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ENVIRONMENTAL ASSESSMENT of the RURAL ELECTRIFICATION PROJECT Philippines

United States Agency for International Development

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and

Inter-Agency Committee for Ecological Studies

ENVIRONMENTAL ASSESSMENT

of the

RURAL ELECTRIFICATION PROJECT

prepared for the

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

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SUMMARY

(X) Draft EA ( ) Draft EIS

( ) Final EA ( ) Final EIS

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1. **Name of Action:** (X) Administrative Action

( ) Legislative Action

2. **Brief Description of the Action:**

The Rural Electrification Project (five separate loans) is a line of credit to be used by the National Electrification Administration (NEA) to finance imports of electrical distribution equipment and materials. These imported materials will be used, together with locally available materials and labor funded by NEA, to continue implementation of a nation-wide rural electrification program.

The USAID funds support the activities of rural electric cooperatives located throughout the Philippines. While the cooperatives are responsible for either purchase or generation of power and its distribution, USAID funds only support the distribution activities. The distribution activities include 69 KV transmission lines, 13.8 KV backbone systems and 7.3 KV lateral and secondary connections.

3. Summary of Environmental Impacts and Adverse Environmental Effects

A. Impacts on vegetation are limited to selected trimming and clearing in the right-of-ways. There are no herbicides used to control vegetation.

B. While soil erosion was noted in a few cases, there was no gullying observed in any right-of-ways inspected by the EA study team.

C. Since there is limited disturbance of vegetative cover in the right-of-ways, the possibility of significant sediment load in streams due to the project is minimal.

D. The availability of cheap electricity attracted large-scale industries to Misamis Oriental. One of these industries discharges uncontrolled plating wastes.

E. The availability of electricity has resulted in the establishment of a few pump irrigation systems, where farmers increase their use of fertilizers and pesticides. Persistent pesticides, if applied incorrectly and in excessive amounts, can adversely affect fish, snails and frogs regularly caught in rice fields. Run-off of these chemicals in sufficiently large quantities would also adversely affect aquatic organisms in streams and rivers.

F. The availability of cheap electricity attracted large-scale industries to Misamis Oriental and some of these industries discharge air-borne residuals, primarily particulate matter.

G. Rural electrification may have some limited effect on the birth rate and probably no effect on migration rates.

H. Electrification has resulted in the opening of night classes in a limited number of schools.

I. Electrification has improved the standard of living, primarily through the illumination of houses.

J. Hospitals and rural health units now utilize a greater range and number of medical instruments.

K. Some rural communities are starting to convert their water supply systems to deep wells because of the avilability of electric pumps.

L. No section of the transmission line or backbone system inspected by the EA study team passes through a national park or forest.

M. Although irrigated riceland has the potential to double production, the surveys and interviews with three rural electric cooperatives did not show a significant increase in the number of electric pump irrigation systems.

N. Electrification has stimulated to some extent small businesses in two of the three provinces inspected by the EA study team and a few large-scale industries in one province. The impact is limited because other factors are also important in stimulating growth.

4. **Alternatives Considered:**

A. No project.

B. Delay in project.

C. Alternative location of distribution lines.

5. **Conclusions and Recommendations**

The potential for adverse environmental impacts from construction and operation and maintenance of the rural electrification projects are minimal. However, there is some potential for adverse environmental impacts from the activities, primarily large-scale industry and irrigated agriculture, stimulated by the availability of electricity. Large-scale industries, if unregulated, will discharge significant quantities of air- and water-borne residuals and the intensified agricultural activity associated with electric pump irrigation systems will result in an increased run-off of persistent pesticides.

In light of these findings, the EA study team recommends:

(a) that the NEA in conjunction with individual cooperatives, work with the NPCC in limiting the discharge of air- and water-borne residuals. NEA in conjunction with the cooperatives should require that industries install the pollution control equipment recommended by the NPCC before providing electric service. Moreover, the NEA in conjunction with the cooperatives should develop with the NPCC corrective measures to insure that industries operate the equipment; and

(b) that the NEA in cooperation with the Bureau of Agricultural Extension, the Farm Systems Development Corporation and the Fertilizer and Pesticide Authority should develop an information campaign about the adverse effects of certain types of pesticides for farmers participating in electric pump irrigation systems.

Chapter 1

I N T R O D U C T I O N

1.1 Environmental Assessment

The Agency for International Development (AID) responded to the provisions of the National Environmental Policy Act (NEPA) of 1969 by issuing Regulation 16, "Environmental Procedures." In fulfilling the requirements of this regulation, AID has the responsibility of insuring that the environmental consequences of proposed AID-financed activities are identified and considered by AID in collaboration with the host country and that appropriate environmental safeguards are adopted in order to minimize adverse environmental impacts. In addition, AID agreed to assist the host country in strengthening its capability to identify and evaluate the potential environmental effects of proposed development plans and projects, and to select, implement and manage effective environmental protective measures.

The extensive requirements of an Environmental Assessment (EA), which is the AID term for an Environmental Impact Statement not requiring a public hearing, are best seen by defining the terms environment and assessment. The term environment, in the context of an EA, means the total setting for economic development activities. The term refers, not only to the naturally occuring milieu (the ecological systems which surround and collectively support man), but also extends to the socio-economic milieu which man has created to adapt to the demands and challenges of this naturally occuring surroundings.* The term assessment, in the context of an EA, means a forecast of the effects of a proposed action on the environment. The term refers to a projection of effects rather than a post hoc evaluation of a project. To date, many assessments (forecasts) have been based on professional judgement and intuitive reasoning.

Yet another way to clarify the requirements of an Environmental Assessment is to identify the three principal tasks in preparing one. The first task is description of a project and its environment. This task involves careful

* World Bank, Environment and Development, 1975.

identification of both the construction and operational phases of a project and of the environmental factors which might potentially be affected by a project. The second task is prediction of the quantitative and spatial dimensions of impacts on environmental factors. This task is most difficult because it involves identifying relationships, if any, among environmental factors and the direction, strength and duration of the relationships. The third task is evaluation of primarily the adverse environmental effects associated with a project. At a minimum, evaluation involves discussion of mitigation (offsetting) measures, alternatives to the project and of short-term gains versus long-term losses. At a maximum, evaluation involves factor profiles, trade-off accounts, weighing procedures and cost-benefit analysis.

1.2 USAID/Philippines Environmental Assessments

The USAID Mission to the Philippines determined on the basis of Initial Environmental Examinations that Environmental Assessments were needed on four of its more than 20 on-going projects. These four projects are the Bicol River Basin Integrated Area Developments, Barangay Water, Small Farmer Systems and Rural Electrification.

The actual preparation of the EAs was a joint effort of the GOP and USAID between April 1977 and March 1978. AID recruited an Environmental Specialist from the U.S. and gave a grant to the GOP Inter-Agency Committee on Ecological Studies (ICES). The role of the Environmental Specialist was to provide technical assistance to ICES as it directed the preparation of the Environmental Assessments. The role of ICES was to secure the services of in-country environmental professionals and to collect data needed for the preparation of Environmental Assessments.

The primary objective of AID in this exercise was to diffuse environmental awareness throughout GOP institutions. Thus there was an emphasis on training and involvement in preparation of Environmental Assessments of personnel with limited or no expertise in environmental work. Moreover, as many personnel as possible were involved in order to spread the training.

The second product to emerge from this training exercise is an Environmental Assessment of the Rural Electrification Project.

1.3 Rural Electrification EA

One of the principal tasks of environmental assessment was defined differently for the Rural Electrification EA than for the other three EAs. In this case, the principal tasks were description, assessment and evaluation. Assessment of the environmental effects of existing projects was substituted for prediction or forecasting of future effects, in view of three special circumstances, which permitted such a fortunate change.

First, there has been an operating rural electrification program in the Philippines for the past six years. The Misamis Oriental Rural Electric Service Cooperative (MORESCO) energized the first section of its system in 1971 and completed major construction in June 1972. The MORESCO project is similar in all significant ways to the current project of the National Electrification Administration (NEA).

Second, the socio-economic impacts of rural electrification have been quantified to some extent. During the past two years, three geographic specific area (Misamis Oriental, La Union and Panay Provinces) and one national level surveys have been completed under the sponsorship of the NEA. While these studies did not collect baseline data before an area was energized and then measure the effects after so many years, they still provide a reasonable assessment of the effects of electrification.

Third, the natural environmental impacts of rural electrification are usually minimal for several reasons. One reason is that USAID does not fund the generation of electricity, only its distribution (transmission lines). Another reason is the nature of the institutional arrangements for installation and maintenance of transmission lines. As will be explained in more detail in the following chapters, the planning and design guidelines for rural electrification are sensitive to environmental parameters, the labor intensive installation techniques cause minimal disruption and maintenance procedures do not involve the use of herbicides. The last reason is that rural electrification programs seldom stimulate the growth of industrial establishments which are significant dischargers of residuals.

There are two primary advantages to substituting assessment for prediction. First, the substitution means that the description of the actual environmental effects would be more factual and quantitative than in the case of prediction. Given resource constraints, the EA study team would have relied on expert consensus for prediction. Expert consensus would have been basically subjective and qualitative. The EA study team considered a post-evaluation superior to expert consensus under these circumstances.

Second, the final product would be useful to other missions preparing Initial Environmental Examinations and Environmental Assessments. The final product would be a well-documented analogous situation on which to base predictions for other rural electrification projects. The scope and magnitude of the impacts from the on-going project would form the basis for determining the impacts of new projects corrected for changes in scale of a project and unique environmental conditions.

1.4 Organization of the Report

The remainder of this report consists of four chapters. Chapter Two documents the accomplishments of the NEA from a national perspective and of three rural electric cooperatives. Included in these accomplishments are detailed descriptions of transmission lines installed in areas as well as the features of the project where there is the greatest possibility of adverse environmental impacts. Chapter Three describes the impacts on the natural and socio-economic environments from the national perspective and from the perspective of the coops. Chapter Four integrates the effects described in Chapter Three in order to provide an assessment of rural electrification. Chapter Five incorporates the various evaluative measures required by the Council on Environmental Quality -- mitigation measures, alternatives, short-term gains versus long-term losses, irreversible and irretrievable commitment of resources and benefits and considerations which offset adverse effects.

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Chapter 2

RURAL ELECTRIFICATION AND ITS ACCOMPLISHMENTS

This chapter briefly describes the major components and practices associated with rural electrification and the accomplishments of the National Electrification Administration (NEA) and three rural electric cooperatives. This chapter is equivalent to descriptive material on a project found in an EA. Thus, the description of the project is limited to those factors which are essential to an environmental evaluation rather than a complete description of the project, which includes such factors as institutional arrangements and financial matters.

2.1 Project Features

2.1.1 Components

Power acquisition and distribution are the two major components of rural electrification.

Coops acquire power either by purchase from the National Power Corporation (NPC) or by the operation of coop-owned generation units. The NPC utilizes thermal (mostly oil-burning) and hydro power and supplies most of the needs of cooperative consumers in the Luzon and Mindanao regions. The coop generation units are diesel engines and supply most of the cooperative consumers in the Visayas region.

Coops distribute power among municipalities through the backbone systems which consist of 13.8 KV lines. Lateral and secondary connections consisting of 7.5 KV lines link consumers within a municipality to a backbone system. The Environmental Assessment focuses on the backbone system because it has the most potential for disrupting the environment.

2.1.2 Practices

The following sections describe the different activities associated with project implementation. They provide background information for analysis of the impacts on the natural environment.

2.1.2.1 Planning

Planning, which includes staking and mapping of the backbone system is done by NEA consultants. They consider the following factors in making route selections: (1) minimal disturbance of the vegetation, particularly fruit trees; (2) distance of poles from a stream. Usually poles are placed at points where water cannot reach them when at its maximum level; (3) shortest distance between municipalities; (4) potential household connections; (5) potential irrigation areas; and (6) possibility of having large and small industries.

2.1.2.2 Clearing

This particular activity is carried out in different ways by the cooperatives. According to the NEA "Specifications and Drawings,"* the coops should clear a three-meter width on either side of the line. In practice, coops often trim the vegetation rather than clear the right-of-way. Coops limit the clearing in deference to the attitude of local residents and in order to preserve economically-useful vegetation.

2.1.2.3 Construction

Construction activities consist of transporting poles, digging of holes, erecting of poles and lifting of lines. These construction activities are often labor-intensive.

Boom trucks are being used for transporting poles in areas where the backbone system is beside the road. In hilly terrain or forested areas, transporting of poles is done by carabao or by laborers.

Holes for the poles are dug by means of hand. The diameter of the hole is 60 - 70 cms. and the depth depends on the length of the pole.

Erection of poles is done by placing one end of the pole in the hole and lifting the other end gradually with the help of wooden braces. This procedure

* NEA, "Specifications and Drawings For 7.62/13.2 KV Line Construction," 1973.

is always used where there is no access road, primarily in hilly and some flat areas. For areas where the backbone system is constructed beside the road, boom trucks are used to erect the poles.

Installation of backbone lines on both hilly and flat areas is done by pulling one end of the line until it reaches the last pole in the area. The lifting of lines is done with a long pole with a hook at the tip.

2.1.2.4 Maintenance

Maintenance is done in some areas by trimming and in other areas by cutting down the vegetation. Maintenance is usually done once a year for those areas where vegetation is cut and three times a year for those areas where vegetation is just trimmed.

There are no herbicides used to control the encroachment of vegetation in the right-of-way.

2.2 National Electrification Administration

2.2.1 History of National Electrification Administration

The National Electrification Administration (NEA) was created in June 1969. Immediately, the NEA adopted the area coverage concept and chose electric cooperatives as the primary means of program implementation.

In August 1973, the NEA was converted into a public corporation which made it stronger financially and more flexible as an institution. The corporate powers and additional funding resulted in a significant shift from institution building to actual construction of coop physical facilities.

2.2.2 Accomplishments

The accomplishments of NEA are best illustrated by the increase in the number of energized cooperatives, towns and barrios (Table 2.1). As of 1976, there were approximately 3,900 barrios and 415 energized towns. In addition, there were 63 energized cooperatives out of a total of 79 registered cooperatives.

Another measure of accomplishment is the physical structure in place as of December 1976 (Table 2.2). Among other

Table 2.1

NEA ACCOMPLISHMENTS

	As of 1975	As of 1976
No. of Energized Cooperatives	51	63
No. of Energized Towns	301	414
No. of Energized Barrios	2,241	3,893
No. of Connected Houses	298,798	467,879

SOURCE: NEA "1976 Annual Report"

Table 2.2

NEA PHYSICAL STRUCTURES: 1970, 1975, 1976

	1970	1975	1976
A. Completed			
Headquarters Facilities	0	21	33
Transmission Systems	0	0	0
Distribution Systems	0	15	30
Power Plants	0	7	18
B. On-going			
Headquarters Facilities	0	22	2
Transmission Systems	0	--	4
Distribution Systems	0	21	19
Power Plants	0	9	8

SOURCE: NEA "1976 Annual Report"

things, headquarter facilities had been completed for 33 out of the 79 registered cooperatives and were under construction for 9 more. The NEA cooperatives had installed 18 power plants (diesel units) and were constructing 8 more.

A final measure of accomplishment is the number of participants in the special programs. In the case of small-scale industry, NEA has been involved in 10 projects (Table 2.3). Also, NEA has collaborated with the Farm Systems Development Corporation and National Irrigation Administration in irrigation projects (Table 2.4). Likewise, NEA has been involved in the Illumination For Learning And Work (ILAW) Project. As of December 1976, a total of 2,100 school rooms in 350 rural public schools located in 175 municipalities all over the country had been lighted by coops.

Table 2.3

NEA INVOLVEMENT IN SMALL-SCALE INDUSTRY
(as of December 1976)

	Approved Loans (₱1,000)	Pesos Released (₱1,000)
Capiz Garments	600	301
Albay Fibercraft	300	295
Pampanga Bamboo Craft	250	147
La Union Woodcraft	300	187
Bulacan Embroidery Apparel	250	239
Aklan Pina Cloth	100	55
Laguna Garments	250	192
Nueva Ecija Furniture	450	431
Benguet Weaving	200	132
Bulacan Garments	650	-o-
T O T A L:	₱3,350	₱1,979

SOURCE: NEA "1976 Annual Report"

Table 2.4

NEA INVOLVEMENT IN IRRIGATION

	As of 1975	As of 1976
With FSDC		
No. of Pumps Installed	185	375
Area Irrigated (Ha.)	13,250	28,200
With NIA		
No. of Pumps Installed	35	50
Area Irrigated (Ha.)	2,900	5,900

SOURCE: NEA "1976 Annual Report"

2.3 La Union Electric Cooperative (LUELCO)

2.3.1 Brief Profile of La Union Province

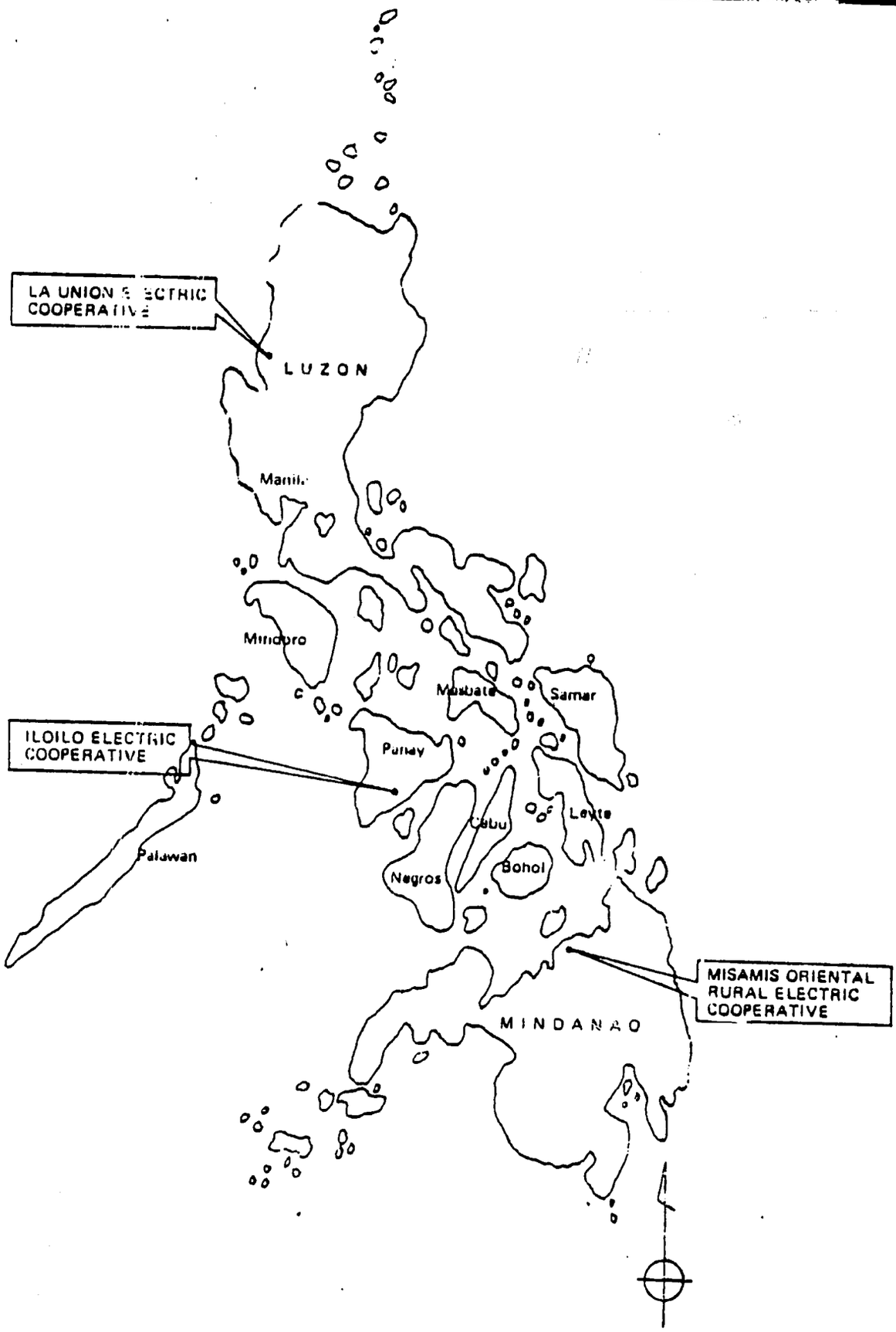
La Union Province is located on the western coast of Northern Luzon (Figure 2.1). It is richly endowed with a clean and sprawling coastline along the South China Sea and the Lingayen Gulf. The eastern boundary of the province passes through the foothills of the Cordillera mountains.

The total land area of La Union Province is 1,490 square kilometers. Its total population in 1975 was 413,000.

The total land area within the LUELCO service area is 905 square kilometers, which is approximately 60 percent of the provincial territory. The total population within the LUELCO service area was 209,000 in 1975, which was approximately 50 percent of the provincial population.

The majority of the people are engaged in tobacco farming, fishing and cottage enterprises.

Figure 2.1



Republic of the Philippines
National Electrification Administration
ENVIRONMENTAL ASSESSMENT
RURAL ELECTRIFICATION PROJECT

LOCATION MAP

2.3.2 History of LUELCO

LUELCO was incorporated in August 1971. Its original service area included the municipalities of Aringay, Caba, Tubao, and the five eastern barrios of Agoo (Figure 2.2). LUELCO inaugurated its headquarters facilities in August 1974. At the same time, it energized the substation and several sections of the distribution system.

The rapid growth of the coop can be explained by the take-over of several private electric franchises. In February 1975, LUELCO took over the Agoo Light and Power and the Naguilian Systems. In 1976, it took over the Bangar and Sudipen Systems.

2.3.3 Accomplishments

The accomplishments of LUELCO cannot easily be illustrated by the change in the number of consumers and increased load between August 1974 and December 1976 because there are no available data on consumers and load in 1974. Authorities say that there were several thousand consumers at that time since there were private electric companies in the service area. As of December 1976, there were approximately 15,000 consumers and a load factor of 3,300 KW (Table 2.5).

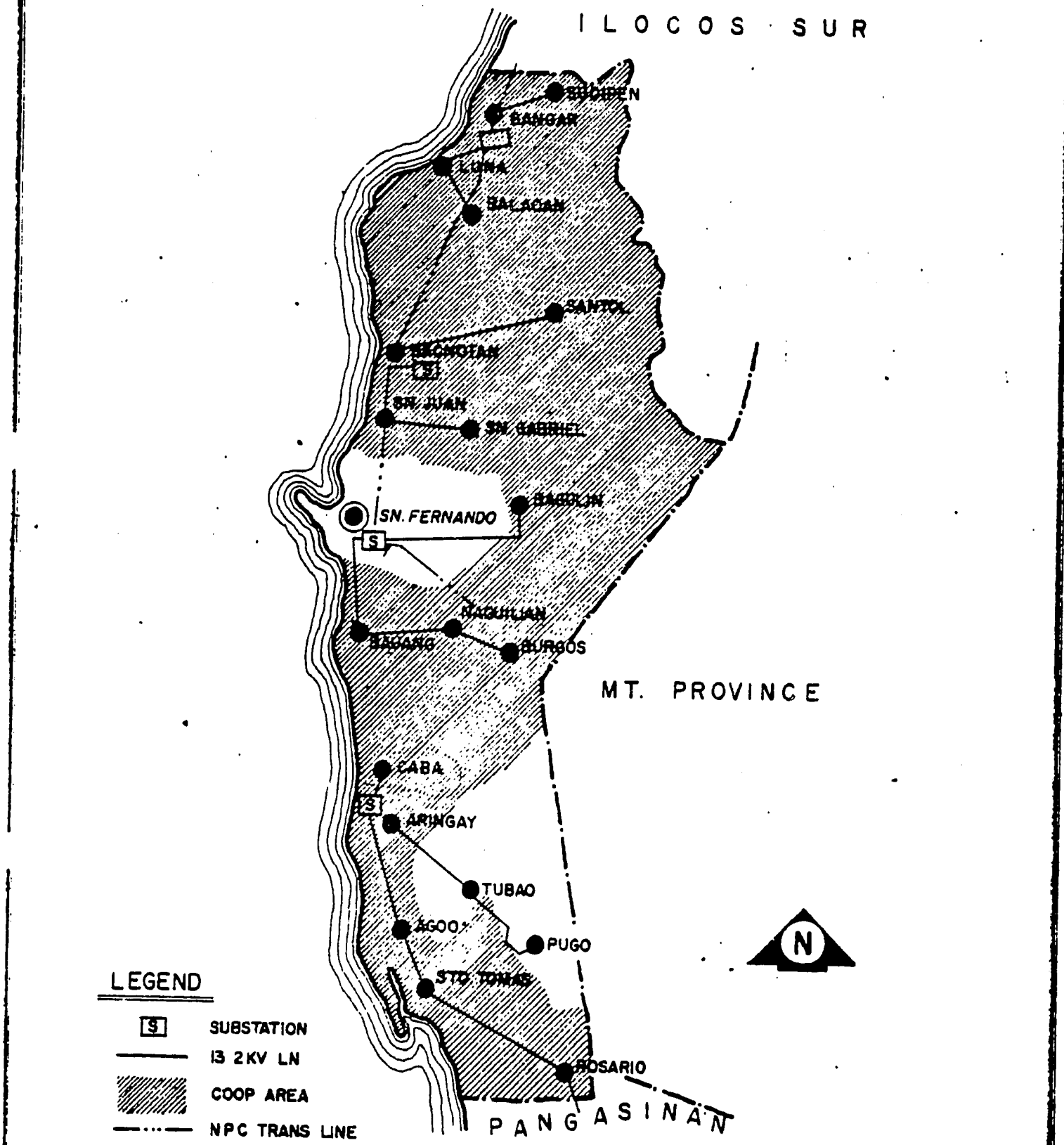
Table 2.5

CONSUMERS AND LOAD, AUGUST 1974 AND DECEMBER 1976

	Consumers	Load (KW)	Consumers	Load (KW)
Residential	N/A	N/A	13,670	1,339
Commercial	N/A	N/A	970	229
Industrial	N/A	N/A	24	1,325
Irrigation	N/A	N/A	6	110
Public Buildings	N/A	N/A	171	130
Street Lights	N/A	N/A	183	102
Sale for Resale	N/A	N/A	1	65
Waterworks	N/A	N/A	2	4
T O T A L:	N/A	N/A	15,033	3,304

SOURCE: LUELCO "Five-Year Work Plan"

Figure 2.2



LA UNION ELECTRIC COOP., INC.

CIRCUIT DIAGRAM
BACKBONE SYSTEM

A second measure of accomplishment is the number of barrios in La Union Province energized by LUELCO (Table 2.6). As of August 1974, only 5 percent of the barrios were energized, but by December 1976, more than 50 percent were energized by LUELCO.

Table 2.6

STATUS OF LUELCO ENERGIZED BARRIOS

Municipalities	No. of Barrios	August 1974	% of Total	December 1976	% of Total
Agoo	49	--	--	47	96
Ariagay	24	5	21	18	75
Bacnotan	47	--	--	21	45
Bagulin	10	--	--	1	10
Bangar	33	--	--	17	52
Burgos	12	--	--	4	33
Caba	17	7	41	14	82
Naguilian	37	--	--	21	57
Pugo	13	3	23	12	92
Rosario	33	--	--	19	58
San Gabriel	15	--	--	1	6
San Juan	41	--	--	6	15
Santo	11	--	--	--	--
Santo Tomas	25	--	--	16	64
Sison (Pangasinan)	28	--	--	11	39
Sudipen	17	--	--	3	18
Tubao	18	5	--	11	61
T O T A L	430	20	5	222	52

SOURCE: LUELCO

Yet another measure of accomplishment is the physical structure in place as of December 1976 (Table 2.7). LUELCO has initially concentrated on covering the entire service area and in the future will work on intensifying the number of connections in the area.

Table 2.7

PHYSICAL STRUCTURES, 1974 AND 1976

Category	1974	1976
Primary (Kms)		
3 Ø - Backbone	30	78
3 Ø - Irrigation	1	2
1 Ø - Laterals	6	54
Secondary (Kms)	16	61

SOURCE: LUELCO

A fourth measure of accomplishment is industrial coverage and consumption (Table 2.8). All of the industries with electrical consumption in 1975 existed before LUELCO was energized in August 1974. Only 2 percent of the 1976 KWH consumption can be attributed to new industries established in 1976. For most of the industrial consumers, LUELCO provided them with more dependable service and a larger power supply.

A final measure of accomplishment is the number of participants in special programs. LUELCO had one participant, La Union Woodcraft, in the small-scale industry program as of December 1976. It also initiated the first barangay domestic water supply project in Barrio Sta. Teresa, Tubao in July 1976. Lastly, it supported a number of hectares of irrigated ricelands in cooperation with the Farms Systems Development Corporation.

Table 2.8

INDUSTRIAL CONSUMERS

		Number of Establishments	KWH Consumption
1975	Existing	19	338,500
	New	0	0
1976	Existing	19	338,500
	New	5	5,000
1977	Existing	23	343,400
	New	6	4,000

SOURCE: LUELCO

2.3.4 Backbone Systems Inspected

Of the 107 kilometers of backhone system installed by 1976, approximately 25 kilometers are in hilly or mountainous terrain. The backbone system chosen for inspection was selected from these because the terrain would be most susceptible to environmental deterioration such as soil erosion and the failure of vegetation to re-establish itself after construction.

The first backbone system inspected was an 11-kilometer line from the poblacion of Naguilian to the poblacion of Bagulin. Only 6 kilometers of the line passed through hilly terrain with a maximum elevation of 30 meters. The system was constructed in 1975 at a cost of ₱191,000 ($26,000) (Figure 2.2).

The second backbone system inspected was a 7-kilometer line from the poblacion of Naguilian to Barrio Bilis, municipality of Burgos. Most of the 7-kilometer line passed through hilly terrain with a maximum elevation of 250 meters. The system was constructed in 1976 at a cost of ₱340,000 ($47,000).

2.4 Misamis Oriental Rural Electric Cooperative (MORESCO)

2.4.1 Brief Profile of Misamis Oriental Province

Misamis Oriental Province is a coastal province in North Central Mindanao Island (Figure 2.1). The MORESCO service area, which lies in the western part of the province, is characterized by a relatively narrow coastal strip and a series of ridges which rise abruptly from 20 to 100 meters within three kilometers from the coast.

The total land area of the province is 3,570 square kilometers. The total population of the province was 558,000 in 1975.

The total land area within the MORESCO service area is 870 square kilometers which is approximately 24 percent of the provincial territory. The total population within the MORESCO service area was 124,000 in 1975, which was approximately 22 percent of the provincial population.

The province's economy, as well as the service area, is basically agriculture. The main agricultural products of Misamis Oriental are palay, coconut, white corn, fruits and vegetables, coffee, cabbage, root crops, bananas and tobacco. The livestock industry is also important. However, the fishing industry is still unexploited, which probably means that there are not enough fish caught to meet the demands of the province's population.

2.4.2 History of MORESCO

MORESCO was incorporated in 1967. Its initial service area included the following ten municipalities -- Alubijid, El Salvador, Gitagum, Initao, Laguindingan, Libertad, Lugait, Manticao, Naawan and Opol (Figure 2.3). In 1977, MORESCO extended its coverage to five barrios of Cagayan de Oro, which were not served by the city system.

In September 1971, MORESCO energized the first major section of its system. It completed major construction, including headquarter facilities, in the following year.

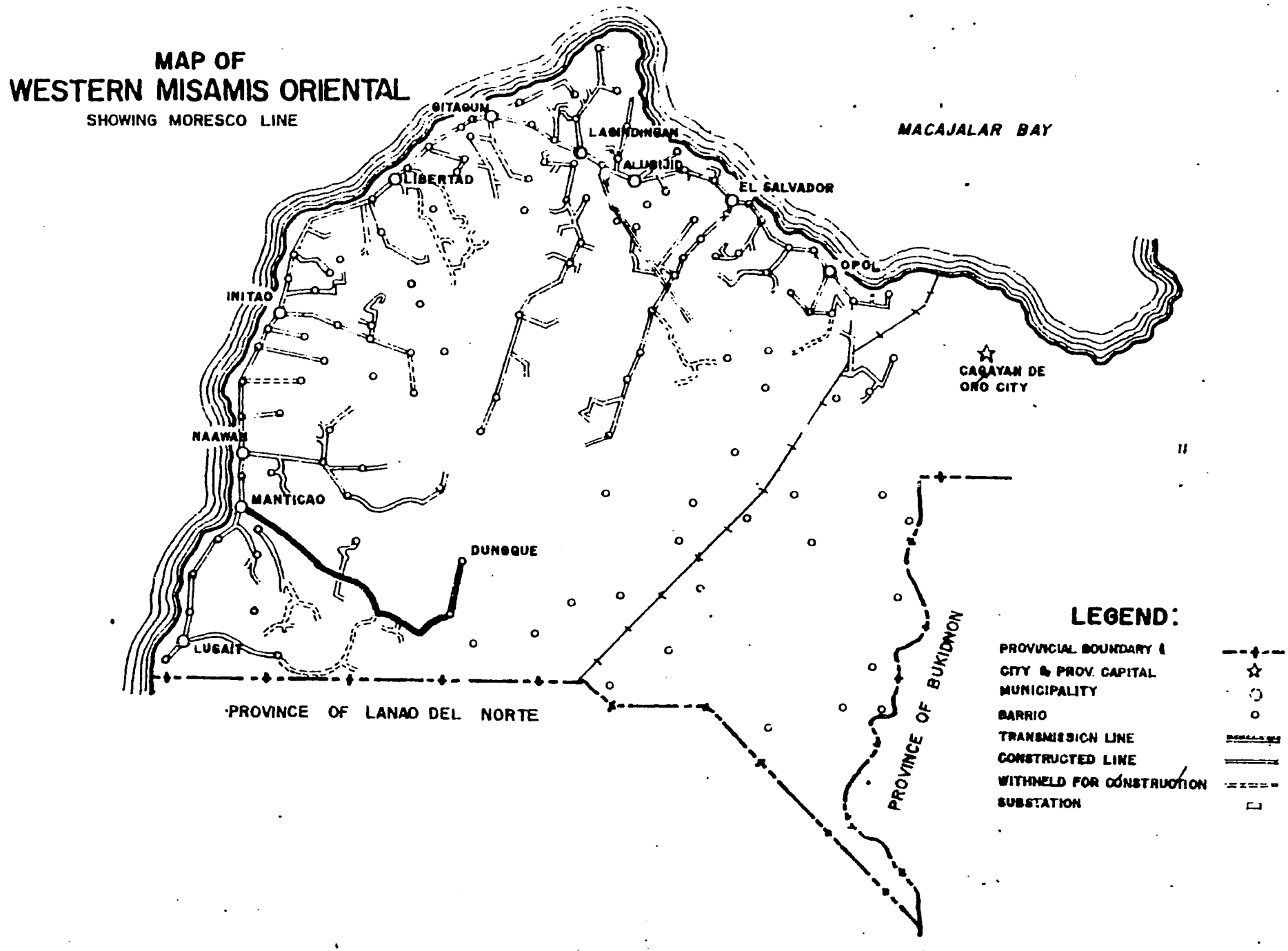

MAP OF
WESTERN MISAMIS ORIENTAL
SHOWING MORESCO LINE
MACAJALAR BAY
GITAGUM
LAGINDINGAN
ALUBIJID
LIBERTAD
EL SALVADOR
OPOL
INITAO
CAGAYAN DE ORO CITY
NAAWAN
MANTICAO
DUNGQUE
LUGAIT
PROVINCE OF LANAO DEL NORTE
PROVINCE OF BUKIDNON
LEGEND:
PROVINCIAL BOUNDARY
CITY & PROV. CAPITAL
MUNICIPALITY
BARRIO
TRANSMISSION LINE
CONSTRUCTED LINE
WITHHELD FOR CONSTRUCTION
SUBSTATION

Figure 2.3

The coop started, in contrast to most other coops, in an area which was not served with electricity.

2.4.3 Accomplishments

The accomplishments of MORESCO are best illustrated by the number of consumers and the increase in KWH consumption between 1970 and 1975 (Table 2.9). The number of consumers increased from zero (0) in 1970 to 7,300 in 1975. Electrical consumption (KWH) increased from zero (0) in 1970 to 468,000 KWH in 1975.

Table 2.9

CHANGES IN CONSUMERS AND KWH CONSUMPTION

	Consumers			Load		
	1970	1972	1975	1970	1972	1975
Residential	0	4,516	6,176	0	110,510	224,558
Commercial	0	330	356	0	56,297	117,017
Industrial	0	0	3	0	0	46,000
Irrigation	0	5	15	0	763	5,356
Public Buildings	0	226	270	0	9,037	22,282
Street Lights	0	360	497	0	20,205	28,610
Sale for Resale	0	0	0	0	0	0
Waterworks	0	11	30	0	3,111	24,466
T O T A L	0	5,448	7,347	0	199,923	468,289

SOURCE: MORESCO

A second measure of accomplishment is in the number of barrios energized between 1970 and 1975 (Table 2.10). As of 1970, none of the barrios were energized, but by 1975 MORESCO had connected 105 barrios.

Table 2.10

STATUS OF BARRIOS ENERGIZED

Municipality	No. of Barrios	1970	1975	% of Total
Alubijid	20	0	15	75
El Salvador	18	0	15	83
Gitagum	12	0	11	91
Initao	16	0	15	94
Laguindingan	11	0	11	100
Libertad	9	0	6	66
Lugait	8	0	5	62
Manticao	13	0	8	62
Naawan	10	0	10	100
Opol	15	0	9	60
T O T A L	132	0	105	80

SOURCE: MORESCO

A third measure of accomplishment is the physical structure in place as of December 1975 (Table 2.11). MORESCO has initially concentrated on covering the entire service area and in the future will work on intensifying the number of consumers in the area.

Table 2.11

PHYSICAL STRUCTURES, 1970, 1972, 1975

Category	1970	1972	1975
Primary (Kms)			
3 Ø - Backbone	0	63	93
3 Ø - Irrigation	0	0	2
1 Ø - Laterals	0	231	280
Secondary (Kms)	0	74	115

SOURCE: MORESCO

A fourth measure of accomplishment which is important for environmental assessment is the industrial coverage as of December 1975 (Table 2.12). As can be seen, only one plant was in existence in the service area before MORESCO was energized in 1972.

2.4.4 Backbone Systems Inspected

Of the 91 kilometers of the backbone system established by December 1975, approximately 30 kilometers are located in hilly or mountainous terrain. The backbone systems chosen for inspection were selected from these because the terrain would be most susceptible to environmental deterioration such as soil erosion and the failure of the vegetation to re-establish itself after construction.

The only backbone system inspected was a 16-kilometer line from the poblacion of Manticao to Dunque. Of this, only 6 kilometers pass through mountainous terrain with a maximum elevation of 500 meters (Figure 2.3).

Table 2.12

INDUSTRIAL COVERAGE, DECEMBER 1975

Name	Type of Activity	Date Established	Output	KW or KWH (1975)
Berbum	cold storage	1976	N/A	N/A
Engineering Steel Inds.	foundry	1976	N/A	N/A
Ferro Chemicals	chemicals	1975	N/A	N/A
Floro Cement *	cement	1969	1,500 T per day	N/A
Meiho Philippines	sorghum	1975	75 T per day	N/A
Mindanao Steel Corp.	steel	1972	75,000 T per day	N/A
Polar Refrigeration	ice	1977	N/A	N/A
Timber Inds. of the Philippines	sawmill	1975	N/A	N/A

SOURCE: MORESCO Study and National Pollution Control Commission

* Connected directly with the NPC Grid which is the source of power for MORESCO.

2.5 Iloilo Electric Cooperative (ILECO)

2.5.1 Brief Profile of Iloilo Province

Iloilo Province is the largest of the four provinces on the Island of Panay in the Western Visayas region. The topography of the province varies from rolling land and hills to mountain peaks and ranges. A mountain chain runs from the northeast to the southeast with the highest peak being over 1,700 meters. More than a hundred rivers and streams cut across the province (Figure 2.1).

The total land area of the province is 5,300 square kilometers. The total population of the province was 1,315,000 in 1975.

The total land area within the ILECO service area is 3,700 square kilometers, which is approximately 70 percent of the provincial territory. The total population within the ILECO service area was 204,000 in 1975, which is approximately 15 percent of the provincial population.

The province is predominantly agricultural with approximately 60 percent of the work force in this sector. Iloilo is one of the top five rice-producing provinces in the Philippines. It also ranked third in inland fish production and fourth in sugar production.

2.5.2 History of ILECO

ILECO was incorporated in June 1974. It initially covered eight municipalities, namely: Oton, Tigbauan, San Miguel, Leon, Alimodian, Tubungan, Miagao, and Guimbal (Figure 2.4).

In October 1975, ILECO completed headquarter facilities, substations and several sections of the distribution system.

2.5.3 Accomplishments

The accomplishments of ILECO are best illustrated by the change in the number of consumers between 1973 and 1975 (Table 2.13). The number of consumers increased from zero (0) in 1973 to 27,570 in 1975.

A second measure of accomplishment is the number of barrios energized between 1973 and 1976 (Table 2.14). By 1976, approximately 25 percent of the barrios were served by ILECO.

A third measure of accomplishment is the physical structure in place as of December 1976 (Table 2.15). ILECO has initially concentrated on covering the entire service area and in the future will work on intensifying the number of connections in the area.

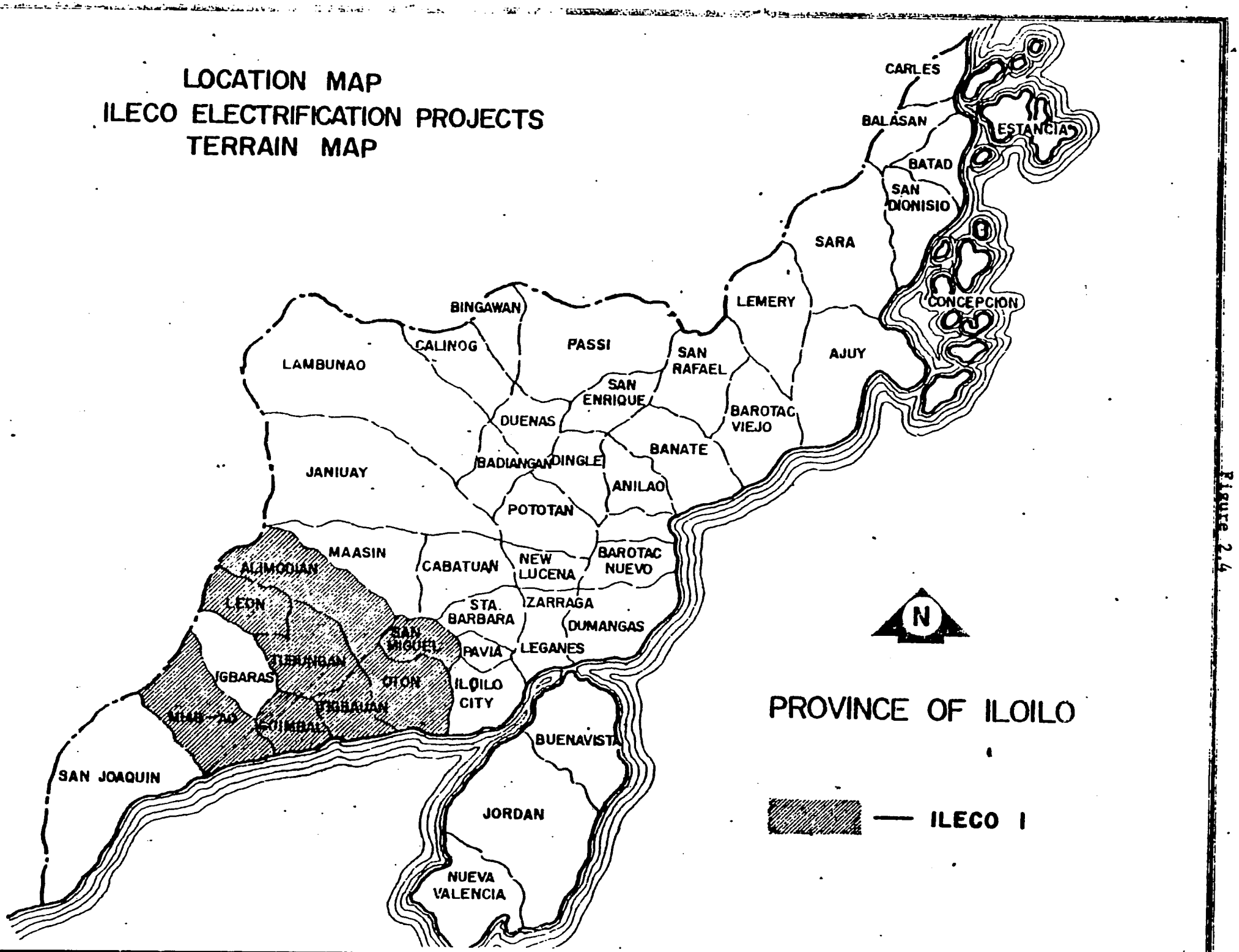

LOCATION MAP
ILECO ELECTRIFICATION PROJECTS
TERRAIN MAP
CARLES
BALASAN
ESTANCIA
BATAD
SAN DIONISIO
SARA
CONCEPCION
LEMERY
AJUY
BINGAWAN
CALINOG
PASSI
SAN RAFAEL
LAMBUNAO
SAN ENRIQUE
BAROTAC VIEJO
DUENAS
BANATE
BADIANGAN
DINGLE
JANIUAY
ANILAO
POTOTAN
MAASIN
ALIMODIAN
CABATUAN
NEW LUCENA
BAROTAC NUEVO
LEON
STA. BARBARA
ZARRAGA
DUMANGAS
SAN MIGUEL
PAVIA
LEGANES
TUBUNGAN
IGBARAS
OTON
ILOILO CITY
MIAGAO
TIGBAUAN
GUIMBAL
BUENAVISTA
SAN JOAQUIN
JORDAN
NUEVA VALENCIA
N
PROVINCE OF ILOILO
ILECO I

Figure 2.4

Table 2.13

CHANGE IN CONSUMERS, 1973, 1975, 1976

	1973	1975	1976
Residential	0	27,670	N/A
Commercial	0	540	N/A
Industrial	0	N/A	N/A
Irrigation	0	N/A	N/A
Public Buildings	0	N/A	N/A
Street Lights	0	N/A	N/A
Sale for Resale	0	N/A	N/A
Waterworks	0	N/A	N/A

SOURCE: ILECO

Table 2.14

STATUS OF BARRIOS ENERGIZED

Municipality	No. of Barrios	1973	1976	1976 as % of Total
Oton	35	0	14	40
Leon	84	0	10	12
Tubungan	45	0	7	16
San Miguel	8	0	4	50
Tigbauan	44	0	15	34
Miag-ao	112	0	24	21
Guimbal	21	0	19	90
Alimodian	50	0	5	10
T O T A L	399	0	98	24

SOURCE: ILECO

Table 2.15

PHYSICAL STRUCTURES, 1973, 1975 AND 1976

Category	1973	1975	1976
Primary (Kms)			
3 Ø - Backbone	0	72	95
3 Ø - Irrigation	0	0	2
1 Ø - Laterals	0	13	14
Secondary (Kms)	0	84	108

SOURCE: ILECO

A final measure of accomplishment is the number of participants in special programs. ILECO serves 1,700 hectares of irrigated land in cooperation with the National Irrigation Administration and the Farm Systems Development Corporation. Likewise, it provides lighting for 190 classrooms under the TANGLAW project.

2.5.4 Backbone Systems Inspected

Of the 95 kilometers of backbone system installed by 1976, approximately 20 kilometers are located in hilly or mountainous terrain. The backbone system chosen for inspection was selected from these because the terrain would be most susceptible to environmental deterioration such as soil erosion and the failure of vegetation to re-establish itself after construction.

The backbone system inspected was a 13-kilometer line from the poblacion of Miag-ao to the poblacion of San Joaquin. Only four kilometers of the line passed through hilly terrain with a maximum elevation of 30 meters (Figure 2.4).

Chapter 3

ENVIRONMENTAL EFFECTS OF RURAL ELECTRIFICATION

3.1 Introduction

The rural electrification project is an undertaking which has an impact on both the natural and socio-economic environments. Effects on the natural environment result from the installation of the backbone system, maintenance of the right-of-way and attraction of industries which release effluents causing air and water pollution. Effects on the socio-economic environment result from activities such as population growth, job creation and housing construction which are stimulated by the availability of electricity.

Documentation of the environmental effects is based on an ocular reconnaisance survey of the backbone system and from a national survey and case studies in three provinces: La Union, Misamis Oriental and Iloilo. Methodological discussions are included in each presentation.

3.2 Nationwide Survey

The nationwide survey investigated several topics including demographic characteristics, housing conditions, household expenditures, community facilities, etc. Only those topics which are relevant to the Environmental Assessment are discussed in the following sections. A complete list of major topics is included in the following section on sources of data.

3.2.1 Socio-Economic Environment

3.2.1.1 Use of Family Planning Methods and Incidence of Pregnancy

To clarify this issue, the survey asked if any member of the household practised family planning methods, both natural and artificial, and if so, to number them. The responses were then tabulated against electrification status. Table 3.1 shows that there is a greater percentage of electrified than non-electrified households practising family planning.

Table 3.1

FAMILY PLANNING USE BY ELECTRIFICATION STATUS, 1977
(percent of households)

	Total	Electrified	Non-Electrified
Family Planning User	19	22	18
Non-User	81	78	82
	100	100	100

SOURCE: NEA "Nationwide Survey"

While responses to the questions indicate that use of a family planning method is related to electrification, certain qualifications relevant to the question asked of the respondents must be made before establishing any conclusions. First of all, no attempt was made to differentiate users of effective methods such as IUD, the pill, and sterilization from users of less effective methods such as rhythm and coitus interruptus. Secondly, users were not differentiated as to whether or not they are registered in a recognized Population Commission Family Planning Clinic.

Aside from the practice of family planning, the survey also investigated the incidence of pregnancy. Respondents were asked whether any female member of the household was pregnant in the past 12 months. Table 3.2 shows that in the aggregate, electrified households experienced less pregnancies than non-electrified households: 18 percent as against 22 percent.

Although this is a straightforward question, the results would have been better had live births been asked instead. Nevertheless, it would be safe to assume that there is a close correspondence between the two.

Table 3.2

INCIDENCE OF REPORTED PREGNANCY BY ELECTRIFICATION STATUS, 1977
(percent of households)

	Total	Electrified	Non-Electrified
With reported pregnancy	21	18	22
With no reported pregnancy	79	82	79
	100	100	100

SOURCE: NEA "Nationwide Survey"

3.2.1.2 Migration

The survey asked about in-migration but did not ask about out-migration. Only a small proportion (six percent) of the total households had the experience of someone moving into their houses. Of these migrants, 60 percent elected to stay in an electrified household, while 40 percent elected to stay in a non-electrified household. This is regardless of the electrification status of the migrant's place of origin.

Most migrants in the sample do not live far from where they used to live. For instance, roughly three out of four migrants did not leave their province and of these, roughly one-third actually did not leave their barrio. The great bulk of migratory movement is apparently intra-provincial.

3.2.1.3 Recreation

The primary impact of electricity on households in terms of recreational activities is watching television. A majority of residents watched television: 59 percent of coop households and 69 percent of non-coop households (Table 3.3). Electric radios and stereos

Table 3.3

OWNERS AND USERS OF ELECTRIC TELEVISION AND RADIO/STEREO, 1977
(percentage of households)

	COOP AREAS		NON-COOP AREAS	
Electric Appliances	Owner	User[a]	Owner	User[a]
Television Sets	32	59	45	69
Radio/Stereo	41	47	50	52

[a] Outside household

SOURCE: NEA "Nationwide Survey"

(47 percent in coop areas and 52 percent in non-coop areas) were also important sources of entertainment.

The survey also noted that sharing of these appliances had added benefits to households. Aside from the entertainment, they also provided opportunities for social visits.

3.2.1.4 Water Supply

The only public health parameter surveyed was the source of drinking water (Table 3.4). As seen in the table, there is a significant difference between an electrified area versus a non-electrified area in terms of the sources of drinking water. Electrified areas more often used piped water from a central source and artesian wells, which usually have safer water than other sources.

3.2.1.5 Amenities

Use of electricity in rural households is primarily for lighting (Table 3.5). In some instances, electricity is used for domestic conveniences other than lighting.

Table 3.4

SOURCE OF DRINKING WATER AND ELECTRIFICATION STATUS, 1977
(percentage of households)

	Total	Electrified	Non-Electrified
Piped from central source	33	45	28
Artesian wells	38	43	37
Open wells	17	6	22
Springs	6	1	9
Rainwater	1	--[a]	1
Piped from central source plus one or more sources	1	3	--[a]
River	--[a]	--[a]	--[a]
Two or more sources (central source excluded)	1	--[a]	2
T O T A L	100	100	100

[a] Less than 1 percent.

SOURCE: NEA "Nationwide Survey"

The introduction of electricity provides an alternative source of energy for cooking. If it were used extensively, there would be less demand for forest products, wood and charcoal, and thus less encroachment on forest resources. However, the survey results show that only one percent of the electrified households at the most used electricity for cooking. Wood is still a cheaper source of energy than electricity.

Table 3.5

USE OF ELECTRICITY BY ELECTRIFIED HOUSEHOLDS
BY COOPERATIVE STATUS, 1977
(percentage of households)

Uses of Electricity	Cooperative Areas	Non-Cooperative Areas
Lighting	100	100
Ironing	32	54
Ventilation	32	40
Refrigeration	31	37
Cooking	0	1

SOURCE: NEA "Nationwide Survey"

3.2.2 Sources of Data - National Study

The source of data for the nation as a whole is the recent "Nationwide Survey on Socio-Economic Impact of Rural Electrification" conducted by NEA. The survey of approximately 4,000 households was conducted in January 1977. There was no survey of commercial or industrial establishments.

There were several objectives of the survey. The study was primarily exploratory and designed to provide baseline information for future comparisons. In addition, the survey focused on differences between coop and non-coop areas and electrified and non-electrified households and the impact of factors other than electricity on the level of living. The main areas of investigation were:

a. Demographic characteristics of household;
b. Housing conditions and facilities;
c. Electricity usage and expenses in electrified households;
d. Substitute power sources and cost in non-electrified households;
e. Availability, accessibility and use of community facilities;

f. Income of households by sources of income and expenditures on inputs in family owned or operated enterprises;
g. Perception of the impact of electricity on the community;
h. Attitudes toward and reactions to electricity costs and service.

Two sets of samples were drawn from the population of Philippine households. One set was from those areas covered by a cooperative franchise (cooperative areas) and the other from those areas not covered by a cooperative franchise (non-cooperative areas). A total of 4,000 samples was taken; 3,000 from coop areas and 1,000 from non-coop areas. Within each category, households were stratified by electrification status. Thus a total of 1,020 electrified and 1,980 non-electrified households were selected for interview in the cooperative areas (107 barrios). Similarly, a total of 309 electrified and 696 non-electrified households were selected for interview in non-cooperative areas (107 barrios).

The results of the survey showed that 33 percent of the combined samples live in urban areas. This is comparable with the national figure of 32 percent urban. The medium-sized household has six members, which is close to the national average size of households. The median educational attainment of household heads in the two areas surveyed is 6 years.

3.3 La Union Electric Cooperative (LUELCO)

3.3.1 Natural Environment

3.3.1.1 Effects of Installation and Maintenance of the Backbone System

Table 3.6 presents a description of the Naguilian and Burgos backbone systems. The EA team observed the following parameters:

NAGUILIAN:

a. Vegetation. Effects on vegetation in this particular area are limited to the trimming of vegetation in the right-of-way

Table 3.6

DESCRIPTION OF NAGUILIAN AND BURGOS BACKBONE SYSTEMS

Barrio	Stretch of Backbone	Types of Area	Vegetation
NAGUILIAN:			
From Poblacion to Barrio Liaoc	1 kilometer	Line passes mostly near a flat road.	Mixed vegetation of fruit bearing trees (bananas, star apples, etc.), bamboo, shrubs, herbs.
Liaoc - Barrio Gusing	2 kilometers	1 km. passes thru a ricefield. 1 km. passes over a hill-top with an elevation of approximately 40 meters.	Mixed vegetation except in ricefields.
Gusing - Barrio Tudingan	1 kilometer	Passes mostly along the road. Passes over 10-meter wide stream. Passes over 5-meter wide stream.	Mixed vegetation.
Tudingan - Bo. Mamanting Norte	3 kilometers	Runs up a hill for 500 meters and then crosses over a 50-meter wide river. Then runs for 2 kms. along a flat road.	Mixed vegetation.
Town of Baculin	10 kilometers	Steep terrain with highest point approximately 75 meters	Mixed vegetation.
BURGOS:			
From Bo. Ribsuan (Naguilian) to Barrio Bilis (Burgos)	7 kilometers	Mostly hilly and steep terrain approximately 140 meters at highest point.	Mixed vegetation, mostly bananas.

SOURCE: Ocular Reconnaissance, 1977

and in a few cases cutting of trees, primarily bamboo, near the distribution line. Vegetation in the right-of-way is similar to the surrounding vegetation with a little depression of the canopy under the backbone line due to trimming. Grasses are found at the base of the poles;

b. Soil. Gullying and soil erosion were not seen in the right-of-way; and

c. Water Quality. No sediment loading due to soil erosion from the right-of-way was seen in the study area. The stream crossed by the right-of-way was only slightly turbid. However, it was not raining in the area during the survey, thus the impact on water quality due to soil erosion cannot be accurably discussed in this EA.

BURGOS:

a. Vegetation. The impact on vegetation was limited to trimming and in some cases, cutting of trees. In steep areas, the vegetation at the periphery of the six-meter wide right-of-way could not be distinguished from the vegetation in the right-of-way because of the continuous successional growth;

b. Soil. No significant gullying can be seen in the right-of-way although most of the area is steep mountainous terrain; and

c. Water Quality. No water course passed through the right-of-way.

3.3.1.2 Effects of Industries

No new large-scale industries have been attracted to the service area since the establishment of the cooperative. Moreover, none of the existing industries in the area have discharges of residuals which could cause noticeable air and water pollution.

3.3.2 Socio-Economic Environment

3.3.2.1 Population

While the total population of La Union increased between 1960 and 1970, the population growth rate for 1970 - 1975 was lower than the growth rate for 1960 - 1970 (Table 3.7). The growth rate between 1960 and 1970 was 2.9 percent but declined to 2.5 percent between 1970 - 1975. This decline in population growth can be attributed to a lower birth rate and an increase in out-migration. Net out-migration between 1960 - 1970 was 7,500, but for 1970 - 1975 was 4,500. The latter number is 60 percent of the 1960 - 1970 estimate. (We assume that out-migration is also positive but there are no data to support this assumption.

The survey did not attempt to determine whether the availability of electricity had any effect on the birth rate or out-migration. In any case, electrification is only one factor among many which would affect the birth rate and out-migration. For example, a change in out-migration is due more to job and land availability than to the availability of electricity with its associated comfort and convenience.

Table 3.7

POPULATION GROWTH AND AREA, 1960 - 1975

		1960	1970	1960-70	1975	1970-75
Unit	Area (ha)	Population (No.)	Population (No.)	Annual Growth Rate-%	Population (No.)	Annual Growth Rate-%
Sampled Area	61,750	123,300	157,800	2.6	174,800	2.2
LUELCO Area	90,500	148,400	188,100	2.4	209,300	2.3
La Union	149,300	293,300	373,700	2.9	413,400	2.5

SOURCE: National Census and Statistics Office, compiled by Provincial Development Staff, La Union.

3.3.2.2 Education

Course offerings have been affected by availability of electricity in conjuction with other factors. The Aringay Folk School now has regular night classes. In addition, two other schools have reported the opening of night classes.

Electricity has also made possible the use of modern equipment in vocational courses.

3.3.2.3 Amenities

Electricity is used primarily for lighting purposes. Only in a few instances is electricity used for domestic convenience other than lighting (Tables 3.8 and 3.9).

Table 3.8

FUEL FOR COOKING FOOD BY HOUSEHOLD CATEGORIES
(percentage by households)

	User[a]	Non-Adoptor[b]	Inaccessible[c]
Firewood	71	93	92
Charcoal	4	1	1
Electricity	10	2	2*
Gas/Kerosene	15	4	5
T O T A L	100	100	100

* By generator

a Uses electricity
b Lives in LUELCO service area but does not use electricity.
c Does not live in LUELCO service area.

SOURCE: U.P. Baguio "Socio-Economic Survey"

Table 3.9

STORAGE OF PERISHABLE FOODS BY HOUSEHOLD CATEGORIES
(percentage of households)

	User	Non-Adoptor	Inaccessible
Refrigerators	12	0	2*
Screened Cabinets	41	25	26
Baskets	36	58	49
Others/No Storage	11	17	23
T O T A L	100	100	100

* By generator.

SOURCE: U.P. Baguio "Socio-Economic Survey"

3.3.2.4 Health

Electricity has had an impact on services offered by health institutions due to the use of electrically operated equipment such as X-ray machines, sterilizers, incubators, dental equipment, etc. In Rural Health Units and Maternal Child Health Centers, however, electricity use is limited to lighting.

3.3.2.5 Agriculture

Electrification can have an impact on agriculture in terms of production because of the possibility of electric pump irrigation systems. Irrigated riceland is planted usually twice a year, with some having three croppings. Each cropping has an average yield of 70 - 100 cavans per hectare compared to single-cropped rainfed fields which yield an average of 50 cavans per hectare. However, to date, power driven irrigation systems have not yet appeared to have much impact on farming water sources (Table 3.10).

Table 3.10

SOURCES OF WATER FOR IRRIGATION
(percentage of farms)

	User	Non-Adoptor	Inaccessible
Hand Pump	6	3	2
Electric Pump	7	0	2*
Gravity	73	72	70
Seasonal Sources (spring and rain)	14	25	16
T O T A L	100	100	100

* By Generator.

SOURCE: U.P. Baguio "Socio-Economic Survey"

3.3.2.6 Business/Industries

Business establishments in La Union have grown in terms of number of establishments and volume both for the province as a whole as well as by individual municipality. The types of business that have grown fastest are recreation, farm supply products, handicrafts, food service, funeral service and grocery/sari-sari store (Table 3.11). Ranking businesses according to their electricity-dependence and their rate of growth shows little correlation between availability of electricity and growth in number of electricity-dependent business establishments.

The growth in number of business establishments has been largely a growth of "small" (less than 10 employees) businesses. (Table 3.12). An analysis of these small businesses leads to the observation that electricity is not a precondition for the establishment of small businesses. This is shown by the fact that 48 percent were not electricity-dependent businesses, i.e. some of these businesses were able to start without

Table 3.11

RATES OF GROWTH OF BUSINESSES IN RELATION TO ELECTRICITY DEPENDENCE

Rank	Business Ranked According To:	Rate of Growth (%)	Degree of Electricity Dependence*
1	Recreation	137	none in sample
2	Farm Supply/Products	88	9
3	Handicrafts	76	9
4	Food Service	73	4
5	Funeral Service	69	None in sample
6	Grocer/Sari-Sari Store	64	9
7	Transportation/Warehousing	64	9
8	Rice Mill	62	7
9	Utilities	61	none in sample
10	Tailoring/Dress Shop	58	3
11	Gas Station/Fuel Service	51	5
12	Barber/Beauty Shop	49	6
	Average Rate for All	48	
13	Bakery	46	1
14	Vulcanizing	45	8
15	Pharmacy/Drug Store	40	9
16	Wholesale/Retail	38	none in sample
17	Business/Personal Service	32	none in sample
18	Livestock	30	9
19	Photo Service	30	8
20	Dental/Medical Clinic	30	6
21	Fishing/Fish Drying	25	9
22	Tobaco-Related	24	9
23	Construction	23	none in sample
24	School/Community Service	18	none in sample
25	Factory/Manufacturing	14	2
26	Lodging	10	none in sample

* one (1) indicates great dependence
nine (9) relatively small

SOURCE: U.P. Baguio "Socio-Economic Survey"

Table 3.12

PROPORTION OF SMALL AND LARGE BUSINESS ESTABLISHMENTS IN LA UNION, 1975

Size	Size	Number 1975	Percentage Successes
Small:	(less than 10 employees)	5,680	98
Large:	10 employees and more	96	2
	50 employees and more	18	0*
	100 employees and more	13	0*

* Less than one-half of one percent.

SOURCE: U.P. Baguio "Socio-Economic Survey"

electricity (one out of every three businesses) and others, which already had electricity, had no electricity-dependent activity in their business.

In spite of the availability of electricity, large scale businesses in La Union have not grown in number. This shows that although the availability of electricity is necessary for the establishment and growth of large-scale businesses, it is not a sufficient condition. Other factors like adequacy of capital, tax incentives for industries to locate in remote regions, greater supply of trained technical manpower and transportation network, also play a part in the growth of large-scale businesses.

Although electricity is not a precondition for the establishment of businesses, it is beneficial to both small and big businesses. Between 1961 and 1975, businesses have been converting from use of other sources of energy to use of electricity.(Table 3.13).

Table 3.13

SOURCES OF ENERGY FOR LIGHTING, COOKING/HEATING
All Businesses : 1961 - 1975
(percent of establishments)

	Lighting				Cooking/Heating			
	1961	1966	1971	1975	1961	1966	1971	1975
None	--	--	--	3	6	4	2	7
Electricity	39	42	58	65	17	27	21	36
Firewood	--	--	--	--	37	26	27	21
Charcoal	--	3	--	--	6	7	16	11
Kerosene	28	26	19	15	15	22	11	68
Candle	10	10	8	7	--	--	--	1
L P G	--	--	--	--	6	7	14	14
Petromax	21	17	13	9	--	--	2	1
Others	2	2	2	1	13	7	7	3
T O T A L	100	100	100	100	100	100	100	100

SOURCE: U.P. Baguio "Socio-Economic Survey"

At this point, one must say that electricity did not have much impact on the establishment of new businesses except for some small establishments and no impact on the growth of large industries. However, the availability of electricity had made operation more comfortable.

3.3.2.7 Employment

Growth in employment is another measure of the growth in businesses. While some types of businesses grow slowly in terms of number of establishments, they increase rapidly in terms of number of employees. One such example is the St. Louis University (Table 3.14).

Table 3.14

INDICATORS OF INTERNAL GROWTH - ST. LOUIS UNIVERSITY
1961 - 1975

	1961	1975	Percentage Change
Enrollment	1,480	1,700	30
Number of Employees	63	72	25

SOURCE: U.P. Baguio "Socio-Economic Survey"

Growth in employment, however, should not be attributed solely to electrification. As shown in the analysis of business growth, electricity is not the sole factor inducing the growth of establishments. Thus, no conclusion can be made about the effect of electricity on employment.

3.3.3 Sources of Data

There were three major sources of data for the LUELCO assessment. The first source was "A Socio-Economic Survey of the Impact of Rural Electrification in the LUELCO Area," by the University of the Philippines - College of Baguio. The methodology and limitations of this survey will be discussed in the next paragraph. The second source was a review of the records of the coops and discussion with the coop staff. The third source was the ocular reconnaissance of part of the backbone system.

The U.P. Baguio study was originally designed to utilize two different techniques, survey research and participant observation. The participant observation period, due to the logistics constraints of the study, was too short to provide maximum benefits for its application. However, as a basis for orientation to the field, the extent to which it was utilized greatly improved the development of the survey instruments in form and in data-gathering power. It can only be noted that further application would have meant more refinement and accuracy in asking these questions which are most pertinent to the interests of the study and most likely

to yield relevant data. Seven survey instruments were utilized: 1) Household Interview Schedule, 2) Business Interview Schedule - province-wide sample, 3) Business Interview Schedule - Intensive sample, 4) Municipal Information Inventory, 5) Questionnaire for Banks and Financial Institutions, 6) Barrio Captains Interview Schedule, 7) Interview Schedule for Heads of Associations. These methods were supported by collection and review of all available records and publications from private and government agencies.

The fact that only a few changes in socio-economic variables could be attributed to the introduction of electrical service is not surprising. First and most important, the survey was completed only two years after the area received electrical service. The effects of electrification, particularly on business, would probably not be noticeable for at least five years. A survey after two years is just too soon to measure any change. Second, the experimental design was not adequate for measuring change. Either a before and after survey or the use of experimental and control groups is a more appropriate design. Detection of change is very difficult with only an ex-post facto audit, which was the experimental design in this case. Third, the availability of electricity is a necessary, but not sufficient condition for an increase in large-scale industrial activity as found in Misamis Oriental. Other factors, primarily the availability of capital and entrepreneurial ability, are equally important to the establishment or expansion of industrial acticity. The presence of these factors in La Union was not considered in this particular survey.

3.4 Misamis Oriental Rural Electric Service Cooperative (MORESCO)

3.4.1 Natural Environment

3.4.1.1 Effects of Installation and Maintenance of the Backbone System

Table 3.15 presents a description of the backbone system surveyed from Poblacion Manticao to Dunque. The EA team observed the following parameters.

a. Vegetation. In the first 17 kilometers where the terrain is mostly flat, the impact on vegetation occured from clearing

Table 3.15

MANTICAO BACKBONE SYSTEM

From Poblacion to Barrio Tuod	17 kilometers	Mostly through flat areas	Mixed vegetation mostly coconuts
From Barrio Tuod to Barrio Dunque	6 kilometers	Passes through steep terrain approximately 200 meters at the highest point.	Vegetation is mostly shrubs, herbs and grasses.

SOURCE: Ocular reconnaissance.

coconut trees and shrubs in the right-of-way. In the remaining six kilometers, the backbone system passes through steep terrain which is mostly a cut-over area. The limited impact on vegetation resulted from clearing some second-growth trees, herbs and shrubs in the right-of-way;

b. Soil. Significant soil erosion was was not seen in the right-of-way near the road. In steep areas, where maintenance was done a month prior to inspection, slight erosion was evident in few cases; and

c. Water Quality. No sediment loading coming from the right-of-way was seen because it was not raining during the reconnaisance.

3.4.1.2 Effects of Industries

Some industries attracted to the area because of the availability of cheap electricity generate residuals which cause serious air and water pollution problems (Table 3.16). In some cases, these industries have not installed

Table 3.16

INDUSTRIAL ESTABLISHMENTS

Name	Date Established	Anti-Pollution Device Available	Type of Pollution
Mindanao Steel Corporation	1972	none	water
Meiho-Philippines	1975	none	air
Ferro-Chemicals	1976	Dust-Washing System	air
Floro Cement Corporation	1969	Wheelbrator	air

SOURCE: National Pollution Control Commission

pollution control equipment and in other cases, these industries do not operate their equipment.

3.4.2 Socio-Economic Environment

3.4.2.1 Population

Population data for the MORESCO area show that the average annual population growth over the five-year period (1970 - 1975) was 2.9 percent. Thus the population growth in the MORESCO area slowed down slightly from its growth in the decade of the 1960's when it was more than 3 percent (Table 3.17).

As shown in the table, birth rates have declined in the western half of Misamis Oriental Province since the establishment of the MORESCO. Analysis made on the data mentioned the possibility of electricity as a catalyst for the fertility decline. Desire for improved conditions at home, illumination, appliances, etc. would make families weigh the costs of an additional child against the purchase price of such commodities. In the absence of supporting data, this assumption was not tested. Moreover, the analysis noted that numerous other factors

Table 3.17

POPULATION, BIRTH AND DEATH RATES
MORESCO AREA 1960 - 1975

Year	Population	Births/ 1000	Deaths/ 1000
1960	79,000	N/A	N/A
1970	107,900	46.0	13.2*
1971	111,000	45.8	13.0
1972	114,300	43.8	12.8
1973	117,600	38.6	12.6
1974	121,000	31.4	12.4
1975	124,500	31.7	12.2*

* No data or partial data for these years.

SOURCE: Madigan, et.al. "Evaluative Study of MORESCO"

such as family planning, delayed marriage, etc. might have caused this decline.

Migration data for 1972 indicate that the number of in-migrants and of out-migrants has been relatively large, about 16 and 14 percent respectively, of the total population. However, the net migration has been small as indicated below:

In-migrants, 1972 - 20,000
Out-migrants, 1972 - 17,800
Net Migration, 1972 - 2,200

Since numerous factors are responsible for a change in the birth rate and migration, it is difficult to determine the effect of electricity on these parameters.

3.4.2.2 Education

Electrification of the MORESCO area has made possible the opening of night classes. Although no statistical data were presented, mention was made of existing night classes in the area. Electrification has also encouraged the introduction of new vocational and technical courses in such fields as automobile repair, electronics, woodwork, etc. Electricity-dependent equipment is now utilized in these courses making the teaching more effective.

In addition, the Institute of Fisheries and Research Development was established in Naawan in 1975. The complexity of such operations had made it totally dependent, on a 24-hour basis, upon electricity which provides power for equipment, appliances, water pumps and lighting.

3.4.2.3 Amenities

Electrification has affected the lives of the people by allowing them to use labor-saving appliances. Among the appliances found to be in use were electric irons, refrigerators, stoves, freezers, etc. (Table 3.18). Consequently, users of electricity in the MORESCO area generally consider themselves to be enjoying a better present life situation than their neighbors.

3.4.2.4 Health

The five years of electrification in the rural west of Misamis Oriental have witnessed improved water supply systems and parallel progress in medical and health activities.

Electricity encourages people to build safer drinking water systems. This is primarily because they can now easily abstract water from deep wells with electric-driven pumps. Table 3.19 shows that for the MORESCO area, there are 37 electric-powered deep well systems.

Table 3.18

OWNERSHIP OF ELECTRICALLY OPERATED APPLIANCES AND EQUIPMENT

Appliance Equipment	No. Owning During 1st Year of Connection	Percent	No. Owning As of Interview Date	Percent	Total Increase in Number Owning
Radio	29	14	53	26	24
Iron	29	14	41	20	12
Stereo	17	8	24	12	7
Refrigerator	16	8	23	11	7
Stove	9	4	12	6	3
Fan	9	4	11	5	2
Television	10	5	10	5	0
Water Pump	4	2	5	3	1
Freezer	3	2	5	3	2
Sewing Machines	3	2	3	2	0
Others	0	0	0	0	0
T O T A L	129		187		58

SOURCE: Madigan, et. al. "Evaluative Study of MORESCO"

Table 3.19

DISTRIBUTION OF ELECTRIC WATER SYSTEMS
IN MORESCO AREA AS OF JULY 1976

Municipality	Number of Barrios	No. of Electric Powered Water Systems
Opol	14	1
El Salvador	15	3
Alubijid	16	1
Laguindingan	11	11
Gitagum	11	9
Initao	16	4
Naawan	10	4
Mantocao	13	2
Lugait	7	1
T O T A L	121	37

SOURCE: MORESCO

The advent of electricity allowed rural health units and hospitals to improve some of their services primarily lighting during emergency operations and sterilization. They now use medical instruments like X-ray machines, operating lamps, sterilizers and suction machines.

3.4.2.5 Agriculture

Electrification has had an impact upon agricultural practices and production by making possible the establishment of irrigation systems using electric-driven motor pumps.

An example of a direct beneficiary of the electrification program is the Alubijid Irrigators Service Association (ALISA). Seventy-five of the 175 hectares of farm land belonging to the members of ALISA are irrigated by two 25 horsepower electric pumps.

Prior to irrigation, the main crop had been corn and the yield averaged about ten cavans per hectare per harvest. After irrigation, the main crop was rice. According to local production technicians, there had been, as of November 1975, three cropping seasons. They estimated the yield per hectare in the first cropping season (November 1974) to have ranged between 50 to 80 cavans of palay per hectare. Yields during the second harvest season (May 1975) were higher, ranging from 75 to 85 cavans. Yields in the third cropping season (November 1975) were about as good, ranging from 75 to 83 cavans.

3.4.2.6 Business/Industries

The availability of cheap electricity has stimulated the establishment and growth of small, medium and large business establishments. As can be seen on Table 3.20, most industries in the service area were established after 1972. A large number of these businesses are totally electricity-dependent while others are partially electricity-dependent. All rely upon electricity for lighting and for convenience and efficiency in business conditions.

3.4.2.7 Employment

With the establishment of new industries or businesses and the growth of already existing industries and businesses due to the availability of cheap electricity, there has been a reported increase in employment. Although the MORESCO study reports that employment of persons outside the family is minimal in most of the establishments interviewed, still there is an increase in employment (Table 3.21).

Table 3.20

LARGE AND SMALL INDUSTRIES AND DATE OF THEIR OPERATION IN MORESCO SERVICE AREA

Type of Industry	Date Operational
Large Industries	
Mindanao Steel Corporation	1972
Timber Industries of the Phil.	1975
Meiho-Philippines Agro-Industries Incorporated	1973
Ferro Chemicals	1976
Floro Cement Corporation	1969
Small Industries	
Auto Repair Shop (1)	1959
(1)	1971
(3)	1972
(1)	1975
Engineering Steel Industries	1975
Hollow Blocks	1971
Bulldozing, Hauling, Ground Clearing, and Coconut and Other Trees	1973
Rice and Corn Mills (6)	1964
(1)	1970
(4)	1972--1975
Piggery	1974
Naawan Sawmill and Construction Corp.	1975
Box Factory (3)	1972--1974
Woodwork and Duckpin (2)	1973
Copra, Tobacco and General Merchandise	1973
Tailoring Shop	
Movie House	1974
Pharmacy	1973
Bakeries (1)	1973
(2)	1975
General Merchandise (1)	1946
(1)	1947
(1)	1951
(1)	1975
Sari-Sari Store (22)	Before 1971
(1)	1971
(3)	1972
(2)	1973
(4)	1974
(1)	1975

SOURCE: Madigan, et. al. "Evaluative Study of MORESCO"

Table 3.21

ESTABLISHMENTS AND EMPLOYMENT

Year	Number of Establishments BY YEAR	Number of Establishments CUMULATIVE	Amount of Direct Employment Generated BY YEAR	Amount of Direct Employment Generated CUMULATIVE
1971	6	6	28	28
1972	7	13	35	63
1973	6	19	233	296
1974	2	21	20	310
1975	4	25	120	430
TOTAL	25	--	430	--

SOURCE: Madigan, et. al. "Evaluative Study of MORESCO"

3.4,3 Sources of Data

There were four major sources of data for the MORESCO assessment. The first source was "An Evaluative Study of the Misamis Oriental Rural Electric Service Cooperative, Inc." prepared by Francis Madigan, et. al. The methodology and limitations of this report will be discussed in the next paragraph. The second source was a review of the records of the coop and discussion with the staff of the coop. The third source was an ocular reconnaissance of part of the backbone system. The fourth source was the records of the National Pollution Control Commission, which maintains files on industrial discharges of air and water borne residuals.

The study prepared by Francis Madigan, et. al. consisted of two samples: one was an exploratory sample designed to demonstrate the basic economic and social effects of electrification in the MORESCO area. This sample included municipalities, educational institutions, irrigation cooperatives and commercial and industrial establishments. The other was a probablility sample of 411 households.

The experimental design in this case, an ex-post facto audit, was reasonably adequate because there was no electrical service in the area before the establishment of MORESCO and the survey was conducted four years after electrification. The study did reveal some significant changes in socio-economic parameters, primarily the use of electrical equipment and industrial growth, which could not have occured without electrical services. However, the experimental design was not adequate for measuring other changes such as population-related variables. Either a before or after survey or the use of experimental and control groups is a more appropriate design.

3.5 Iloilo Electric Cooperative (ILECO)

3.5.1 Natural Environment

3.5.1.1 Effects of Installation and Maintenance of Distribution Line

Table 3.22 presents a description of the Miag-ao - San Joaquin backbone system and the Barrio San Fernando lateral line system. The EA team observed the following parameters:

a. Vegetation. Impact on vegetation is on the clearing of trees in the right-of-way. They are mainly coconut trees with some mango and star apple trees. Other vegetation such as shrubs, herbs and slow-growing trees were seldom cut even if they were within the right-of-way. Vegetation within and outside the right-of-way cannot be distinguished due to selective cutting of trees and limited of shrubs and herbs;

b. Soil. Minor soil erosion is occuring in a few cases around the poles and supporting guy wires of the lateral line which was recently installed by ILECO; and

c. Water Quality. No water course passed through the right-of-way.

Table 3.22

MIAG-AO SAN JOAQUIN BACKBONE SYSTEM AND BARRIO SAN FERNANDO - MIAG-AO LATERAL LINE SYSTEM

Backbone System/Lateral Line System	Distance (kms)	Type of Area	Vegetation
Miag-ao San Joaquin Backbone System	13 kilometers	Passes mainly through hilly areas and in a few cases through flat areas.	Mixed vegetation, mostly coconut with a few mango and star apple trees. Shrubs and herbs are also found.
Barrio San Fernando - Miag-ao Lateral Line System	4.5 kilometers	Lateral line through hilly area beside a road.	Mixed vegetation, mostly fruit trees and underbrush.

SOURCE: Ocular reconnaissance, 1977.

3.5.1.2 Effects of Industries

No large industries that affect air and water quality have been established in the service area.

3.5.2 Socio-Economic Environment

3.5.2.1 Population

Population data from 1960 to 1975 show an annual increase in the population of 1.6 percent in the ILECO I area (Table3.23)

The survey noted a decrease in out-migration and an increase in in-migration after energization. It stated that before electrification (1974), out-migration for User and Non-User households was 85 and 266 persons respectively. After the area was energized (1975),

Table 3.23

ILECO I AREA POPULATION
1960-1975

Municipality	Population			Annual Growth (%)
	1960	1970	1975	1960 - 1975
Alimodian	18,100	19,700	21,600	1.2
Guimbal	13,500	16,300	17,900	2.3
Leon	25,100	26,900	30,200	1.2
Miag-ao	37,100	37,600	40,600	1.6
Oton	27,300	32,900	36,700	2.0
San Miguel	10,000	12,000	12,500	1.5
Tigbauan	22,800	27,400	30,600	2.0
Tubungan	11,400	12,400	14,000	1.1
T O T A L	160,800	185,300	204,000	1.6

SOURCE: National Census and Statistics Office.

the figures dropped to 67 and 115 persons. Similarly, in-migration figures for both User and Non-User households were 2 and 7 persons respectively. After energization, the figures increased to 8 and 14 persons. None of the in-migrants mentioned electrification as a reason for settling in the service area.

3.5.2.2 Education

Electrification has made possible the use of schools, overtime work, evening classes and cultural activities. The Miag-ao Vocational School, which offers carpentry and mechanical courses, is now equipped with machine shop tools

which are dependent on electricity. In addition, the use of electricity has enhanced the operation of the Southeast Asia Fisheries Development Center (SEAFDEC).

3.5.2.3 Amenities

Electricity is basically used for illumination. There is only minimal use of electrical appliances.

3.5.2.4 Health

Introduction of electricity has helped hospitals to improve their surgical capability due to the availability of power facilities at any given time. Likewise, there has been a marked difference in the effectiveness of hospital services due to the use of X-ray machines, suction apparatus, water heaters and water pumps.

3.5.2.5 Agriculture

A small increase in agricultural productivity (rice production) for the year 1974-1975 was noted in the ILECO area. Although there was an increase in production, such changes cannot be attributed solely to the use of electricity. Other factors such as the presence and use of gravity and diesel driven pumps and the application of agricultural chemicals also contributed to the increase.

3.5.2.6 Business/Industries

The number of business establishments in the ILECO area increased slightly after energization (Table 3.24). These establishments are classified either as commercial or other industries in both poblacion and barrio. Most of the businesses are not electricity-dependent, so that growth cannot be solely attributed to electricity. A number of factors contribute to the change. However, electricity is used for lighting and storage of perishable goods in the majority of the stores.

Table 3.24

ABSOLUTE NUMBER AND PERCENTAGE INCREASE IN POBLACION AND BARRIO BUSINESS ESTABLISHMENTS SET UP AFTER ELECTRIFICATION BY TYPE OF ESTABLISHMENT AND CONSUMPTION

Poblacion

Type of Establishment	Number of Establishments Set Up: Before	After	Total	% Increase
COMMERCIAL				
- Non-User	29	8	37	28
- Small (1-20 kwh)	88	21	109	24
- Medium (21-500 kwh)	79	18	97	23
- Larger (greater than 500 kwh)	2	0	2	0
- Sub-Total	198	47	245	
HOME, COTTAGE AND LIGHT INDUSTRIES				
- Non-User	15	3	18	20
- Small (1-20 kwh)	23	8	31	35
- Medium (21-500 kwh)	19	6	25	32
- Large (greater than 500 kwh)	0	0	0	0
- Sub-Total	255	64	319	
T O T A L	453	111	564	

Barrio

Type of Establishment	Number of Establishments Set Up: Before	After	Total	% Increase
COMMERCIAL				
- Non-User	31	10	41	32
- Small (1-20 kwh)	41	17	58	41
- Medium (21-500 kwh)	21	10	31	48
- Large (greater than 500 kwh)	0	0	0	0
- Sub-Total	93	37	130	
HOME, COTTAGE AND LIGHT INDUSTRIES				
- Non-User	9	6	15	67
- Small (1-20 kwh)	4	3	7	75
- Medium (21-500 kwh)	3	4	7	133
- Large (greater than 500 kwh)	0	0	1	0
- Sub-Total	16	14	30	
T O T A L	109	51	160	

SOURCE: U. P. Iloilo "Impact of Electrification"

3.5.2.7 Employment

No significant increase in employment was noted in business establishments (Table 3.25).

Table 3.25

INCREASE IN THE NUMBER OF PERSONNEL OF SAMPLE BUSINESS ESTABLISHMENTS BY ELECTRIFICATION STATUS SINCE 1974

Increase In No.of Personnel Since Electrification	USER		NON-USER	
	No. of Establishments	Percent	No. of Establishments	Percent
POBLACION				
0	282	97	65	98
1 - 2	5	2	1	2
3 - 5	3	1	0	0
6 - 9	1	0	0	0
10 & above	0	0	0	0
T O T A L	291	100	66	100
BARRIO				
0	119	98	56	100
1 - 2	2	2	0	0
3 - 5	0	0	0	0
6 - 9	0	0	0	0
10 & above	0	0	0	0
T O T A L	121	100	56	100

SOURCE: U. P. Iloilo "Impact of Electrification"

Less than two percent of the establishments showed any significant increase in the number of employees. However, the user group in both the poblacion and barrios did show a greater increase in the absolute number of employees.

3.5.3 Sources of Data

There were three major sources of data for the ILECO assessment. The first source was "The Impact of Electrification in the ILECO Area" by U.P. College Iloilo. The methodology and limitations of this report will be discussed in the next paragraph. The second source was a review of the records of the coop and discussions with the coop staff. The third source was an ocular reconnaisance of part of the backbone system.

The first source was an effort to document changes in socio-economic variables as a result of the introduction and availability of electricity. In order to document effects, U.P. College Iloilo interviewed household heads, owners of business establishments and heads of government offices. The respondent households were classified according to the availability and non-availability of electricity. The total number of respondents was 1,648 of which 848 were "users" and 800 were "non-users" -- living in eight energized towns. The number of businesses (including agricultural activity) and institutions interviewed is not stated in the report.

The fact that only a few changes in socio-economic variables could be attributed to the introduction of electrical service is not surprising. First and most important, the survey was completed only 18 months after the area received electrical service. The effects of electrification, particularly on business, would probably not be noticeable for at least five years. A survey after 18 months is just too soon to measure any change. Second, the experimental design was not adequate for measuring change. Either a before or after survey or the use of experimental and control groups is a more appropriate designs. Detection of change is very difficult with only an ex-post facto audit, which was the experimental design in this case. Third, the availability of electricity is a necessary but not sufficient condition for an increase in large scale industrial activity such as found in Misamis Oriental. Other factors, primarily availability of capital and entrepreneurial ability, are equally important to the establishment or expansion of industrial activity. The presence of these factors in Iloilo was not considered in this particular survey.

Chapter 4

SUMMARY OF ENVIRONMENTAL EFFECTS

There are two major types of environmental effects associated with rural electrification. First, the natural environment is affected by transmission lines and by large scale industries attracted by the availability of electrical service. (This EA does not evaluate the natural environmental effects of power generation because USAID does not fund power generation in the Philippines). Among the major ecological parameters potentially affected are water quality, air quality, soil stability and vegetative cover. Second, the socio-economic environment is affected by human activities stimulated by the availability of electricity. Among the major socio-economic parameters potentially affected are population growth, business activity and availability of social services.

This chapter integrates the findings of Chapter 3.

4.1 Natural Environment

4.1.1 Vegetation

Impacts on vegetation occur largely during the construction phase of the project. Impacts are the trimming and clearing of vegetation. Continued maintenance by clearing of vegetation in the right-of-way maintains the early successional stages of grasses and shrubs. There are no herbicides used to control vegetation in the right-of-way.

4.1.2 Soil

Soil erosion was noted in a few cases. No gullying was observed in any right-of-way.

4.1.3 Water Quality

Since there is limited disturbance of vegetative cover, the possibility of significant sediment load in streams due to the project is minimal. Turbidity was not observed in streams, although it is expected to occur during the rainy season in recently cleared right-of-ways.

The availability of cheap electricity attracted large-scale industries to Misamis Oriental. One of these industries, Mindanao Steel Corporation, discharges water-borne residuals, primarily plating wastes. Although the magnitude of the discharge and waste assimilative capacity are unknown, the residuals would have some effect on the environment because of the nature of the residuals and the absence of pollution control devices.

The availability of electricity has resulted in the establishment of a few pump irrigation systems. Although they would help increase production, they would also encourage the farmers to apply more fertilizers and pesticides. Persistent pesticides, if applied incorrectly and in excessive amounts, can adversely affect fish, snails and frogs regularly caught in rice fields. Run-off of these chemicals in sufficiently large quantities would also adversely affect aquatic organisms in streams and rivers. While sufficient data on water quality are not available to determine the seriousness of the problem, the EA team did check the type of chemicals recommended to farmers involved in intensified agricultural development. Presently, there are 124 insecticide, 64 herbicide and 29 fungicide formulations being recommended by the National Food and Agricultural Council. Quite a number of these are organochlorines, such as Thiodan, Endosulfan, and Chlorodane, and these are generally persistent.

4.1.4 Air Quality

The availability of cheap electricity attracted large-scale industries to Misamis Oriental and several of these industries discharge air-borne residuals, primarily particulate matter. Although data on the magnitude of the discharge and the degradation of environmental quality are not publicly available, the EA team was informed that the industries either have not installed pollution control equipment or they do not operate it.

4.2 Socio-Economic Environment

4.2.1 Population

Rural electrification may have some limited effect on birth rate and probably no effect on migration rates.

Both the National Survey and the MORESCO study noted a change in the birth rate after the availability of electricity. However, the causal relationship between the availability of electricity and the decline in the birth rate is not understood. None of the surveys observed a significant change in migration patterns which suggests that the availability of electricity is not sufficient to induce population shifts. Other factors such as employment and social opportunities are more important in attracting people to an area.

4.2.2 Education

Electrification of an area has resulted in the opening of night classes in a limited number of schools. Also, electrification has made possible the introduction of new vocational and technical courses and contributed to the operation of colleges and research institutes such as the Southeast Asian Fisheries Development Center in Iloilo and the College of Fisheries in Misamis Oriental.

4.2.3 Amenities

Electrification has improved the standard of living of people in the service area. Homes are now illuminated and some of them utilize labor-saving devices. Their recreational pattern has been altered with the availability of television.

4.2.4 Health

Electrification has had two notable impacts on health-related parameters. First, the hospitals and rural health units now utilize a greater range and number of medical instruments such as X-ray machines, operating lamps, sterilizers, etc. Second, the rural water supply systems are starting to convert to deep wells because of the availability of electric pumps. These deep wells provide safer water and make larger quantities of water available.

4.2.5 Aesthetics

Impacts on aesthetics would result primarily from the installation of backbone systems in national

parks and forests. No part of the backbone systems in any of the three cooperatives passes though a dedicated natural area.

4.2.6 Agriculture

Electrification has the potential to enhance agricultural production because it permits the installation of electric pump irrigation systems. Irrigated ricelands can be planted two to three times a year compared to rainfed land which has only one cropping a year.

Although irrigated riceland has the potential to double production, the surveys and interviews with the three cooperatives did not show a significant increase in the number of electric pump irrigation systems. However, the provision of electrical services to rural areas is a recent change and the technical assistance program of the government for small-scale irrigation systems is only in its second year of operation. The cooperatives anticipate that more systems will be installed in the future.

4.2.7 Business/Industries

Electrification encourages both the establishment of new business and the expansion of established business. In addition, it enhances the efficiency of basic operations like illumination, heating and cooling.

In both Misamis Oriental and La Union, there has been a significant increase in small business with the introduction of electricity. However, many of the small businesses are not electricity-dependent for their operation. Thus, estimation of the importance of electricity in stimulating this growth is difficult.

Electrification has had an impact on large-scale industry in Misamis Oriental because of the availability of cheap electric power and the development program of the national government. In other two provinces, there has not been any increase in large-scale industry at present. Aside from the absence of the above-mentioned growth factors, other factors such as capital, transport network and availability of skilled manpower, are not available to stimulate growth.

In summary, the availability of electricity has had only a limited impact on agricultural and industrial production because other factors are also equally important in stimulating growth and electricity has not been available for a sufficient time to induce change.

Chapter 5

EVALUATION OF ADVERSE ENVIRONMENTAL IMPACTS

The Council on Environmental Quality's "Guidelines for the Preparation of Environmental Impact Statements" specify that several evaluative discussions be included in an Environmental Impact Statement. Usually, these discussions are listed as separate chapters in an EA. In this case, all discussions are listed in one chapter in order to clarify the presentation.

5.1 Mitigation of Adverse Impacts

The major significant adverse environmental impact noted in this assessment is the discharge of air and water borne residuals from the large scale industries attracted to Misamis Oriental by the availability of cheap electricity. In some cases, the industries have not installed pollution control equipment and in other cases, where the equipment is installed, they usually do not operate it. This adverse impact was observed only in Misamis Oriental Province and not in the other two provinces because no large-scale industries had been established in the latter since the introduction of electricity.

The EA study team recommends that rural electric co-operatives work with the NPCC in solving this type of problem. Rural electric cooperatives should check with the NPCC before they service large-scale industries to see if the industries are planning to or have already installed pollution control equipment. If the industries are not planning to install any equipment, a coop could suggest to them that installation of the proper equipment is a pre-requisite for electrical service.

The role of coops is more limited once an industry has received electrical service and is not operating pollution control equipment. A coop such as MORESCO does not have the legal authority to enforce pollution control laws nor a staff to deal with the problem. Given the present institutional arrangements, it is limited to expressing its concern to the NPCC.

Another long-run adverse environmental impact is the increased use of agricultural chemicals associated with electric pump irrigation systems. Persistent pesticides, if applied incorrectly and in excess amounts, can adversely affect fish, snails and frogs regularly caught in ricefields. Run-off of

these chemicals in sufficiently large quantities would also adversely affect aquatic organisms in streams and rivers.

The EA study team thus recommends that the NEA, in cooperation with the Bureau of Agricultural Extension, the Farm Systems Development Corporation and the Fertilizer and Pesticide Authority, develop an information campaign about pesticides for farmers participating in electric pump irrigation systems. The campaign might consist of a pamphlet written in the major dialects. The pamphlet would classify pesticides as more or less hazardous and describe the hazards to applicators and aquatic organisms. Another possibility is to hold coop meetings in which the staff could transmit information from NEA to local farmers.

5.2 Alternatives

There are no viable alternatives to transmission lines for distribution of electrical energy. Nor does delay in installment of transmission lines make sense. A delay would only prevent isolated instances (like the large-scale industries in Misamis Oriental) of environmental deterioration.

In no cases observed would the EA study team recommend an alternative location of a transmission line. No lines were observed which passed through critical environmental areas or lands designated as national parks and forests.

5.3 Short-Term Gain Versus Long-Term Loss

The one significant trade-off is the short-term economic gain resulting from the establishment of large scale industries versus the long-term environmental loss resulting from the discharge of air and water borne residuals. As mentioned earlier, the uncontrolled discharge of residuals is not an inevitable consequence of industrialization. Industries can control residuals if they install and operate pollution control equipment. Thus there need be no trade-off between short-term economic gain and long-term environmental loss.

Another potential trade-off is the short-term economic gain resulting from double cropping of rice versus the long-term loss resulting from the run-off of persistent pesticides. There are no data to specify the dimensions of the trade-off. However, the environmental loss will be limited in the immediate future given the limited acreage which will be irrigated by electric pump systems and the low input nature of agricultural practices.

5.4 Irreversible and Irretrievable Commitment of Resources

There is no significant irreversible and irretrievable commitment of resources.

5.5 Benefits and Considerations Which Offset Adverse Effects

The employment and income gains resulting from large-scale industrialization appear to be more than enough to offset adverse air and water pollution effects particularly if they are limited by the use of pollution control equipment.

5.6 Conclusions and Recommendations

The potential for adverse environmental impacts from construction and operation and maintenance of the rural electrification project are minimal. However, there is some potential for adverse environmental impacts from the activities, primarily large-scale industry and irrigated agriculture, stimulated by the availability of electricity. Large-scale industries if unregulated, will discharge significant quantities of air and water-borne residuals and the intensified agricultural activity associated with electric pump irrigation systems will result in an increased run-off of persistent pesticides.

In light of these findings, the EA study team recommends:

(a) that the NEA in conjunction with individual cooperatives, work with the NPCC in limiting the discharge of air and water-borne residuals. NEA in conjunction with the cooperatives should require that industries install the pollution control equipment recommended by the NPCC before providing electric service. Moreover, the NEA in conjunction with the cooperatives should develop with the NPCC corrective measures to insure that industries operate the equipment; and

(b) that the NEA in cooperation with the Bureau of Agricultural Extension, the Farm Systems Development Corporation and the Fertilizer and Pesticide Authority should develop an information campaign about the adverse effects of certain types of pesticides for farmers participating in electric pump irrigation systems.

Appendix A

PREPARATION AND REVIEW

PREPARATION:

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REVIEW:

This document has not been officially reviewed by the GOP.

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Appendix B

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