.6	87.9	98.1	46.1	66.9	168.1	259.2	285.3	366.3
Total		84.8	133.4	221.2	257.3	358.7	386.7	451.7	555.1	603.9	649.4
Own Consumption	GWH	1.7	1.4	1.9	3.9	5.3	1.6	5.2	13.3	16.1	16.3
Total Net Generation	GWH	83.1	132.0	219.3	253.4	353.4	385.1	246.5	541.8	587.8	633.1
Maximum Demand	MW	25.5	35.2	50.1	57.6	81.0	90.5	101.2	116.4	123.4	142.3
Losses 2/	%	4.9	5.0	2.6	3.9	4.6	3.8	3.2	4.3	3.0	3.5
<b>2. Sales</b>											
Detailed Sales	GWH										
Residential		8.4	9.8	9.2	4.8	6.0	7.9	10.3	12.8	16.1	20.2
Commercial		---	---	1.7	4.8	6.4	6.8	7.6	9.4	10.7	12.3
Industrial		1.7	3.0	1.5	1.7	2.9	4.9	6.1	6.5	10.0	11.7
Governmental		---	---	---	1.2	1.5	1.5	1.7	2.4	3.2	4.4
Municipal		---	---	1.5	0.5	0.6	0.7	0.8	1.0	1.2	1.6
Public Lighting		0.4	---	---	3.0	3.5	4.0	4.4	4.9	5.3	4.8
Sub-Total	GWH	10.5	12.8	13.9	16.0	20.9	25.8	30.9	37.0	46.5	55.0
Gross Sales	GWH	68.5	112.6	199.6	227.5	316.4	344.5	401.2	481.6	523.5	556.0
Total Sales	GWH	79.0	125.4	213.5	243.5	337.3	370.3	432.1	518.6	570.0	611.0
<b>3. Charges</b>											
Detailed	Thousand Q										
Gross		520.5	554.9	611.7	773.5	961.4	1,168.8	1,468.6	1,776.7	2,098.2	2,593.9
Total	Thousand Q	1,235.3	2,203.0	3,426.0	4,064.1	5,425.5	6,127.7	7,049.3	8,205.9	12,363.3	16,387.6
<b>4. Average Price</b>											
Detailed	¢ / kWh										
Gross		4.96	4.34	4.40	4.83	4.60	4.53	4.75	4.80	4.51	4.72
Total	¢ / kWh	1.80	1.96	1.72	1.79	1.71	1.78	1.76	1.70	2.37	2.95
<b>5. Combustion (used for generation)</b>											
Diesel Consumption 3/ Diesel Cost	Thousand Barrels Thousand Q	164 477.4	154 530.1	279 1,000.6	307 1,190.6	135 547.3	205 863.4	337 1,430.8	267 1,432.5	202 3,194.3	346 5,381.0
Bunker Consumption Bunker Cost	Thousand Barrels Thousand Q	---- ----	---- ----	---- ----	---- ----	---- ----	---- ----	116 275.7	348 899.3	427 4,679.7	498 5,879.0
<b>6. Others</b>											
Consumers 1/ Villages Served	Number Number	16,258 73	15,525 84	17,326 102	22,571 108	26,287 129	30,905 224	37,462 273	44,725 320	52,682 379	58,071 416

\* Taken from the 1975 Statistics Report of INDE  
 1/ Taken up to the 31st of December of each year  
 2/ 1- Sales  
 Net Generation  
 3/ Barrel = 42 gallons

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problem solving approach, INDE's system is providing reasonably adequate service, except near the end of over-extended lines.

INDE's rapid growth has been financed mainly through bond issues and GOG contributions. The GOG equity in INDE now amounts to \$108.5 million. In addition INDE has a total long term debt of over \$53.6 million, including \$35 million owed to AID, CABEI, IBRD and IDB.

2. INDE Organization and Project Implementation Responsibilities

INDE is an autonomous government corporation whose Board of Directors consists of representatives from the private sector and the Office of the Presidency. A General Manager is the chief executive officer. There are three line divisions: Administration, Technical Services, and Special Projects. Each is headed by an Assistant Manager. INDE's organization chart is shown in the Graph on the following page.

This project has been largely planned in conjunction with the Technical Services Division, which will bear the major implementation responsibility. Each of the Divisions' five Departments - Planning, Projects, Construction, Operations and Commercial - will have a role in implementing the project.

The Planning Department developed much of the data and conducted the basic analyses for the Project Paper. In implementing the project, this department will be responsible for the evaluation activities described in the Implementation Plan.

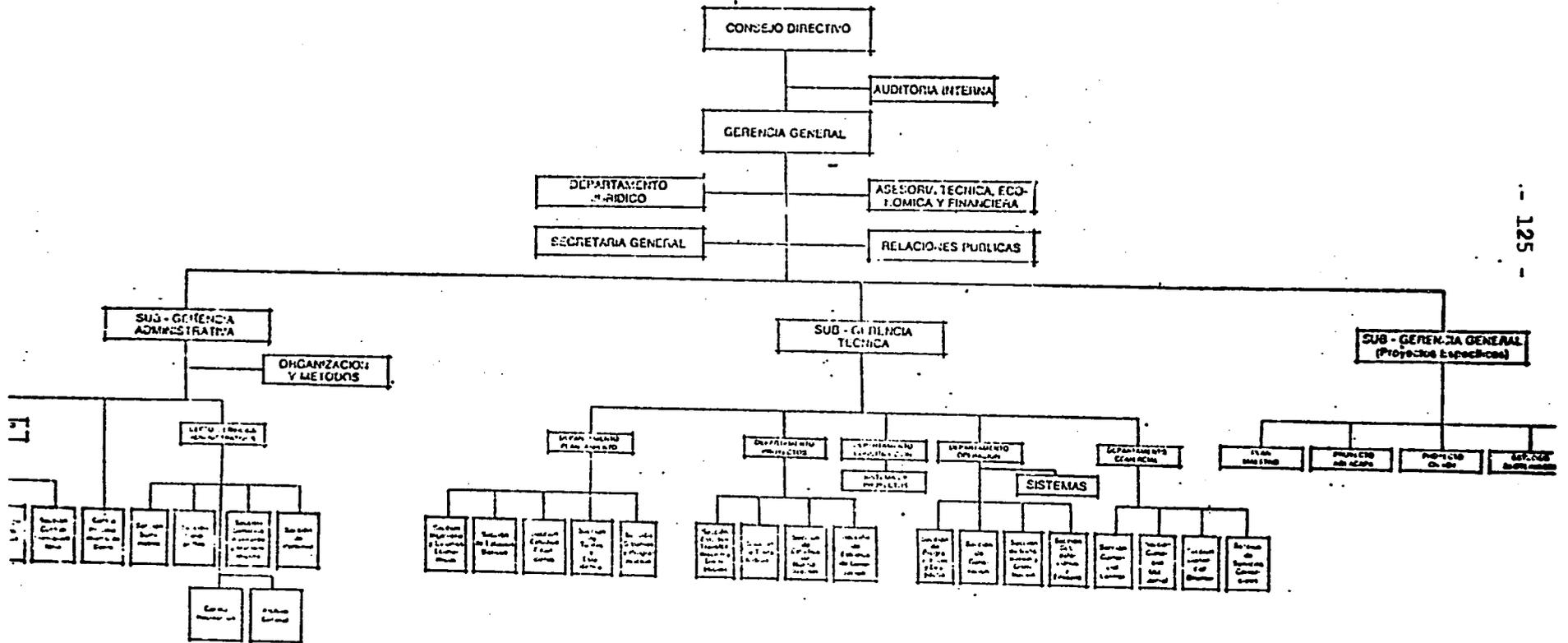
The Projects Department will prepare the Invitation for Bids and Requests for Proposals needed for procurement actions. The department is familiar with AID procedures.

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INDE ORGANIZATIONAL CHART

ORGANIGRAMA DEL INSTITUTO NACIONAL DE ELECTRIFICACION

INDE



based on the experience in implementing AID Loan 019. Review of bids and awards will be carried out by an inter-departmental review board.

The Construction Department will be responsible for all construction aspects of the project. Consulting engineering services will be retained for supervision of construction and certification of payments. This department has had extensive experience in force account construction, including the distribution systems built through Loan 019. The department maintains 13 warehouses throughout the country which will be adequate for storing materials during project implementation.

Service drops in already electrified towns (including short extensions of secondary distribution lines) will be carried out by the Operations Department. This department also performs minor customer service functions such as disconnects and reconnects.

The Commercial Department is responsible for consumer service functions such as consumer education, processing applications for connections, meter reading, and connect/disconnect orders. The department has 30 field offices most of which are in the target area. It will open additional offices and expand existing ones as needed to serve the consumers hooked up under the project.

This department has not carried out any promotion/consumer education activities in the recent past. Technical assistance will be provided to the department to assist in developing a promotion and consumer education campaign for the rural areas. In addition to regular functions the department will be responsible for the baseline data needed for the impact evaluation.

The Administration Division will have two roles during project implementation. First, it will prepare reimburse-

ment requests for loan disbursements and keep complete financial records for the project. Secondly, it will provide data processing services to the Commercial Department for customer billing and Planning Department for processing and computer analysis of baseline data.

3. Implementation Activities

a. Field

The Commercial Department will have first contact with the target group. Department representatives will attempt to develop "Pro-electrification committees" in each town or area to be electrified. These committees will be asked to arrange a meeting of the villagers to discuss electrification. At an agreed upon time and place department representatives will arrive and explain the uses and costs of electricity and will provide practical demonstrations of the use of electricity in household and productive activities.

Subsequently, villagers will be interviewed individually to determine if they desire the service and to collect baseline data for the impact evaluation. An application will be taken from those who wish the service. If house wiring services are desired, an agreement for repayment will be included on the application form. The potential customers will be informed of the approximate date of connection. During these site visits, Construction Department engineers will also accompany the Commercial Department representatives to answer technical questions, assess construction requirements, and identify possible candidates for short term construction jobs.

b. Headquarters

After the initial site visits a determination will be made by the Construction Department on the quantities and types of materials needed. Material delivery and construction will be scheduled for those already electrified villages where construction will be carried out through force account. Contract construction schedules will be developed by the Projects Department based on data collected through the initial site visits for those villages to be newly electrified and for the construction of substations and subtransmission lines.

Construction supervisors and field crews, both contract or force account, will carry out construction activities according to the schedules prepared at headquarters. House wiring will be accomplished according to the procedures already described in Sections III and IV. A. Service will start when the meter is installed, by which time the customer will have paid a \$2 deposit which approximates a month's utility bill.

In addition to their normal duties, meter readers will deliver bills for user charges, and collect payments from the customers. INDE will analyze its billing and collection procedures during project implementation with the aid of loan financed technical assistance. Depending on the design

of the data collection procedures adopted for the impact evaluation, the meter reader may also periodically interview target group users to collect additional data on the uses of electricity. Alternatively, special enumerators hired by INDE may be used for this purpose.

4. Overall Assessment of INDE Capacity to Carry Out the Project

INDE has sound management and in general its 6,000 employees are well trained and perform adequately. A recent analysis by the World Bank detected some areas, such as financial management, asset evaluation and rate analysis, where improvement is needed. Technical assistance is being made available in these areas as part of the Aguacara IBRD loan for generation facilities signed this year. A subsequent analysis by an AID consultant identified additional areas in which technical assistance would help to improve INDE's overall capacity. Technical assistance will be provided by the loan in these areas to complement IBRD financed assistance and improve INDE's capacity to rapidly expand its rural electrification distribution system.

From a technical standpoint AID's Loan Project was implemented in a satisfactory and timely manner except for delays encountered in delivery of some materials beyond the control of INDE. A consultant's review of the project indicated high quality construction and maintenance. Although design standards used for substations and line construction may be excessive in some instances resulting in unjustified expenditures. Specifications for these elements of this project will be examined by consultants provided by the TA element of this project and INDE engineers before bidding documents are prepared in order to reduce standards to the extent possible consistent with sound construction practices and quality of service.

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INDE is also the GOG's executing agency for implementation of the international loans which are financing the the Aguacapa and Chixoy projects. While INDE will not actually carry out construction work with its own personnel under these projects, it will be responsible for construction contracting (much of which has already been accomplished) and procurement of certain major equipment items. The World Bank and IDB have concluded that INDE has the capacity to adequately manage these functions.

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B. Implementation Plan1. Overview

The project will be implemented over a four-year period. It is anticipated that the process of negotiating, signing, and ratifying the loan agreement will take approximately 9 months. During this time, INDE will undertake certain pre-project activities that will facilitate initiation of field activities on completion of CP's. Procurement specifications and bidding documents for procurement of hardware will be prepared. Construction activities are expected to begin approximately 9 months after authorization and continue until shortly before the PACD.

The scheduled of hookups by year and the corresponding loan and counterpart investments are given below:

	<u>Project Year</u>	<u>No. of Connections</u>
	1	17,000
	2	17,500
	3	17,500
	<u>4</u>	<u>18,000</u>
Total	.... 4 years.	70,000

Technical assistance will be largely provided during the first two years. Evaluation activities (see Section C) will continue through the full four years of the project. A PPT which describes the sequence of activities is included at the end of this section. There are several specific implementation issues that require special treatment. These are discussed below:

## 2. Special Implementation Arrangements

### a. Terminal Date for Signing Loan Agreement (TDSL)

AID's experience has been that the GOG approvals which are required prior to signature of loan agreements in Guatemala takes considerably more time than the 120 days normally allowed. For instance, it has taken approximately 180 days to complete this activity for loans 027 and 029. The Mission has taken several steps to facilitate signing within 120 days including prenegotiation of the standard project agreement provisions. However, it should be noted that an extension of the TDSL could still be necessary if the GOG pre-signing approval process cannot be accelerated.

### b. Terminal Date for Meeting CP's (TDCP)

After signature, the loan agreement must be ratified by the Guatemalan Congress. It is reviewed by several Congressional committees prior to floor debate and approval. This process typically takes 6 to 12 months. Thus, it may be necessary to extend the terminal date for meeting CP's beyond the normal 90-day limit.

### c. Eligibility of Contracts for Loan Financing Signed Prior to Meeting CP's for Loan Financing

In order to ensure timely implementation of the project, INDE has agreed to initiate procurement of technical assistance and engineering services as soon as possible after signing the loan agreement. In view of the

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long lead time anticipated for meeting CP's for initial disbursement, INDE would like to contract for these services prior to meeting CP's. Because INDE will follow AID procurement regulations, and the Mission will monitor this process, the Mission intends to authorize reimbursement of eligible contract costs incurred prior to the TDCP.

d. INDE Project Manager

INDE has agreed to appoint a project manager. The role of the project manager would be to ensure that necessary coordination is achieved between AID and INDE's Technical Division. The Mission has included the designation of a Project Manager as a CP to loan disbursement.

3. Disbursement Procedures

AID loan funds will finance 100% of all foreign exchange costs, training, technical assistance, vehicles and equipment costs, and housewiring. Disbursements for foreign exchange costs will be made through standard Letter of Commitment procedures. Direct reimbursement methods will be used for local costs.

The Mission and INDE have discussed using the FAR disbursement method. Because of the high proportion of foreign exchange costs to be financed by the loan and the extensive use of contractors for construction, the FAR method was not considered appropriate.

4. Procurement Plan

INDE will be the action agent for all procurement under the project. Approximately 13 different procurement actions are anticipated. The goods and services, needed, contracting modes, and basis for award (where relevant) are specified in the Procurement Plan on the next page. This plan is based on INDE direct procurement of all materials requirements for contract as well as force account construction following the practice used under the earlier rural electrification project. However, INDE is also considering the alternative of including materials for contract construction under construction contracts. The final determination will be made prior to disbursement and approved by AID as a CP. INDE is familiar with AID's procurement regulations from Loan 019. The Mission is satisfied that INDE's procurement capability and process are adequate to ensure timely provisions of project inputs.

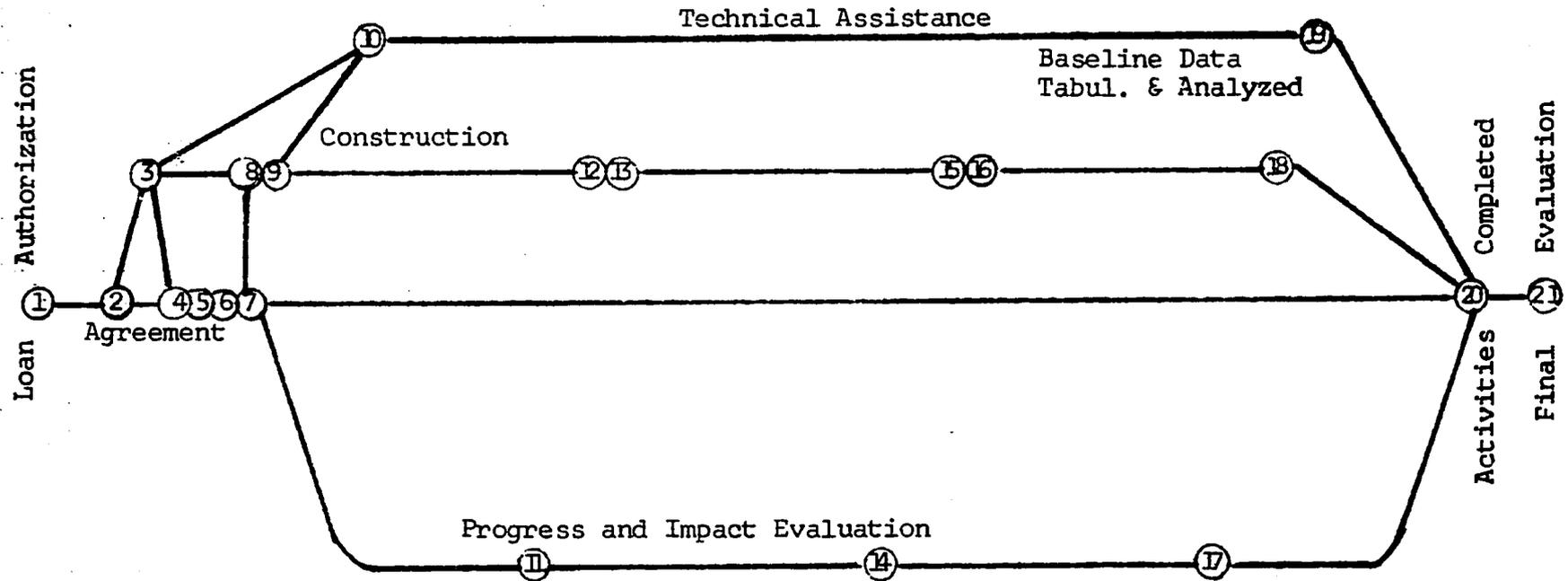
INDE PROCUREMENT PLAN SUMMARY - RURAL ELECTRIC DISTRIBUTION SYSTEMS

Action No.	Description of Goods and Services	Estimated Cost(s)	Origin (O) Source(s)	Contracting Mod:	Award Basis	Date G&S needed	Date of Solicitation	Date of Contract	Completion Date	% Loan Financed	Loan Disbursement Procedure
1.	Offshore procurement: (10KV 756 KV/ transformers, 70,000 electric meters and others)	2,024	0-941 S-941 And HC*	IFB	Lowest price	30% - 6/80 70% - 6/81	12/78	3/79	9/82	100%	GOG Financed Letter of Credit
2.	Offshore procurement: equipment for substations	230	0-941 S-941 And HC*	IFB	Lowest price	9/81	9/79	2/80	9/82	100%	GOG Financed Letter of Credit
3.	Construction services for substations	60	0-941 and HC S-HC	IFB	Lowest price	9/81	9/79	2/80	9/82	33%	GOG Reimbursement
4.	Materials procured locally, and construction services for lines and house wiring	6,976	0-941 and HC S-HC	IFB	NA	30% - 6/80 70% - 6/81	NA	NA		33%	LC Reimbursement
5.	Vehicles	50	0-000 S-941 and HC*	IFB	Lowest price	5/79	1/79	3/79	4/79	100%	GOG Financed Letter of Credit
6.	Equipment	250	0-941 S-941 and HC*	IFB	Lowest price	1/80	1/79	5/79	12/79	100%	GOG Financed Letter of Credit
7.	T.A., Training and Evaluation	300	O/S-941 and HC	RFP	Neg. price	8/79	3/79	7/79	9/82	100%	GOG Financed Letter of Credit
8.	Engineering Consultant Services	300	O/S-HC	RFP	Neg. price	9/79	2/99	5/79	9/82	100%	LC Reimbursement
9.	INDE Engineering and Administration	760	O/S-941								
10.	Force Account Construction	2,250	O/S-941								
11.	Contingencies and Inflation	1,800	O/S-941							56%	
		15,000									

\* Bids will be accepted from authorized local representatives of Code 941 manufacturers.

GUATEMALA: RURAL ELECTRIFICATION II

- Implementation Activities Flow Diagram -



June 1978

Year 1979

Year 1980

Year 1981

Year 1982

GUATEMALA: RURAL ELECTRIFICATION II

EVENTS OF IMPLEMENTATION FLOW DIAGRAM

<u>No.</u>	<u>E v e n t</u>	<u>Date</u>
1.	Loan authorized	6/78
2.	Loan Agreement signed	9/78
3.	Site Evaluations begin	10/78
4.	INDE Project Manager named	11/78
5.	First year construction sites selected	12/78
6.	Loan Agreement ratified	2/79
7.	All CP's satisfied	2/79
8.	Rights-of-way obtained	2/79
9.	Construction begins	3/79
10.	Contract for TA in eval. syst. design signed	7/79
11.	Evaluation System designed and first annual evaluation begins	12/79
12.	Second year construction schedule prepared	3/80
13.	Rights-of-way obtained	3/80
14.	Second annual program evaluation held	12/80
15.	Third year construction schedule prepared	3/81
16.	Rights-of-way obtained	3/81
17.	Third Annual Progress Evaluation held	12/81
18.	Fourth year construction schedule prepared	3/82
19.	Baseline data tabulated & analyzed; TA completed for impact evaluation	4/82
20.	All project activities completed	9/82
21.	Final progress and impact evaluation held	12/82

C. Evaluation Plan

Two types of evaluations will be carried out under the project.

1. Yearly (Output Level) Progress Evaluations

INDE and AID will hold a yearly progress evaluation in January of each year starting in 1979. INDE's progress report for the preceding quarter will be expanded to include an overall review of progress in implementing the project. This report will serve as the basis for discussing the targets for output achievement vs. actual performance, timeliness of AID and GOG inputs; INDE contracting procedures and AID approval processes; and, in general, any implementation problems that are affecting output achievements. In the later years of the project, these annual evaluations will monitor improvement in INDE's institutional capability to continue to extend electrical service to rural areas as well as the completion of physical project outputs.

2. Impact Evaluation

a. State of the Art

The state of the art of impact evaluations of rural electrification programs was dealt with in some detail in a recent AID financed evaluation of NRECA activities. <sup>1/</sup> That report distinguishes between Type I impact studies, which attempt to establish causality between rural electrification and development objectives, and Type II impact studies which can be, "used to provide evidence of any positive changes among the target population which

1/ Development Alternatives, Inc. An Evaluation of the Program Performance of the International Program Division of NRECA. Prepared under Contract No. AID/otr-c-1383, January, 1977.

coincide with, but are not necessarily attributable to, the introduction of rural electrification programs." Impact studies carried out to date have been type II studies. As such they share the characteristics--negative and positive--noted on page 77 of DAI's report: "... (they provide) no measure of the magnitudes or levels of benefit and little potential for cost/benefit analysis; (but are sufficient to) suggest to reasonable men that rural electrification... (has) ... positive benefits."

Evaluations planned as part of recently approved rural electrification programs are attempting to move closer towards the type I analysis. At a minimum, the evaluations that will be carried out in Bolivia and Honduras are expected to address the methodological deficiencies that the DAI report noted in its review of studies carried out to date. The impact evaluation that will be carried out under this program will be similar in many respects to the Bolivia and Honduras efforts.

b. Impact Evaluation Strategy

It is difficult, if not impossible, to try to design an evaluation strategy that will provide answers within the project implementation period to a broad range of questions about the impact of rural electrification and the causal links between it and increased incomes and well-being of AID's target group. Thus, TAB funded research may be more appropriate for further analyzing possible causal links between rural electrification and decreased birth rate, improved health, and rising incomes (or savings from current expenditure levels).

Accordingly, the project evaluation strategy will focus on a more limited objective: documenting and analyzing the rate of adoption of electricity for productive purposes by low income rural residents and assessing the direct impact on their productivity. The implicit assumption behind the strategy is that impact on productivity may be measurable

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even over a relatively short period of time (4 years), whereas the impact on other aspects of rural life are too indirect and difficult to quantify to produce results within a short period.

c. Impact Evaluation Plan

Shortly after signature of the loan agreement, USAID will request from TA/RD (Rural Development Office of the Technical Assistance Bureau) the services of an evaluation specialist, who is financed under the FY 1977 interregional project entitled "Rural Development Data Gathering and Analysis Methods,<sup>1/</sup>" to design an evaluation methodology for implementing the strategy, collection instruments and a data collection and storage process. The data collection process will be designed to fit into INDE's normal operations to the maximum degree possible in order to minimize data collection costs. The evaluation specialist will train local personnel in the data collection procedures adopted.

INDE will use Loan funds to finance local costs attendant to gathering baseline data such as income, present productive activities (farming, cottage industries, service sector occupations), production volume and processes, and intention to adopt electrification in the productive processes. As these data will be collected throughout the life of the project, the communities surveyed will have had electricity for from one to four years. The evaluation design will match these users against families that don't desire electricity and those who live in villages that will not be electrified under the program for control purposes. Comparisons also will be made with families who were INDE customers before the project began.

Near the end of the project, AID will request the services of a firm specialized in evaluation to carry out the impact evaluation. This contract will involve a sample survey of users for varying periods of time, analysis of the data and preparation of the evaluation report.

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<sup>1/</sup> This project, funded in FY 1977 for three years for \$701,000, will provide Missions with access to consultants who are expert in the design and implementation of evaluation systems for specific types of rural development problems including rural electrification. A "Methods" Paper on rural electrification data gathering and analysis is also included. Guatemala may serve as one of the case studies for the Methods Paper on rural electrification.

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D. Conditions Precedent and Covenants

1. Conditions Precedent to Initial Disbursement

Prior to the first disbursement under the loan, Borrower shall, except as AID may otherwise agree in writing, furnish to AID in form and substance satisfactory to AID:

a. An opinion of the Ministerio Público or other counsel acceptable to AID that this Agreement has been duly authorized and/or ratified by, and executed on behalf of the Borrower, and that it constitutes a valid and legally binding obligation of the Borrower in accordance with all of its terms;

b. A statement of the names of authorized Borrower representatives for loan implementation purposes, and a specimen signature of each person specified in such statement.

c. An executed Agreement between the Ministry of Finance and INDE which provides:

(i) That INDE shall be the GOG institution responsible for execution of the Project;

(ii) That all funds disbursed by the Borrower and AID to INDE will be on a non-reimbursable basis; and,

(iii) That terms and conditions of the Loan Agreement will govern the use of Project funds by INDE;

d. Evidence that INDE has designated a Project Manager;

e. Evidence that INDE's rate schedule and additional charges are in consonance with the objectives of this project;

- f. A detailed financial plan indicating projected annual GOG counterpart contributions which will be made available to support the Project;
- g. A detailed technical assistance plan, including the uses to be made of such technical assistance and where and when such assistance will be obtained.

2. Conditions Precedent to Disbursement for Other than Technical and Professional Services

Prior to any disbursement or issuance of any Letter of Commitment other than for Technical and Professional Services, the Borrower shall furnish to AID in form and substance satisfactory to AID:

- a. A detailed time phased Implementation Plan with cost estimates covering:
  - i. A procurement plan for obtaining materials and contract construction services; and,
  - ii. A construction schedule by geographic area for subtransmission and distribution lines.
- b. Evidence that INDE has made satisfactory arrangements to retain consultant engineering services for the project;

3. Conditions Precedent to Disbursement or Commitment in Excess of \$6 million of Loan Funds

Prior to any disbursement or to the issuance of commitment documents in excess of \$6 million under the Loan, INDE shall submit in form and substance satisfactory to AID a plan for expansion of rural electrification systems to serve additional low income customers following disbursement of the Loan. The plan will provide for the connection of 10,000 additional hook-ups in rural areas in each year subsequent to Loan disbursement which will be financed with INDE's own revenues along with other sources of financing as may be required.

4. Covenants

The borrower covenants and agrees that, except as AID may otherwise agree in writing, the Borrower shall:

- a. Contribute to the project on a timely basis not less than the equivalent of \$6 million four hundred thousand United States Dollars (\$6,400,000) during the implementation period of the Project;
- b. Cause INDE to carry out the plan in accordance with condition precedent number three above;
- c. Cause INDE to carry out an impact evaluation in the Project Area prior to the PACD and annual progress evaluations each year of project implementation;
- d. Cause INDE to obtain rights-of-way for all construction activities prior to initiation of construction on the property involved;
- e. Cause INDE to submit an annual construction schedule to AID.

RESPONSE TO DAEC MESSAGE

STATE 159969

JULY 11, 1977

SUBJECT: RURAL ELECTRIFICATION II - INTERIM REPORT

A. THE INTERIM REPORT WAS REVIEWED BY THE DAEC ON JUNE 10, 1977 AND APPROVAL WAS GIVEN TO PROCEED WITH THE PREPARATION OF THE PROJECT PAPER. THE FOLLOWING COMMENTS AND DECISIONS OF THE DAEC SHOULD BE TAKEN INTO CONSIDERATION IN THE PREPARATION OF THE PP.

1. RURAL DEVELOPMENT STRATEGY. THE DAEC REQUESTED THAT THE PP DISCUSS THE ROLE OF THE ELECTRIFICATION PROJECT WITHIN THE MISSION'S OVERALL RURAL DEVELOPMENT STRATEGY GIVING EXAMPLES OF LINKAGES BETWEEN THE PROPOSED LOAN AND OTHER MISSION AND IFI FINANCED PROGRAMS.

RESPONSE: SEE SECTION II. A. & B., PROJECT BACKGROUND AND STRATEGY.

2. SIZE OF PROJECT AND GOVERNMENT OF GUATEMALA CONTRIBUTION. IN VIEW OF CONGRESSIONAL RESERVATIONS ABOUT THE USE OF AID FINANCING FOR LARGE INFRASTRUCTURE INVESTMENTS, AND THE ALREADY LARGE GOG COUNTERPART CONTRIBUTIONS SCHEDULED FOR THE POWER SECTOR, THE DAEC RECOMMENDED THAT A MORE APPROPRIATE LEVEL OF AID FUNDING FOR THIS PROJECT WOULD BE DOLS. 10 MILLION. AT A MINIMUM, GOG CONTRIBUTION SHOULD NOT BE LESS THAN THE 40 PERCENT RATIO AS SHOWN IN THE INTERIM REPORT.

RESPONSE: SEE SECTION I. SUMMARY AND RECOMMENDATIONS.

3. PROJECT DESIGN. ALTHOUGH THE DAEC RECOGNIZED THAT BUILDING ADDITIONAL SUBTRANSMISSION LINES WOULD ASSURE THE RELIABILITY OF POWER SERVICE TO THE TARGET AREA, THE PP

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SHOULD DEMONSTRATE THAT INSTALLATION OF THESE LINES IS DIRECTLY LINKED TO MAXIMIZING THE NUMBER OF CUSTOMER HOOKUPS TO THE TARGET GROUP AS WELL AS TO PROVIDING THEM WITH RELIABLE POWER SERVICE. THE MISSION IS REQUESTED TO REVIEW DURING PP PREPARATION THE TECHNICAL JUSTIFICATION FOR INCLUDING SUBTRANSMISSION LINES IN THE PROJECT. IF THE DECISION IS MADE THAT SOME OR ALL OF THESE SUBTRANSMISSION LINES ARE NECESSARY TO MAXIMIZE HOOKUP OF AID'S TARGET GROUP, THIS LINKAGE SHOULD BE CLEARLY DEMONSTRATED IN THE PP.

RESPONSE: SEE SECTION IV. A. TECHNICAL ANALYSIS.

4. RATE STRUCTURE. THE DAEC EXPRESSED THREE MAJOR CONCERNS CONCERNING THE RATE STRUCTURE PROPOSALS OUTLINED IN THE INTERIM REPORT. ONE IS THAT A RATE STRUCTURE BE CHOSEN WHICH WOULD BE AFFORDABLE BY THE TARGET GROUP; SECONDLY, THAT A SURCHARGE FEE WOULD DISCRIMINATE AGAINST THE TARGET GROUP AND MIGHT BECOME INSTITUTIONALIZED ONCE ACCEPTED BY INDE EVEN IF A STANDARD RATE IS SUBSEQUENTLY ADOPTED; AND FINALLY, THAT WHATEVER RATE STRUCTURE IS CHOSEN, IT SHOULD ENSURE A SUFFICIENT FLOW OF INCOME INTO INDE TO ALLOW A REASONABLE LEVEL OF HOUSEHOLD CONNECTIONS TO CONTINUE EACH YEAR.

THE MISSION SHOULD SEEK TO EXPLORE WITH INDE THE ADOPTION OF A STANDARD RATE, AND AT A MINIMUM, INDE SHOULD AGREE TO ELIMINATE THE PRIOR CASH PAYMENT OF THE FRONT END CHARGE FOR DISTRIBUTION LINES AND HOUSE SERVICE CONNECTIONS. IN MAKING ANY DECISION ON A STANDARD RATE OR SURCHARGE, BOTH AID AND THE GOG SHOULD BE GUIDED BY THE RATE STUDY CURRENTLY SCHEDULED FOR COMPLETION IN JANUARY, AND COORDINATE SUCH DECISION WITH THE WORLD BANK.

RESPONSE: SEE SECTION III. PROJECT DESCRIPTION AND SECTION IV. D. SOCIAL ANALYSIS.

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5. REPLICABILITY. THE DAEC WAS CONCERNED THAT AFTER THE COMPLETION OF THE PROJECT, A HOOKUP CHARGE, IF ELIMINATED, MIGHT BE REINTRODUCED, OR THAT THE LEVEL OF CONNECTIONS MIGHT DROP DRASTICALLY. THE PP SHOULD EXPLAIN HOW CONTINUED INVESTMENT IN DISTRIBUTION FOR THE TARGET GROUP WILL BE INSURED WITHOUT REVERTING TO THE PRACTICE OF REQUIRING A FRONT END HOOKUP CHARGE.

RESPONSE: SEE SECTION III. PROJECT DESCRIPTION AND SECTION V. D. CONDITIONS PRECEDENT, COVENANTS.

6. FINANCIAL ANALYSIS. THE INTERIM REPORT DID NOT CONTAIN A PROJECTED FINANCIAL RATE OF RETURN FOR THE MISSION'S PREFERRED ALTERNATIVE III BECAUSE OF THE ABSENCE OF AN AGREED UPON STANDARD RATE. HOWEVER, FOR THE PURPOSES OF COMPLETING THE REQUIRED FINANCIAL ANALYSES, THE MISSION SHOULD ASSUME A MAXIMUM STANDARD RATE AFFORDABLE TO THE RURAL POOR WHICH WILL ALSO ALLOW FOR EXPANSION OF THE PROJECT, AND COMPUTE A RATE OF RETURN ON THIS BASIS.

RESPONSE: SEE SECTION IV. B. FINANCIAL ANALYSIS.

7. ECONOMIC ANALYSIS. THE DAEC QUESTIONED THE METHODOLOGY USED TO COMPUTE THE SURPLUS BENEFITS TO THE REGION THAT CAN BE EXPECTED FROM THIS PROJECT (ESTIMATED AT 25 PERCENT OF NET SALES). IT IS SUGGESTED THAT THE MISSION USE AVAILABLE DATA FROM INDE IN RECENTLY ELECTRIFIED AREAS TO SHOW INDUSTRIAL AND COMMERCIAL USES OVER TIME WHICH WOULD PROVIDE A MORE REALISTIC BASIS FOR PROJECTING THE PROJECT'S ECONOMIC RATE OF RETURN.

RESPONSE: SEE SECTION IV. C. ECONOMIC ANALYSIS.

MINISTERIO DE FINANZAS PUBLICAS  
GUATEMALA, C. A.

01008

Guatemala,  
26 de agosto de 1977

Señor Frederick W. Schieck  
Director Agencia para el  
Desarrollo Internacional  
Presente.-

Señor Director:

En mi calidad de representante del Gobierno de la República de Guatemala ante los Organismos Financieros Internacionales, confirmo por este medio nuestras conversaciones y solicito por este medio de la manera más atenta que la Agencia a su digno cargo, nos otorgue financiamiento hasta por el equivalente de US\$10,800,000.00 que será reforzado por una contrapartida en moneda nacional durante la vigencia del Proyecto, de una cantidad no menor de Q.7,400,000.00. Los fondos de préstamo y de contrapartida serán proporcionados al INDE en forma no reembolsable.

Los fondos del referido programa serán destinados a un programa de desarrollo que permita la participación de familias de ingresos bajos conectarse al sistema de electrificación del INDE. Se ha previsto que con dichos fondos se podrán conectar aproximadamente unas 75,000 familias que habitan en 375 aldeas y caseríos que se encuentran localizadas en la región oriental, occidental y en el altiplano del país. El sistema comprenderá la instalación de aproximadamente 727 kilómetros de líneas de distribución primarias y 656 kilómetros de líneas secundarias. Para asegurarse una calidad mínima aceptable de servicio en las áreas en donde los sistemas de distribución se extenderán y expandirán, se financiarán también 170 kilómetros de 69 KV de líneas de sub transmisión y dos subestaciones. Para fortalecer la capacidad del INDE de prestar servicio a los 75,000 nuevos usuarios, el programa incluirá asistencia técnica, adiestramiento, equipo para mantenimiento y vehículos. Se ha previsto que el proyecto tendrá una dura--

MINISTERIO DE FINANZAS PUBLICAS  
GUATEMALA. C. A.

/...

- 2 -

Señor Director de AID

ción aproximada de cinco años y después de dicho período el Instituto Nacional de Electrificación, INDE, en su calidad de Unidad Ejecutora del Proyecto con sus propios fondos continuará haciendo conexiones similares a un ritmo de 6,000 conexiones anualmente. Finalmente, es importante señalar que la estructura de tarifas del INDE requiere de revisión, con el objeto de incorporar un programa dinámico de electrificación rural.

Al anticiparle nuestra amplia colaboración en el referido programa y en espera de una resolución favorable a nuestra solicitud, hago propicia la oportunidad para reiterarle mi distinguida consideración y suscribirme atentamente,

  
JORGE LAMPORT RODIL  
Ministro Finanzas



JLR/Imc

STATUTORY CHECKLIST

A Country Checklist for Guatemala was included in the first Project Paper presented during the current fiscal year. No items have changed to date.

PROJECT CHECKLIST

A. GENERAL CRITERIA FOR PROJECT.

1. App. Unnumbered; FAA Sec. 653(b)

(a) Describe how Committees on Appropriations of Senate and House have been or will be notified concerning the project;  
(b) is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than \$1 million over that figure plus 10%)?

The project was the subject of a Congressional Notification.

2. FAA Sec. 611(a)(1). Prior to obligation in excess of \$100,000, will there be (a) engineering, financial, and other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?

Yes, See Parts IV A. and B. The cost estimates of the project are reasonably firm.

3. FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?

Further legislation is not required.

4. FAA Sec. 611(b); App. Sec. 101. If for water or water-related land resource construction, has project met the standards and criteria as per Memorandum of the President dated Sept. 5, 1973 (replaces Memorandum of May 15, 1962; see Fed. Register, Vol 38, No. 174, Part III, Sept. 10, 1973)?

N/A

5. FAA Sec. 611(e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed \$1 million, has Mission Director certified the country's capability effectively to maintain and utilize the project?

Yes, See Annex E.

A.

6. FAA Sec. 209, 619. Is project susceptible of execution as part of regional or multi-lateral project? If so why is project not so executed? Information and conclusion whether assistance will encourage regional development programs. If assistance is for newly independent country, is it furnished through multi-lateral organizations or plans to the maximum extent appropriate?

This project will compliment regional assistance programs but is not susceptible to execution as a regional program. Guatemala is not a newly independent country.

7. FAA Sec. 601(a); (and Sec. 201(f) for development loans). Information and conclusions whether project 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.

Project will improve the technical efficiency of industry and agriculture by substituting electricity for higher cost alternative energy sources.

8. FAA Sec. 601(b). Information and conclusion 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).

U.S. construction contractors may work on construction component. U.S. manufactured equipment and supplies will be used in construction. U.S. vehicles will be purchased.

9. FAA Sec. 612(b); Sec. 636(h). Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized to meet the cost of contractual and other services.

Guatemala will provide a substantial local currency contribution to the project in accordance with the financial plan set forth in the Project Paper. No U.S. owned foreign currencies are available for utilization in the project.

10. FAA Sec. 612(d). Does the U.S. own excess foreign currency and, if so, what arrangements have been made for its release?

No.

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

a. FAA Sec. 102(c); Sec. 111; Sec. 281a. Extent to which activity will (1) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production, spreading investment out from cities to small towns and rural areas; and (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions?

80% of all electrical connections will be made in low-income households. 40% of all connections are in villages of less than 200 families. All connections in the project are in the rural areas.

B1.

b. FAA Sec. 103, 103A, 104, 105, 106, 107. Is assistance being made available: [include only applicable paragraph -- e.g., a, b, etc. -- which corresponds to source of funds used. If more than one fund source is used for project, include relevant paragraph for each fund source.]

- (1) [103] for agriculture, rural development or nutrition; if so, extent to which activity is specifically designed to increase productivity and income of rural poor; [103A] if for agricultural research, is full account taken of needs of small farmers;
- (2) [104] for population planning or health; if so, extent to which activity extends low-cost, integrated delivery systems to provide health and family planning services, especially to rural areas and poor;
- (3) [105] for education, public administration, or human resources development; if so, extent to which activity strengthens nonformal education, makes formal education more relevant, especially for rural families and urban poor, or strengthens management capability of institutions enabling the poor to participate in development;
- (4) [106] for technical assistance, energy, research, reconstruction, and selected development problems; if so, extent activity is:
  - (a) technical cooperation and development, especially with U.S. private and voluntary, or regional and international development, organizations;
  - (b) to help alleviate energy problem;
  - (c) research into, and evaluation of, economic development processes and techniques;
  - (d) reconstruction after natural or manmade disaster;
  - (e) for special development problem, and to enable proper utilization of earlier U.S. infrastructure, etc., assistance;
  - (f) for programs of urban development, especially small labor-intensive enterprises, marketing systems, and financial or other institutions to help urban poor participate in economic and social development.

Yes. The project is specifically designed to increase the productivity and incomes of rural poor. The beneficiaries will be small scale farmers and landless rural workers and their families.

(5) [107] by grants for coordinated private effort to develop and disseminate intermediate technologies appropriate for developing countries.

c. FAA Sec. 110(a); Sec. 208(e). Is the recipient country willing to contribute funds to the project, and in what manner has or will it provide assurances that it will provide at least 25% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or has the latter cost-sharing requirement been waived for a "relatively least-developed" country)?

d. FAA Sec. 110(b). Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to Congress been made, and efforts for other financing?

e. FAA Sec. 207; Sec. 113. Extent to which assistance reflects appropriate emphasis on; (1) encouraging development of democratic, economic, political, and social institutions; (2) self-help in meeting the country's food needs; (3) improving availability of trained worker-power in the country; (4) programs designed to meet the country's health needs; (5) other important areas of economic, political, and social development, including industry; free labor unions, cooperatives, and Voluntary Agencies; transportation and communication; planning and public administration; urban development, and modernization of existing laws; or (6) integrating women into the recipient country's national economy.

f. 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 civic education and training in skills required for effective participation in governmental and political processes essential to self-government.

The Government of Guatemala has provided assurances that it will provide 40% of the total cost of the project.

The project does not involve grant financing of capital costs.

The project will train local electricians in Guatemala in house wiring and appliance repair. The project will make possible improved food storage, medicines and vaccines requiring refrigeration, and increase availability of pumped water in remote rural areas. Irrigation requiring electric pumping will be possible. Increased employment opportunities will be created by small industries attracted to rural areas by electricity. Women especially, will be able to increase their production of woven materials and find jobs as seamstresses and tailors.

A sample survey conducted in low income rural areas found that almost all respondents surveyed desired electricity. The GOG's electrification institute will have full responsibility for project implementation and will receive technical assistance under this project to strengthen its administrative and rural services capability. Villages will form electrification communities to discuss the need for electrification with INDE representatives and to decide for themselves whether to participate in the project.

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g. FAA Sec. 201(b)(2)-(4) and -(8); Sec. 201(e); Sec. 211(a)(1)-(3) and -(5). Does the activity give reasonable promise of contributing to the development: of economic resources, or to the increase of productive capacities and self-sustaining economic growth; or of educational or other institutions directed toward social progress? Is it related to and consistent with other development activities, and will it contribute to realizable long-range objectives? And does project paper provide information and conclusion on an activity's economic and technical soundness?

h. FAA Sec. 201(b)(6); Sec. 211(a)(5), (6). Information and conclusion on possible effects of the assistance on U.S. economy, with special reference to areas of substantial labor surplus, and extent to which U.S. commodities and assistance are furnished in a manner consistent with improving or safeguarding the U.S. balance-of-payments position.

2. Development Assistance Project Criteria  
(Loans only)

a. FAA Sec. 201(b)(1). Information and conclusion on availability of financing from other free-world sources, including private sources within U.S.

b. FAA Sec. 201(b)(2); 201(d). Information and conclusion on (1) capacity of the country to repay the loan, including reasonableness of repayment prospects, and (2) reasonableness and legality (under laws of country and U.S.) of lending and relending terms of the loan.

c. FAA Sec. 201(e). If loan is not made pursuant to a multilateral plan, and the amount of the loan exceeds \$100,000, has country submitted to AID an application for such funds together with assurances to indicate that funds will be used in an economically and technically sound manner?

d. FAA Sec. 201(f). Does project paper describe how project will promote the country's economic development taking into account the country's human and material resources requirements and relationship between ultimate objectives of the project and overall economic development?

There is a reasonable expectation that the project will stimulate productivity of small enterprises and household users and attract new businesses to locate in the rural areas, thereby contributing to economic growth and the achievement of the GOG's long range development objectives. The Project Analysis section of the project paper provides information and conclusions on the technical and economic feasibility of the project.

The project is not expected to adversely affect the US economy or areas of substantial labor surplus in the United States.

Financing for the project is not forthcoming from other free world sources, including private sources within the U.S.

In view of Guatemala's traditional underutilization of its credit capacity, and considering its long term economic prospects, there is a reasonable expectation that Guatemala will have the capacity to repay the loan.

Financing for the project has been requested and assurances have been provided that funds will be used in an economically and technically sound manner.

The Project Analysis and Project Description sections of the project paper contain such descriptions.

e. FAA Sec. 202(a). Total amount of money under loan which is going directly to private enterprise, is going to intermediate credit institutions or other borrowers for use by private enterprise, is being used to finance imports from private sources, or is otherwise being used to finance procurements from private sources?

f. FAA Sec. 620(d). If assistance is for any productive enterprise which will compete in the U.S. with U.S. enterprise, is there an agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan?

3. Project Criteria Solely for Security Supporting Assistance

FAA Sec. 531. How will this assistance support promote economic or political stability?

4. Additional Criteria for Alliance for Progress

[Note: Alliance for Progress projects should add the following two items to a project checklist.]

a. FAA Sec. 251(b)(1), -(3). Does assistance take into account principles of the Act of Bogota and the Charter of Punta del Este; and to what extent will the activity contribute to the economic or political integration of Latin America?

b. FAA Sec. 251(b)(8); 251(h). For loans, has there been taken into account the effort made by recipient nation to repatriate capital invested in other countries by their own citizens? Is loan consistent with the findings and recommendations of the Inter-American Committee for the Alliance for Progress (now "CEPCIES," the Permanent Executive Committee of the OAS) in its annual review of national development activities?

All loan funds will be channeled to Guatemala's National Electrification Institute, a semi-autonomous agency of the government which will contract much of the construction and materials and equipment in the project with private companies, either U.S. or CACM. Approximately 20 vehicles from private sources in the U.S. will be imported and financed with loan funds.

Assistance is not for a productive enterprise which will compete in the United States.

Not applicable.

The project takes these principles into account. A modest favorable impact on the economic integration of Central America is expected.

Guatemala does not have exchange controls and repatriation of capital is unregulated. The loan is consistent with relevant OAS findings and recommendations.

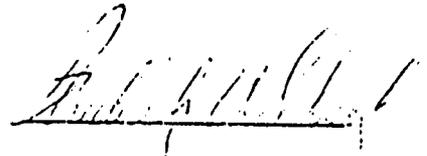
UNCLASSIFIED  
ANNEX E  
Page 1 of 1

CERTIFICATION PURSUANT TO SECTION 611 (e) OF THE  
FOREIGN ASSISTANCE ACT OF 1961, AS AMENDED

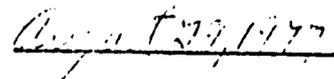
I, Frederick W. Schieck, the principal officer of the Agency for International Development in Guatemala, having taken into account, among other things, the maintenance and utilization of projects in Guatemala previously financed or assisted by the United States, do hereby certify that in my judgment Guatemala has both the financial capacity and the human resources capability to effectively utilize and maintain the facilities and equipment provided as part of this capital assistance project, Rural Electrification.

This judgment is based upon the improving implementation record of AID-financed projects in Guatemala and the quality of the planning which has gone into this new project.

(signed)



(date)



LOG FRAME

SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
<p><u>Goal</u>            Improve the well-being of rural Guatemalans by increasing small farmer income and increasing employment in the rural areas.</p>	<ol style="list-style-type: none"> <li>1. Average income of users increases more rapidly than income of non-users.</li> <li>2. Quality of life improvements such as increased educational opportunities; improved health and nutrition; and reduction of household drudgery.</li> </ol>	<ol style="list-style-type: none"> <li>1. Survey of users and non-users when INDE canvasses selected towns/villages for application survey of users, non-users and disconnectors in those towns prior to final loan disbursement.</li> <li>2. Index of social indicators such as infant mortality rates, malnutrition rates, and school drop-out rates.</li> </ol>	<ol style="list-style-type: none"> <li>1. Other GOG programs (e.g. Small Farmer Marketing) completed on schedule.</li> <li>2. Prices for agricultural produce do not decrease.</li> </ol>
<p><u>Purpose</u>            Increase the number of electric connections in low-income rural areas and improve INDE's capacity for continuing the extension of local power services to additional low income rural areas.</p>	<p><u>EOPS</u></p> <ol style="list-style-type: none"> <li>1. 70,000 low income users served with reliable electric energy.</li> <li>2. Plan for connection of 6,000 additional low income users per year following and of program prepared by INDE and accepted by AID.</li> </ol>	<ol style="list-style-type: none"> <li>1. INDE records; final impact evaluation.</li> <li>2. USAID loan files.</li> </ol>	<ol style="list-style-type: none"> <li>1. Disconnect rate does not exceed 2%.</li> <li>2. Increases in generating capacity brought on stream as planned.</li> </ol>
<p><u>Outputs</u>            1. Rural Electric Distribution Systems</p> <p>a. Distribution, Secondary Line, Meters and Service Drops.</p>	<ol style="list-style-type: none"> <li>1. a. (1) 7.6 kms. of 34.5 KV subtransmission lines.                (2) 196 Kms. of 19.9 KV and 13.2 KV distribution lines.                (3) 387 Kms. of 7.6 KV distribution lines.                (4) 489 Kms. of secondary (120/240 V) lines installed.                (5) 70,000 service drops, meters and house wiring installed.</li> </ol>	<ol style="list-style-type: none"> <li>1. INDE records and progress reports</li> </ol>	<ol style="list-style-type: none"> <li>1. Timely GOG counterpart contributions.</li> <li>2. Loan ratified by Guatemalan Congress within one year from date of authorization.</li> </ol>

LOG FRAME

SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
b. Subtransmission Lines and Distribution Substations	b. (1) 150 Kms. of 69 KV subtransmission lines. (2) One substations constructed.		
2. Improved INDE Outreach capability.	2. a. Field Offices will have capability to maintain the rural electrification system and provide customer services. b. 250 local electricians will be trained in house wiring and appliance repair. c. Purchase of maintenance equipment and fifteen vehicles. d. Development of a promotional/educational program for the rural areas.	2. INDE records and Progress reports.	Timely TA received.
3. Improved INDE Administrative Capacity	3. a. Technical Assistance provided in key areas. b. Billing & Collection system improved. c. In-house capability for cost to serve and rate analysis developed. d. Fifteen INDE management personnel trained.	3. INDE records and Progress reports.	Timely TA received.
4. Impact Evaluation Conducted	4. Evaluation System developed and installed.		Timely TA received.

LOG FRAME

SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION			ASSUMPTIONS
		(in \$000)			
<u>Inputs</u>		<u>AID</u>	<u>GOG</u>	<u>TOTAL</u>	
	1. Construction of Subtransmission and Distribution Systems	6,670	4,870	11,540	Rate structure adopted by INDE is acceptable to AID.
	2. Consulting Engineering Services	300	-	300	
	3. INDE Engineering and Administration	-	760	760	
	4. Maintenance and Service Equipment	300	-	300	
	5. Technical Assistance and Training	300	-	300	
	6. Inflation	940	700	1,640	
	7. Contingency	<u>90</u>	<u>70</u>	<u>160</u>	
	T O T A L	<u>8,600</u>	<u>6,400</u>	<u>15,000</u>	

DRAFT PROJECT DESCRIPTION

This project will contribute to a balanced power development program for Guatemala by assuring the participation of low-income rural populations in INDE's energy investment program. INDE will accelerate its services to the rural population by connecting 70,000 new users in numerous villages in the Western and Central Highlands, Eastern and South Coast Regions of Guatemala. Technical assistance, training, maintenance equipments and vehicles will be provided directly to INDE to strengthen its administrative and outreach capability to service the 70,000 additional new customers. Approximately 37,000 residential and commercial connections will be made in villages which are partially electrified. An additional 33,000 new residential and commercial users will be hooked up in villages which are non-electrified. Approximately 95% of all connections will be residential and 5% will be commercial.

The project area is defined by the departamental boundaries of the seven Highland Departments of Totonicapan, El Quiche, Huehuetenango, Solola, Chimaltenango, Alta Verapaz and Baja Verapaz, and the natural boundaries formed by the mountain range cutting across the Highland Departments of San Marcos and Quezaltenango. The project area in these two departments is determined by altitude; the project area will be 5,000 feet and above. Below that elevation are large coffee plantations which clearly do not include the target group. In the Eastern Region the project will operate in all the Departments of Jutiapa, Jalapa, El Progreso, Chiquimula and Santa Rosa. In the Department of Zacapa, only the area south of the Motagua River Valley will be included in the project. In the South Coast Region the project will include the departments of Suchitepequez, Retalhuleu and Escuintla.

To ensure minimally acceptable quality of service in the areas where distribution systems are to be extended and expanded, 150 kms. of 69KV subtransmission lines will be financed. One substation is also required to provide transformation of voltage and protection for the new distribution lines. A total of 591 kms. of primary distribution lines and 489 kms. of secondary lines will be built. Service drops, meters, and customer-owned house wiring for 70,000 new users will be installed. Funds to finance house wiring, which will be paid by the customer by affixing a charge to his monthly utility bill for four years

are provided by the loan. An impact evaluation which measures the rate of adoption of electricity for productive purposes by lowincome rural families will be carried out during the last year of the project.

After the project has terminated, INDE will continue to connect on an annual basis at least 10,000 annual connections after the project represent an increase in the rate of connecting target group families during the last four years. The financing for the 10,000 hookups in low income rural areas will come from INDE's own resources.

The total cost of the project is estimated at \$15,000,000 of which \$8,6000,000 will be financed with Loan funds disbursed over the projected five year life of the project. The Government of Guatemala will contribute the equivalent of \$6,400,000 during the same period. The National Institute of Electrification INDE will be the Implementing Agency and responsible for the extension of rural distribution systems to serve additional low income customers each year after the project has terminated.

DRAFT PROJECT AUTHORIZATION

GUATEMALA - RURAL ELECTRIFICATION

Pursuant to Part I, Chapter I, Section 103 of the Foreign Assistance Act of 1961, as amended, I hereby authorize a Loan to Guatemala (the "Borrower") of not to exceed eight million six hundred thousand United States Dollars (\$8,600,000) to help in financing certain foreign exchange and Central American Common Market local currency costs of goods and services required to carry out a rural electrification program, which is described in the following paragraph.

The project consists of extending electric services to benefit new users in small villages in the Western and Central Highlands, Eastern and South Coast Regions of Guatemala and providing technical assistance to strengthen the administrative and outreach capability of the GOG's Electrification Institute (INDE) to continue the program after the loan has been fully disbursed. The entire amount of the AID financing herein authorized for the project will be obligated when the Project Agreement is executed. I hereby authorize the initiation of negotiation and execution of a Project Agreement or Project Agreements as may be appropriate by the officer to whom such authority has been delegated in accordance with AID regulations and Delegations of Authority, which Agreement or Agreements shall be subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as AID may deem appropriate.

I. Interest Rate and Terms of Repayment of the Loan

The Borrower shall repay the Loan to AID in United States Dollars within twenty (20) years from the date of first disbursement of the Loan, including a grace period of not to exceed ten (10) years. The Borrower shall pay to AID in United States Dollars interest from the date of first disbursement of the Loan at the rate of two percent (2%) per

annum during the first seven (7) years, and three percent (3%) per annum thereafter, on the outstanding disbursed balance of the Loan and on any due and unpaid interest accrued thereon.

II. Source and Origin

Except for ocean shipping, goods and services financed by AID under the project shall have their source and origin in the Central American Common Market or in countries included in AID Geographic Code 941, except as AID may otherwise agree in writing. Ocean shipping financed by AID under the project shall be procured in any eligible source country except countries which are members of the Central American Common Market.

III. Conditions Precedent to Initial Disbursement

Prior to the first disbursement under the Loan, Borrower shall, except as AID may otherwise agree in writing, furnish to AID in form and substance satisfactory to AID:

A. An opinion of the Ministerio Público or other counsel acceptable to AID that this Agreement has been duly authorized and/or ratified by, and executed on behalf of the Borrower, and that it constitutes a valid and legally binding obligation of the Borrower in accordance with all of its terms;

B. A statement of the names of authorized Borrower representatives for loan implementation purposes, and a specimen signature of each person specified in such statement.

C. An executed Agreement between the Ministry of Finance and INDE which provides:

1. That INDE shall be the GOG institution responsible for execution of the Project;

2. That all funds disbursed by the Borrower and AID to INDE will be on a non-reimbursable basis; and

3. That terms and conditions of the loan agreement will govern the use of Project funds by INDE;

D. Evidence that INDE has designated a Project Manager;

E. Evidence that INDE's rate schedule and additional charges are in consonance with the objectives of this Project;

F. A detailed financial plan indicating projected annual GOG counterpart contributions which will be available to support the Project;

G. A detailed technical assistance plan, including the uses to be made of such technical assistance and where and when such assistance will be obtained.

IV. Conditions Precedent to Disbursement for Other than Technical and Professional Services.

Prior to any disbursement or issuance of any Letter of Commitment other than for Technical and Professional Services, the Borrower shall furnish to AID in form and substance satisfactory to AID:

A. A detailed time-phased implementation plan with cost estimates covering:

1. A procurement plan for obtaining materials and contract construction services; and

2. A construction schedule by geographic area for sub-transmission and distribution lines.

B. Evidence that INDE has made satisfactory arrangements to retain consultant engineering services for the project;

V. Condition Precedent to Disbursement of Commitment in Excess of \$6 Million of Loan Funds

Prior to any disbursement or to the issuance of commitment documents in excess of \$6 million under the Loan, INDE, shall submit in form and substance satisfactory to AID a plan for expansion of rural electrification systems to serve additional low income customers following disbursement of the Loan. The plan will provide for the connection of 10,000 additional hook-ups in rural areas in each year subsequent to Loan disbursement which will be financed with INDE's own revenues along with other sources of financing as may be required.

VI. Covenants

The Borrower covenants and agrees that, except as AID may otherwise agree in writing, the Borrower shall:

- A. Contribute to the project on a timely basis not less than the equivalent of six million four hundred thousand United States Dollars (\$6,400,000) during the implementation period of the Project;
- B. Cause INDE to carry out the plan in accordance with condition precedent number three above;
- C. Cause INDE to carry out an impact evaluation in the Project Area prior to the PACD and annual progress evaluations each year of project implementation.
- D. Cause INDE to obtain rights-of-way for all construction activities prior to initiation of construction on the property involved.
- E. Cause INDE to submit a yearly construction schedule to AID.

COST ESTIMATES FOR TECHNICAL ASSISTANCE AND  
TRAINING FOR INDE MANAGEMENT AND TECHNICAL PERSONNEL

I.	<u>TECHNICAL ASSISTANCE</u>		<u>\$227,000</u>
	1. Technical Practices		<u>\$35,760</u>
	4 months x \$7,560/month (includes salary, overhead \$ fee)	= \$30,240	
	Travel 1 x \$600/r.t.	= 600	
	Per Diem 120 days x \$41	= 4,920	
	2. Rate Analysis		<u>\$18,180</u>
	2 months x \$7,560/month	= \$15,120	
	Travel 1 x \$600/r.t.	= 600	
	Per Diem 60 days x \$41	= 2,460	
	3. Commercial Operations		<u>\$89,100</u>
	10 months x \$7,560/month	= \$75,600	
	Travel 2 x \$600/r.t.	= 1,200	
	Per Diem 300 x \$41	= 12,300	
	4. Other Consultants		<u>\$53,340</u>
	6 months x \$7,560/month	= \$45,360	
	Travel 1 x \$600/r.t.	= 600	
	Per Diem 180 days x \$41	= 7,380	
	5. INDE Contract Personnel and Evaluation Local Costs		<u>\$30,620</u>
II.	<u>TRAINING</u>		<u>\$ 73,000</u>
	1. One month course in rural electrification in Nicaragua and Costa Rica for 8 persons		\$10,900
	Travel	= \$ 800	
	Per Diem	= 9,600	
	Other	= 500	

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2. Five INDE Executives to special courses in U.S. for 30 days		<u>\$20,400</u>
Travel	=	\$ 3,000
Per Diem	=	5,400
Course expenses	=	10,000
Travel in U.S.	=	2,000
3. Equivalent of Three Technicians for one-year training in U.S. at \$13,900 each		<u>\$41,700</u>

G R A N D T O T A L

\$300,000

ON-LINE GENERATING PLANTS

INDE INTERCONNECTED PLANTS

<u>Number</u>	<u>Name</u>	<u>Type</u>	<u>Total Capacity MW</u>
1	Jurón Marinalá	Hydro	60.00
2	Esclavos	Hydro	13.00
3	El Salto	Hydro	5.50
4	San Luis	Hydro	5.00
5	Palín	Hydro	1.63
6	Río Hondo	Hydro	2.40
7	Santa María	Hydro	5.94
8	El Porvenir	Hydro	2.28
9	Escuintla	Steam	86.00
10	Escuintla	Gas	75.00
11	Varios	Diesel	4.34
		SUB-TOTAL	261.09

EMPRESA ELECTRICA INTERCONNECTED PLANTS

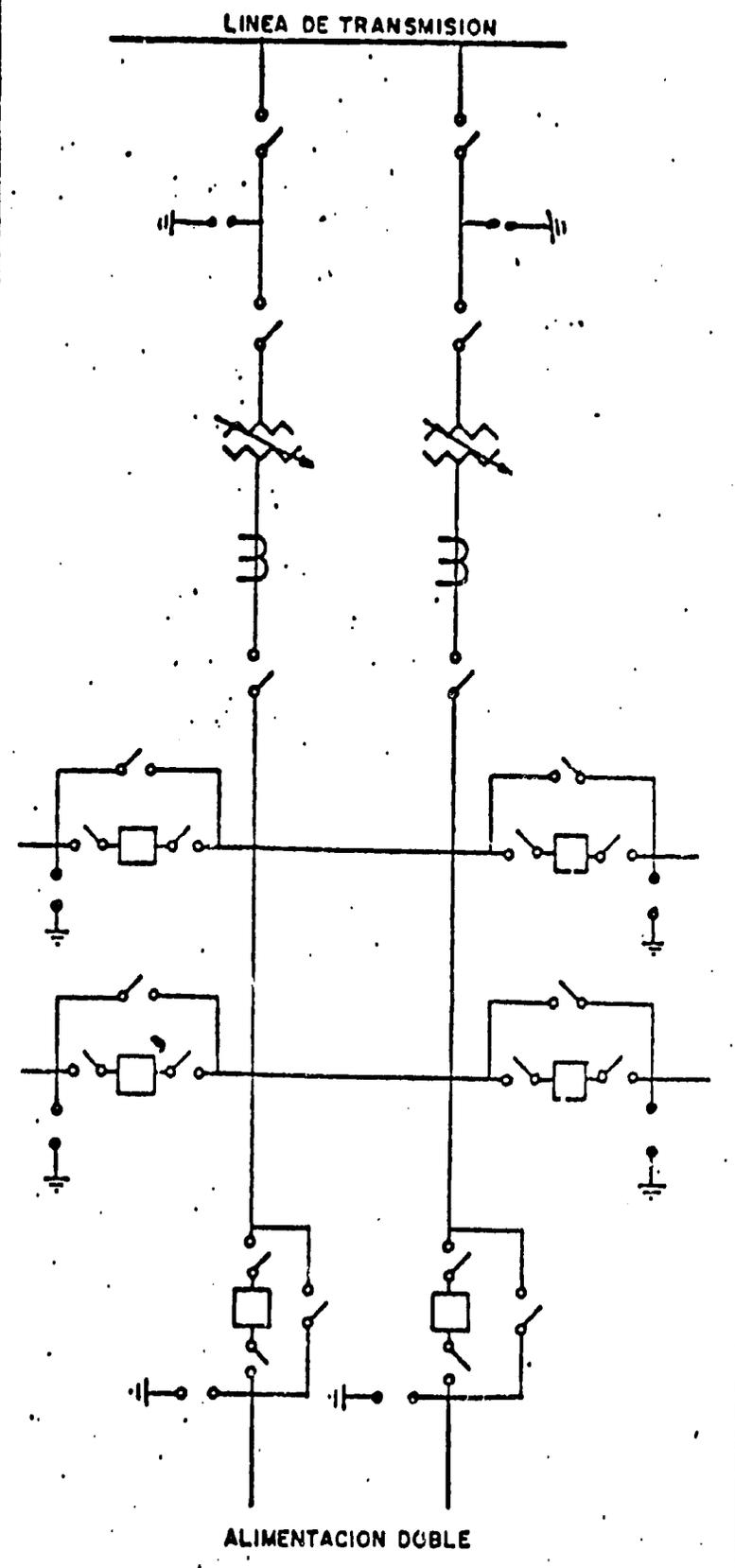
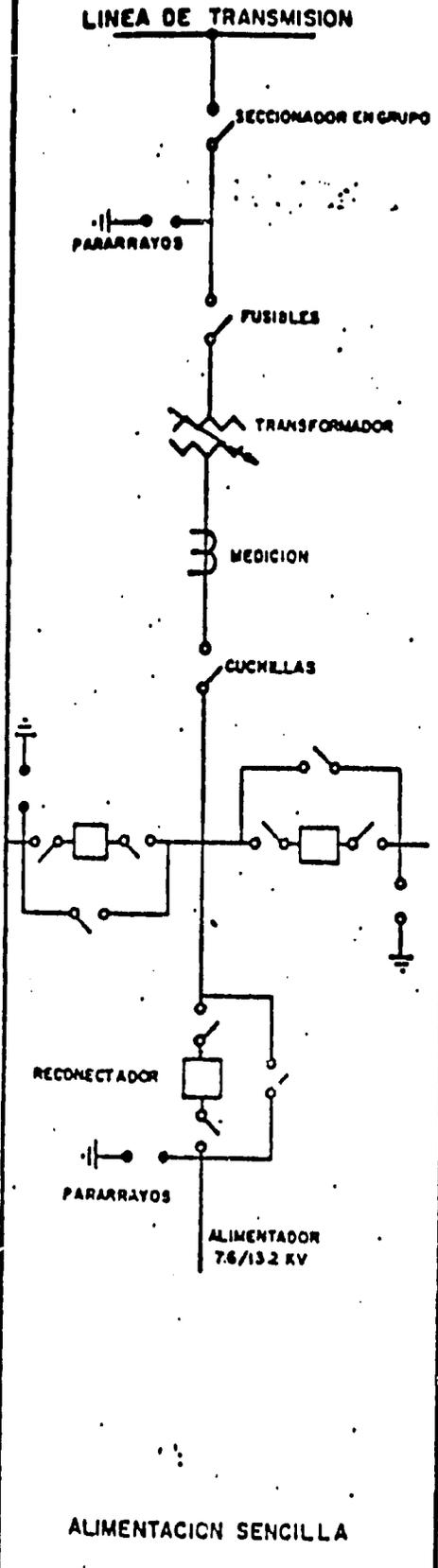
12	Laguna	Steam	30.00
13	Laguna	Gas	12.50 + 25
14	Laguna	Diesel	4.00
15	Castellana	Diesel	5.00
		SUB-TOTAL	76.50

OTHER NON-INTERCONNECTED PLANTS

16	Municipal	Hydro	5.19
17	Various	Diesel	7.81
18	Private and municipal	Diesel	3.76
		SUB-TOTAL	16.76
		TOTAL	<u>354.35</u>

GENERATION PLANTS UNDER CONSTRUCTION  
OR PRESENTLY PLANNED

<u>NAME</u>	<u>OWNER</u>	<u>TYPE</u>	<u>TOTAL CAPACITY MW</u>	<u>EXPECTED IN SERVICE</u>
Laguna 3	EEGSA	Gas	25	6/78
Aguacapa	INDE	Hydro	90	1979
Chixoy	INDE	Hydro	300	1982



GUATEMALA RURAL ELECTRIC SYSTEMESSENTIAL EQUIPMENT

## Cost Estimate

Metering Laboratory

<u>Item No.</u>	<u>Qty.</u>	<u>Description</u>	<u>Unit Price</u>	<u>Total</u>
1	2	Meter Calibration Table	7,000	14,000
2	2	Electric Portable Chronometer	150	300
3	2	Accuracy Wattmeter	750	1,500
4	2	Universal Bridges	1,200	2,400
5	2	Portable Meter Testers	3,000	6,000
6	2	Phase Sequence Indicator	75	150
7	4	Portable Multimeters	450	1,800
8	2	Transformer Polarity Testers	100	200
9	2	Portable Current Transformer Tester	150	300
10	2	Portable Volt Meters	300	600
11	2	Portable Amp Meters	300	600

Protection Laboratory

12	1	Automatic Reclosure Test Equip.	15,000	15,000
13	1	Relay Test Table	30,000	30,000

Maintenance & Operation Equip.

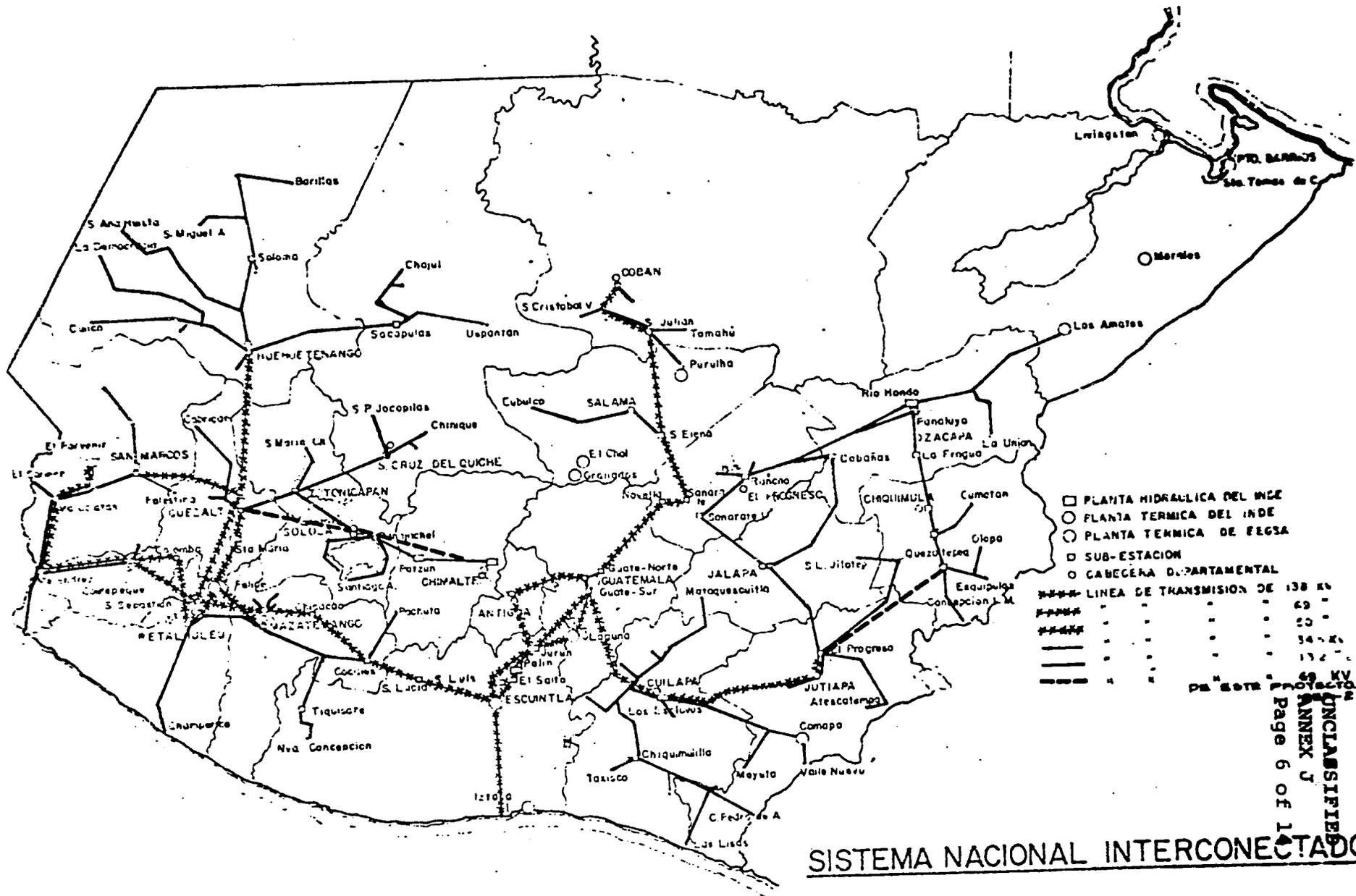
14	60	Lineman Equipment Sets	200	12,000
15	9	Pick up 1 1/2/T with body compartments	7,000	63,000
16	3	Winch truck(mechanical)		
		Line construction	40,000	120,000
17	1	Hot Line Trailer	35,000	35,000

GRAND TOTAL (SAY)

300,000

INDE ADMINISTRATIVE AND ENGINEERING COSTS

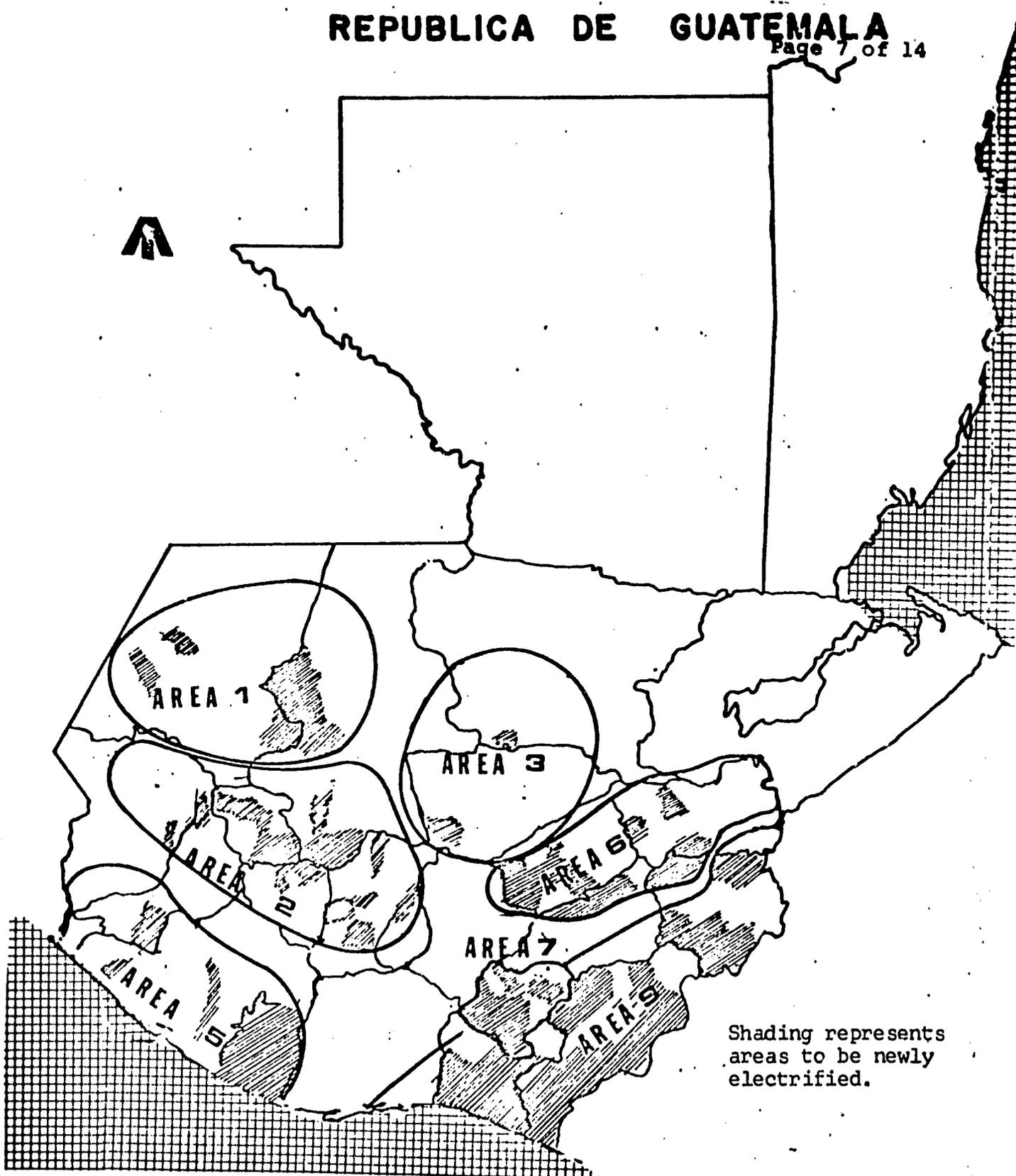
<u>Item</u>	<u>Adm &amp; Engr Cost</u>
1. Subtransmission	\$166,000
a. Zaragoza to Quezaltenango	\$104,000
b. El Progreso to Quezaltepeque	62,000
2. Distribution Substations	\$ 32,000
a. Quezaltepeque	\$ 32,000
3. Primary Distribution Lines	\$182,000
a. 34.5 KV (3)	\$ 5,000
b. 19.1 KV (1)	40,000
c. 13.2 KV (3)	27,000
d. 7.6 KV (1)	110,000
4. Secondary Distribution Lines	\$207,000
a. 120/240 V new villages	\$186,000
b. 120/240 V electrified villages	21,000
5. Distribution Transformers (10 KVA) 7.6 KV/120-240 V	\$ 24,000
a. New Villages	\$ 23,000
b. Electrified villages	1,000
6. Meter & Service Drops	\$150,000
a. New villages	\$ 92,000
b. Electrified villages	58,000
 TOTAL	 \$761,000



**SISTEMA NACIONAL INTERCONECTADO**

DE ESTE ANEXO 5  
 Page 6 of 14  
 UNCLASSIFIED

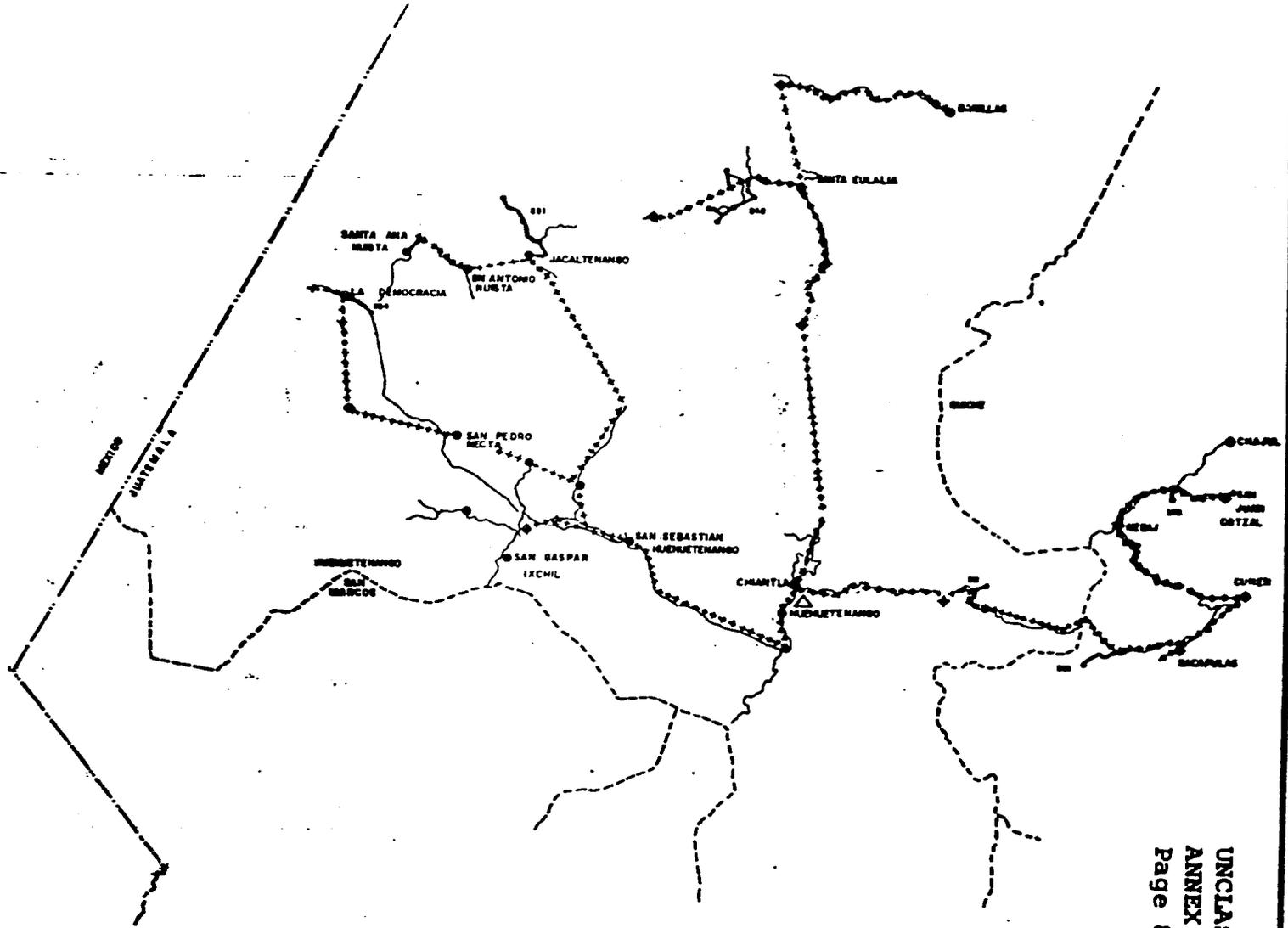
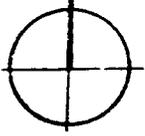
# REPUBLICA DE GUATEMALA



Shading represents areas to be newly electrified.

RURAL ELECTRIFICATION SYSTEM

PROJECTED AREAS



**NOMENCLATURA**

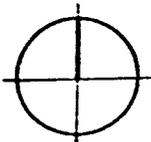
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- PUEBLOS ELECTRIFICADOS
- ◆ PUEBLOS ELECTRIFICADOS A AMPLIARSE
- LIMITE DEPARTAMENTAL
- - - LIMITE INTERNACIONAL
- LINEA CONSTRUIDA
- ..... LINEA PROYECTADA
- △ SUBESTACION



UNCLASSIFIED  
ANNEX J  
Page 8 of 10

INDE		DEPARTAMENTO DE PLANEAMIENTO	
MAYA DE LOCALIZACION DE LINEAS		SECCION DE INGENIERIA Y ESTUDIOS ECONOMICOS	
AREA I	PLAN DE ELECTRIFICACION RURAL N° 2		HOJA N°





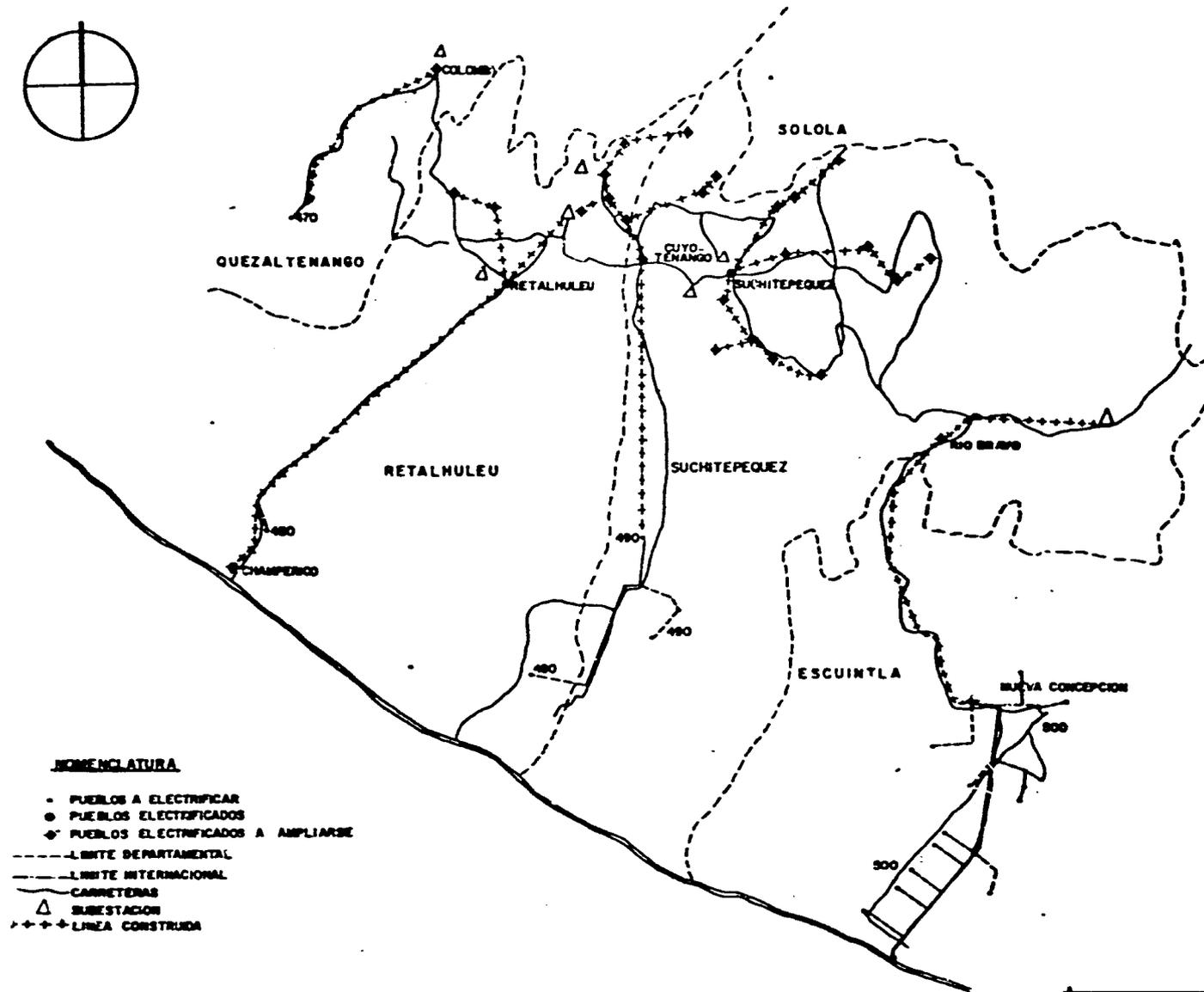
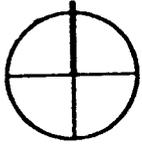
**NOMENCLATURA**

- PUEBLOS A ELECTRIFICAR
- PUEBLOS ELECTRIFICADOS
- ◆ PUEBLOS ELECTRIFICADOS A AMPLIARSE
- - - LIMITE DEPARTAMENTAL
- +--- LINEA CONSTRUIDA
- LINEA A CONSTRUIR
- ▲ SUBESTACION



UNCLASSIFIED  
ANNEX J  
Page 10 of 14

INDE		DEPARTAMENTO DE PLANEAMIENTO	
MAPA DE LOCALIZACION DE LINEAS		SECCION DE INGENIERIA Y ESTUDIOS ECONOMICOS	
AREA 3	PLAN DE ELECTRIFICACION RURAL N° 2		HOJA N°

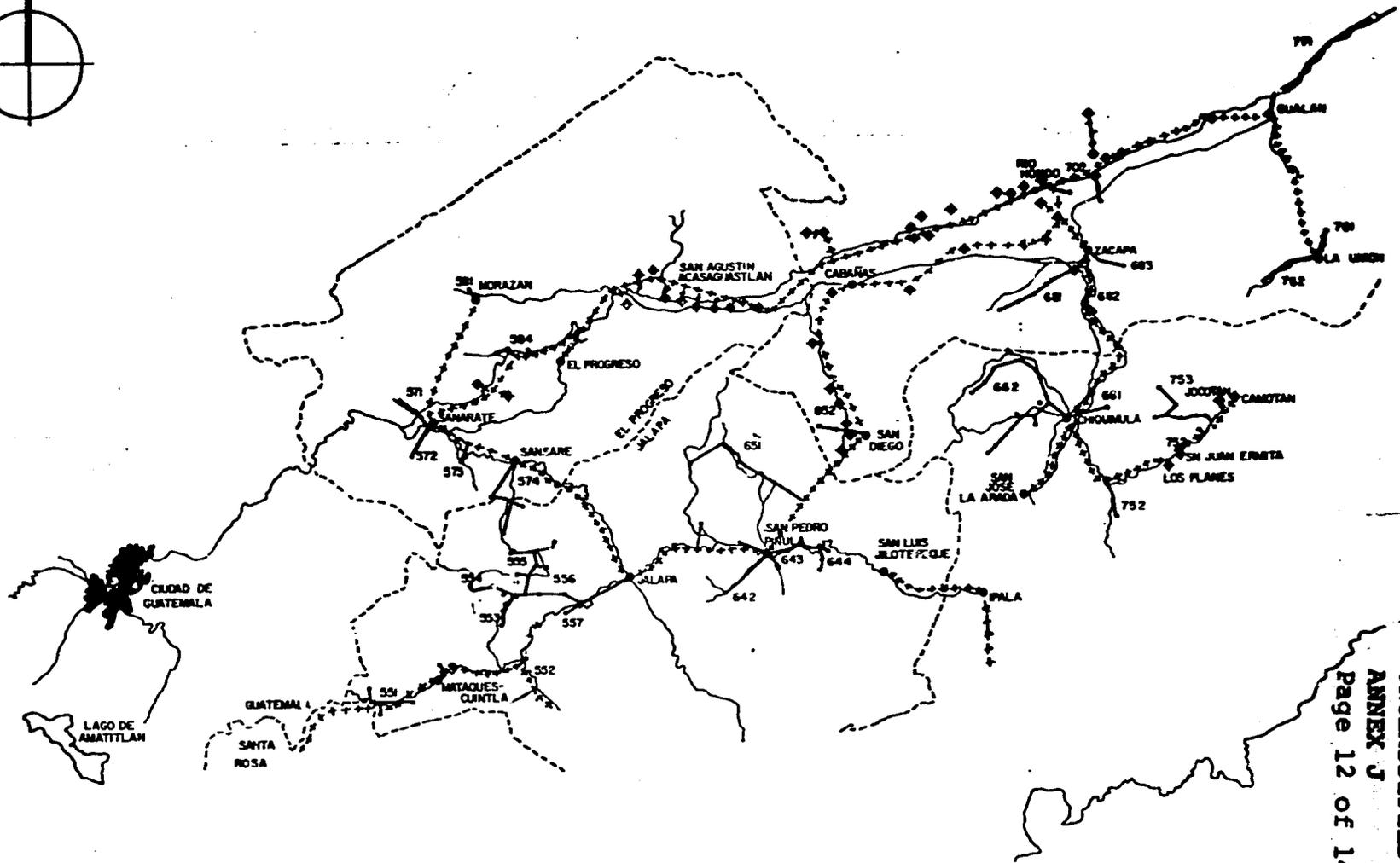
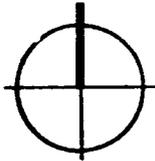


**NOMENCLATURA**

- PUEBLOS A ELECTRIFICAR
- PUEBLOS ELECTRIFICADOS
- ◊ PUEBLOS ELECTRIFICADOS A AMPLIARSE
- LIMITE DEPARTAMENTAL
- LIMITE INTERNACIONAL
- CARRETERAS
- △ SUBESTACION
- ++++ LINEA CONSTRUIDA



INDE		DEPARTAMENTO DE PLANEAMIENTO	
MAPA DE LOCALIZACION DE LINEAS		SECCION DE INGENIERIA Y ESTUDIOS ECONOMICOS	
AREA 5	PLAN DE ELECTRIFICACION RURAL Nº 2		

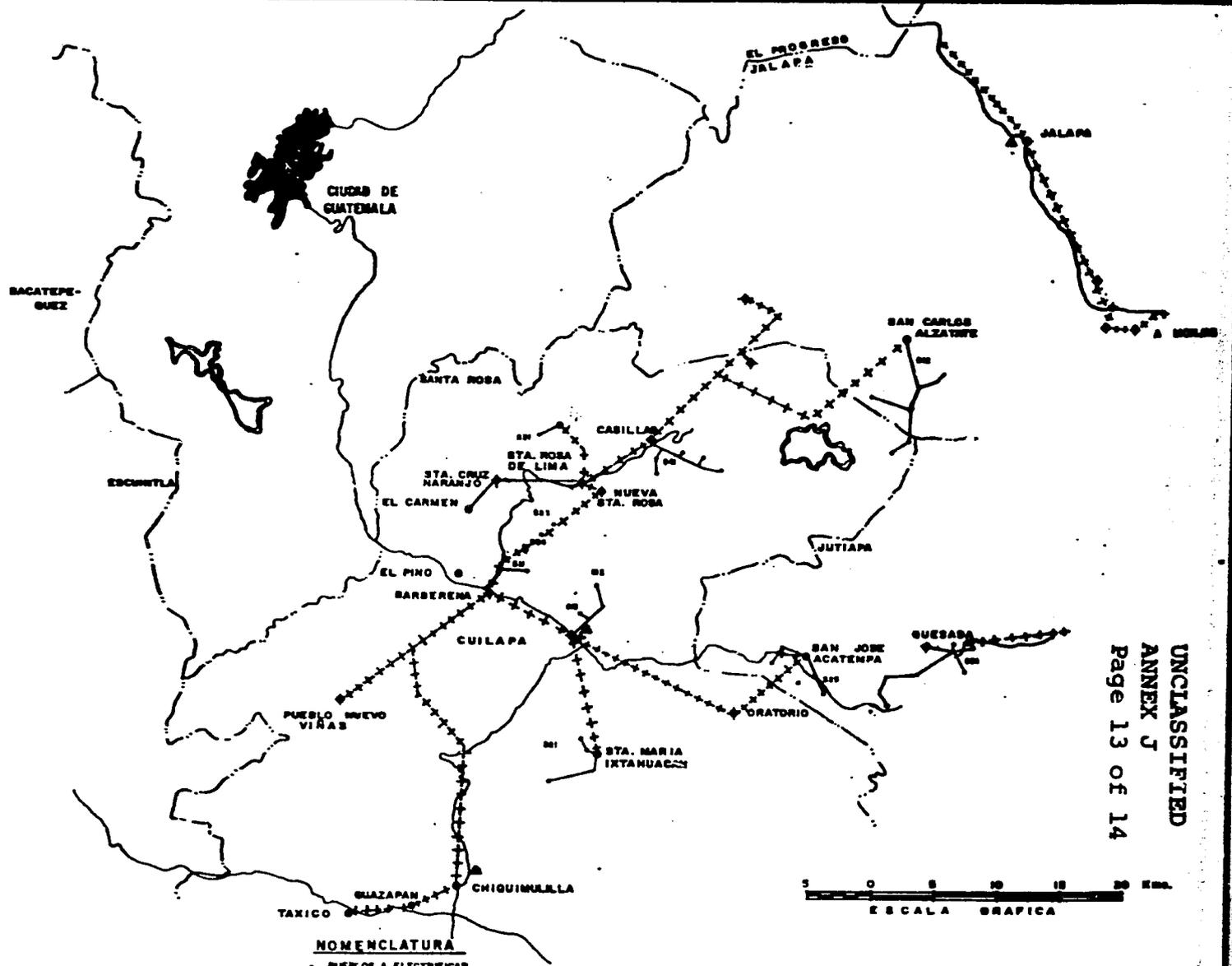
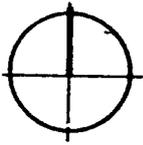


**NOMENCLATURA**

- PUEBLOS A ELECTRIFICAR
- PUEBLOS ELECTRIFICADOS
- ◆ PUEBLOS ELECTRIFICADOS A AMPLIARSE
- - - LIMITE DEPARTAMENTAL
- LINEA CONSTRUIDA
- - - - LINEA A CONSTRUIR
- △ SUBESTACION



INDE DEPARTAMENTO DE PLANEAMIENTO		
MAPA DE LOCALIZACION DE LINEAS		SECCION DE INGENIERIA ESTUDIOS ECOSOM: 504
AREA N° 6	PLAN DE ELECTRIFICACION RURAL N° 2	HOJA N°



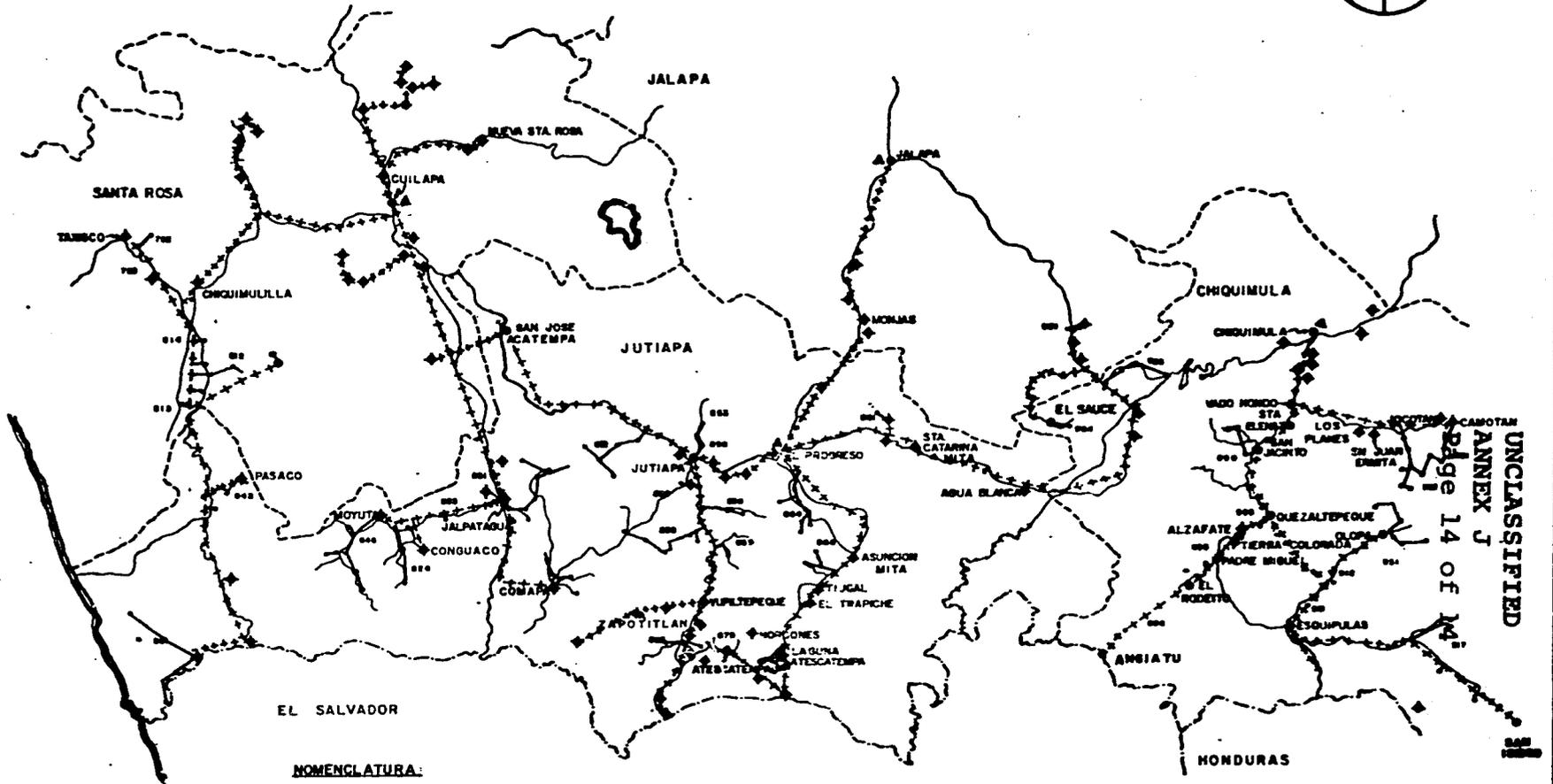
**NOMENCLATURA**

- PUEBLOS A ELECTRIFICAR
- PUEBLOS ELECTRIFICADOS
- ◆ PUEBLOS ELECTRIFICADOS A AMPLIARSE
- LIMITE DEPARTAMENTAL
- LINEA CONSTRUIDA
- - - - - LINEA PROYECTADA
- △ SUBESTACION



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INDE DEPARTAMENTO DE PLANEAMIENTO		
MAPA DE LOCALIZACION DE LINEAS		SECCION DE SISTEMAS Y ESTUDIOS ECONOMICOS
AREA 7	PLAN DE ELECTRIFICACION RURAL Nº 2	HOJA 88



**NOMENCLATURA:**

- PUEBLOS A ELECTRIFICAR
- PUEBLOS ELECTRIFICADOS
- ◆ PUEBLOS ELECTRIFICADOS A AMPLIARSE
- - - - LIMITE DEPARTAMENTAL
- LIMITE INTERNACIONAL
- CARRETERAS
- ▲ SUBESTACION
- +++++ LINEA CONSTRUIDA



INDE		DEPARTAMENTO DE PLANEAMIENTO	
MAPA DE LOCALIZACION DE LINEAS		SECCION DE INGENIERIA Y ESTUDIOS ECONOMICOS	
AREA 9	PLAN DE ELECTRIFICACION RURAL N° 2		Hoja N°

UNCLASSIFIED  
 ANNEX J  
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COMPUTATION OF RESIDENTIAL AND COMMERCIAL SALES

UNCLASSIFIED  
ANNEX K  
EXHIBIT 2

Assumptions	Year	Residential					Commercial				
		1	2	3	4	5	6	7	8	9	10
		Average Number of Connections	KWH Per Consumer	MWH Total	MWH Sales Price	(US \$000) Total Sales	Aver. No. of Connections	KWH Per Consum.	MWH Total	MWH Sales Price	(US \$000) Total Sales
<b>A. Residential</b>	1	8055	200	1611	75	121	424	600	254	55	14
1. Column 1. Average number of connections - computed annual average of residential customers connected calculated by adding 1/2 of current years increase in residential customers to the previous years cumulative total.	2	24422	200	4884	75	366	1285	600	771	55	42
	3	41313	206	8527	75	640	2175	630	1370	55	75
	4	58521	213	12465	75	935	3080	662	2037	55	112
	5	69999	220	15387	75	1154	3684	695	2559	55	141
	6	75699	227	17173	75	1288	3984	729	2906	55	160
	7	81399	234	19057	75	1429	4284	766	3281	55	180
	8	87099	245	21309	75	1598	4584	789	3616	55	199
	9	92799	256	23725	75	1779	4884	812	3968	55	218
	10	98499	267	26315	75	1974	5184	837	4338	55	239
	11	104199	279	29091	75	2182	5484	862	4727	55	260
2. Column 2. Estimated KWH usage per year per customer. INDE's estimate of 200 KWH in the first year increased at the rate of 3.2% per year, until year 7 when increase will jump to 4.5%.	12	109899	292	32063	75	2405	5784	888	5135	55	282
	13	115599	305	35244	75	2643	6084	914	5563	55	306
	14	121299	319	38646	75	2898	6384	942	6012	55	331
	15	127024	333	42291	75	3172	6684	970	6484	55	357
	16	132699	348	46168	75	3463	6984	999	6978	55	384
	17	138399	364	50318	75	3774	7284	1029	7496	55	412
	18	144099	380	54748	75	4106	7584	1060	8039	55	442
	19	149799	397	59475	75	4461	7884	1092	8608	55	473
3. Column 3. Total MWH sold to residential consumers - average connections (column 1) x KWH/year/consumer (column 2) rounded to thousands of kwths.	20	155499	415	64516	75	4839	8184	1125	9203	55	506
	21	161199	434	69891	75	5242	8484	1158	9827	55	540
	22	164399	453	74486	75	5586	8784	1193	10480	55	576
	23	170099	473	80536	75	6040	9084	1229	11163	55	614
	24	178299	495	88217	75	6616	9384	1266	11877	55	653
	25	183999	517	95134	75	7135	9684	1304	12625	55	694
4. Column 4. Sales Price - INDE's estimate of sales price to residential consumers per MWH.	26	189699	540	102495	75	7687	9984	1343	13406	55	737
	27	195399	565	110326	75	8274	10284	1383	14223	55	782
	28	201099	590	118653	75	8899	10584	1425	15077	55	829
	29	206799	617	127507	75	9563	10884	1467	15970	55	878
5. Column 5. Total Sales. Total MWH sold (column 3) x sales price (column 4).	30	212499	644	136918	75	10269	11184	1511	16903	55	930

**B. Commercial**

As above except column 2 - estimated KWH per year per consumer - INDE's estimate of 600 KWH in the first year increased at the rate of 5% through year 7; thereafter at 3% to a maximum usage of 1510 KWH.

COMPUTATION OF PUBLIC LIGHTING, GOVERNMENT AND MUNICIPAL, AND INDUSTRIAL SALES  
Annual Average Totals Cumulative

UNCLASSIFIED  
ANNEX K  
EXHIBIT 3

Assumptions	Year	Public Lighting					Gov't/Municipal			Industrial		
		Newly Electrified Connections (Residential)	Average No. of Connections	MWH Used (40 KWH / Consumers)	MWH Sales Price	(US \$000) Total Sales	MWH Used ( 8 KWH/ Consumer)	MWH Sales Price	(US \$000) Total Sales	MWH Used (1.5% of total Residential Consumption)	MWH Sales Price	(US \$000) Total Sales
<b>A. Public Lighting</b>	1	7,228	3,614	145	45	7	29	45	1	24	35	1
	2	14,970	11,099	444	45	20	89	45	4	73	35	3
1. Column 1. Total Connections for newly electrified residential users and additional residential connections. See Exhibit 1, Columns 3 and 5.	3	23,248	19,109	764	45	34	153	45	7	126	35	4
	4	31,623	27,436	1,097	45	49	219	45	10	187	35	7
	5	36,435	34,029	1,361	45	61	272	45	12	231	35	8
	6	41,225	38,830	1,553	45	70	311	45	14	258	35	9
	7	45,992	43,609	1,744	45	78	349	45	16	286	35	10
	8	50,735	48,364	1,935	45	87	387	45	17	320	35	11
2. Column 2. Average number of Connections - Annual Average of residential customers connected	9	55,455	53,095	2,124	45	96	425	45	19	356	35	12
calculated by adding 1/4 of current years increase in residential customers to the previous years cumulative total.	10	60,150	57,803	2,312	45	104	462	45	21	395	35	14
	11	64,820	62,485	2,499	45	112	500	45	22	436	35	15
	12	69,464	67,142	2,686	45	121	537	45	24	481	35	17
	13	74,082	71,773	2,871	45	129	574	45	26	529	35	19
	14	78,673	76,378	3,055	45	137	611	45	27	580	35	20
	15	83,236	80,955	3,238	45	146	648	45	29	634	35	22
	16	87,770	85,503	3,420	45	154	684	45	31	693	35	24
3. Column 3. Public lighting consumption rates were established at the rate of 40 KWH per year. Totals in this column are rounded to MWH used.	17	92,276	90,023	3,601	45	162	720	45	32	755	35	26
	18	96,751	94,514	3,781	45	170	756	45	34	821	35	29
	19	101,197	98,974	3,959	45	178	792	45	36	892	35	31
	20	105,611	103,404	4,136	45	186	827	45	37	968	35	34
	21	109,992	107,802	4,312	45	194	862	45	39	1,048	35	37
	22	114,340	112,166	4,487	45	202	897	45	40	1,117	35	39
4. Column 4. Sales Price - INDE's estimate of Sales price to public lighting consumers in MWH.	23	118,655	116,498	4,660	45	210	932	45	42	1,208	35	42
	24	122,936	120,796	4,832	45	217	966	45	43	1,323	35	46
	25	127,180	125,058	5,002	45	225	1,000	45	45	1,427	35	50
	26	131,388	129,284	5,171	45	233	1,034	45	47	1,537	35	54
5. Column 5. Total Sales - Total MWH sold (column 3) x sales price	27	135,559	133,474	5,339	45	240	1,068	45	48	1,655	35	58
(column 4)	28	139,692	137,626	5,505	45	248	1,101	45	50	1,780	35	62
	29	143,786	141,739	5,670	45	255	1,134	45	51	1,913	35	67
	30	147,839	145,813	5,833	45	262	1,167	45	52	2,054	35	72

**B. Government and Municipal Consumption**

Columns 6,7 and 8 as above except column 6 consumption rates estimated at 8 KWH per consumer.

**C. Industrial Consumption**

1. Column 9 was estimated at 1.5% of total MWH of residential consumption See column 3, Exhibit 2.

2. Column 10. Sales Price - INDE's estimate of sales price for industrial consumption in MWH.

3. Column 11. Total Sales - Total of column 9 x column 10.

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ANNEX K  
EXHIBIT 4

AGGREGATION OF TOTAL SALES  
(US \$000)

<u>Assumptions</u>	<u>Year</u>	<u>1</u> <u>Residential</u>	<u>2</u> <u>Commercial</u>	<u>3</u> <u>Public</u> <u>Lighting</u>	<u>4</u> <u>Government</u> <u>and</u> <u>Municipal</u>	<u>5</u> <u>Industrial</u>	<u>6</u> <u>Total</u> <u>Costs</u>	<u>7</u> <u>Less 2%</u> <u>Bad</u> <u>Debts</u>	<u>8</u> <u>Net Sales</u>
1. Columns 1 thru 6. Aggregation of total sales distributed by type of customers. The computation of total sales for each type appears in Exhibits 2 and 3, Computation of Sales.	1	121	14	7	1	1	144	3	141
	2	366	42	20	.	3	435	9	426
	3	640	75	34	7	4	760	15	745
	4	935	112	49	10	7	1113	22	1091
	5	1154	141	61	12	8	1376	28	1348
	6	1288	160	70	14	9	1541	31	1510
	7	1429	180	78	16	10	1713	34	1679
	8	1598	199	87	17	11	1912	38	1874
2. Column 7. Uncollectable billings have been estimated at 2% of each year's sales.	9	1779	218	96	19	12	2124	42	2082
	10	1974	239	104	21	14	2352	47	2305
	11	2182	260	112	22	15	2591	52	2539
	12	2405	282	121	24	17	2849	57	2792
3. Column 8. Net sales result from the deduction of uncollectable billings from total sales of electricity.	13	2643	306	129	26	19	3123	62	<del>3061</del>
	14	2898	331	137	27	20	3413	68	3345
	15	3172	357	146	29	22	3726	75	3651
	16	3463	384	154	31	24	4056	81	3975
	17	3774	412	162	32	26	4406	88	4318
	18	4106	442	170	34	29	4781	96	4685
	19	4461	473	178	36	31	5179	104	5075
	20	4839	506	186	37	34	5602	112	5490
	21	5242	540	194	39	37	6052	121	5931
	22	5586	576	202	40	39	6443	129	6314
	23	6040	614	210	42	42	6948	139	6809
	24	6616	653	217	43	46	7575	152	7424
	25	7135	694	225	45	50	8149	163	7986
	26	7687	737	233	47	54	8758	175	8583
	27	8274	782	240	48	58	9402	188	9214
	28	8899	829	248	50	62	10088	202	9886
	29	9563	878	255	51	67	10814	216	10598
	30	10269	930	262	52	72	11585	232	11353



COMPUTATION OF INVESTMENT 1/

UNCLASSIFIED  
APPENDIX K  
Exhibit 6

<u>Assumptions</u>	<u>Year</u>	<u>1</u>	<u>2</u>		<u>3</u>		<u>4</u>		<u>5</u>		<u>6</u>
		<u>Project Investment</u> (US\$000)	<u>Additional Connections in Project Towns</u> Number Cost (US\$000)		<u>Connections in Newly Electrified Towns</u> Number Cost (US\$000)		<u>Connections in Newly Electrified Towns</u> Number Cost (US\$000)		<u>Total Investment</u> (US\$000)		
Computation of investment											
1) Column 1 - Project Investment	1	3925	--	--	--	--	--	--	--	--	3925
	2	8174	--	--	--	--	--	--	--	--	8174
2) Column 2 - Number of additional connections in towns connected by project.	3	1388	--	--	--	--	--	--	--	--	1388
	4	1513	--	--	--	--	--	--	--	--	1513
	5	--	1767	141	4233	1185	--	--	--	--	1327
Year 5 - 2.5% assumed rate of additional connections x 75,900 customers connected by project.	6	--	1811	145	4189	1173	--	--	--	--	1318
	7	--	1857	149	4143	1160	--	--	--	--	1309
	8	--	1903	152	4097	1147	--	--	--	--	1299
Year 6 through 30 - annual rate of increased customers - 2.5%	9	--	1951	156	4050	1134	--	--	--	--	1290
	10	--	1999	160	4001	1120	--	--	--	--	1280
	11	--	2049	164	3950	1106	--	--	--	--	1270
3) Column 3 - number of new customers (Col. 2) x \$80 average cost to connect each customer.	12	--	2100	168	3899	1092	--	--	--	--	1260
	13	--	2153	172	3848	1077	--	--	--	--	1250
	14	--	2207	177	3793	1062	--	--	--	--	1239
	15	--	2262	181	3738	1047	--	--	--	--	1228
4) Column 4 - 6000 customer/year connection agreement by INDE less those connected in already electrified towns.	16	--	2319	185	3681	1031	--	--	--	--	1216
	17	--	2377	190	3623	1014	--	--	--	--	1205
	18	--	2436	195	3565	998	--	--	--	--	1193
	19	--	2497	200	3503	981	--	--	--	--	1181
	20	--	2559	205	3441	963	--	--	--	--	1168
5) Column 5 - number of new customers in newly electrified towns (Col. 4) x \$280 average cost to connect each customer (including town lines).	21	--	2623	210	3377	946	--	--	--	--	1155
	22	--	2889	215	3310	927	--	--	--	--	1142
	23	--	2756	220	3244	908	--	--	--	--	1129
	24	--	2825	226	3176	889	--	--	--	--	1115
	25	--	2896	232	3104	869	--	--	--	--	1101
	26	--	2968	237	3032	849	--	--	--	--	1086
6) Column 6 - Total investment - Col. 1 plus Col. 3 plus Col. 5.	27	--	3042	243	2958	828	--	--	--	--	1072
	28	--	3118	249	2882	807	--	--	--	--	1056
	29	--	3196	256	2804	785	--	--	--	--	1041
	30	--	3276	262	2723	762	--	--	--	--	1025

1/ Project investment and continuing investment of 6000 connections per year in project area.



INSTITUTO NACIONAL DE ELECTRIFICACION (INDE)  
Comparative Balance Sheets 1/  
As of December 31, 1973, 1974, 1975 and 1976  
(US \$000's)

<u>ASSETS</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>
<b>Current Assets</b>				
Cash in Banks	1,321.3	704.5	4,128.1	2,513.5
Internal Debt Amortization Fund	-.-	174.7	560.7	671.4
Accounts Receivable	1,956.0	3,976.8	2,899.3	4,252.2
Contract Advances	-.-	-.-	-.-	8,585.1
Contributions Receivable from the GOG	-.-	-.-	4,215.5	13,256.7
Restricted Deposits	818.1	1,686.0	1,094.0	3,003.3
Prepaid Expenses	443.1	409.4	132.2	78.6
Construction and Maintenance Materials	2,185.9	2,278.9	2,943.0	3,365.8
Administrative Supplies	39.0	37.6	13.5	14.5
<b>Total Current Assets</b>	<u>6,763.4</u>	<u>9,267.9</u>	<u>15,986.3</u>	<u>35,741.1</u>
<b>Fixed Assets</b>				
Property, Plant and Equipment (Net)	53,148.9	53,112.6	54,751.0	70,963.0
Construction in Process	4,609.9	13,430.5	26,936.1	48,424.4
Materials and Supplies	3,992.1	4,282.4	5,986.4	6,635.8
Plans and Studies	7,300.6	8,690.0	13,659.4	13,483.9
<b>Total Fixed Assets (Net)</b>	<u>69,051.5</u>	<u>79,515.5</u>	<u>101,332.9</u>	<u>139,567.1</u>
<b>Deferred Charges</b>				
Interest and Various Expenses	479.8	357.0	234.6	112.2
<b>TOTAL ASSETS</b>	<u>76,294.7</u>	<u>89,140.4</u>	<u>117,553.8</u>	<u>175,420.4</u>
<b>LIABILITIES AND CAPITAL</b>				
<b>Current Liabilities</b>				
Bonds Payable - Current Portion	-.-	835.0	1,148.5	1,332.0
External Loans - Current Portion	820.0	855.0	905.0	1,725.0
Accounts Payable	2,648.0	2,568.0	3,680.2	11,559.1
Employee Benefits	310.1	217.6	261.3	339.3
Contract Retainage	67.6	113.1	343.6	699.0
Employee Discounts	69.6	71.0	92.6	124.4
Consumer Deposits	78.6	109.2	120.3	171.3
Undistributed Income	23.0	229.3	237.1	285.2
<b>Total Current Liabilities</b>	<u>4,016.9</u>	<u>4,996.2</u>	<u>6,796.6</u>	<u>16,235.3</u>
<b>Long-Term Debt</b>				
Bonds Payable	-.-	2,465.5	13,449.5	16,757.5
External Loans and Other	23,923.6	24,951.1	26,832.1	33,845.6
<b>Total Long-Term Debt</b>	<u>23,923.6</u>	<u>27,416.6</u>	<u>40,281.6</u>	<u>50,603.1</u>
<b>CAPITAL</b>				
Donated Capital	41,131.3	47,468.5	61,373.2	96,988.5
Retained Earnings	7,222.9	9,257.1	9,102.4	11,593.5
<b>Total Capital</b>	<u>48,354.2</u>	<u>56,725.6</u>	<u>70,475.6</u>	<u>108,582.0</u>
<b>TOTAL LIABILITIES AND CAPITAL</b>	<u>76,294.7</u>	<u>89,140.4</u>	<u>117,553.8</u>	<u>175,420.4</u>
<b>FINANCIAL INDICATORS:</b>				
Current Ratio	1.68:1.00	1.85:1.00	2.35:1.00	2.20:1.00
Acid-Test Ratio	1.02:1.00	1.31:1.00	1.90:1.00	1.46:1.00
Debt-Equity Ratio	0.58:1.00	0.57:1.00	0.67:1.00	

INSTITUTO NACIONAL DE ELECTRIFICACION (INDE)  
Comparative Statements of Earnings and Retained Earnings 1/  
For Fiscal Years Ended December 31, 1973, 1974, 1975 and 1976  
(US \$000's)

	1973		1974		1975		1976	
	Amount	%	Amount	%	Amount	%	Amount	%
<b>Income</b>								
Block Sales	8,207.2	82.2	14,758.4	87.4	16,445.4	85.9	20,399.7	81.0
Direct Sales	1,778.1	17.8	2,136.7	12.6	2,710.1	14.1	4,801.1	19.0
<b>Gross Sales</b>	<u>9,985.3</u>	<u>100.0</u>	<u>16,895.1</u>	<u>100.0</u>	<u>19,155.5</u>	<u>100.0</u>	<u>25,200.8</u>	<u>100.0</u>
<b>Expenses</b>								
<b>Operating Costs:</b>								
Generation & Maintenance	571.2	5.8	667.3	4.0	753.0	3.9	820.2	3.3
Transmission & Transformation	186.7	1.9	337.5	2.0	416.5	2.2	507.1	2.0
Distribution	284.8	2.9	393.5	2.3	448.1	2.3	524.1	2.1
Fuel	2,254.9	22.6	7,582.9	44.9	11,355.7	59.3	13,555.3	53.8
Insurance	110.1	1.1	129.7	.8	124.3	.7	142.0	.6
Interest	1,120.3	11.2	1,228.1	7.3	1,205.2	6.3	1,220.3	4.8
Depreciation	1,970.1	19.7	2,236.7	13.2	2,300.7	12.0	2,489.5	9.9
System Administration	1,141.4	11.4	1,102.9	6.5	1,391.3	7.3	1,756.6	7.0
General Administration	653.5	6.5	750.4	4.4	790.5	4.1	1,275.9	5.0
	<u>8,293.0</u>	<u>83.1</u>	<u>14,429.0</u>	<u>85.4</u>	<u>18,785.4</u>	<u>98.1</u>	<u>22,290.4</u>	<u>88.5</u>
General & Administrative Costs	1,909.3	19.1	2,077.5	12.2	2,344.0	12.2	3,092.5	12.3
Less: Capitalized Expenses	( 1,077.2)	(10.8)	( 1,172.7)	( 6.9)	( 1,371.3)	( 7.2)	( 1,409.1)	( 5.6)
Charges to Oper. Costs	( 653.5)	( 6.5)	( 750.4)	( 4.4)	( 790.6)	( 4.1)	( 1,275.9)	( 5.1)
	<u>178.6</u>	<u>1.8</u>	<u>154.4</u>	<u>.9</u>	<u>182.1</u>	<u>.9</u>	<u>407.5</u>	<u>1.6</u>
<b>Income from Operations</b>	<u>1,513.7</u>	<u>15.1</u>	<u>2,311.7</u>	<u>13.7</u>	<u>188.0</u>	<u>1.0</u>	<u>2,502.9</u>	<u>9.9</u>
Other Income (Expense) Net	( 241.2)	2.4	( 271.9)	1.6	( 159.4)	.8	( 12.1)	.1
<b>Net Income for the Period</b>	<u>1,272.5</u>	<u>12.7</u>	<u>2,039.8</u>	<u>12.1</u>	<u>28.6</u>	<u>.2</u>	<u>2,490.8</u>	<u>9.8</u>
Retained Earnings at Beginning of Year as Restated 2/	<u>5,950.4</u>		<u>7,217.3</u>		<u>9,073.8</u>		<u>9,102.7</u>	
Retained Earnings at End of Year	<u>7,222.9</u>		<u>9,257.1</u>		<u>9,102.4</u>		<u>11,593.5</u>	
<b>EARNING INDICATORS:</b>								
Rate of Earnings on Total Capital Employed		1.67		2.29		0.02		1.42
Rate of Earnings on Equity		2.63		3.60		0.04		2.29
Net Income as a Percentage of Sales		12.74		12.07		0.15		9.88

1/ Extracted from Financial Statements audited by External Auditors  
2/ Beginning year retained earnings restated to reflect \$304, \$183,217 and \$5,629.  
Prior year adjustments entered in 1976, 1975 and 1974 respectively.

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EXHIBIT 10

INSTITUTO NACIONAL DE ELECTRIFICACION (INDE)  
Comparative Statement of Changes in Financial Position 1/  
For Fiscal Years Ended December 31, 1973, 1974, 1975 and 1976

(US \$000's)

<u>RESOURCES PROVIDED</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>
From Operations				
Net Income	1,272.5	2,039.8	28.6	2,490.8
Plus Non-Cash Items:				
Depreciation	2,127.2	2,353.8	2,424.2	2,646.1
Amortization	149.4	122.8	122.4	122.4
Guatemalan Government Subsidies	3,549.1	4,516.4	2,575.2	5,259.3
Loans from International Institutions	4,487.2	6,352.0	13,390.8	35,094.2
Bond Sales	2,883.9	1,882.5	2,785.9	7,938.5
Prior Year Adjustments	-.-	3,500.0	11,700.0	4,800.0
Other	-.-	69.4	7.6	34.3
	32.4	-.-	-.-	-.-
<b>Total Resources Provided</b>	<u>10,952.6</u>	<u>16,320.3</u>	<u>30,459.5</u>	<u>53,126.3</u>
 <u>RESOURCES APPLIED</u>				
Construction/Purchase of Property, Plant & Equipment	8,336.4	11,411.7	18,758.2	36,238.2
Project Studies and Plans	1,601.7	1,399.2	4,969.4	4,120.9
Principal Payment - International Loans	820.0	855.0	905.0	925.0
Bond Retirement	-.-	1,034.5	716.0	1,492.0
Prior Year Adjustments	128.4	96.8	190.8	34.0
Increase in Various Deposits and Options	-.-	.2	-.-	-.-
Other	122.7	-.-	-.-	-.-
<b>Total Resources Applied</b>	<u>11,009.2</u>	<u>14,797.4</u>	<u>25,539.4</u>	<u>42,810.1</u>
 Increase (Decrease) in Working Capital	<u>(56.6)</u>	<u>1,522.9</u>	<u>4,920.1</u>	<u>10,316.2</u>

1/ Extracted from Financial Statements audited by External Auditors.

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EXHIBIT 11

BREAKDOWN OF INDE'S CAPITAL ACCOUNT

(In US \$000's)

	1973		1974		1975		1976	
	\$	%	\$	%	\$	%	\$	%
Government Subsidies	22,276.2	46.1	28,628.2	50.5	42,019.0	59.6	77,113.2	71.0
Government Bonds	15,000.0	31.0	15,000.0	26.4	15,000.0	21.3	15,000.0	13.8
Other Gov. Contributions	3,419.2	7.1	3,394.4	6.0	3,394.8	4.8	3,394.8	3.1
Municipalities and Other	375.6	.8	385.6	.7	385.7	.6	385.7	.4
Interest on Bonds	60.2	.1	60.2	.1	60.2	.1	60.2	.1
Other	.1	-.	.1	-.	513.5	.7	1,034.7	.9
	41,131.3	85.1	47,468.5	83.7	61,373.2	87.1	96,988.5	89.3
Retained Earnings	7,222.9	14.9	9,257.1	16.3	9,102.4	12.9	11,593.5	10.7
	<u>48,354.2</u>	<u>100.0</u>	<u>56,725.6</u>	<u>100.0</u>	<u>70,475.6</u>	<u>100.0</u>	<u>108,582.0</u>	<u>100.0</u>

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Characteristics of Target Sub-Groups

1. Rural Setting - An Overview

a. Ethnic Groups

The population in the rural sector of the Highlands is composed of people from two distinct ethnic groups - Ladinos and Indians. Definitions vary considerably, and the drawing of a clear cut line between the two is difficult because of an active process of Indians "passing", i.e. becoming ladinized.

In general the Ladino classification is applied to those people who have a European ancestry or to those Indians who have adopted a Western life style. Spanish is either their first or principal language. Western style clothing is worn, and there is a preference for the mass produced consumer products of modern technology.

Economically, Ladinos earn their main source of income from commerce or service enterprises or as professionals. Although many own agricultural land, few are practicing farmers. They prefer to rent land to the Indians who farm it. Finally, they possess a set of cultural forms and values which is distinct from that of Indians. More prominent practices and attitudes include the nuclear family as the basic social unit, a class consciousness and a quest for upward mobility, a determination of social status on the basis of lineage and source of wealth, a secular brand of Roman Catholicism in which the overt practice of religion is much more expected of women than men, and an ideology which emphasizes the welfare of the individual over that of the group. Machismo is prominent among Ladino men.

The Indians are descendants of the ancient Maya and have not adopted Western practices and values. They are native speakers of one of the numerous indigenous languages, although many of the men and some of the women are conversant in Spanish, and continue to wear native styles of dress (women adhere more strictly to this practice than men). They derive their main source of income from agriculture as either day laborers, subsistence farmers, or small scale market-oriented growers. Many supplement farming income with a

craft specialty. Their religious practices are a curious blend of traditional Mayan and Catholic beliefs in which both men and women participate on an equal basis. Culturally, the basic social and economic unit is often an extended household made up of parents, children and the spouses of married children and grandchildren.

A system of religious brotherhoods (cofradías) ensures participation in community affairs as well as being a method of internal leadership. In general, there is no formal class structure within the Indian sector, although gradations of wealth do exist. Capital gain is desired but it does not elicit status and rank. Rather, social rank is a product of age and prestige, with the latter being acquired through contributions of both time and money to the cofradía system.

It is important to note that the Indians are not a single homogeneous block. The ecologically caused isolation of one settlement area from another and ancient migration patterns have resulted in distinct language groups in the Highlands, with each possessing unique variations in the general cultural traits described above. A principle variation concerns the leadership structure. There are sectors of the target area, the Northwest in particular, where the cofradía system does not exist or plays only a minor ceremonial function.

#### b. Social Organization

The social organization of the rural Highlands is a more or less rigidly class stratified arrangement which parallels the basic ethnic group divisions. One group consists of the Ladino elites. Although the attributes of this class vary from region to region, generally they are the social and political leaders of the community and set the styles in dress, recreation, and social activity. Their political power has weakened considerably since townships were given the right to elect a local government, but they continue to maintain at least tacit control of the economic, social, and religious affairs of the community.

Ladinos and Transitional Indians who generally reside in the Cabeceras of the Municipios and the larger nucleated Aldeas form a second group. Ladinos in this group tend to occupy distinct neighborhoods near the central plaza and

generally enjoy better housing and access to social services than the traditional Indian. They earn their living from a variety of small commercial and service enterprises (storeowner, truckdriver) or as semi-professionals, such as administrative clerks, nursing auxiliaries, or school teachers. The transitional Indians in this group have either taken up occupations similar to those of the Ladinos or are the owners of small scale holdings.

The Ladinos in this group have received some formal schooling (many have completed primary school), and they encourage their children to continue their education beyond the sixth grade, if possible. Many transitional Indians, on the other hand, are illiterate, although they are perfectly conversant in Spanish and have developed a facility for dealing in a market economy. They do see the value of formal education for their children and encourage them to stay in school through the primary grades.

The third group is composed of the large mass of Indian peasants who earn their living as landless day laborers and (modified) subsistence farmers. Very few have had formal education. Of those who have been to school, many have regressed to illiteracy. Nevertheless, like the transitional Indians, almost all of the men are conversant in Spanish and deal effectively in local markets. Although the Indian peasant recognizes the value of formal training for his children, he considers their economic inputs, as part of the extended household more important. As a result, absenteeism, repetition, and drop-out rates among Indian children are high with few progressing beyond the third grade.

## 2. Target Sub-Groups

Based on socioeconomic characteristics one can identify three types of rural families as prime targets of AID assisted rural development programs: (1) landless agricultural workers; (2) subsistence farmers, both those without prospects of a significant farming solution as well as those with one; and (3) small to medium market oriented

farmers. These sub-groups will be the primary beneficiaries of this project.

a. Landless Day Laborers

A 1970 SIECA/FAO study estimated that there are approximately 175,000 families in Guatemala who earn their main source of income as agricultural day laborers either with stable full time employment on a larger holding in the area or by migrating from one place to another in search of seasonal employment. It is estimated that a high percentage of these landless laborer families live in the target group area.

In the Western Highlands, almost all these families are Indians who have arrived at their present situation either because they are the offspring of landless day laborers, or because they inherited a parcel of land too small to support themselves and their families. Those who have stable positions on larger farms earn \$.50 - \$.75 daily for labor as field hands. In some cases food is included; in others not. The arrangement depends upon the discretion of the farm owner. Those day laborers fortunate enough to work for an enlightened owner have higher aggregate incomes than rural campesinos in general. In addition they are considered to be permanent members of the communities in which they live and have access to social services equal to that of the Indian.

Migratory farm laborers generally return from time to time to their native towns and villages where they either maintain a residence of their own or live with relatives. A strategy which they commonly employ is to hire out on local farms in the mountains during the planting and harvesting seasons and then migrate to the South Coast to work as field hands on large coffee, cotton, sugar, and banana plantations in the intervening period.

b. Subsistence Farmers

Subsistence farmers are defined as small scale growers who live on and work farms that are less than four hectares in size. However subsistence farming, in its

classical sense, is a misnomer when applied to the peasants of the Guatemalan highlands. They are as a group small scale capitalists who have devised strategies for dealing in a market economy and mechanisms to avoid, or at least minimize, the risk involved in such undertakings.

In the first instance most do not grow crops solely for home consumption. Rather, in addition to their subsistence plots (milpas) of corns, beans, and squash, they reserve a portion of their land, if possible, for cash generating produce (fruits and vegetables). Furthermore, an ever increasing number are applying modern farming techniques such as terracing, construction of rudimentary irrigation systems, and using fertilizers and other chemical products. There is also increasing evidence of small farmer participation in savings and loan cooperatives for the purpose of borrowing money to purchase land, and technological farm inputs. In addition, many subsistence families are involved in handicraft production which complements the farming and is marketed.

As with the landless day laborers, there is considerable variation within the subsistence farmers. To facilitate effective programming they can be further divided into two sub-groups. The first sub-group is composed of those with holdings so small or of such poor quality, that prospects for a noteworthy contribution to an improved quality of life and increased by better farming methods is highly unlikely. This group includes all families working .7 hectares or less and some of the farms between .7 and 4 hectares. These farms are generally located in the most isolated communities.

The second sub-group is those small farmers whose land quantity and quality and managerial potential provide a reasonable prospect for a better life-style by means of agricultural improvements. This group includes most of the families on farms of .7 to 4 hectares. The total number of families in these two sub-groups in Guatemala was 475,000 in 1970.

c. Small to Medium Market-Oriented Farmers

Members of this group have holdings of between

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4 to 7 hectares. In Guatemala they numbered approximately 45,000 families in 1970. At present a high percentage of a larger group lives in the target area. Their major production enterprise is normally in the traditional grains but they maintain a milpa for subsistence purposes. They tend to use technical farming inputs, crop diversification and animal raising to a much greater degree than the smaller scale farmers. In addition, many hire part-time or full-time field workers because they do not have sufficient labor within the household for carrying on the production operation.

Compared to the landless laborers and subsistence farmers, they are generally more integrated into the Western style of life. Most are fluent in Spanish, and some have completed several years of primary school. As a group they recognize the benefits of education for their children. In addition, they have the desire, as well as the higher incomes needed, to acquire the consumer goods produced by modern technology.

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"INSTITUTO NACIONAL DE ELECTRIFICACION"  
SURVEY OF EXISTING INFRASTRUCTURE IN TOWNS OF AREA II  
QUESTIONNAIRE

Name of Town \_\_\_\_\_ Municipality \_\_\_\_\_

Department \_\_\_\_\_

- |   | <u>Coefficient</u> |
|---|--------------------|
| 1. In the surveyors' view: Is there a settlement of houses in the town and are the houses located in a relatively small area?<br>Yes <input type="checkbox"/> No <input type="checkbox"/> | 10                 |
| 2. Is the road to the town an all weather road?<br>Yes <input type="checkbox"/> No <input type="checkbox"/>   | 15                 |
| 3. Is there a water system in the town?<br>Yes <input type="checkbox"/> No <input type="checkbox"/>   | 10                 |
| 4. Is there a health post in the town?<br>Yes <input type="checkbox"/> No <input type="checkbox"/>  | 150                |
| 5. The number of schools in the town is<br>_____  | 0                  |
| 6. Do the schools in the town have an average of 3 or more classrooms?<br>Yes <input type="checkbox"/> No <input type="checkbox"/>  | 60                 |
| 7. Is the maximum level of primary education the 6 <sup>th</sup> grade?<br>Yes <input type="checkbox"/> No <input type="checkbox"/>   | 10                 |
| 8. Is there a cooperative in the town?<br>Yes <input type="checkbox"/> No <input type="checkbox"/>  | 100                |
| 9. Is there a market in the town?<br>Yes <input type="checkbox"/> No <input type="checkbox"/>   | 20                 |

	<u>Coefficient</u>
10. Is there a slaughterhouse or "matadero" in the town? Yes <input type="checkbox"/> No <input type="checkbox"/>	0
11. The number of first class businesses in town is of? _____	24
12. The number of second class businesses in town is of? _____	2
13. Is there an artisan activity in the town? Yes <input type="checkbox"/> No <input type="checkbox"/>	10
14. Is the agriculture in town diversified? Yes <input type="checkbox"/> No <input type="checkbox"/>	10
15. Does the town have a municipal or private electric plant? Yes <input type="checkbox"/> No <input type="checkbox"/>	280
16. Of the number of houses in town, at least 50% are formal houses not built of straw, with walls of sun-dried brick or block and roofs of tile or zinc? Yes <input type="checkbox"/> No <input type="checkbox"/>	0

Name of the Surveyor \_\_\_\_\_

Survey No. \_\_\_\_\_ Date \_\_\_\_\_