CONTRIBUTION OF AID DOCUMENTATION TO THE EVALUATION OF ITS RURAL ELECTRIFICATION PROJECTS

VOLUME I

Submitted to

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Office of Evaluation
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by

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CHAPTER I. INTRODUCTION

Purpose of Study

The objective of this study, as outlined in the contract with the Program Design and Evaluation Division (PDED) of the Office of Evaluation, is "to explore existing AID documentation holdings for evaluation and program design purposes," in order "to develop evidence to demonstrate program effectiveness and to identify specific program approaches which will lead to desired impacts of Rural Electrification (RE) projects."[1] Therefore, the primary issue examined in this contract is: To what extent can existing documentation contribute to the evaluation of the effectiveness of AID's rural electrification projects?

It was anticipated that with the scope of the RRNA analysis based on existing documentation located both in Washington and the USAID Missions,[2] the Office of Evaluation could be in a better position to examine what complementary and supplementary approaches (field trips, etc.) would be warranted in order to attain the ultimate objective of determining rural electrification project effectiveness.

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1. AID Contract No. AID/afr-C-1380, Work Order No. 16, p. 1.
2. In June 1979 AID issued a purchase order during which additional documentation from USAID Missions was requested.

Organization of the Report

The full report is divided into two volumes. Volume I contains the introduction and purpose of the study, conclusions and recommendations, and methodology -- including a description of the conceptual and analytical frameworks. Volume II contains three separate kinds of analysis. Part I presents the issues outline which served as a guide for evaluating the project documentation. Part II represents an interproject analysis of each issue as is identified in the conceptual framework. For example, persons interested in a summary regarding reaching rural poor in these projects should look at that particular issue as indicated in Part II. Similarly, persons interested in knowing about the range of productive versus household use of electricity across these projects would examine that section. Issues in Part II are presented in sequence similar to the conceptual framework.

Part III presents summaries of information currently available on rural electrification projects in the seven countries, and is therefore organized by country. Persons interested in projects in a particular country should utilize this section.

CHAPTER II. CONCLUSIONS AND RECOMMENDATIONS

Evaluating Projects versus Evaluating Project Documents

The information contained in the documents collected for the case study analysis was not adequate to make conclusions regarding the effectiveness of these rural electrification projects. First, coverage of the issues as identified in the issues outline was thin; rarely was there even mention of pertinent information in more than a few of the 20 projects. Second, the information which was provided was itself inadequate. Too often descriptive as opposed to analytical information was provided. For example, the number of firms or population in a project area might be provided, but no indication was given as to the proportion which would be likely or potential consumers. This information is vital if the intended impacts are to be assessed. For example, many farms might have their own generators and might not want to switch to project electricity. Also much of the population might not be able to afford the project electricity. Actual usage will be less than projected, and financial viability of the sub-borrower may be threatened. To reduce costs the electricity may never be extended to rural areas where distribution costs are higher than in the urban areas and rural outreach is threatened.

Third, there was a dearth of comprehensive evaluations or impact studies. Those which did exist covered only a few issues or impacts and analysis was incomplete, even for those subjects. One principal reason for this situation appears to be the absence of a uniform set of guidelines for evaluating (as well as planning and designing) these projects. Hence, trying to make interproject comparisons is difficult, if not impossible, because apples and oranges are not comparable. For example, the Checchi evaluation of the sub-projects in Bolivia covers principally operations and management issues, while the DAI[1] study of NRECA[2] in Bolivia covers a few impact issues with no mention of how operational issues are interrelated. It's virtually impossible, therefore, to make the appropriate connections or fill in the gap without first-hand knowledge of the project. Other documentation was inadequate in filing such gaps.

Fourth, the form of the information presented did not allow comparisons among projects or countries. For example, in some instances project outreach was indicated by the number of consuming units (i.e., households, commercial establishments, etc.) while in other instances, it was indicated by number of persons. Information which would permit the use of one definition was not provided. Hence, it could not be determined how many people or units were intended or actually reached among all the projects.

Although the documentation did not form a basis for making conclusions regarding project effectiveness, it has been particularly useful in designing a uniform methodology for evaluating documents in this study and for undertaking future evaluations and other project assessments.

In the absence of this evaluative type of information, RRNA's task was to evaluate the documentation. That is, each project was reviewed according to the RRNA designed conceptual framework and corresponding issues outline to the extent each issue was addressed. Information which was pertinent has been reported and any serious omissions necessary to make evaluative judgments are noted.

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1. Development Alternatives, Inc.
2. National Rural Electrification Cooperative Associates.

Summary

The principal conclusion of this study is that existing documentation on AID's rural electrification projects is not adequate to make generalizations regarding their effectiveness. The primary reasons are:

1. The existing documentation does not cover the full range of issues or factors pertinent to project effectiveness.

2. The existing documentation does not adequately analyze or provide sufficient information for analyzing the issues that are covered in the documents.

3. The documentation itself varies widely in scope, form, and content within projects and among projects; it is impossible to make interproject comparisons for most issues.

4. Relatively few evaluations or studies measure even a few project impacts and there is insufficient information on results of projects after they were implemented to make conclusions regarding these impacts. Part of the problem stems from the fact that most of these projects preceded the time when an emphasis was placed on evaluations within AID and the scope of these evaluations has to date not been well defined.

5. Of the projects in the seven countries which were reviewed, only projects in the Philippines, Guatemala and Bolivia are likely candidates for further evaluative work. The other projects have either long since ceased or conditions are not suitable for further work. Evaluation plans are underway for the Philippines, Guatemala and Bolivia.

6. Given the conclusion in number 5, the greatest opportunities for ascertaining the effectiveness of rural electrification projects lie in currently ongoing and future projects.

To overcome the problems which now exist with respect to the earlier projects the following recommendations are made.

Recommendations

1. AID should establish uniform guidelines for assessing rural electrifications projects during each phase of the project decision-making process (pre-project through implementation). If followed, the appropriate data and information collected should serve as an adequate base for determining project effectiveness. A uniform set of guidelines will also facilitate comparisons so that more generalizable information can be fedback into the project planning and design phases.

2. These guidelines should also serve as a basis for determining the scope of the work for the evaluation and the methodology for testing the full range of project issues or hypotheses.

To futher the introduction of such guidelines, RRNA, during the second phase of this contract, has prepared such a scope of work. The scope of work is designed to overcome each of the current weaknesses which contributed to our failure to make conclusions on rural electrification project effectiveness at this time. These guidelines are included as part of this volume.

CHAPTER III. EVOLUTION OF THIS PROJECT

This study represents work undertaken through two contracts. Under the first contract, RRNA initiated work in November 1978. In keeping with the project purpose, the principal functions or tasks to be performed were: (1) the identification of AID-financed rural electrification projects; (2) a search for documentation; (3) the selection of several projects for further case study analysis; and (4) the extraction of sets and patterns of information which would serve as a <u>basis</u> for forming conclusions regarding project efficiency and performance, effectiveness and impacts. To guide the extraction of information, a conceptual framework defining the scope of issues to be addressed was designed.

In accordance with these functions or tasks, the following steps, as outlined below, were identified.

1. Identification of AID's Rural Electrification Projects

2. Search for Documentation

3. Selection of Projects for Case Study Analysis

4. Design of Conceptual Framework

5. Conduct of Case Study Analysis (Pretest)

A draft of the study was submitted to AID in February 1979. It was then distributed among several AID offices, comments were received, and a second contract was signed which authorized RRNA to go further in designing a uniform set of guidelines and indicators for project assessments, including evaluations, throughout the project decision-making phase. This report represents a synthesis of work undertaken in both contracts.

Identifying AID's Rural Electrification Projects

Project documents in the automated Development Information System (DIS), originally intended to be the principal source, are limited to projects active in 1974 and later, and their documentation is, by DIS's own estimation, incomplete. Only 17 rural electrification projects were identified in DIS. A wider search using alternative sources, i.e., other automated AID files (PBAR, PAIS, Status of Loan Agreements Reports, Bureau files, etc.), revealed additional loans bringing the total to 49.

A list of 166 more loans for power, transmission, irrigation and integrated rural development was also compiled, but lack of information in existing AID sources precluded our identifying those with a possible rural electrification component.

Thus, the 49 loans may understate the actual number of rural electrification loans[1] but there is no way of documenting the real total without going through the time consuming exercise of retrieving retired files of the remaining 166 loans and checking available information. Monies for this kind of search were not provided in this contract.

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1. Defined as projects so named as well as other projects with a rural electricication component.

Furthermore, the 49 loans do not include planned projects, nor are grants represented. AID has financed special, feasibility and other studies which are not accounted for among the 49, nor have special NRECA[1] projects which are subsumed under any of the 49 loans been included.

Available Project Documents

Because not only the identification of projects but also documentation available in DIS was incomplete, we proceeded to search for additional documents through other sources (i.e., Development Information Center, Central Engineering Library and files of retired engineers, Regional Development Project Files, Regional Evaluation Offices, Regional Development Resources Files and NRECA Files). Identified documents were presented in RRNA's interim report submitted to AID in November, 1978.

Selection of Projects for Case Study

Based on the above review, nine countries were selected in which AID had financed rural electrification projects and for which there appeared to be enough information to conduct case studies. A minimally acceptable information base was defined as having at least one document in each of three project phases (project need assessment, project design and feasibility, and project implementation). From this list, PDED, by letter, instructed RRNA to proceed with the analysis of seven countries -- Bolivia, Colombia, Costa Rica, Nicaragua, Philippines, Thailand and Morocco. However, the key evaluation for Morocco was not available, and the documentation on Thailand did not provide an adequate

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1. National Rural Electrification Cooperative Association.

base for analysis; thus both countries were eliminated. Ecuador and Guatemala were subsequently added in their place. Thus, the case study phase covers seven countries containing 20 AID loans or grants with distribution of rural electrification projects by country as follows:

Country	Loan or Grant	Effective Date
Bolivia	Santa Cruz Electric Power	1966
	Rural Electrification Phases I and II	1974
Colombia	Rural Electrification Cooperative	1964
	American Institutes of Research Grant	1965
Costa Rica	Rural Electrification	1964
Ecuador	Rural Electrification Cooperative	1964
	Santa Elena Electric Power	1964
	Rural Electrification	1972
Guatemala	Rural Electrification	1971
	Rural Electrification II	1978
Nicaragua	Rural Electrification Cooperative	1963
	Rural Electrification Cooperative II	1968
	Rural Electrification Cooperative III	1971
Philippines	Victorias Rural Electric Coop (VRESCO)	1968
	Misamis Oriental Rural Electric Coop (MORESCO)	1968
	Rural Electrification	1971
	Rural Electrification II	1974
	Rural Electrification III	1974
	Rural Electrification IV	1976
	Rural Electrification V	1977

These loans are valued at $160 million or about 30 percent of AID's estimated expenditure ($500 million) on rural electrification to date. Because the universe of rural electrification projects has not adequately been defined, however, these loans are not necessarily a representaative sample of all of AID's rural electrification projects. These projects were selected strictly on the basis of existing documentation, not on how representative they might be. These projects span the full life of AID rural electrification financing -- 1963 to 1978 --although the more recent projects are not proportionately represented since many are too recent to have been evaluated. The 1978 Guatemalan project was selected for this case study review in the hope that it might contain information on the earlier loan. In fact, countries with more than one loan were preferentially incorporated so that the evolution of AID-financing of rural electrification projects in each country could also be ascertained.

Sources of Documentation Collected for Case Study

Most documents for the case study were assembled from the following sources:

1. Development Information System - DIS
2. Development Information Center (previously AID Reference Center) - ARC
3. Central Engineering Library - CE/L
4. Central Engineering - Files of Retired Engineers - CE/F

5. AID Regional Development Project Files - ___/DP
6. AID Regional Evaluation Offices - ___/E
7. AID Regional Development Resource File - ___/DR
8. NRECA Files - NRECA
9. AID Retired Files - RF
10. AID Auditor General Offices - AGO
11. USAID Mission of Each Country - USAID

In addition, we benefited from conversations with many persons within AID and in other organizations which have been engaged in research on this topic. We consider our research to be much broader than originally planned in the contract. In a follow-up contract to the first, we extended our request for documents to USAID missions in each of the countries.[1] We received several new documents - one which we had specifically requested from the Bolivian USAID, two letters on the Guatemala project, two studies for the Philippines, and one NRECA evaluation for Costa Rica, and monthly progress reports for Colombia. AID/Washington also submitted updated information on the 1974 Bolivian loan.

Kinds of Project Documents Collected

It was originally intended that "evaluations" would serve as the principal kind of documentation selected. However, the term was broadened to "evaluative" because information on previous projects after implementation could often be found in CAP's,[2] project papers, etc. In addition,

1. Due to turmoil in Nicaragua no such request was made to USAID there.
2. Capital Assistance Papers.

information which impinges on project effectiveness is contained in documents throughout the project decision-making process - both prior to and after implementation. It was thus decided that a full set of documents - from pre-project surveys through to post project evaluations would be collected. Over 150 such documents for the 20 rural electrification loans and grants were, therefore, collected and reviewed and serve as the basis for the analysis undertaken in this report.

CHAPTER IV. METHODOLOGY

Historical Perspective of Rural Electrification Project Evaluations Within AID

The concept and role of evaluations within AID have changed over the period in which rural electrification projects have been designed and implemented.

In the early 1960's, infrastructure was a major focus of economic development within AID and the general international development community. Power projects were viewed as vital to the establishment of adequate power capacity and hence rural electrification, which focused more on transmission and distribution facilities, seemed premature in many countries until adequate generation capacity was in place.[1]

Consistent with this emphasis, rural electrification projects within AID in the early 1960s were viewed as primarily capital projects. Their design and feasibility were determined principally by engineers. In fact, most such projects were developed within a Central Engineering Office of AID. The project paper was entitled Capital Assistance Paper. Thus, criteria for project approval and evaluation often reflected the same kind of focus and intent. Engineering design and projected financial viability of borrowers were primary concerns for getting projects approved. Hence economic cost/benefit analysis was rarely undertaken which would have required a more precise assessment of broader

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1. In contrast, the National Rural Electrification Cooperative Association (NRECA) believed in promoting the idea of extending electrification to "rural" recipients, particularly households, based on the success of such efforts in the United States more than 50 years before.

social and economic project contributors. Evaluating a rural electrification project was viewed in terms of whether the infrastructure was built, the construction was completed as scheduled and whether funds were disbursed appropriately and hence was more an audit than socioeconomic assessment.

Thus, coverage of other project issues was minimal throughout the project decision-making phase. Projects were approved if it was felt that they were "a good thing," but no formal criteria or guidelines existed for defining this more precisely. Certain statutory criteria were to be met according to the Foreign Assistance Act of 1961, but this did not contain adequate criteria for assessing feasibility or evaluating a project. For example, the Act required that some account be taken of the "manner in which the loan will promote the country's economic development and contribute to the welfare of its people."[1] Capital Assistance Paper therefore included unsubstantiated statements regarding likely consumers (households, commercial and industrial enterprises, governments and farms) and their range of uses. It was assumed that if the electricity were available it would be utilized by each of these groups in such a way as to promote the welfare of "the people."

In the project implementation evaluative documents it was perhaps noted that a certain number of household connections had been made and perhaps this was compared to intended figures as given in the pre-project documents. The financial viability of the borrowers and sub-borrowers was also mentioned. Beyond this, there was no discussion of

1. Section 251(a), Foreign Assistance Act, 1961.

actual economic and social contributions of projects to recipients or local communities. In many instances the goals set out in the CAP's were merely restated as having occurred (without documentation) in the later documents.

The above described situation was not unique with respect to rural electrification projects. The concept of "evaluation" had not been clearly defined and hence there was little consensus regarding its increasingly more frequent use. This problem existed not just within AID but with respect to most Federal government programs.

Thus, even to date, there is an overabundance of definitions and far too little consensus on what actually constitutes an evaluation. Some persons use the term in reference to pre-project cost-benefit analysis. During a project, or after it is implemented, the term may refer to a range of project reviews -- from short-run studies (several weeks) gauging overall project progress or only one aspect of a project (i.e., an audit) but without resort to sophisticated research methods to long-run impact measurement studies or program effectiveness studies utilizing econometric or survey and statistical techniques. Defining the term, therefore, is critical to determining the scope of review and the desired results.

The evolution of the evaluation of rural electrification projects within AID is consistent with this dilemma. Prior to 1970 there were few if any project evaluations using the broader definition to include the assessment of social and economic factors and impacts. Most information on project performance (as opposed to project impacts) was contained in CAP's for subsequent projects or audits. In a few instances special studies were undertaken by AID contractors, to include university sociologists, who were interested in profiling project recipients (age, income, level of living, education, etc.) but more of this kind of information was collected prior to initiation of the project than during or after project implementation. Where baseline data were collected no follow-up studies were undertaken to assess the extent to which the project had changed the lives of the intended recipients or the extent to which intended goals and purposes had been achieved. The first project evaluation found among the 150 documents we collected for these 20 projects was one undertaken in 1970 for the first two loans in Ecuador.

The specification of goals and purposes in the project design documents reflects how the concept and scope of project evaluation evolved. Through 1966 purpose and goal statements stressed two principal functions -- the expansion and construction of electrical systems and facilities and the use of the electricity for agricultural, residential, commercial and industrial purposes. Between 1966 and 1976 there was no longer any mention of the construction function but a continued emphasis on electricity use. In addition, there was a pronounced emphasis on improving welfare and standard of living, especially in the rural areas, the provision of reliable electricity at reasonable rates on a continual basis, institution building both in terms of sub-borrowers and borrowers. Mention of rural poor, however, did not appear until the 1977 loan in the Philippines, reflecting a further delineation of the intended target group.

This later change in direction was stimulated by the Congressional mandate of 1973, which required AID programs to attempt to reach the "poor majority" as defined by certain "benchmark" criteria (per capita income, health, nutrition status).

How Rural Electrification Projects are Viewed Today

Within the Washington bureaus differences in attitudes towards electrification projects are apparent. Rural electrification projects are now identified in USAID missions and their design and feasibility feasibility assessed within AID bureaus in relevant geographic regions. In the Latin American bureau, for example, there has been a trend away from electrification projects per se, whereas in the 1960s most rural electrification projects were located in this region. A broader development and energy focus has been adopted emphasizing the need to develop coherent institutions as the basis of multi-facet AID "packages," aimed again at improving the standard of rural life. Rural electrification is viewed as merely one element in such an approach. New projects tend to involve experimental, or pilot programs, which can then be expanded with the help of other agencies such as Inter-American Development Bank or World Bank. Interest in rural energy which incorporates a consideration of alternative energy sources including electricity has been stimulated by world oil price increases.

In contrast, rural electrification within the Asia bureau is becoming increasingly more important after a long lapse since projects undertaken in the mid 1960s. The one exception is the Philippines whose "apparent success" is responsible for the renewed interest in the Asian bureau. Projects are anticipated in India, and recent programs have been initiated in Indonesia, Bangladesh, and Pakistan.

There is also a slight trend towards funding alternative energy sources that can be utilized with relatively low-cost loans.[1]

Not much activity has occurred in Africa. Feasibility studies are underway regarding electrification in the Senegal valley and around the Niger river. Political constraints and a lack of emphasis upon the goal of rural electrification may be factors underlying this relatively limited development.

Project Decision-Making Process

There are three principal phases through which projects pass until completion. Phase I is the pre-project need assessment. The key issues addressed are the extent to which there is a need for rural electrification in general and for such projects in a particular country. This phase corresponds to the work undertaken for project identification. In Phase II the project is designed and its feasibility determined; this culminates in a Capital Assistance Paper (CAP) or Project Paper (PP) approved by AID. Issues and analyses in Phase II relate to specific sites or settings. Phase III begins with the implementation of the project and culminates when the loan is fully disbursed. However, the project is likely to continue operating especially if it has been successful, well after disbursement. The need to analyze information through the three phases is derived from the concept of project effectiveness itself.

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1. Guatemala, revised project paper, (June 12, 1978), p.8.

Definition of Effectiveness

The term "effectiveness" in and of itself is meaningless. To say something is effective says nothing unless there is a further definition of "in terms of what." The "what" can take on a wide variety of definitions: it can mean "reaching the rural poor," "providing reliable service," "lighting homes," "providing employment," "being financially viable and so on. It is thus necessary to determine the scope of effects (or impacts) upon which a project can be evaluated. For this, a conceptual framework is required. A project can be simultaneously effective in some of these and not in others. Whether a project is determined to be effective on an overall basis depends on how one ranks each effect and there is no generalized concensus on relative positions of one effect versus another in the rank.

Evaluative Approaches

In the academic literature, two principal approaches to evaluations are recommended - systems and goal attainment. Goal attainment approaches involve evaluating a project in terms of that which is intended. However, there are often results (positive and negative) which were not intended and these may be ignored even though they may provide useful information for project design and planning purposes. Some goals are unattainable through the simple introduction of a project.

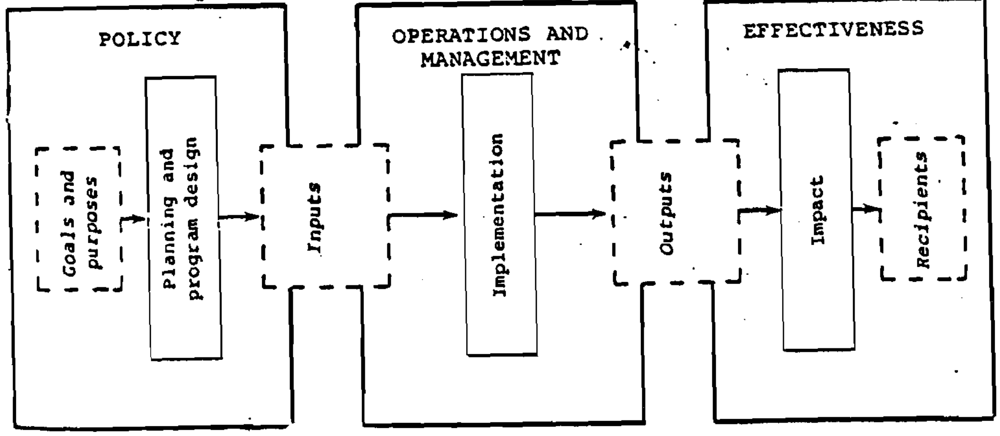
In contrast, a systems approach covers the range of effects or impacts and their determining factors which stem from the inherent nature of the project and its interrelationship with its setting or environment. This format serves as the basis for our analysis.

Conceptual Framework

The structure of the conceptual framework was presented in the interim report for this contract but for readers who did not review this document, it is briefly described herein.

The rural electrification project itself is decomposed into three components - policy-making; operations and management; and effectiveness. These components are interrelated in that policy and operations aspects impinge or facilitate effectiveness while the latter feeds back into the policy and operations components. It is important to understand to what extent policy issues affect the effectiveness of a program as opposed to operational issues or of local conditions in which the program operates. These will surely vary from one program to another and from one country to another.

The three components are linked by project <u>elements</u> - goals, purposes, inputs, outputs (electricity) and recipients and these elements are tied together by three <u>processes</u> - program design and planning, implementation; and impacts. The implementation process is analyzed in terms of the relevant range of functions which are to be carried out, i.e., cost and budgeting, management and administration, hiring of personnel and contractors, training, maintenance and repair, etc. The following chart summarized these relationships.



Range of Project Effectiveness Impacts

The range of project effects can be described in one word, impacts. For rural electrification projects, the following kinds of impacts can be identified.

Outreach.

Proportion of population in an area
rural versus urban
poor versus non-poor
residential versus productive
previously electrified versus previously non-electrified
intended versus actual
cooperative member versus consumer

The above list can be expanded further by combining two or more categories as follows "To what extent does a project reach rural poor versus rural non-poor?"

Range and Types of Uses

a. public usage
b. household usage
c. productive usage

Costs

a. to consumers
b. vis-a-vis consumers income (affordability)
c. subsidization among consumers
d. energy losses

Financial Viability.
Employment.
Other Impacts.

- health
- education
- environment
- security
- communications
- infrastructure
- migration
- community and local participation
- family planning
- substitutibility with other fuels and other fuel supply
- institution building

Determinants of Project Effectiveness

These impacts are determined by five major factors which stem from the inherent nature of the project and its setting. They are:

Project Phase	Determinants of Project Effectiveness	Endogenous or Exogenous
Pre-project need assessment	1. socioeconomic characteristics of a project area	Exogenous
	2. related economic development and energy policies and priorities	Exogenous
Project design feasibility	3. intended project design and structure	Endogenous
project Implementation	4. actual program policies, goals and purposes	Endogenous
	5. actual project operations and management functions.	Endogenous

These factors correspond to the three phases of the project decision-making process. These factors can also be differentiated as exogenous factors (non-program) or endogenous (intra-program factors).

For illustrative purposes, an example of each factor is provided to indicate how it may impinge on project effectiveness. Assume the particular impact to be analyzed is "reaching the rural poor." Characteristics of the socio-economic setting likely to affect reaching the rural poor are the size of the rural and urban population; their income; proportion of consumer budgets devoted to energy expenditures; availability and relative prices of other energy sources; the population density which will affect cost of distribution, the number of people served and costs per consumer; the range of possible uses for electricity in homes and in productive enterprises; number and type of related programs and projects, etc.

Under development policies and priorities on a national, regional or local level, commitment to rural electrification will affect the level and kind of resources available for a project; and the attraction of other resources will attract productive enterprises and offer employment prospects for the rural poor. For project design and feasibility a rural electrification project may be designed in terms of an urban-located, central-grid system which has the capacity and infrastructure to reach rural areas but only at costs which the rural poor cannot afford and which urban consumers are unwilling to subsidize. Therefore, reaching the rural poor might not be financially viable and a differently designed project may be more feasible. For project policies, the implementing agency may promote a national, urban-oriented, central-grid system. Despite AID's desire to reach rural poor, the national goal or purpose may predominate. Under operations and management, unless the infrastructure is built, personnel are adequate or supplementary training is provided to maintain and repair systems then the rural poor may not be reached.

A set of these issues can be identified for each of the relevant impacts. The significance of each factor may, however, vary with each type of impact.

The proposed approach lends itself both to quantitative and qualitative analysis. The above factors can be expressed functionally as follows:

$$Y = F(X_1, X_2, X_3, X_4, X_5)$$

where Y = project effectiveness in terms of a range of impacts

X_1 = socioeconomic characteristics

X_2 = related economic development and energy policies and priorities

X_3 = intended project design and structure

X_4 = actual program policies, goals and purposes

X_5 = actual program operations and management activities

Factors not directly quantifiable can be specified through the use of dummy variables. Other data can be collected, and the appropriate equations can be estimated using multiple regression analysis.

In the absence of an adequate data base at this stage, most analysis in this study was undertaken in qualitative terms. That is, a set of issues associated with each factor has been identified and the existing documentation is reviewed and conclusions are reported.

Issues Outline for Assessing Rural Electrification Projects Throughout Decision-Making Process

The following outline specifies the full range of issues and analyses which should be undertaken as part of each phase in the project decision-making process. It is designed to encourage more analytical -- as opposed to merely descriptive -- assessments. If utilized appropriately, it also makes a vital contribution to project evaluation. That is, the information and data collected in the pre-project phases and the analysis of each issue should provide an adequate set of baseline information for future project evaluation. The format is thus economical. The likelihood of having to repeat the expensive task of collecting such information, designing expensive systems, etc. is eliminated since the information is already collected to serve not only evaluation but other project purposes - planning and design. It also acknowledges the close interrelationship between evaluation and the other phases of the project decision-making process and fosters the needed kind of feedback into the earlier stages - project planning and design. Approval of projects can be made on a much sounder base which ultimately should improve project effectiveness.

The organization of the issues outline is premised on the logical sequence of six analytical steps:

1. Review or survey current status and potential for RE
2. Given (1), determine need for RE in the country

3. If a need for RE is established, determine need for AID-financed RE project in alternate settings

4. If an appropriate setting is identified, determine design of RE project and its feasibility

5. If project is feasible and is approved, implement project

6. During implementation evaluate project.

<u>Exhibit A - Issues Outline</u>

EXHIBIT A.

Issues Outline

Issues as Phrased for:	Issues as Phrased for Review of Documentation
I. Pre-Project Need Assessment	To what extent was current and projected status of rural electrification assessed in the country?
A. What is the current and projected status of rural electrification (RE) in the country.	
1. To what extent are national economic development and energy plans and goals compatible with RE and to what extent is RE a priority among energy goals.	To what extent was compatibility of RE with national economic de-development and energy plans and goals assessed and priority did RE have among these goals?
2. What is the current status of RE in this country and what lessons have been learned.	To what extent was the current status and previous experiences with RE assessed?
3. To what extent are there constraints and opportunities for RE in this country.	To what extent were constraints and opportunities for RE assessed?
4. To what extent is cooperative development fostered in this country.	To what extent was the cooperative movement assessed?
B. To what extent is there a need for Rural Electrification	To what extent was a need for RE assessed?
1. What are alternative energy sources, i.e., electricity, of solar, gas, and kerosene, etc. and to what extent is each:	To what extent were alternative energy sources assessed for each of these items?
Available for use among regions and sectors (rural vs urban).	
Costly in proportion to incomes of consumers by type of consumer.	
Utilized efficiently in production and distribution.	
Serving diverse uses and purposes.	
Costly in terms of financial viability of operating enterprise.	

(Continued) --

Issues as Phrased for:	Issues as Phrased for Review of Documentation
2. What are the opportunity costs of investing in RE versus investing in other energy activities.	To what extent were opportunity costs of alternative investments assessed?
3. To what extent is there a need for RE as an input into other development programs and projects.	To what extent was RE assessed as an input into other development program and projects?
C. To what extent is there a <u>need for a Rural Electrification Project</u>?	To what extent was a need for RE project assessed?
1. What socio-economic characteristics are or non-supportive of a RE project?	To what extent were each of the socio-economic characteristics assessed?
Geographic distribution of population.	
Income characteristics.	
Production and employment.	
Physical infrastructure.	
Local community support.	
Existence of related development programs and systems.	
Institutional and technical capability to implement and manage the project.	
Availability of adequate financial resources.	
Special constraints to developing a RE project.	
Substitutability with other energy sources and supplies.	
2. What resources are required to maximize use of electricity and to what extent are these resources present?	To what extent was the existence and availability of the resources required to maximize use of electricity adequately determined and assessed?

(Continued) --

Issues as Phrased for:	Issues as Phrased for Review of Documentation
3. To what extent are experiences of other countries with RE relevant to this country and this project?	To what extent were other country experiences which were relevant to RE in this country assessed?
II. Project Design and Feasibility Appraisal (Intended)	
A. What should be the <u>structural design</u> of the project.	To what extent was the structural design of the project assessed?
1. Determine and analyze project goals and purposes and compatability among the participating agencies.	To what extent were project goals, purposes and compatabilities among participating agencies determined and analyzed?
2. Determine and analyze the availability of local and foreign inputs and proportion of each to be provided by each participating agency. To what extent can local linkages be fostered?	To what extent was the availability and proportion of resource inputs provided by local and foreign agencies adequately determined and and analyzed; and to what extent were local linkages to be fostered and analyzed?
3. Differentiate and analyze target groups by type: (1) location (2) income status (3) current electrification status (4) comsumption vs productive use (5) political status, (6) access to infrastructure, health and education.	To what extent was the project target group assessed and differentiated by each types?
4. Differentiate and analyze range of consumption and productive uses to which electricity is to be put by each type of consumer.	To what extent was the range of electrical consumption and productive uses by type of consumer determined and analyzed?
5. Specify and analyze range of impacts intended to be achieved.	To what extent was range of intended impacts identified assessed?
B. What should be <u>engineering design</u>, capacity and electricity output to satisfy above determined demand purposes?	To what extent was engineering design, capacity and electricity output analyzed in light of the above determined demand purposes?
1. Specify alternative engineering designs and analyze in terms of each energy source :	To what extent were alternative engineering designs specified and analyzed in terms of each energy source, and in terms of the following items:
Generation, transmission and distribution costs to target groups.	
Consumer costs by category and relation to current and alternate rate structures.	

(Continued) --

Issues Phrased for:	Issues as Phrased for Review of Documentation
Costs (installation and service) to target groups as specified above.	
Projected usage and adaptability; load density and growth, phasing of service.	
Sustainability Ease of Administration, maintenance and repair	
Cost regulation - meters versus non meters.	
Required engineering inputs and sources.	
C. What should be <u>organizational design</u> and management requirements?	To what extent are organizational designs and management requirements specified and analyzed?
1. What is history and profile of activities of alternative electrification organizations in the project area.	To what extent were the histories and profiles of alternative electrification organizations in the project area described and analyzed?
2. What are necessary functions to be undertaken by each participating agency and to what extent can each kind of origanization carry these out.	To what extent were necessary functions assessed to have been adequately undertaken by each of the porticipating agencies; and what extent was each kind of organization assessed to have been suited to cary out its assigned function?
3. Which organizational type offers the best prospects for financial viability and why?	To what extent was the attempt made to assess which organizational type offered the best prospects for financial viability and why?
4. How are participating agencies to be interrelated?	To what extent were participating agencies assessed to have been interelated?
D. What is <u>feasibility</u> of alternate project designs?	To what extent was the feasibility of alternate project designs assessed?
1. What are projected costs?	To what extent were projected costs assessed?
2. What are projected benefits?	To what extent were projected benefits assessed?
3. What is financial rate of return of net benefits stream?	To what extent was the financial rate of return of net benefits assessed?
4. What are projected cash flows, and income streams and relate to existing financial status of institutions.	To what extent were projected cash flows and income streams assessed to have been related to existing financial status of institution?

(Continued) --

Issues Phrase for:	Issues as Phrased for Review of Documentation
E. What is the economic and social feasibility of the project to be applied to each alternative project design?	To what extent was the economic and social feasibility of the project assessed?
1. What are projected input costs valued by opportunity cost of their use?	To what extent were projected input cost valued by the opportunity cost of their use assessed?
2. What are projected benefits (quantified to the extent possible) to the local region and populace?	To what extent were projected benefits (quantified to the extent possible) to the local region and populace by type assessed?
3. What is net present value and/or economic rate of return?	To what extent was the net present value and/or economic rate of return assessed?
F. What should be the terms of loan?	To what extent were terms of loan assessed to have been adequately specified and assessed?
1. What should be interest rate and to what extent does this imply a subsidy?	To what extent were the interest rates applied to the loan found to imply a subsidy?
2. What is credit status of borrower and its access to capital markets?	To what extent was the credit status (access to capital market) of the borrower specified and analyzed?
3. To what extent are there alternate sources of of financing for the project?	To what extent were alternative sources of financing for the project specified and analyzed?
4. What should be other conditions of a loan?	To what extent were other conditions of a loan specified and analyzed?
III. Project Implementation (Actual)	
A. To what extent did project policies affect project impacts?	To what extent were project policies assessed to have affected project impacts?
1. How does the project comport with national and local development, and energy goals, priorities, and needs?	To what extent did the documentation assess project comportment with national and local development and energy goals, priorties and needs?
2. What was the relationship between actual rate structures and project impacts?	To what extent were relationships between actual rate structures and project impacts assessed?
3. To what extent were goals and purposes of participating agencies compatible and how did they affect project impacts?	To what extent were goals and purposes of participating agencies assessed to be compatible, and how was this assessed to affect project impacts?

(Continued) --

Issues Phrased for:	Issues as Phrased for Review of Documentation
B. To what extent were operation and management activities related to project impacts.	To what extent were operation and management activities assessed to be related to project impacts?
1. To what extent were each of the following carried out:	To what extent did the documentation assess the degree to which each of the following functions were carried out:
Mamagement & Administration	
Cost & budgeting	
Monitoring & Evaluation	
Membership promotion and education	
Training	
Recruitment and training of direct personnel	
Construction	
Contracting and scheduling	
Ordering receipt and delivery of inputs.	
C. To what extent did project impacts occur (intended and unintended).	To what extent were intended and unintended project impacts assessed?
1. To what extent did did the project reach its target group in terms of:	To what extent was the project assessed to have reached its target group in terms of:
Total population	
Rural vs. urban	
Poor vs non-poor	
Residential vs. productive	
Previously electrified vs. previously nonelectrified	
Members vs consumers	

(Continued) --

Issues Phrased for:	Issues as Phrased for Review of Documentation
2. To what extent was output (electricity) adequate for: Public usage; Household usage; Productive usage	To what extent was output (electricity) assessed to have been adequate for each item:
D. To what extent did project and electricity costs and their determinants affect: Outreach among target group by type. Subsidization among consumer types. Financial viability of implementing agency and sub-borrower. Installation and front end cost and affordability by consumers. Relative costs among sub-borrowers.	To what extent were project and electricity costs and their determinants assessed to affect:
E. To what extent was employment generated and who were principal beneficiaries.	To what extent was employment assessed to have been generated and who, if anyone, were determined to be the chief beneficiaries?
F. To what extent were each of the following impacts realized? Health; Education; Environment; Security; Communication; Infrastructure; Migration	To what extent were each of the following impacts assessed to have been realized?

(Continued) --

Page 8. (Continued)

Issues Phrased for:	Issues as Phrased for Review of Documentation
Community and local participation	
Family planning	
Substitutability with other fuels and other fuel supplies.	
Linkages with other projects and programs	

Analytical Framework

Throughout the project decision-making phases, data and other information should be collected in accordance with the conceptual framework and issues outline which will also serve ultimately as a base for evaluating the project. The analytical framework serves as a guide not just for evaluations but also for analysis in each of the project decision-making phases. Exhibit B indicates the relevant issues to be analyzed in each phase (column 1); the data and information required for the analysis (column 2); the indicators or measures necessary for the econometric or qualitative analysis (column 3) and the sources of data and information to be collected (column 4).

Not all of the information which will be used for qualitative or econometric analysis is easily quantifiable. Hence indicators may take several forms. In instances where no directly quantifiable term can be identified, dummy variables or other proxies may be used. For example, in assessing the extent to which there is a priority on rural electrification dummy variables can be used to indicate whether or not such a priority exists. If yes then a 1 is used; if no then a 0.

Another approach is to set up a coded scale from say 1-5 where numbers closer to one represent higher priority while numbers closer to 5 represent lower priority.

If data and information are collected in accordance with this framework then an adequate base will gradually be built, all in a uniform and comparable manner so that when the final set of data are collected during project implementation the evaluation exercise will be more productive in the kinds of results that will emanate from it.

Analytical Framework

Issues	Data and Information Required	Indicators	Data and Information Sources
I. Pre-Project Need Assessment			
A. What is the current and projected status of rural electrification (RE) in the country?			
1. To what extent are national economic development and energy plans and goals compatible with RE and to what extent is RE a priority among energy goals?	National budget and expenditures for energy and electricity.	Proportion of national budget devoted to energy and RE projects and activities.	National budget and plans.
	National budget and expenditures for rural areas.	Proportion of national budget devoted to rural programs by type of program.	National budget and plans.
	Role of RE.	Dummy variables or other proxies.	National plans and RE & energy documents.
2. What is the current status of RE in this country and what lessons have been learned?	Pre-project electrical systems infrastructure by type, capacity etc.	Voltage, geographic coverage and efficiency data.	RE surveys and studies.
	Data on supply shortages and outages and reliability.	Frequency of outages, energy losses (%) duration of service (hours.)	RE surveys and studies.
3. To what extent are there constraints and opportunities for RE in this country.	Projected costs of upgrading autogeneration or extending central grid system.	Relative costs of each kind of system to diverse regions.	Previous electrification studies and surveys; electrification plans.
	Income level data and projected rate schedules.	Costs per type of consumer as proportion of income.	
4. To what extent is cooperative development fostered in this country.	Role of cooperatives.	Dummy variables or other proxies.	National plans, documents of cooperative projects, etc.
		Amount of foreign technical assistance and expenditures on cooperative development nationally and locally.	Documents of foreign donors (i.e. AID, IBRD).

(Continued) --

Issues	Data and Information Required	Indicators	Data and Information Sources
B. To what extent is there a need for rural electrification.			
1. What alternative energy sources, i.e. electricity, oil, solar, gas, and kerosene, etc. and to what extent is each:	Amounts and distribution of each of these resources available.	Percentage of population utilizing each; kerosene, hydro, wood, biomass.	
Available for use among regions and sectors (rural vs urban).	Distribution of availability and use by region and sector (rural and urban).	Supply and use of each by region and sector.	Special studies, energy surveys and plans, interviews with energy personnel, evaluation documents.
Costly in proportion to income of consumers by type of consumer.	Relative prices, average consumption and per capita incomes.	Costs and proportion of consumer budgets by type of consumer.	
Utilized efficiently in production and distribution.	Utilization rates.	Utilization rates.	
Serving diverse uses and purposes.	Range of uses: lighting, productive communication, cooking ironing, motors, etc.	Proportion of households, commercial and industrial enterprises, and governments utlizing electricity.	
Costly in terms of financial viability of operating enterprise.	Financial status of operating enterprise.	Profit levels, cash flows, etc.	
2. What are the opportunity costs of investment in RE versus investments in other national energy activities.	Costs of RE and costs of other development needs.	Relative costs of RE versus other programs.	National budget and plans.
3. To what extent is there a need for RE as an input into other development programs and projects.	Relationship between activities of RE and each of the other development programs and projects which are funded or planned.	Number of projects, geographic distribution, and incidence of electricity use by type:	Evaluative documents of related projects.
		Irrigation	
		Agro-industry	
		Health/Education Development	
		Commercial development	
		Industrial development	

(Continued) --

Issues	Data and Information Required	Indicators	Data and Information Sources
C. To what extent is there a need for a rural electrification project?			
1. What socio-economic characteristics are supportive or non-supportive of a RE project?	Demographic Data for Profit Area.		Survey of proposed project sites.
Geographic distribution of population.	Population density in rural areas.	Rural population as proportion of total population; rate of population increase in rural areas.	National census reports and U.N. demographic studies.
Income characteristics.	Income levels and distribution in rural and urban areas.	Average rural and urban income per capita.	(Same as above).
Production and employment.	Number, output and employment in agricultural, agro-industrial, manufacturing and commercial activities.	Contribution of agriculture and principal productive activities to GNP; unemployment rates, labor force size.	Pre-project surveys and feasibility studies, local censuses.
Physical infrasturcture.	Existence of paved roads, other transport systems, proximity to markets and trade, public sewerage, educational and health facilities.	Miles of paved roads, distance from major cities (time and mileage), number of schools, students, teachers (ratio) number of health clinics, medical personnel, literacy rates.	(Same as above).
Local community support.	Number and type of community and political organizations.	Dummy variables or proxies.	Project area surveys.
Existence of related development programs and projects.	Number and type of rural development and other programs.	Proportion of a local aid funds to related development programs fand projects.	Local budgets; AID studies.
Currently available electrical and other energy systems.	Type of systems and energy sources available, capacity, miles of lines, problems encountered.	Proportion of population (households, commercial and industrial enterprises, governments, farms) utilizing electricity; frequency of outages, energy losses, duration of service (hours).	Project area survey.
Institutional and technical capability to implement and manage project.	Adequacy of technical staff, financial status of organization.	Number and years experience of personnel by type, length of operations, of equity/debt structure, and other financial measures.	Interviews with personnel in these organizations.

(Continued) --

Issues	Data and Information Required	Indicators	Data and Information Sources
Availability of adequate financial resources.	Available working capital value and terms of external grants and loans (national and foreign).	Value of local and external financial resources, by source.	Interviews with local and foreign donors and financial institutions.
Special constraints to developing a rural electrification project.	To be specified.	Dummy variables or proxies.	Project area surveys and interviews.
Substitutability with other energy sources and supplies.	Prices of alternate energy sources: diesel, solar, gas, kerosene, hydro, wood, biomass.	Relative prices of each type of energy source, projected unit price of electricity.	Electrical company pricing data and survey.
2. What resources are required to maximize use of electricity and to what extent are these resources present?	To be specified.	Dummy variables or proxies.	Project area surveys and interviews.
3. To what extent are other country experiences with RE relevant to this country and project?	Existence of adequate power sources.	Dummy variables or proxies.	Evaluative documents of these projects.
	Pre-project electrical infrastructure.		
	Experience of delays due to inadequate materials and human resources.		
	Adequacy of indigenous supply materials.		
	Data on profit margins, rate of average use.		
	Adequacy of technical and managerial skills.		
	Socio-economic impact of projects in similar areas.		
II. Project Design and Feasibility Appraisal (Intended)			
A. What should be the <u>structural design</u> of the project.			
1. Determine and analyze project goals and proposals, and compatability among participating agencies.	Specify range of goals and purposes.	Dummy variables or proxies.	Interviews with people in participating agencies.

(continued) --

Issues	Data and Information Required	Indicators	Data and Information Sources
2. Determine and analyze the availability of local and foreign inputs and the proportions provided by each participating agency. To what extent can local linkages be fostered.	Number and costs of personnel or labor by type, equipment and machines by type, funds, buildings or other infrastructure, meters etc.	Proportion of total value of inputs accounted for by each type of input by source (agency and foreign vs. local).	(Same as above).
3. Differentiate and analyze target groups by type: (1) location (2) income status (3) current electrification status (4) consumption vs. productive use (5) political status, (6) access to infrastructure, health or education.	(1) rural vs urban (2) poor vs non-poor (3) previously electrified vs previously non-electrified, commercial vs farm vs irrigation etc.	Number of intended consumers by categories 1-4.	(Same as above).
4. Differentiate and analyze range of consumption and productive uses to which electricity is to be put by each type of consumer.	Households, ironing, cooking, lighting, heating, productive.	Proportion of household and productive use by each subtype of use.	(Same as above).
	Productive - motors, irrigation etc.	Proportion of consumers using the electricity in each manner.	
5. Specify and analyze range of impacts intended to be achieved.	See list under Section III-C.	See indicators under impacts section III-C.	(Same as above).
B. What whould be <u>engineering design</u>, capacity and electricity output to satisfy above-determined demands?			
1. Specify alternative engineering designs and analyze in terms of each energy source:	Central grid, autogenerated, individual microgenerated. scale and voltage, miles of transmission and distribution lines.	System requirements and power energy sources.	(Same as above).
Generation, transmission and distribution costs to target groups.	Cost of thermal, hydro, wind, solar use by target group.	Relative costs of each type of system in each type of target group.	(Same as above).
Consumer costs by category in relation to current and alternate rate structures.	Rate structure (incentive rates declining block rates or progressive rates) and volume of sales to each consumer group.	Relative costs among consumer categories and proportion of target group budgets.	(Same as above).

(Continued) --

Issues	Data and Information Required	Indicators	Data and Information Sources
Costs (installation and service) to target groups as specified above.	Costs of installing meters, providing service, etc.	Installation, meter and other up front costs, and proportion of estimated consumer budgets.	(Same as above).
Projected usage and adaptability; load density and growth, phasing of service.	Same as indicated in question.	Information as provided in question.	(Same as above).
Sustainability		Percent of energy losses. Reduction in frequency of outages. Frequency of breakdown and length of outages.	
Ease of administration, maintenance and repair.	Organizational structure.	Number of maintenance and repair personnel required, administrative, maintenance and repair costs and proportion of organization costs.	
Cost regulation - memters versus non meters.	Recovery of costs with and without meters.	Relative costs with and without meters.	(Same as above).
Required engineering inputs and sources.	Volume and value of such inputs.	Proportion of value of inputs accounted for by poles, wires, etc.	(Same as above).
C. What should be organizational design and management requirements?			
1. What is history and profile of of activities of alternate electrification organizations in the project area?	Cooperatives and public (local or national) organizations private or mixed corporations.	Dummy variables or proxies.	(Same as above).
2. What are necessary functions to be undertaken by each participating agency and to what extent can each kind of organization carry these out.	List functions of each organization and resources available to each to carry out these functions (i.e., power use promotion, maintenance, repair, training.	Dummay variables or proxies.	(Same as above).

(Continued) --

Issues	Data and Information Required	Indicators	Data and Information Sources
3. Which organizational type offers the best prospects for financial viability and why?	Financial status selected sub-borrower. Source of funds, income statements, organizational structure.	Projected profits, number of personnel.	(Same as above).
4. How are participating agencies to be interrelated?	Flow of work among agencies?	Dummy variables or proxies.	(Same as above).
D. What is feasibility of alternate project designs.			
1. What are projected costs.	Construction, fised, operating administrative, local and foreign-AID and other costs.	Projected of financial cost stream.	Calculations based on data obtained from above mentioned sources.
2. What are projected benefits.	Revenues or sales by type of consumer.	Project benefit stream.	(Same as above).
3. What is financial rate of return of net benefit stream.	Same as 1 and 2.	Financial rate of returen.	(Same as above).
4. What are projected cash flows and income streams, and relate to existing financial status of institutions.	Cash flow tables, income statements.		(Same as above).
E. What is economic and social feasibility of project to be applied to each alternative project design.			
1. What are projected input costs valued by opportunity cost of their use.	Inputs as identified previously and shadow prices.	Projected economic cost stream.	(Same as above).
2. What are projected benefits (quantified to the extent possible) to the local region and populace.	To be specified - examples are cost savings attributed to electricity, expansion of demand, benefits differentiated by consumer categories. Need present consumption of electricity by each consumer group and relative prices of electricity and other energy sources.	Projected economic benefit stream.	(Same as above).
3. What is net present value and/or economic rate of return.	Same as 1 and 2.	Derived economic rate of return.	(Same as above).

(Continued) --

Issues	Data and Information Required	Indicators	Data and Information Sources
E. What should be loan-terms?			
1. What should be interest rate and to what extent does this imply a subsidy?	Cost of capital.	Interest rate.	(Same as above).
2. What is credit status of the borrower and its access to capital markets?	Access to capital markets. Future access to credit.	Bond rating or other financial rating.	(Same as above).
3. To what extent are there alternate sources of financing for the project?	Other sources of funding, i.e., international organizations, domestic and local organizations, foreign governments.	Dummy variables or proxies.	(Same as above).
4. What should be other conditions and terms of the loan?	To be specified.	To be specified.	(Same as above).
III. Project Implementation (Actual)			
A. To what extent did project policies affect project impacts.			Project monitoring and evaluation information and project evaluation visits.
1. How does the project comport with national and local development and energy goals priorities, and needs.	National and local commitment to RE project.	Dummy variables or proxies.	Development plans and interviews with persons in planning offices and other ministries.
2. What was relationship between actual rate structures and project impacts?	Actual rate structure, financial status of sub-borrowers, consumer costs, number of consumers, pattern of electricity use.	Dummy variables or proxies.	Interviews with personnel in participating agencies.
3. To what extent were goals and purposes of participating agencies compatible and how did this affect project impacts.	Goals and purposes of each participating agency and project impact information from section III-C.	Dummy variables or proxies.	Interviews with personnel in participating agencies.
B. To what extent were operation and management activities related to project impacts?			

(Continued) --

Issues	Data and Information Required	Indicators	Data and Information Sources
1. To what extent were each of the following functions carried out:	See itemization as in column 1.	Dummy variables or proxies of performance measures (i.e., number of accounting personnel.	Field evaluation trips; interviews with project personnel, audit reports and project records.
Cost & budgeting		Number of visits by staff per member	
Monitoring & Evaluation		Number of members recruited.	
Membership promotion and education		Number of trainees per trainer.	
Training		Training cost per trainee.	
Recruitment		Number of vacancies per year as proportion of total staff.	
Maintenance and Repair		Duration of outages, cost per breakdown.	
Construction		Completion date.	
Contracting and scheduling		Actual vs. expected completion	
Ordering, receipt and delivery of inputs.		Number of unfilled orders per type of input.	
Management and administration			
C. To what extent did project <u>impacts</u> occur (intended and unintended).			
1. To what extent did the project reach its target group in terms of:	Intended and Actual Data.	Compare intended information from Part II with actual from Part III.	Visits to project sites and interviews with project personnel and recipients. Monitoring and evaluation records, impact studies or surveys.
Total population	Same as itemization in column 1.	Proportion of population in this area. Proportion of number of rural consumers to number of actual urban consumers.	

(Continued) --

Issues	Data and Information Required	Indicator	Data and Information Sources
Rural vs. urban	Sectoral distribution data	Proportion of rural/urban population connected.	
Poor vs nonpoor	Income data on target group.	Proportion of poor to nonpoor in areas which are connected. Proportion of actual consumers who are poor and nonpoor.	
Residential vs productive	Target group data by category.	Proportion of all residences, farms, commercial and industrial enterprises to which are actual consumers.	
Previously electrified vs. previously nonelectrified	Previous access to electricity.	Proportion of actual consumers which are residential vs. productive.	
Members vs. consumers	Membership information.	Proportion of members who are connected.	
2. To what extent was output (electricity) adequate for:			
Public usage	Information on use of electricity by target groups.	Proportion of public usage for lighting, communications, etc.	
Household usage		Proportion of household usage for ironing, cooking, heating, lighting.	
Productive usage		Proportion of productive usage for irrigation, lighting etc. actual usage vs intended usage and frequency of use.	
D. To what extent did project and electricity costs and their determinants affect:			
Outreach among target groups by type.	Indicated in column 1.	Costs of distribution, transmission,, generation.	
Subsidization among consumer types.	Indicated in column 1.	Proportion of revenue and consumption by each type of consumer or target group.	

(Continued) --

Issues	Data and Information Required	Indicators	Data and Information Sources
Financial viability of implementing agency and sub-borrower.		Retail costs per type of consumer vs. costs of dis- to each type.	
		Costs of sub-borrower vs. revenues; profit status.	
		Cash flow status.	
Costs and energy losses.		Rate of energy loss and project costs.	
Installation (including meter) and up front costs and affordability by consumers.		Installation and front-end costs as proportion of consumer monthly income.	
Relative costs among sub-borrowers.		Costs per sub-borrower.	
E. To what extent was employment generated and who were principal beneficiaries.	Employment data in sub-borrower agencies and among users.	Additional jobs directly on project.	
		Loss of jobs result directly from project.	
		Net gain or loss of jobs directly from project employment.	
		Change a productive consumers.	
F. To what extent were other impact impacts realized?		Proportion of new employees which were among the poor, landless and unemployed.	
Health	Number of health units using electricity, and on the area.	Proportion of health units using electricity before project and after project.	
Education	Number of schools using electricity, and in the area.	Proportion of schools using electricity before and after project.	
Environment	Wood supply before and after project.	Rate of forest depletion in area.	
Security		Dummy variable for positive or negative aesthetic impact.	

(Continued) --

Issues	Data and Information Required	Indicators	Data and Information Sources
Security		Frequency of use of electricity by policy and ary before and after project. Crime rate before and after project.	
Communications	Number of communications facilities using electricity before and after project.	Frequency of use of electricity by communications facilities.	
Infrastructure	Electricity sales for sewerage and water systems before and after project.		
Migration	Migration flows before and after project.	Proportion of population leaving and entering area before and after project. Proportion of consumers who are new to the area.	
Community and local participation	Number of cooperative members and personnel participating in other community activities.	Proportion of cooperative members who joined community organizations since joining cooperative. Proportion of cooperative personnel who hold community offices.	
Family planning	Birth data.	Birth rate among consumers and non consumer both before and after project. New births in consumer households since project energized.	
Substitutability with other fuels and other fuel supplies	Relative costs and pattern of of use among alternate energy sources before and after the project.	Electricity uses as proportion of of energy use before and after project.	
Linkages with other projects and programs	Inputs provided from other projects contributions of RE porject to other projects.	Proportion of inputs provided by other projects. Dummy variables or proxies.	

CONTRIBUTION OF AID DOCUMENTATION TO THE EVALUATION OF ITS RURAL ELECTRIFICATION PROJECTS

VOLUME II

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VOLUME II. Table of Contents

PART I. THE CONCEPTUAL FRAMEWORK

The conceptual framework was designed to serve two purposes. First, it provides a list of the analytical areas and related issues which should be addressed at each stage of the project cycle -- project need assessment; project design and feasibility; and project implementation. It has consequently enabled us to conduct systematically the review of AID rural electrification project documentation, and to assess the evaluative usefulness of this documentation by a consistent standard. Second, the framework has enabled the identification of significant gaps in and shortcomings of this documentation, and the relation of these inadequacies to particular stages in the project cycle. It therefore permits the formulation of specific recommendations which will hopefully contribute, through their potential impact on the rigor and consistency of AID evaluations, to improved projects and programs.

The framework is an attempt to establish a standard of comprehensiveness to (1) permit ultimate determination of the effectiveness of a particular project, and (2) make comparisons among rural electrification projects among countries. If similar comprehensive evaluation guidelines are implemented for other kinds of projects (i.e., health, education, rural development, etc.) then ultimately comparisons can be made among different types of projects to ascertain the opportunity costs of one kind of investment versus another in a particular country.

Cost-benefit analysis, in principle if not in practice, is a standard methodology for examining opportunity cost issues in the preproject appraisal phase. In the evaluation phase, it can be useful for establishing a consistent, standard methodology for conducting project impact evaluations, quite likely incorporating post-project cost-benefit techniques; applying the methodology across country program sectors (and across countries); and comparing the relative impacts of alternative interventions to arrive at judgments regarding project effectiveness.

Quite clearly, this is a complex order, particularly for a real modern world in which methodological data and resource constraints have hindered the production of a large number of impact evaluations. However, improvements in the AID decisionmaking process including evaluations, methodology and implementation designs as proposed in this study should assist in removing some of the constraints. Such a state of affairs will, in the case of rural electrification, permit the systematic ordering of knowledge regarding the impacts of past rural electrification projects by scale, technological types, organizational types, settings, etc. It will therefore contribute to the future design of these projects. Just as importantly, as more impact evaluations become available across program sectors, (i.e. rural electrification, health, agricultural credit, feeder roads, etc.) they may contribute to the assessment of relative developmental effectiveness of these program sectors (by setting, stage of development, structure of production, etc.). The evaluations may then contribute to the fundamental, but presently ad hoc and judgmental, process of setting country and agency program priorities.

Issues Outline

Issues as Phrased for:	Issues as Phrased for Review of Documentation
I. Pre-Project Need Assessment	To what extent was current and projected status of rural electrification assessed in the country?
A. What is the current and projected status of rural electrification (RE) in the country.	
1. To what extent are national economic development and energy plans and goals compatible with RE and to what extent is RE a priority among energy goals.	To what extent was compatibility of RE with national economic de-development and energy plans and goals assessed and priority did RE have among these goals?
2. What is the current status of RE in this country and what lessons have been learned.	To what extent was the current status and previous experiences with RE assessed?
3. To what extent are there constraints and opportunities for RE in this country.	To what extent were constraints and opportunities for RE assessed?
4. To what extent is cooperative development fostered in this country.	To what extent was the cooperative movement assessed?
B. To what extent is there a need for Rural Electrification	To what extent was a need for RE assessed?
1. What are alternative energy sources, i.e., electricity, of solar, gas, and kerosene, etc. and to what extent is each:	To what extent were alternative energy sources assessed for each of these items?
Available for use among regions and sectors (rural vs urban).	
Costly in proportion to incomes of consumers by type of consumer.	
Utilized efficiently in production and distribution.	
Serving diverse uses and purposes.	
Costly in terms of financial viability of operating enterprise.	

(Continued) --

Issues Phrased for:	Issues as Phrased for Review of Documentation
B. To what extent were operation and management activities related to project impacts.	To what extent were operation and management activities assessed to be related to project impacts?
1. To what extent were each of the following carried out:	To what extent did the documentation assess the degree to which each of the following functions were carried out:
Mamagement & Administration	
Cost & budgeting	
Monitoring & Evaluation	
Membership promotion and education	
Training	
Recruitment and training of direct personnel	
Construction	
Contracting and scheduling	
Ordering receipt and delivery of inputs.	
C. To what extent did project impacts occur (intended and unintended).	To what extent were intended and unintended project impacts assessed?
1. To what extent did did the project reach its target group in terms of:	To what extent was the project assessed to have reached its target group in terms of:
Total population	
Rural vs. urban	
Poor vs non-poor	
Residential vs. productive	
Previously electrified vs. previously nonelectrified	
Members vs consumers	

(Continued) --

Issues Phrase for:	Issues as Phrased for Review of Documentation
E. What is the economic and social feasibility of the project to be applied to each alternative project design?	To what extent was the economic and social feasibility of the project assessed?
1. What are projected input costs valued by opportunity cost of their use?	To what extent were projected input cost valued by the opportunity cost of their use assessed?
2. What are projected benefits (quantified to the extent possible) to the local region and populace?	To what extent were projected benefits (quantified to the extent possible) to the local region and populace by type assessed?
3. What is net present value and/or economic rate of return?	To what extent was the net present value and/or economic rate of return assessed?
F. What should be the terms of loan?	To what extent were terms of loan assessed to have been adequately specified and assessed?
1. What should be interest rate and to what extent does this imply a subsidy?	To what extent were the interest rates applied to the loan found to imply a subsidy?
2. What is credit status of borrower and its access to capital markets?	To what extent was the credit status (access to capital market) of the borrower specified and analyzed?
3. To what extent are there alternate sources of of financing for the project?	To what extent were alternative sources of financing for the project specified and analyzed?
4. What should be other conditions of a loan?	To what extent were other conditions of a loan specified and analyzed?
III. Project Implementation (Actual)	
A. To what extent did project policies affect project impacts?	To what extent were project policies assessed to have affected project impacts?
1. How does the project comport with national and local development, and energy goals, priorities, and needs?	To what extent did the documentation assess project comportment with national and local development and energy goals, priorties and needs?
2. What was the relationship between actual rate structures and project impacts?	To what extent were relationships between actual rate structures and project impacts assessed?
3. To what extent were goals and purposes of participating agencies compatible and how did they affect project impacts?	To what extent were goals and purposes of participating agencies assessed to be compatible, and how was this assessed to affect project impacts?

(Continued) --

Issues Phrased for:	Issues as Phrased for Review of Documentation
Costs (installation and service) to target groups as specified above.	
Projected usage and adaptability; load density and growth, phasing of service.	
Sustainability Ease of Administration, maintenance and repair	
Cost regulation - meters versus non meters.	
Required engineering inputs and sources.	
C. What should be <u>organizational design</u> and management requirements?	To what extent are organizational designs and management requirements specified and analyzed?
1. What is history and profile of activities of alternative electrification organizations in the project area.	To what extent were the histories and profiles of alternative electrification organizations in the project area described and analyzed?
2. What are necessary functions to be undertaken by each participating agency and to what extent can each kind of origanization carry these out.	To what extent were necessary functions assessed to have been adequately undertaken by each of the porticipating agencies; and what extent was each kind of organization assessed tp have been suited to cary out its assigned function?
3. Which organizational type offers the best prospects for financial viability and why?	To what extent was the attempt made to assess which organizational type offered the best prospects for financial viability and why?
4. How are participating agencies to be interrelated?	To what extent were participating agencies assessed to have been interelated?
D. What is <u>feasibility</u> of alternate project designs?	To what extent was the feasibility of alternate project designs assessed?
1. What are projected costs?	To what extent were projected costs assessed?
2. What are projected benefits?	To what extent were projected benefits assessed?
3. What is financial rate of return of net benefits stream?	To what extent was the financial rate of return of net benefits assessed?
4. What are projected cash flows, and income streams and relate to existing financial status of institutions.	To what extent were projected cash flows and income streams assessed to have been related to existing financial status of institution?

(Continued) --

Page 3. (Continued)

Issues as Phrased for:	Issues as Phrased for Review of Documentation
3. To what extent are experiences of other countries with RE relevant to this country and this project?	To what extent were other country experiences which were relevant to RE in this country assessed?
II. Project Design and Feasibility Appraisal (Intended)	
A. What should be the <u>structural design</u> of the project.	To what extent was the structural design of the project assessed?
1. Determine and analyze project goals and purposes and compatability among the participating agencies.	To what extent were project goals, purposes and compatabilities among participating agencies determined and analyzed?
2. Determine and analyze the availability of local and foreign inputs and proportion of each to be provided by each participating agency. To what extent can local linkages be fostered?	To what extent was the availability and proportion of resource inputs provided by local and foreign agencies adequately determined and and analyzed; and to what extent were local linkages to be fostered and analyzed?
3. Differentiate and analyze target groups by type: (1) location (2) income status (3) current electrification status (4) comsumption vs productive use (5) political status, (6) access to infrastructure, health and education.	To what extent was the project target group assessed and differentiated by each types?
4. Differentiate and analyze range of consumption and productive uses to which electricity is to be put by each type of consumer.	To what extent was the range of electrical consumption and productive uses by type of consumer determined and analyzed?
5. Specify and analyze range of impacts intended to be achieved.	To what extent was range of intended impacts identified assessed?
B. What should be <u>engineering design</u>, capacity and electricity output to satisfy above determined demand purposes?	To what extent was engineering design, capacity and electricity output analyzed in light of the above determined demand purposes?
1. Specify alternative engineering designs and analyze in terms of each energy source :	To what extent were alternative engineering designs specified and analyzed in terms of each energy source, and in terms of the following items:
Generation, transmission and distribution costs to target groups.	
Consumer costs by category and relation to current and alternate rate structures.	

(Continued) --

Issues as Phrased for:	Issues as Phrased for Review of Documentation
2. What are the opportunity costs of investing in RE versus investing in other energy activities.	To what extent were opportunity costs of alternative investments assessed?
3. To what extent is there a need for RE as an input into other development programs and projects.	To what extent was RE assessed as an input into other development program and projects?
C. To what extent is there a <u>need for a Rural Electrification Project</u>?	To what extent was a need for RE project assessed?
1. What socio-economic characteristics are or non-supportive of a RE project?	To what extent were each of the socio-economic characteristics assessed?
Geographic distribution of population.	
Income characteristics.	
Production and employment.	
Physical infrastructure.	
Local community support.	
Existence of related development programs and systems.	
Institutional and technical capability to implement and manage the project.	
Availability of adequate financial resources.	
Special constraints to developing a RE project.	
Substitutability with other energy sources and supplies.	
2. What resources are required to maximize use of electricity and to what extent are these resources present?	To what extent was the existence and availability of the resources required to maximize use of electricity adequately determined and assessed?

(Continued) --

Page 7. (Continued)

Issues Phrased for:	Issues as Phrased for Review of Documentation
2. To what extent was output (electricity) adequate for:	To what extent was output (electricity) assessed to have been adequate for each item:
Public usage	
Household usage	
Productive usage	
D. To what extent did project and electricity costs and their determinants affect:	To what extent were project and electricity costs and their determinants assessed to affect:
Outreach among target group by type.	
Subsidization among consumer types.	
Financial viability of implementing agency and sub-borrower.	
Installation and front end cost and affordability by consumers.	
Relative costs among sub-borrowers.	
E. To what extent was employment generated and who were principal beneficiaries.	To what extent was employment assessed to have been generated and who, if anyone, were determined to be the chief beneficiaries?
F. To what extent were each of the following impacts realized?	To what extent were each of the following impacts assessed to have been realized?
Health	
Education	
Environment	
Security	
Communication	
Infrastructure	
Migration	

(Continued) --

Issues Phrased for:	Issues as Phrased for Review of Documentation
Community and local participation	
Family planning	
Substitutability with other fuels and other fuel supplies.	
Linkages with other projects and programs	

The proposed conceptual framework follows: it is organized by each issue in the project decision-making phrase -- pre-project need assessment, project design and feasibility and project implementation. Each issue is phased in two ways: (1) as it would be phrased if one were conducting a pre-project need assessment or designing a project or evaluating a project and (2) as a guide for evaluating the documentation which covers all phases of the project cycle. The phrasing of the issue in the second instance is the guide or outline which was followed by RRNA in our review of the documentation. It thus serves simultaneously as an outline for Part II - The Inter-project Issues Analysis.

I. Pre-Project Need Assessment

Preliminary Review of Rural Electrification Status and Potential

Country Program Goals

Prior to the recent formalization of the country program planning process, with the introduction of Development Assistance Program (DAP) papers, and even more recently the Country Development Strategy Statements (CDSS), mention of the relevance of rural electrification to country program goals was restricted to very general statements entitled "Place of Project in the Development Program."

The CAPs, the principal source of any discussion for most of the projects reviewed in this study, generally provide a section on the place of the project in the economic development of the country or in development strategy. We did find at least one document, however, with no such discussion(second Bolivia loan). These discussions tend to be descriptive rather than analytical in their presentation of AID and most government development strategies, projects and programs. In a parallel manner they present rural electrification aims. However, linkages between the two are based either on unsubstantiated claims that electrification has been a principal constraint in national economic development or that the proposed rural electrification project will be located in areas where other development projects are being implemented. Rural electrification will therefore provide important supportive infrastructure to these projects or programs. No discussion is provided as to whether other types of energy projects could provide a better support base, an omission partly attributable to the document's purpose of justifying a specific project rather than assessing objectively a range of projects. Although some improvement in the treatment of rural electrification projects and country goals in the CAPs was noticed over time, no documents contained discussions of possible alternative rural electrification development options.

Review of Historic In-Country and Other Country Experience With Rural Electrification

Most relevant documents consider almost exclusively the United States experience under the Rural Electrification Administration (REA) as the model for the need and design of rural electrification projects. This preoccupation stems primarily from the dominant role NRECA has played in pre-project need assessments through its country surveys and feasibility reports. Later AID documents refer to rural electrification experiences in other developing countries (i.e., the Project Review Paper for the second Guatemala loan), but mention is made of the successes rather than pitfalls of these projects and often even the success is not substantiated in these documents.

Reviews of in-country experience with rural-town electrification generally were limited to describing the deficiencies of existing systems (by U.S. standards), and to noting the priority of extending central grid systems in urban as opposed to rural areas. Little attention in the documents was given to assessing the adequacy of the REA type systems within the local setting, to exploring means of improving the performance of existing systems or to assessing the priority of immediate extension of U.S. grade service to low-density areas. Thus the general recommendation of such reviews, to the extent they took place, tended to call for the replacement of existing systems by systems based on the REA model.

One exception to this rule is the 1965 Searls Guatemala report for NRECA where, due to the unavailability of low-cost hydropower, Searls did not recommend rural electrification cooperative development. Rather he recommended that efforts to assist municipal and small private systems be undertaken at that time.

Most loan documents also refer to any previous AID-financed rural electrification grants and loans. In many instances these previous projects are simply described rather than analyzed and "successes" are stated, not substantiated. As an exception, the second Nicaraguan loan did assess a limited range of accomplishments and problems in the previous loan. Mechanisms for overcoming the problems were supposedly built into the second loan. Ironically, documents for the second Guatemala loan, which referenced uncritically the "success" in Philippines, Nicaragua and

Costa Rica, did not incorporate a review of the first Guatemala loan.

In only two countries -- Ecuador and the Philippines --was a formal evaluation or survey of previous country loans used as a part of the decisionmaking process for the second loan.

Potential Rural Electrification Impacts

In the pre-project phase, assessment of potential impacts seems to have followed a course similar to that of the review of historical experience. That is, in the early period such assessments drew heavily on the direct transference of experience from the U.S. model with little or no modification; and focused primarily on farm output and production, rural incomes, household ammenities, and democratic participation. As time progressed, expectations regarding rural-urban migration, family planning and the preservation of forestry resources were added although these have been considered in only one or two instances. More recently, and subsequent to the results of some of the major evaluative studies, many such expectations have been revised. This is perhaps illustrated by the language of the project paper relating to the second Guatemala loan. It does not claim that lack of electric power is a major constraint to increasing target population incomes, but it assesses potential electrification impact on potential income and welfare as that of an infrastructure input to a broad, multi-project, sectoral development strategy. Linkage to such projects and the productive use of electricity in rural areas are stressed as being a requisite for the realization of rural electrification's potential impacts.

Rural Electrification as a Priority

Few documents indicate the relative priority of rural electrification in these countries as perceived by most host nationals or AID. The issue is generally treated in terms of national commitment to the project, substantiated by letters from key government officials. However, in many instances these letters are from officials in agencies who are involved in electrification projects and who by necessity would rank electrification highly rather than from Ministers of Planning whose ranking of rural electrification must consider other kinds of development projects. For example, in no documents was the proportion of the national budget devoted to energy or electricity matters provided or compared with other kinds of programs. In a CAP for Nicaragua, several statements were provided indicating rural electrification was one of the highest national priorities, yet no further substantiation was presented.

Constraints and Opportunities for Rural Electrification

National power surveys and plans provide important information on the existing impediments or opportunities for extending electrification throughout a country and should be identified, collected and reviewed before determining whether it is necessary to investigate further the opportunity for rural electrification. These documents provide an indication of geographic areas of electricity concentration and absence of electricity and plans for extending existing systems among these areas; the nature of primal generation systems and their distribution by region, capacity and output, demand prospects by region and determination of sites where power shortages appear to be severe. The existing impediments on both supply and demand should be reviewed to determine the scope for further action and avoid unnecessary effort duplication.

However, there was no evidence among the documents collected that this had been done prior to the decision to consider the prospects for a rural electrification project, even in instances where such documents and studies existed (i.e., Colombia). The incentive for considering rural electrification appeared to be based on the "success" of U.S. experience rather than on a justified rationale or case for any particular developing country. NRECA in the Philippines, however, did suggest that it participate in an upcoming power survey, a relevant aspect of the next section.

Rural Electrification Need Assessment

Prior to determining the need for a project, the need for rural electrification itself should be assessed. This includes consideration of existing non-electricity and electricity systems and their uses.

Existing Non-Electricity Sources

There appear to be two contrasting situations among the projects in this case study analysis with respect to an assessment of non-electricity sources.

Virtually all pre-project documentation for loans in Bolivia, Colombia, Ecuador and Nicaragua failed to consider existing non-electricity energy forms (i.e., wood, kerosene, etc.). The omission of information on availability and distribution, cost and proportion of consumer income, utilization and efficiency, alternative use pattern, and reliability and geographic distribution of the consumption of alternate non-electricity forms for these countries in pre-loan documents is critical, given the assumption in most of these loans that population in the area will substitute new electricity for the existing energy forms. Even James Ross' 1966 study of cooperatives in Colombia, Nicaragua and Ecuador focused almost entirely on electrical energy.

In contrast, documents for the Philippines, Guatemala and Costa Rica did address these issues.

Existing Electricity

Almost all pre-project documents at least mentioned or described availability of existing electricity in proposed project sites.

Country surveys, whether specifically related to rural electrification or conducted in connection with a national power survey, as was the case in the Philippines, generally identified the presence or absence of electric generation facilities at the town and village level. Generally, very little information was developed on the prevalence of independent generation capacity at the farm or industry level. Energy utilization analysis was basically absent for either residential or productive uses, particularly in relation to the analysis of availability and use of other energy sources which are required to substantiate projections of the rate at which electricity may be expected to substitute for these other sources. An exception to this is the second Guatemala project paper, which was based on a rather extensive study of utilization and availability of electric power in project survey areas.

Cost and Proportion of Consumer Income

This analysis usually noted that existing small generation and distribution systems were high-cost in relation to the potential offered by central grid systems. This is particularly true with respect to judgments regarding costs of existing generation systems in productive use.

Costs of residential energy usage, when assessed, were limited to comparisons between estimates of current outlays for candles and kerosene with the projected costs of electrical lighting.

In the Philippines cost of current non-electric residential lighting were lower than an equivalent consumption level of electricity. In Costa Rica, it was found that electricity was more expensive than candles and kerosene, but it was assumed that significant substitutions would still take place on relative quality grounds.

Surveys in Guatemala undertaken before the second loan indicated that users and non-users were spending between 8-13 percent of their annual income for household lighting, though users spent the larger absolute amount. This information was presented as evidence of the affordability of electricity among the target group when, in fact, it may merely document that electricity users were of a higher income status than non-users.

Utilization and Efficiency

Investigation of electricity utilization took place specifically as a part of project preparation in only the 1978 second Guatemala loan.

Reliability

In most of the project documents, the reliability of existing electrical systems is often criticized, and superior reliability of central grid systems asserted as one of their advantages. However, no further analysis of this issue was generally undertaken prior to project initiation.

Even if a need for electrification can be established, there are likely to be other vital needs of the communities as well -- health services, educational facilities and personnel, access to credit, improved roads, water systems, agricultural inputs, etc. It is therefore necessary that the need for rural electrification be examined in terms of the opportunity cost of this investment in these communities. For example, how do people rank electricity among their alternative wants? What added resources do they think are required to make the most use of electricity if it were made available? To what extent is electricity as opposed to other inputs constraining development? These questions should also be analyzed, particularly in light of research in the early 1960s which indicated that the mere availability of electricity is not adequate for ensuring its productive use.[1]

Objective analysis of these questions may reduce the probability of funding inappropriate projects, and simultaneously provide useful baseline data for ultimately evaluating and identifying the major factors associated with the

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1. General Electric Company, Preliminary Report of Field Survey Teams on the Generation and Utilization of Power in Rural Areas of Developing Countries, submitted to AID September, 1962 and Small Scale Power Supplies for Rural Communities in Developing Countries, March, 1963.

effectiveness of the project. This information can then be fed back into the project planning and design process as a basis for making decisons regarding the worthiness as well as the design of future proposed projects.

Rural Electrification Project Need

Rural electrification project need requires an examination of the extent to which alternative sites and socio-economic settings will support a project; the extent of local and national support; the extent to which there would be both positive and negative consequences; the extent to which experience of other countries or other parts of the same country is relevant; and finally, the extent to which foreign assistance as opposed to local and national resources is required.

Alternative Sites

The selection of project sites should be an outgrowth of the previous rural electrification need assessment. However, because of individual predisposition to a particular kind of electrical generating and distribution system, financial viability of the distribution entity, particularly a cooperative, has been a guiding force in pre-project need assessment and selection of sites. Due to the uncertainty regarding the rate of adoption of electricity for productive purposes, there may be a tendency to favor tariff structures which give rise to higher average costs per kwh for residential users. This can then limit access to electricity among the poor and among the rural residents. This scenario is thus a direct outgrowth of failure to consider a broader range of alternative energy systems in the rural electrification need assessment, allowing that process to suggest the appropriate technological form.

Sites selection for rural electrification appears to have been made on the basis of a complex set of issues: potential financial outreach and developmental impact, development status of the region, existence of roads and power infrastructure such as would facilitate construction and operation, political priorities of the host-government, existence of local support for a project, etc. The primary tension which has to be detected among these issues is the tradeoff between assuring financial viability of the system and maximizing development outreach and impact. This is, of course, a function of the type of system being considered among other factors.

Local and National Support

NRECA specialists have consistently made efforts to assess and build on local support for rural electrification cooperatives. This process is included among their "Phases and Steps" to rural electrification project development. In no case were expressions of local support and interest found lacking although the relation of such expressions to effective demand was usually tenious and unclear.

At the national level, expressions of support from interested agencies and politicians are also documented. These politicians generally had been beneficiaries of power sector agencies or congressional representatives of project areas, and there was seldom documentation of support or interest by national or regional development planning agencies.

Even in the case of beneficiary or implementing agencies, the depth of support has at times been questionable. For example, in the case of the Philippine pilot projects, VRESCO and MORESCO, the documentation contained evidence of only lukewarm interest on the part of both the Development Bank of the Philippines and of the Electrification Administration (EA). Neither of these institutions participated in subsequent loans, so the EA was replaced by the National Electrification Administration, which operated under a strong mandate from President Marcos.

In Costa Rica, the National Bank viewed the project purely as a banking transaction and ICE, the power institute, though it participated fully in the implementation of the cooperatives project, showed no interest in replicating this experience. It therefore pursued rural electrification development independently of AID involvement.

Positive and Negative Consequences

The only mention of any possible negative consequences was in the CAP for Nicaragua-Rural Electrification Loan III in its discussion of environmental effects.

> ...we believe that because of the type of work to be performed (placement of power lines poles), the overall adverse impact on the environment will be minimal. In addition, because of the borrowing country's state of development in relation to the expected economic returns to be derived from the project, the limited adverse environmental impact would appear to be warranted under the circumstances.

Project Experiences Within and Among Other Countries

The CAPs frequently mention previous rural electrification loans. The second Nicaraguan loan was partly justified on the basis of the apparent "success" of the first loan.

Success was defined in terms of the completion of the facilities on schedule. Because total sales had exceeded sixth year projections in the second year, the cooperative had been in the black from the beginning even though the projections did not indicate such a financial state until the fourth year. The availability of electricity was a possible reason for the location of two large industries in the project area. Means for overcoming the accounting and management problems in the implementation of the first loan were said to be provided in the second loan. These means, however, were not specified.

The only projects preceded by an evaluation of previous loans were in Ecuador and the Philippines. In Ecuador, an evaluation was undertaken by USAID and the status of both previous projects was judged to be satisfactory based on growth of subscribers, financial status and a profile of electricity. In contrast to these cases, the subsequent Bolivian loan merely mentioned the previous loan without much assessment.

The project review paper for the second Guatemala loan referenced reports on "successes" in Philippines, Nicaragua and Costa Rica, Bolivia and Colombia in distributing electric power to rural inhabitants, positive impacts on target groups, excess power sales over projections during early years, and productive use of power. However, our assembled documents do not support broad generalizations for the projects in all of these countries.

Sources of Financing

Few NRECA surveys raised the question of local or host government financing in their scope of work, and even when mentioned the issue was not assessed completely. The CAPs usually indicate that no other foreign donors are interested in the project and that "local and foreign credit institutions are not able to offer concessional terms and conditions required to make this project feasible."[1]

II. Project Design and Feasibility Appraisal

Structural Design

Project Goals and Purposes

Some of the recent projects, after introduction of a logical framework, differentiate between goals and purposes. There are considerable variations in how these are specified -- from functional emphasis on construction of facilities and provision of reliable service to incorporating residential and productive uses, outreach and other impacts- income, employment, etc. Most also mention some welfare increasing aim.

Goals and purposes, as stated in project documentation, have not been formulated in a manner which permits the measurement of their achievement. This is because of the difficulty in attributing results directly to the projects. The indicators and measures of achievement when provided are inadequate in separating the influence of non-project developments on project implementation and impact. Difficulty in measuring project influences is a reflection of the "single factor fallacy" assumptions about project purposes and goals.

1. CAP, Nicaragua-Rural Electrification III, 1971, 5.

Resources and Inputs

One of the principal issues in this area is the proportion of locally produced versus imported inputs in the project. Since AID generally finances the foreign exchange costs and has traditionally stressed the positive effect of U.S. supplies to these projects on U.S. balance of payments, there has been a tendency to assume most major inputs should be imported from the U.S. Other arguments supporting import preferences from the U.S. are the problems and costs of obtaining large quantities of items locally, particularly if such backward linkage industries are not fully developed, especially near the project area. No corresponding analysis was found of the effect of these imports on host country balance of payments, or on project design and execution. More recently, the earlier bias has been reexamined, and there appears to be a greater role for locally provided inputs, such as poles, than in early designed projects in the early 1960s.

Potential Demand
Target Groups and
Their Characteristics

The second Guatemala loan is the only project reviewed which undertook a survey to identify relevant target groups prior to project design. Usually only estimates of rural and urban population nationally and/or locally were presented, with no indication of what proportion was likely to serve a (incomes, relative price vis-a-vis other energy forms, price of electricity, etc.).

1. CAP, Nicaragua-Rural Electrification III, 1971, 5.

In most cases, at the potential project area level, only total population figures were presented, with yearly projections based on extending service to these at certain implied, but often unspecified and unsubstantiated, rates. In the case of Guatemala, income and other socioeconomic characteristics were surveyed in project areas. Yet no demand analysis was made beyond noting that the average new user would have to pay no larger a proportion of his income for residential lighting than current users, but a somewhat higher proportion than current non-users.

Uses. Projections of use by user-categories -- farm, residential, commercial, industrial, public -- are a characteristic feature of all the NRECA loan engineering and feasibility studies reviewed. However, in the absence of more specific information on incomes, income distribution, energy use patterns, productive structure and economic potential of project areas, it is difficult to characterize these figures as demand projections by use category. In many instances theoretically-based uses were listed, but probability, constraints on such uses, etc., were not considered.

Engineering Design

Alternative Technologies and Organizational Forms

In most cases there was no discussion of alternative technological or organizational approaches to rural electrification. Many of the projects were designed specifically to build cooperative rural electrification distribution systems, large enough to support a competent managerial staff and to provide 24 hour service at "low-cost." This has generally implied an emphasis on distribution from a central grid as opposed to autogeneration system. The cooperative form and 24 hour nature of services have often worked their way into the purpose statements regarding these loans.

Exceptions have occurred in a few of the early Philippine cooperatives where self-generation was provided in Ecuador and Bolivia in which both cooperative and non-cooperative electrification was financed; and in Guatemala where development lacking and where rural electrification development and operation have been the exclusive province of INDE, the national power agency.

Cost

Cost issues not properly addressed, though relevant to technical and organizational choices, include the following: Comparative construction costs of large generation, transmission and central grid distribution systems compared to localized autogenerating and distributing systems; relative power production costs of these system types, including fuel, maintenance, and depreciation; relative administrative and personnel costs, taking into account the scarcity value of skilled management, metering and billing costs, etc.

Costs of obtaining finance are also relevant in considering organizational types. For example, stock-issued cooperative and non-cooperative organizations can obtain finance through equity participation although many cooperatives (i.e. Philippines) are non-stock. Even in the case of stock cooperatives, equity participation is usually restricted to members. State systems do not generally have access to private credit markets, but bond issues, central government support, and foreign assistance are generally available to them. Private and municipal systems can often top private credit markets although not in terms enabling their expansion into low-density areas. Public sector guarantees and interest subsidy support to such private sector systems are potential means of encouraging such expansion, which the documentation indicates have not been explored, at a minimal cost in terms of public finance.

Ease of Administration

Similarly, technology and organization affect administrative requirements. Independently operated central grid systems require good-sized staffs and experienced management. Integrated state systems may offer economies of scale in personnel and management. Small municipal and private systems generally maintain minimal staffs, sometimes at the cost of quality service. Individual metering imposes reading and billing costs which are not occasioned by the use of flat rates and which may exceed potential losses from theft or inappropriate consumer classification. One of the major constraints to low-income residential consumption is, according to several reports (i.e. Davis et. al., Costa Rica), the inability of such households to afford appliances.

Sustainability. This issue is perhaps particularly relevant to the cooperative organizational form. As noted in the Benjamin report to NRECA on the Costa Rican cooperatives (1964) these organizations require, for their continued expansion and viability, continuing technical and financial support from a national entity such as the REA in the United States or the NEA in the Philippines. This may be confirmed by the demise of the cooperatives in Colombia and Ecuador where such support was lacking. The issue of the substainability of a particular organizational form is therefore closely linked to that of assessing the degree of commitment at the national level.

Differential Impacts. The advantages and disadvantages of alternative technological and organizational designs will clearly be reflected in their developmental impact potential. For example, cost of installation, cost to the consumer, ability to operate in low-density areas, quality and duration of service, etc., will all be affected by these choices. The relative effectiveness of these alternatives, guided by the "cost-benefit" appraisal of their developmental impact potential, should therefore be the fundamental criterion in reviewing alternatives.

AID/Local Distribution of Project Costs

In practice, with the exception of the pilot projects in the Philippines and Costa Rica, the degree of AID participation appears to have been determined by financing the foreign exchange component of total project costs. Strict adherence to this criterion may have an undesirable influence on the potential for local provision of inputs and the goal of exploiting the backward linkage impact of AID projects.

Economic Feasibility

Cost-benefit analysis of rural electrification projects was conducted in only a few cases -- the third, fourth, and fifth Philippine loans, the second Bolivian loan, and the second Guatemalan loan.

In the Philippines, the third loan document contained cost-benefit analysis for one of the 12 cooperatives being financed, Ilocos Norte. For this sub-project, a benefit-cost ratio of 1.29 and an internal rate of return of 20 percent were estimated.

The fourth loan paper contained results of benefit cost analysis for 94 cooperative systems for which feasibility study projections were available. No cost-benefit ratio or internal rate of return estimates were presented, although it was stated that all 94 cooperative projects together had a Present Social Value of about 2.24 million pesos. On a combined investment in the neighborhood of 1 billion pesos, this implies a B/C ratio marginally above 1, and an IRR barely superior to the 12 percent discount rate employed.

The fifth loan document states that

> To estimate the financial return on the investment anticipated under the project, the financial data for a hypothetical cooperative have been projected from year 0 through 24. As it is impossible to identify exactly how AID funds will be used, it is reasonable to develop this "representative" cooperative whose revenues and costs are derived from historical relationships established by NEA cooperatives in general.
>
> More specifically the entity analyzed is composed of the typical cooperative population: 79% of total connections are residential, .02% industrial, 11% commercial, 9% street lighting, and .4% public buildings.[1]

A financial internal rate of return of 20 percent is reported for this "cooperative." Elsewhere, an internal

1. Project Paper, Philippines: Rural Electrification V, page 43a.

economic rate of return for the project as a whole is reported to be 30 percent.

Both the second Bolivian and the second Guatemala loans were analyzed using Marcelo Selowsky's methodology as is described in his "Notes on the Appraisal of Rural Electrification Projects" (IBRD). Both of these analyses benefit from project area survey data which facilitated the estimation of price elasticities of demand for electric power in various uses, as well as presented estimates of cost reductions anticipated through the substitution of electricity for other energy sources. In Bolivia a benefit-cost ratio of 1.85 was reported for the project as a whole, while no internal economic rate of return was reported. In Guatemala, base case internal economic rates of return (without including estimated consumer surplus benefits) of 12.5 percent and 3.6 percent were reported for analyses which included and excluded the costs of generation, respectively.

III. Project Implementation

The preceeding analysis focused on pre-project issues. This section examines the extent to which collected documents have assessed the policy, operations and management, outreach and impacts of these projects or sub-projects on various groups of electricity consumers of and on the local communities.

The principal sources for this section are evaluation reports, audits, post-project surveys, CAPs and PPs. However, the wide disparsity in the scope, substance and purpose of these documents makes it difficult to find one term to describe them all. Few if any actual impact measurement studies were found. Some documents are program evaluations which touch on a limited range of impact issues -- (i.e., the 1970 evaluation of the first two Ecuadorean loans). Most striking is the paucity of such documents although the design of most of these loans pre-date AID's major evaluation efforts.

Policy Factors

There are four principal issues with respect to the relationship between project implementation and policies. Collected project execution reports (audit reports, etc.) and evaluation studies serve as the information base for examining the treatment of these issues.

Compatibility of Goals and Purposes Among Participating Agencies

In project planning and design, some commitment from local resources was required in order that the project be approved by AID. However, the extent to which these resources are forthcoming affects how the total project is to be implemented and often depends on whether or not the goals and purposes of host agencies and AID are compatible. Compatibility does not require that the goals be the same or that the same priorities exist. However, different interests and goals can have a marked effect on project implementation and effectiveness.

Only one evaluative document -- the final evaluation report for third rural electrification loan in Ecuador --

addressed the issue of the compatibility of AID and implementing agency goals and the effect on project execution. The original design of the Ecuador project required the establishment of three new cooperatives among the eleven intended sub-borrowers. However, after project implementation, INECEL, implementing agent responsible for national development of rural electrification, decided it was not interested in promoting cooperative establishments since its ultimate aim was to integrate all local systems into a national system after the addition of several large hydroelectric plants. INECEL also took over one of the existing cooperatives. Thus, INECEL did not want to promote locally supported entities such as cooperatives which might challenge INECEL's ultimate takeover of the system. Consequently the entire project was redesigned, and the requirement to construct three new cooperatives was eliminated. This incident raises the question as to whether this issue had been properly addressed prior to project implementation.

Working Relationships Between Sub-borrowers and Borrowers

Since all but the two Guatemalan loans involve both implementing and sub-borrower organizations, it is appropriate to examine this relationship in light of project execution. From the documentation, it appears that AID has been interested in developing both institutions. However, the implementing agency/sub-borrower (especially cooperative) dichotomy in the design of the project does not necessarily imply a harmonious relationship, particularly since in most instances decisions at the sub-borrower level must be approved by implementing agencies. Implementing agencies determine, or maintain, a major influence over important policies and functions (i.e. setting rate structures, training and technical assistance) that affect the sub-borrowers.

The relationship between implementing agencies and sub-borrowers was examined in "evaluative documents" for four of the seven countries -- Bolivia, Ecuador, Nicaragua and Colombia. The 1975 audit report of phase I (CRE and ELFEC) of the second Bolivian loan indicated that "there is a good working relationship among all involved parties."[1] In contrast, evaluative documents in Ecuador (1977 final evaluation report) and Nicaragua (1975 audit) report poor communications and relations between the implementing agencies and the sub-borrowers (Santa Domingo Cooperative in Ecuador and all five cooperatives in Nicaragua) because the implementing agents desired control over the cooperatives who in turn protested such "external" control. Gordon Roth, in his review of the SECA cooperative in Colombia in 1971, argued that CVC viewed SECA as a "small and troublesome operation" which it wanted to absorb except for political repercussions which would result. CVC did ultimately take over SECA while the other two intended cooperatives in the country were never established in spite of already constructed facilities. The issue was not addressed for non-cooperative sub-borrowers.

An alternative approach to the borrower/sub-borrower arrangement was that loans be granted directly to cooperatives. NRECA recommended that loans be granted to such cooperatives as, SECA in Colombia and Cooperative A in Nicaragua. However, perhaps AID loans have been channelled

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1. AID Auditor General, Memorandum Audit Report No. 1-511-76-25, December 22, 1975, page 1.

through implementing agencies with host government guarantees because the sub-borrowers themselves often did not even exist at the time of the loans, and even when they did they were not in a position legally or otherwise to handle all of the contract convenants. However, dual recipient design introduces the question of who the real institutional beneficiary is -- the implementing agency, the cooperatives or both. More often than not, resources went to the implementing agencies to organize and establish the cooperatives when in fact the cooperative commitment there may have been less than through local organizations. For example, the Santo Domingo cooperative, one of the few initiated through local efforts, benefited in its development stages from direct cooperative training from USAID rather than relying on the implementing agency whose interests might differ. These resources, flowing directly into the cooperative, may have been more influential for cooperative development purposes than training personnel in implementing agencies to then train the cooperative personnel. In the latter instances, resources may get diverted to implementing institutional development needs unrelated to the cooperatives. The cooperative,however, was organized prior to the loan. Yet the purpose statements of the loan document, in contrast, specify INECEL as the primary institution to be developed. Thus the strength or weakness of cooperative structure is often dependent on the capability or interest of implementing agencies in cooperative organization. None of the implementing agencies had experience in organzing cooperatives prior to these AID loans.

Despite the predominance of the cooperative form at the distribution level, most project designs provide a substantial role for the national power agencies whose responsibilities usually cover the extension of electrification throughout the country. With a national focus, however, these entities are often concerned with urban-oriented projects which imply reaching larger numbers of people at lower distribution costs. They are often disinterested in financing rural distribution systems, particularly in the early stages of their own development.

These AID loans by design, and often despite purpose statements, provide a means for implementing agencies to develop their own resources -- engineering, construction and management -- without bearing the substantial costs implied in rural electric distribution. Thus the concept of locally-operated and supported systems with some control by the national power authority seems attractive in the initial stages. But as the national power companies are strengthened and viability of some of these systems appears more assured, the implementing agencies could revise their interests in locally controlled systems. This is one possible interpretation of the Nicaraguan results.

Rate Policies

The second policy factor is the relationship between the rate structure and sub-borrower viability. Differential rates between rural and urban types of users, among residential, industrial, commercial etc., had a direct effect on the viability of the sub-borrowers, given certain consumption patterns among the groups. Rate structure analysis was undertaken for some sub-projects in Nicaragua, Bolivia, Philippines and Guatemala. However, the Guatemala study was not available.

The most pronounced instance of negative effect was in Nicaragua where the government had established nationally applicable irrigation rates substantially less than other class rates. In fact, in structuring this project, ENALUF utilized the Government of Nicaragua policy to promote agricultural production through, among other things, the use of electricity. This purpose as stated in the CAP for the second loan, however, led to design of rate structures which subsequent evaluations argued impeded the viability of the cooperatives. Sub-projects with a considerable amount of irrigation usage had suffered financially (i.e., coops B, C, and D) according to subsequent project papers for new loans. Whether in fact this meant residential users were subsidizing irrigation users depended on relative costs of distributing to different users, but evidence in DAI evaluation of NRECA seems to indicate that residential consumers were subsidizing irrigation users and the number of residential consumers was not sufficient to allow revenues to cover costs.

In contrast, according to the same DAI study of NRECA, rate policies and structure in Bolivia, despite higher rates for residential versus irrigation, usage was not viewed as an impediment to viability though the rate differential was not as pronounced as in Nicaragua. Residential rates were also relatively high in Ecuador compared to other production uses, but no linkage in the evaluation document was made with sub-borrowers' viability.

The later project papers for the Philippines also discussed the effect of rate policies in earlier loans to equity and viability factors. The project paper recommended that the rates had been too low and should be increased to facilitate sub-borrower viability. NEA was also experimenting with changes in rate structures away from declining block structures on equity grounds.

Local Participation In Cooperatives

The cooperatives have often been justified in terms of the development of democratic institutions and importance of local involvement. Most of the studies evaluated this aspect of the projects but also indicated that community participation was weakly developed. Ross' 1973 study indicated that in Costa Rica most people were unaware they were members of cooperatives. The DAI report on NRECA indicated that attendance at annual meetings for cooperative B in Nicaragua was low, particularly among rural residents, and that most people were not conscious of their cooperative membership.[1] This was related to lack of personnel and activities in supposed cooperative education and promotion divisions. Community participation in the CRE in Bolivia also tended to be concentrated among a select urban few according to the same DAI study. Evaluations of Philippine projects corroborate this view.

In contrast, the 1970 evaluation of the Ecuador subprojects in Santo Domingo and Daule indicated that while attendance at meetings was less then 20 percent of total membership, it was primarily the critics who came. The large absences, then, merely reflected general satisfaction. The same study, however, rated more highly the cooperative sub-borrowers over the non-cooperative borrowers in terms of communicating with local people. The Santa Elena Company was critized on this count.

1. Cooperative A was structured so as only elected delegates attended meetings and voted.

The Setting and Project Performance

Review of the local setting of a project in the pre-project phase is important in ascertaining the extent to which the local environment is likely to support or inhibit project execution and its results. Thus, during the project implementation phase it is also appropriate to examine to what extent the setting has affected project performance and effectiveness. The local environment is defined to include population and economic growth, supporting physical infrastructure, etc.

The growth and viability of two cooperatives -- CRE in Bolivia and Santo Domingo in Ecuador -- have been attributed in separate evaluation studies to rapid economic and population growth of the areas. Both areas were the focus of colonization projects which had attracted capital and other development resources. In contrast Daule, in Ecuador, continued to be economically stagnant because of its proximity to a major urban area and the outflow of resources from the area. Ultimately INECEL later took over the cooperative.

Linkages With Other Projects

Most pre-project documents include some discussion of the relationship between the proposed project and other local, national or AID programs or projects in the project area or country. The project implementation documents, therefore, should assess the extent to which such linkages did occur. However, direct discussion of the issue has generally been omitted in project implementation documents.

Indirectly, evaluations have acknowledged that some documented results like increases in output or income have occurred (i.e., 1970 evaluation of three sub-projects in Ecuador), but the specific contribution from the rural electrification project could not be isolated nor could the results be attributed to just one project.

How to handle these complementarities between rural electrification and other projects has become a major issue in impact measurement assessments. Most current efforts have struggled with identifying indicators which would reflect project induced impacts as opposed to other impacts. Yet most indicators which have been designed have failed in this respect.[1]

Alternatively, there should be some consideration of measuring combined effects of "sectoral" development recognizing rural electrification not as a sector but as an important input into that sector. At the project level it becomes less important to attempt, usually unsuccessfully, to trace the unnatural separation of "spillover" effects among diverse projects. It may be equally important to know whether or not the project has contributed to development or has not served as a constraint to development. Answers to these questions do not require the rigor or expensive analysis at the project level, a high proportion of which may fail. There are simply some issues that do not lend themselves to analysis at project level.

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1. See discussion in Guatemala country analysis.

Operations and Management Issues

Audit reports and other project implementation evaluative documents serve as the principal sources of information for this section. Generally each issue is discussed in a minority of such documents;therefore, the coverage is not sufficiently broad to generalize the experience among all the projects even in the case study analysis.

Adequacy of Inputs

Inadequate inputs can delay project construction and ultimately outreach and, if very serious, alter the project design. The 1977 audit of the second Bolivian loan provided some discussion of the adequacy or inadequacy of inputs. In this instance, the number of consultant personnel was inadequate and vehicles had not been provided. Both of these problems were contributing to project construction delays. On the other hand, audits in the Philippines and Costa Rica indicated no problems. Other inputs often mentioned as being inadequate and contributing to delays were poles, meters and financing after loan disbursements ceased.

Personnel and Hiring. The number and quality of personnel, particularly those in key positions, is certainly a factor in project performance and effectiveness. Numbers of employees were provided for sub-borrowers in Nicaragua, Bolivia and Ecuador, but this coverage is inadequate in determining ideal size for efficiency purposes, even relative to project area coverage, and persons to be reached. The 1970 Nixon evaluation of three sub-borrowers in Ecuador indicated that the non-cooperative had a substantially larger number of employees (43) compared to the Santo Domingo cooperative (13), even though the non-cooperative had only one generator operating full time, less kilometers of line and no responsibility for contracting. The principal explanation given was that the organization also served political patronage functions.

The Ross study (1973) and DAI evaluation of NRECA indicated that cooperative managers were general well educated and qualified. Most prior experience had been in the implementing agency.

Adequancy of Output

Generation capacity and the output of electricity affect the potential number of people that can be reached. Thus, it is important to know whether the number of people being reached is or is not constrained by generation capacity and output. The 1970 Nixon evaluation of the Ecuador projects examined this issue. It indicated that the Daule cooperative, which originally did not receive AID financing, was constantly obtaining loans from INECEL to expand its capacity and distribution lines to reach more rural people. Generation capacity was not viewed as a constraint on project outreach in the Philippine studies.

Construction Functions

Scheduling. If project construction is not completed in a timely manner, the outreach and impacts of projects are delayed and/or impaired. Audit reports highlight the extent to which project construction is being completed as planned. Of the projects covered -- the second and third Nicaragua loans, AID Colombia loan, several of the Philippine loans, Costa Rican and two Bolivia loans -- only the Bolivia Santa Cruz project was completed as scheduled. Construction on Phase I of the second Bolivia loan and the Colombia loan to SECA was completed 1-2 years late and even longer for the second phase. Substantial delays were also reported for the other projects.

Principal reasons given for such delays were a weakness among implementing agencies and sub-borrowers; delays in disbursement of funds until the implementing agency satisfied contract covenants; procurement and supplier problems (i.e., only 10 percent of poles to be delivered by Guatemalan supplies had been received and contract with new supplier had to be negotiated); changes in construction plans; delayed cooperative manager selection and contracting problems.

Contracting. Contracting discussions focused on the red tape involved and scope of contracts to be signed among the participating agencies and the extent to which they contributed to project execution delays. The evidence, however, varies depending on the relevant agencies and contractors involved. For example, contract negotiations and performance of local contractors were assessed to be good in Costa Rica but poor in the Philippines.

Management Functions

Cost and Budgeting. Adequate records are imperative for determining financial viability. Audit of the Nicaragua, Colombia, and Bolivia projects indicated there were accounting and recordkeeping problems mostly among the sub-borrowers but also among the implementing agency in the latter case. Additional training and/or technical assistance was usually recommended. Cost overruns were identified in the Philippine project and construction shortfalls in Costa Rica and Guatemala.

Monitoring and Evaluation. Unless the relevant agencies are maintaining records of number of consumers, volume of output, etc, it is virtually impossible to evaluate project effectiveness. Emphasis on monitoring and evaluating is relatively recent, however, and it is only the more recent projects that incorporated this into project design (i.e., Guatemala 1978 project and second Bolivia loan). Thus, no treatment of this issue was provided in any of the evaluative documents covering the project implementation phase.

Education and Membership Participation Promition. Because of the design and associated cost of most rural electrification projects, financial viability of sub-borrowers becomes a function of how many consumers it can reach. Particularly for cooperatives, but also for other sub-borrowers, the task of encouraging more consumer usage becomes important. However, despite the existence of separate membership promotion offices to handle such functions Ross' 1973 evaluation of Costa Rica and the DAI NRECA evaluation of Bolivia and Nicaragua indicate that there were virtually no personnel in these sections and, thus, many cooperative members were unaware of their membership. Since no evidence was provided in which strong promotional activities were being undertaken, it was impossible to evaluate the effectiveness of the function. That is, we could not examine whether promotional sales are an effective means of increasing membership or whether an income or other constraint is the more serious impediment to greater outreach.

Other relevant factors are growth potential of the area and existence of complementing developmental projects.

Training. All of the projects entail some institutional development for both implementing agencies and sub-borrowers, and training is the major vehicle for carrying this out. Most training for implementing agencies is provided by technical assistance from NRECA. The DAI evaluation of NRECA performance was disappointing in this respect, for it never really examined the effectiveness of NRECA's role in these projects. In fact, it was difficult to deduce the scope of NRECA's assistance in any of the projects because the CAPs barely mention what NRECA's role is to be.

The AIR Colombia project highlighted the importance of training, particularly at the local level, in organizational matters and maintenance and repair as essential components to the effectiveness of introducing some technological change (i.e., electricity) into a community.

Maintenance and Repair. Good maintenance and repair are essential for the provision of reliable service. The AIR Colombia project identified lack of training in maintenance and repair as the principal cause of outages for the small autogeneration system; personnel could not properly diagnose the causes of the problem. Mention of inadequate maintenance and repair functions was also made in the Philippines projects. No evaluation of this function was found for the other AID projects.

Project Outreach and Impacts

This section relates the output of electricity to its uses and users. A profile of the users by rural/urban;

income class; residential, productive, government; proportion of project area population; cooperative members versus consumers; actual versus projected consumer and previously versus newly electified are examined as far as the documentation sources permit. Impacts are then discussed in terms of the uses to which electricity has been put and the primary and secondary effects evolving from its use.

<u>Outreach</u>

Electricity is distributed by sub-borrowers to users in each sub-project. The exception is the Guatemala loans where the implementing agency is also responsible for distribution. One of the pertinent issues, therefore, is the extent of project outreach.

<u>Population Coverage in Project Area</u>. Although most design documents did not indicate how many of the projected population were to be reached, the proportion of the population in an area is a useful indicator of the extent of actual project outreach. Two documents covering cooperatives in three countries provided such analysis, but coverage of the issue is not sufficient to make broad generalizations.

The NEA survey of the Philippines indicated that 74 percent of the population in project areas were accessible to electricity; 53 percent of those accessible had adopted electricity from the cooperatives. Thus 39 percent of the population in the project area were being reached. This figure, however, is an average of all cooperatives in the nation, and no indication is given of the range. No analysis was provided for non-cooperative distribution entities to make comparisons.

The DAI evaluation of Nicaragua cooperatives indicated that only half of the population in an accessible area was getting electricity (based on viewing of lines to homes). The best coverage was in the Tisma cooperative A area (60 percent of potential consumers) but this was the oldest cooperative and it had the smallest project area. Cooperative B appeared to be reaching 33 to 50 percent of the potential consumers in its area and cooperative D, the largest area, was reaching 25 to 33 percent of potential consumers. Figures on the proportion of population with access to electricity before the project were not provided; therefore, we cannot evaluate the significance of this outreach further. Potential consumers was not defined; therefore, it cannot be determined whether they refer to the entire area's population or simply those with access to the distribution lines who did not decide to adopt the electricity.

The 1977 final evaluation of sub-projects in the third Ecuador loan indicated 1976 end of year coverages[1] ranging from 4.3 to 57 percent among the 11 sub-borrowers. The average for all the sub-borrowers was 29.3 percent, a 13 percent increase from 1972 when 18 percent of population in area were users. The two cooperatives had coverages of 29.5 percent (Santo Domingo) and 11.9 percent (Daule). These coverages were compared to 1972 coverages (14.9 percent and 7.5 percent respectively). The growth rates between 1972 and 1976 for all the sub-borrowers ranged from 6-19 percent with the Santo Domingo cooperative having the highest growth rate (18.6 percent).

1. Proportion of users to population in sub-project areas.

<u>Rural versus Urban Distribution of Users</u>. Since most of these projects are entitled "rural electrification," it is fitting to examine the extent to which the rural populace is being reached. Ironically, as a rural/urban distinction has not been generally made in most project designs (both Bolivia and Colombia loans were exceptions). No guidance for what proportion of projected consumers were intended to be rural was given. The cases which provided such information generally conclude that rural outreach is substantially less than urban by their own definitions of rural and urban. In the Bolivian case, the CRE cooperative began with only urban members but was projected to have 11,100 rural members and 13,000 urban members by 1974. According to the DAI evaluation of May 1976, there were 27,255 members compared to 24,200 projected for 1974. About 95 percent of the 27,255 were urban, and only 50 members were listed as farmers.

The Nixon evaluation of Ecuador distinguished rural/urban membership for the Santo Domingo cooperative. The cooperative began in 1964 with 374 urban members and no rural members. However, according to the loan documents, by 1973 it was to have had 2,000 urban members and 2,000 rural members. By January 1973 it had 3,069 members but no urban/rural breakdown was provided.

The SECA cooperative in Colombia was projected to have 6,700 urban household and 1,020 rural household members by the third year of energization. A Colombia audit indicated that by October 1969, one year after energization, there were 6,200 users but no rural/urban distinction was provided.

Rural members averaged only 35 percent of members among the Philippine cooperatives, according to the NEA survey.

Actual Outreach versus Projected. The loan documents for the third Ecuador loan projected the number of consumers by 1980. The final 1977 evaluation reported that three sub-borrowers (Santa Domingo cooperative, Milagro and El Oro) had exceeded membership projections for 1980 by 1976. An additional four had reached 100 percent of their 1980 projection by 1976.

The DAI evaluation compared outreach of the Nicaragua cooperatives in December 1975 with projections applicable to 1978 for cooperatives C and D and 1981 for coooperative E. Actual residential usage was 83 percent of projected residential usage. Actual commercial usage was 45 percent of projected commercial usage for cooperative C. Actual irrigation usage was 140 percent of projected usage for cooperative B. These were the highest percentages among the four cooperatives. No such comparison was possible for cooperative A because we did not have the CAP in which the projected outreach would have been presented.

Comparing the actual outreach with the projected can be complex since it does mask considerable growth of the cooperative. CRE in Bolivia took over the municipal system in 1970 with 9,500 consumers. At the end of the first year of operations there were 15,000 members and by the end of 1975 there were 26,000 members according to the DAI evaluation. The same DAI evaluation report did not provide a breakdown of rural/ urban users for Nicaragua possibly because such a distinction was not provided in the CAPs for comparison. Such omission is one disadvantage of goal attainment approaches.

Outreach by Income Classification. Particularly with the New Directions interest in AID, there is an emphasis or focus on rural poor participation in electrification projects. However, among the projects in this case study, income targeting is explicitly treated in only one project -- 1978 second Guatemala loan --as reflected in documents available to us.

Several evaluative documents reveal that users tend to be more economically sound than nonusers. The DAI evaluation of Nicaragua cooperatives estimated that median income of users (households) was $700 per month compared to $400 per month for nonusers. The Ross 1973 evaluation of Costa Rica also corroborates this hypothesis. However, the documents do not indicate whether the income of the electrified households falls within the poverty range. Finally, the Colombia AIR autogeneration project indicated that users were more affluent than nonusers. The NEA survey in the Philippines provided the best basis for this analysis. The results of the survey indicated that the average household income of users was ₱10,000 ($1,100) per year which, on a per capita basis, is consistent with the definition of the poor in the Philippines. However, the nonelectrified households had a significantly lower annual income of ₱3500 ($420). It appears that the cooperatives were reaching the poor but not the poorest.

The 1978 Guatemalan loan has specified that user/non-user income comparison be an indicator of its income and employment goal attainment. However, this hypothesis, even if true, does not necessarily imply that the project -- or the electricity made available through the project -- is responsible for the income distribution between user and non-user. Possibly, the same users were better off than the same non-users before the project. This is especially possible since many of the AID project users appear to have utilized electricity prior to the project. The issue then becomes whether or not the differences between the two groups have widened. Even if this is corroborated, the differences could be attributable to other factors -- such as access to credit, better political ties and job prospects, etc.) which may more significantly contribute to their higher economic status than availability of electricity. The mere differentiation of users from non-users by income, therefore, is not a good indicator of project goal achievement.

Income Impact. Limited productive usage also constrains income effects. No evaluative document has been able to prove a direct linkage between availability of electricity and increasing income, despite the prevalence of this impact in purpose statements. In the 1970 Nixon evaluation of three sub-project areas in Ecuador, people were asked if their income had increased because of the availability of electricity; 75-90 percent said "no." Those that said "yes" could not attribute all changes to just electricity, nor was the magnitude of the change indicated.

Some "evaluative documents" have erroneously interpreted income differences between users and non-users as an indication that the project contributed to higher incomes. This interpretation is not correct.

Newly Electrified Previously Electrified. One evaluative document examined the extent to which consumers had or had not previously received electricity. An audit report for the Philippines indicated that about half the consumers had electricity prior to the cooperative. The proportion of users who have previously had electricity is important since, in many respects, the cost is substantially higher than the other energy forms, possibly indicating higher income status prior to the project. Only the 1978 Guatemala loan provided such pre-project information which was then built into the intended outreach.

Inferences from other evaluative documents suggest that a large proportion of consumers had electricity prior to the project. This may be correlated with the relatively large urban representation among consumers and the fact that generation capacity in most projects was from systems located in urban areas.

Residential versus Production (Commercial Farm and Industrial) Usage Distribution of Outreach

The design of these projects highlighted residential usage as well as productive usage in terms of the number of consumers and share of sales. However, there has been considerable concern that even the projected productive usage has not been attained. Considering the interest in heightening the productive utilization of electricity in order to improve income and employment impacts, and it becomes fitting to examine the extent of productive usage.

The Colombian AIR project, the DAI evaluation of CRE in Bolivia, the three cooperatives in Nicaragua, and the Nixon evaluation of three sub-borrowers in Ecuador corroborate the relative absence of productive usage, principally among small and medium farms as compared to projections. In CRE, there were very few farmer members (50 out of 27,000). In Nicaragua, DAI found that no small and medium farmers used electricity for productive purposes, but no indication was provided of their proportion of cooperative membership. In contrast, irrigation use -- often confined to large farm -- was considerable and exceeded projections in some Nicaraguan cooperatives. The Colombia AIR project stressed that no productive use was made of autogenerated electricity even though there was a potential (assessed by them) in six of the 15 towns. Both the DAI evaluation of Nicaragua and the Nixon evaluation of Ecuador suggested that because many farmers and industries had their own generators prior to the formation of the cooperatives, they were using these relatively new items for productive power and using cooperative electricity for lighting in their homes. There was very little, if any, substitution of electricity for alternative energy study even though this was a basic assumption in many project designs. The Nixon evaluation of sub-projects in Ecuador was the only one to highlight considerable small commercial and industrial usage; this was attributable to rapid growth of tourism in the project areas. The principal users were small hotels, bars and restaurants which cater to tourists. In contrast, Nixon indicated that only three of 200 rice mills in the Daule area used the cooperative electricity and only because their own generator had worn out. The other rice mills were still dependent on autogeneration systems they purchased earlier. As these generators were eliminated, however, these users were expected to become more dependent on electricity. The 1977 final evaluation report for Ecuador was much more supportive of productive use especially for spray irrigation, shrimp-growing ponds and processing and packing, but extent of usage was not stated. In neither case, however, was there an attempt to attribute all this usage to the simple availability of electricity.

In contrast to the previously mentioned cases, James Ross, in his 1973 study of the Coopeloosa cooperative in Costa Rica, found that residential users accounted for 80 percent of consumers in 1971 (2-3 years after operations initiated) and consumed 26 percent of power sales. Secondary industry accounted for 50 percent of power sales but only two percent of customers.

The NEA survey in Philippines only considered residential usage.

In a survey of industrial and commercial users in Ecuador, persons were asked if they had started up new operations because of the availability of electricity. About 18-22 percent of those interviewed said yes. However, about 43-57 percent of those interviewed said they had expanded or improved their operations because of electricity. Only 9-30 percent said that their output or sales had increased and not all of this was to be attributable to electricity.

Members versus Users. In many instances a clear distinction is not made between members of cooperatives and actual consumers or users. The 1973 Ross evaluation of Santo Domingo sub-project in Ecuador and the quarterly reports in SECA in Colombia were the only evaluations which made this distinction clear. In Ecuador, of 963 members of cooperatives in October 1965, 631 were receiving electricity and 332 were waiting. It is also important to know how long persons were members before they started receiving electricity. Payment of membership fees without the receipt of electricity could deter many from joining. In SECA, only 48 percent of the users were members of the cooperative.

Agricultural or Food Production Impacts

Some agricultural usage, such as irrigation, was documented for several sub-projects in Nicaragua, Philippines, and Bolivia. However, the collected documents did not analyze the extent to which electricity led to increased agricultural or food output.

Employment Generation

Employment generation is dependent on the productive utilization of electricity to stimulate new economic activity or to expand existing activity. No concrete evidence in any evaluation (the issue only discussed in 3-DAI of Nicaragua and Ross and Nixon studies of Santo Domingo in Ecuador) indicated that any such direct effect has occurred. Where new activities have developed, and are thus providing employment (in Nicaragua and Ecuador), not all employment gain can be attributed to availability of electricity. In some instances expansion or development of one enterprise entails a decline in another. When productivity gains imply reduced labor requirements, there may not even be a net employment gain. No information has been provided on characteristics of new employees to determine if they were among the rural poor.

The DAI evaluation in Nicaragua indicated there was no evidence of small-scale or cottage-industry self-employment using electric equipment. No documents provided a discussion of employment effects from any expanded appliance purchases.

Public Usage

Government and public usage of electricity from these projects has been substantial in both Nicaragua and Ecuador but this has been a somewhat mixed blessing. In Ecuador the municipality, although a member of the cooperative, was refusing to pay for its usage, and in other instances the public sector was in arrears in its payments, creating a burden for other categories of users.

Household Usage

Households make up the vast majority of users. Electricity is most often used for lighting, and small appliances; it is a consumption good. This is corroborated in all of the evaluations.

Household usage may be constrained by income and ability of people to pay, particularly if the cost of electricity is substantially greater than other energy sources. When persons were asked in the Colombia AIR and Nicaragua projects why they did not obtain electricity, most listed cost as the number one factor. Cost includes installation and meter costs, as well as the monthly charges, membership fees of cooperatives and cost of bulbs and appliances. The DAI evaluation of Nicaragua suggested that the cost of electricity in the project area was comparable to electricity cost elsewhere in the country. On a individual level the more relevant comparison considers consumer incomes and relative price of energy sources. The only study that provided some baseline data is the village electricity utilization study in Guatemala which indicated that pre-project electricity costs (operating costs mostly) were greater than costs of alternative sources for all income groups. These costs do not include cost of appliances and bulbs nor installation costs; the differential is likely to be even greater than the numbers indicate. Non-users spent 8-11 percent of their income on energy fuel for lighting and radio batteries (nonelectric energy costs) compared to 8-13 percent of income by users for electricity.

Ross' study of Costa Rica also suggests that while electricity costs per se (installation and operation cost only) are less than alternate costs (wood and kerosene), consumers do not fully substitute electricity for the other sources. Therefore the total energy cost of electricity users was roughly 25 percent greater than energy costs of non-users.

A second reason given (DAI-Nicaragua) for why people in an area do not obtain electricity was that they did not know how to get it. This may, in fact, reflect the fact that electricity is a low priority item as well as that more sales promotion is required.

Meter versus Flat Rates and Costs

Metering, as opposed to flat rate charges, heighten the installation costs. The only study which examined this effect was the Ross evaluation of Santo Domingo cooperative in Ecuador. His calculations indicated that metering and its installation and deposit fee accounted for 25 percent of the total installation cost. Several documents indicated that credit was extended to consumers to offset the apparently costly burden of installation for many people.

AID Project Cost versus Other Distribution Entity Costs

AID rural electrification projects are supposedly targeted to rural areas, and they generally involve substantial investments in construction or improvement of generation, transmission and distribution systems. These characteristics may tend to imply higher costs per unit of power per consumer, especially to urban consumers than other distribution entity costs per unit of power despite inherent subsidies in the loans. In Bolivia, for example, costs through distribution by cooperative in Santa Cruz are higher than ELFEC cost per unit of power in Cochahamba. However, this may be a function of the heavier investment cost of the Santa Cruz system; if ELFEC were to distribute in Santa Cruz, it too might incur much higher costs per unit of power than in Cochabamba without the subsidy inherent in the loan. The distribution system in Cochabamba is part of a nationally-integrated system, and costs per unit of power for ELFEC are lower than for CRE with the isolated Santa Cruz system. In this respect ENDE may eventually be the major beneficiary when the Santa Cruz system is integrated into the national system but without bearing the capital and operating costs particularly during the early years when economic viability is hardest to attain.

Likewise, the AID evaluation of Nicaragua cooperatives indicates that cooperative costs per unit of power were higher than ENALUF's cost per unit of power in its nationally distributed system. However, ENALUF has a much higher urban concentration that the cooperatives, and economies of scale are likely to be easier to achieve in the ENALUF areas than the cooperative area. ENALUF costs per unit of power in the cooperative area would be higher than the cooperative costs per unit of power in the same area if there were no project and subsidy to ENALUF. The same would, of course, be true for the cooperatives.

Energy Losses

Most evaluative reports have not examined energy losses and very little can be said at this time about their relationship to costs. The average energy loss in the Ecuador Santo Domingo cooperative according to the Nixon evaluation was 20 percent, 14 percent in Daule which has a new system installed. Energy losses ranging from 10-25 percent were reported in the Philippines.

Duration of Service and Reliability of Service

One major assumption of these projects has been the desire (as opposed to need) for 24-hour service. Most of the sub-borrowers in these AID projects are providing 24-hour service; however, very little analysis has been provided about the reliability of this service. The DAI evaluation of Nicaragua indicated that large agricultural and industrial users thought diesel generation was more reliable, while electricity was more convenient and cheaper. There has been no substantiation or refutation of this claim in any of the other evaluation reports. The NEA survey in the Philippines is the only study of frequency and duration of outages. On the average, cooperatives had more outages per month outrages and lasted longer than noncooperatives.

Relative Consumer Costs and Subsidy Issue

The DAI evaluation of Nicaragua cooperatives suggests that residential consumers are subsidizing irrigation users because of inequitable rates between them. However, this factor must be examined in relation to costs of distribution to each group. In the Nicaragua evaluation it does appear that residences are substantially subsidizing irrigation costs. However, DAI found that no case for such a subsidy could be made for Bolivia, even though residential and commercial rates were higher than irrigation rates. However, urban consumers were subsidizing rural consumers in the Santa Cruz area. This factor no doubt caused the urban consumers to be reluctant to extend outreach farther into rural areas.

Financial Viability of Sub-borrowers

Information on financial viability of sub-borrowers was contained in most evaluation reports although the form of the information is not necessarily comparable. CRE in Bolivia, San Carlos in Costa Rica and Santo Domingo in Ecuador and about 60 percent of those in Philippines appeared to be viable. The Santa Elena Power Company in Ecuador was also viable. On the nonviable list were the cooperatives Daule in Ecuador and SECA in Colombia and two of the three cooperatives in Costa Rica. Daule and SECA have since been taken over by national power authorities as have all the cooperatives in Nicaragua. The principal problem in Nicaragua appeared to be the rate structure; cooperatives with large irrigation users were unable to cover costs of irrigation distribution, and they lacked sufficient residential customers to offset the deficits. The financial viability of the three sub-borrowers -- CRE, Santo Domingo and Santa Elena -- was attributed to the high growth and development characteristics of those areas. Other factors mentioned which contributed to poor financial status were high petroleum costs and overburdening transmission facility costs on the weak cooperatives.

Other Impacts

Health Impacts

There has been very little assessment of the health impact of electrification even to the point of merely indicating usage by health organizations. The Ross evaluation of Santo Domingo sub-project in Ecuador mentioned a hospital purchasing an x-ray machine and plans to purchase electric sterilizers. The DAI evaluation of Nicaraguan cooperatives stated that there were some rural benefits in larger towns, where hospitals, clinics, etc., were located. The NEA survey in the Philippines identified the clinics which were getting electricity but this in itself is not significant unless information is also provided on proportion of clinics which were reached, how electricity was utilized, proportion of clinics reached which had electricity prior to the projects, etc. None of these issues were discussed.

Family Planning Impact

The only projects for which family planning impacts were assessed were in the Philippines. The results were inconclusive because birth rates declined in some areas but not in others; these changes could not be attributed only to the availability of electricity.

Education Impact

Evidence of formal education impacts is also scanty. Ross indicated in his evaluation of Santo Domingo cooperative in Ecuador that a vocational school had used electricity powered tools. The DAI evaluation of Nicaragua cooperatives indicated that one school obtained electricity but it proved too expensive and thus the meter was removed. No discussions were provided of non-formal educational impacts, i.e., extent of home reading, etc. The treatment of educational impact was the same as health with similar shortcomings; failure to indicate proportion of schools reached, how many were previously electrified, number of students affected, literacy rate in area before and after project.

Environmental and Security Impact

Only one environmental impact assessment was made during project implementation among the projects in this case study. The Lucan environment impact study of the Philippines concluded that there was not much of a negative impact (in terms of vegetation destruction). He did not assess the existence of positive impacts such as changes in rate of forest depletion because of any changes in wood consumption. He did identify a potentially adverse impact of large industries moving into the project areas and polluting air and water; however, he did not think the cooperative areas would attract such industries.

Communications Impact

The Ross evaluation of Santo Domingo cooperative in Ecuador indicated that three radio stations had expanded their facilities and were broadcasting educational programs. More radio and TV purchases were documented in Costa Rica and the Philippines.

Infrastructure Impact

The Colombia AIR study indicated that no community infrastructure effects could be attributed to the projects except those directly related to the installation of the generators. No new water or sewage systems were installed, nor roads improved or streets paved.

Rural Urban Migration Impact

No evidence was provided in any evaluation of AID loans regarding extent to which electricity stemmed from or contributed to migration. However, the Colombia AIR project grant noted that the introduction of new technology can exacerbate class differences so that the users migrate to seek even better opportunities and the non-users migrate because of the heightened disillusionment. The 1969 audit of the SECA cooperative in Colombia noted that migration had been discouraged but no further evidence was provided.

Community Participation Effects

The treatment of community participation effects is scanty. The Colombian AIR study indicated that development committees were organized to facilitate the usage of the autogenerators and community participation was fostered. However, when the system broke down, long-standing community rivalries were exacerbated. The Ross evaluation of Santo Domingo cooperative indicated that five of 14 leaders in the cooperative subsequently assumed leadership roles in the community and were active in initiating and implementing social programs and other social activities.

Institutional Development of Sub-borrowers

The AID projects covered by this review include both cooperative and noncooperative sub-borrowers. The programmatic question arises as to whether any conclusions can be made with respect to which is the better organizational vehicle. The previous discussions should indicate that no conclusive evidence has been provided nor has the hypothesis been tested. However, two evaluative documents have raised the issue but both apply to the same country -- Nicaragua --which only has the cooperative form. The DAI evaluation argues that the cooperatives are such in name only; otherwise, they are organized and operated like private limited ownership corporations. They do little more than distribute electricity and probably at higher cost than ENALUF. In order to maintain viability the cooperatives are becoming more urban, thus reducing the likelihood of rural development impact. They are already subject to considerable ENALUF influence (by design the project calls for ENALUF to approve the cooperative mananger and set rate structures) and thus being taken over by ENALUF would not necessarily be "antidevelopment."

This example is not sufficient to decry all cooperatives forms since there are viable cooperatives with strong local participation and a continuing rural develpment focus (i.e., Santo Domingo in Ecuador). The evidence has not yet been presented regarding the experience of noncooperative sub-borrowers so no generalization in this regard can be made at this time.

AID IN RURAL ELECTRIFICATION PROJECTS IN BOLIVIA

Evolution of AID Rural Electrification Activities in Bolivia

AID has provided one grant and two loans for rural electrification in Bolivia. In 1962, USAID/Bolivia grant-funded three 500-KW generating units for the Santa Cruz area. In 1963, AID became interested in developing rural electric cooperatives in Bolivia but problems between the Cooperative Rural de Electrification (CRE) --the already established cooperative in Santa Cruz -- and the Bolivian government delayed any AID-funded projects from being established until 1966 when the Santa Cruz Electric Power loan was signed.

The 1966 project consisted of expanding existing generation capacity in Santa Cruz by constructing a thermo-electric plant, totally rebuilding the existing urban distribution installations, constructing a transmission line between Santa Cruz and Montero, and constructing rural distribution lines.

The Empresa Nacional de Electricidad (ENDE), an antonomous public corporation, was the borrower which would then sell electrical power to the CRE. The loan also included an allocation for NRECA to provide technical assistance to CRE in the management of the electrical distribution system.

In 1973, AID drafted two rural electrification loans. The first consisted of the construction of electrical transmission, distribution and connection facilities in rural areas adjacent to Cochabamba and Santa Cruz. The borrower was the Government of Bolivia with ENDE as implementing agent and CRE the sub-borrower for Santa Cruz, and Empresa de Luz y Fuerza Electrica Cochabamba, S.A. (ELFEC), the sub-borrower for Cochabamba. The second 1973 loan was to cover parts of the departments of La Paz, Sucre, Tariya and Potosi. Rural distribution lines were to be constructed and attendant installations and equipment were to be provided in each department. Like the first 1973 loan, ENDE was to be the implementing agent while a cooperative, CESSA, was to be the sub-borrower in Sucre. A government agency, INER, intended to be was responsible for distribution functions in La Paz and mixed corporations, SETAR and SEPSA, were to have distribution responsibility in Tarija and Potosi departments respectively.

Before disbursements were made in the first 1973 loan and before the second one was signed, cost overruns became apparent which was due primarily to the impact of oil prices on raw materials imported by Bolivia and a dispute between INER and the Bolivian Power Company (BPC) over which one should be responsible for the La Paz Project. Therefore, a new loan was drafted and signed in June, 1974 which served as a redesign and replacement for both of the 1973 loans. This loan covered the sub-regions of Santa Cruz, Cochabantez, La Paz, Sucre, Potosi, and Tarija. While the overall system capacity was reduced, the intention of reaching the same number of people as originally outlined in rural electrification loans I and II was maintained. The 1974 revised loan covered the construction of electric distribution facilities and construction of related transmission and substation facilities from non-AID funds.

In April of 1978, the La Paz area sub-project was again restructured with INER being replaced as sub-borrower by the newly-formed Cooperative Rural Electrification La Paz (CORELPAZ) and the then newly-formed Cooperative Electrica Yunga (CEY). The former serves the Altiplano areas of Lake Titicaca and Rio Abajo and the latter the Yungas area. This restructuring was apparently enacted due to the failure of INER to review accurately equipment requirements and to manage contract delivery of utility poles, line hardware and other construction materials. Though this restructing took place legally in early 1978, the transfer of sub-project property and records from INER to CORELPAZ and CEY had not taken place as of December 12, 1978 when authority of requested loan extensions was granted. Under the financial restructing of the loan, completion of the La Paz systems was set for the end of February 1980 with loan disbursement completed by the end of May 1980 -- a 15-month extension of the previously set terminal commitment and terminal disbursement dates.

The two AID loans were valued at $26.05 million. The $26.05 million loan represents 71 percent of total project costs of $36.94 million. Other funds have been provided for project feasibility studies but it was impossible to trace these funds since they often had separate work orders and grants to NRECA. The above loan amount represents 9 percent of AID loan assistance to Bolivia between 1962 and 1977 under the Foreign Assistant Act.

Documents Collected

Documents were assembled on AID activities in each of the three categories of project evaluation: pre-project need assessment, project design and feasibility and project implementation. Specifically, pre-project need was examined for the first loan in a report by an NRECA specialist which assessed whether the existing electric service system in the cooperative area, and it whether could control and operate an electric distribution system.

For project design and planning, we assembled two NRECA engineering and economic feasibility studies covering each of the proposed cooperative areas. We also assembled four Capital Assistance Papers, one for the Santa Cruz Electric Power Loan, and three for phases I and II or modifications of the 197374 rural electrification loans.

For the project implementation phase, we found several relevant documents. We reviewed two audit reports drafted in 1975 and 1977 covering administrative and management aspects of projects; a Development Alternatives, Inc. evaluation of NRECA program performance based on visits and discussions with officials of the CRE cooperative in Bolivia; and a Development Associates, Inc. project impact evaluation system designed in 1976 and used to gather baseline data for a future impact evaluation in the Sucre region. Bolivia had been selected for the RRNA case study analysis in the hope that the Development Associates, Inc. impact assessment for all the regions would be completed in time for inclusion in our study. We also reviewed a study by Checchi and Company which undertook an evaluation of the operations and management aspects of the second loan. One final source of information on project implementation is the recently drafted project identification document rural energy program in Bolivia to be funded partially with AID funds.

The following is a list of each document and sources.

Documents	Sources
NRECA Cooperative Planning Report by Paul Richter, 1965	AID Reference Center
NRECA Feasibility Studies (Phases I and II) 1972-1973	AID Reference Center and Central Engineering files of Fred Lowell
CAPs - For both loans, 1966 1973(2) and revised 1974	Central Engineering/ Fred Lowell's files
Development Alternative, Inc. Evaluation of NRECA, 1977	DAI & DIS
Development Associates, Inc. Evaluation System, 1976-77	LA/DP
CESSA - ACLO	USAID Bolivia
Checci and Company, Rural Electrification Evaluation, 1978	Checci's Company
Project Information Document, 1978	AID Bolivia Desk Officer
Project Information Summary, June, 1979	LAC/DP

The profile of AID activities in rural electrification in Bolivia is based on a review of these documents utilizing the conceptual framework. This documentation, however, was inadequate for making conclusions regarding the effectiveness of the projects. We have, however, attempted to assess the extent to which these documents can contribute to the evaluation of these programs as well as to identify what additional steps are required if such an assessment is to be made.

Profile of AID Rural Electrification Projects in Bolivia

Purpose statements in the CAPs* for the Bolivian loans highlight the functional characteristics of the projects to provide generation, transmission and distribution facilities and services. In the CAP for the Santa Cruz project, the purpose is identified as "to provide facilities for generation, transmission and distribution of electricity to Santa Cruz area including the rebuilding of existing distribution installations in the city of Santa Cruz."[1]

The purpose of the second rural electrification loan was "to improve the economic and rural conditions of the inhabitants of rural areas adjacent to major population centers by providing electricity, transmission, distribution and connection services on a self-supporting basis." Additional "objectives" are "to provide a backbone distribution system capable of future expansion; enable urban oriented entities to expand to rural areas; acquire added technical capability and financial resources necessary for future expansion, promote economic development of rural areas by providing energy for agriculture through irrigation and agro-industrial uses; and to improve the quality of rural life."[2]

The purpose statement for the Santa Cruz project is written in such a way that mere completion of the construction facilities in the Santa Cruz area is sufficient for project success using the goal-attainment approach. No indication is provided as to how the electricity is to be

1. CAP; page ii.
2. CAP, Rural Electrification II, October 17, 1973, page i.

used nor by whom as long as users live in Santa Cruz area. This latter point is redundant since users can only get access if they live in the area. Goal attainment approaches, therefore, would not be adequate for ascertaining the broad range of impacts such a project would have.

The purpose statement also indicates a considerable urban emphasis, which, from all indications in subsequent documents, appears to have been the case. The purpose statement is, therefore, somewhat inconsistent with the same CAP's description of the project as "the first rural electrification project in Bolivia."[1]

The purpose statements of the subsequent loans provide a greater indication of the uses to be made of the electricity to be derived from the facilities and services constructed as well as to indicate the ultimate goal of improving the economic and social conditions. Goal achievement, however, requires other conditions and activities which go beyond this project design although the purpose statement does not make this clear. In addition, the purpose statement does not indicate the number of intended users which it can serve as a useful yardstick for evaluating project outreach.

Project Structures and Designs

The major participating agencies are ENDE, and the sub-borrowers -- the four cooperatives, CRE, CESSA CEY and CORELPAS -- and four mixed or public corporations (EFFEC, SEPSA, SETAR, INER). Organizationally, there is a clear distinction between the borrowers and sub-borrowers. ENDE has responsibility for the generation capacity and construction of distribution lines and other physical infrastructure

1. CAP, 1966, page ii.

while the sub-borrowers serve as an intermediaries between ENDE and the ultimate customers or consumers. This intermediary position is not clearly defined in the project design and planning documentation. Much of the project focused on the development of the implementing agency, ENDE; therefore, development of the sub-borrowers was relegated to a secondary status and evolves generally to the extent the implementing agency is capable and committed to promoting cooperative activities. Thus, unless the sub-borrowers, especially cooperatives, are already well established, viable and properly functioning entities at the time the project begins, their ability to carry out the functions and roles of the project is inhibited. Their weakness relative to ENDE is also not necessarily supportive of a close collaborative working relationship with ENDE.

Although technical assistance is to be provided by NRECA to the cooperatives, the assigning of NRECA staff to ENDE reduces its effectiveness vis-a-vis the cooperatives since their members may view NRECA as more interested in furthering ENDE control than assisting them.

Inputs

The project loans provide funds to cover construction materials and consultants for technical assistance. Engineering services were provided by Stanley-Consa Edesa to all sub-borrowers except INER in the La Paz area where COBEE (a Bolivian firm) was responsible for construction. Technical assistance was being provided by NRECA to the two cooperatives and three of the other sub-borrowers (SEPSA, SETAR and INER) and Coopers Lybrand to ELFEC.

Outputs and Its Users and Uses

The CAPs indicate the intended amount of electricity to be sold to consumers is to be 44 million KWH by 1975 for the Santa Cruz system. This document indicates that electricity will be used for household needs, industrial activity, agro-industrial activities and irrigation but it does not specify the distribution of electricity among these uses. Although intended consumers are differentiated between urban and rural -- 78,500 urban persons connected by 1974 compared to 76,035 rural persons in the same year -- these numbers are not disaggregated by type -- residential, industrial, etc. The pre-project urban/rural distribution was 32,000 and 0 in 1964 respectively. No profile of persons connected or not connected in 1964 is provided in order to serve as benchmark data for future project analysis.

For phases I and II of the second loan, differentiation is made among the categories of users; residential, general, large industrial, special and street lighting in urban areas for rural -- residential -- commercial, general, irrigation and street lighting and four categories projected to the year 1986. The following summarizes this distribution by 1986.

Location	Number of Consumers	Total Consumption (MWH)
Urban:		
Residential	50,423	58,491
General	12,528	47,970
Large industrial	67	71,891
Special contracts	N/A	21,700
Street lighting	N/A	8,100
Total urban		208,152
Rural:		
Residential - commercial	17,861	11,145
General	185	7,228
Irrigation	N/A	7,200
Street lighting	N/A	560
Total rural		20,242
Grand Total		228,394

N/A = not applicable

These figures raise the critical issue of whether either the Santa Cruz Electric Power Project or the subsequent loans are appropriately entitled "rural electrification." In each instance, the rural distribution is a function of urban-based centrally organized generation units.

An evaluation of the "trickle out" approach in the context of Bolivia thus appreantly shows that if centrally organized systems are used, there will be a substantial lag in reaching rural areas. No alternative, more directly focused approaches appeared to have been considered.

Issues Analysis

Santa Cruz Electric Power Project

Pre-Project Need Assessment

Among the documents collected, none was found with an expressed purpose ascertaining the extent to which a need for rural electrification existed. However, the 1966 CAP indicated that regional development of the Santa Cruz area in the 1960s, stimulated by completion of a road from Cochabamba and the development of petroleum and natural gas industries in the area, led to concern among the Government of Bolivia and local citizens that municipal services including electricity supply were not keeping pace with the rapid growth.

In 1962 USAID grant-funded three 500-KW generating units and in 1963 an emergency loan from Inter-American Development Bank (IDB) was provided to Santa Cruz and other areas to reduce an apparent electricity scarcity identified by the International Engineering Company. In 1963 AID, IDB and World Bank met with officials of Government of Bolivia to discuss joint financing of an overall power development program. IDB and World Bank interests centered primarily on construction of several hydroelectric plants and AID interests focused on capacity generation and distribution in the four isolated areas of Santa Cruz, Tarija, Sucre and Potosi.

The Santa Cruz Setting

Some information on the demographic and socioeconomic characteristics of the Santa Cruz area prior to the first loan was provided in the 1966 CAP. The department of Santa Cruz covers one-third of the area of Bolivia (144,000 square miles) and the city of Santa Cruz is the agricultural center. In 1965 the population of the department was estimated to be 4.1 million, and the city had an estimated population of 75,000. The area within a 62-mile radius of the city was well populated and included several colonies, some of which were established as the major road was completed and others through a governmental policy of inducing non-Bolivians into the area. Thus Santa Cruz was already the most rapidly growing area in the country and most of this growth was in the rural colonized areas. Within the planned project area, the Malaria Control Center estimated that there were 36,339 families (or 164,000 people) of which 43 percent (15,450 families) were urban and 57 percent (20,889 families) were rural.

Because of suitable soils, the area was also the target for other programs and projects to expand agricultural production. Adequate electrical facilities were viewed as a catalyst for increasing agricultural production such as developing food processing plants which afforded backward-and-forward development linkages. To date, Santa Cruz has had the highest rate of production growth and per capita income of the market-oriented population has been well above the national average.

Existing electric power service was described as "inadequate and unreliable" in the 1966 CAP.[1] The city system had a dependable installed electrical capacity of 2,050 KW and there were plans to increase output capacity by an additional 1,000 KW by the end 1966. Average energy loss was estimated at 45 percent due to inadequate distribution facilities; and it was concluded that this inadequate generating capacity and antiquated distribution system were retarding economic development. Smaller towns in the area had diesel electric units of less than 100 KW each which provided lighting for a few hours a day.

The demand for electric power was estimated by profiling existing large users and their average KW usage. Although, it was noted that most businesses had their own diesel-powered generating units, it was assumed that they would convert to public power when it became available.[2] Use of electricity was also thought to be constrained by the progressive rate schedule and higher rates charged to commercial users than residential users.

The Deutsches Projekt Union (DPU) conducted a census of the potential electrical power market. Residential use and "data for a town sector similar to rural settlements was used for determining basic values for the rural areas."[3] The census concluded that there were 54,000 potential consumers in the city of which 59 percent (32,000) had some electrical service, however inadequate. About 22,000 potential consumers in the city and 35,000 potential consumers in the rural areas were without any service whatsoever. There

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1. 1966 CAP, page 15.
2. 1966 CAP, page 18.
3. Paul Richter report, page 20.

was no further identification of potential consumers (i.e., by income class).

From this information, forecasts for electricity demand of 8,000 KW by 1970 and 19,000 KW by 1976 were made. No analysis of the relative costs of electricity to consumers as compared to other energy forms or of the existence of income or similar constraints, particularly in rural areas, was presented. It was assumed that electricity would be used for consumption and productive purposes and no attempt was made to examine the proportions of these usages.

The CRE was organized with NRECA assistance in November 1962 and legally recognized in February 1964, that is, prior to the AID loan. After USAID became interested in rural electric cooperatives, in 1966, an NRECA specialist selected the Santa Cruz area for promoting the further development of CRE. According to the Paul Richter NRECA report, the co-operative had 5,566 members in June 1965 but only 163 were paid in full. All of the members were urban and most (76 percent) resided in the city of Santa Cruz.

Project Design and Feasibility

According to the 1966 CAP, AID was interested in the success of both ENDE and the electric cooperative, CRE, but there were differences between the two in how they foresaw their responsibilities. The cooperative wanted to generate and distribute power, whereas ENDE wanted to provide the generated power and use the cooperative as the distribution agency. The issue was resolved with ENDE maintaining re-sponsibility for generation with the provision that CRE would own the distribution system once it was constructed.

It was also indicated that the success of the cooperative would allow ENDE to withdraw ultimately from distribution responsibilities.

Final design for the system was to be performed by a U.S. engineering firm with the design in the feasibility study reviewed to insure it was the best solution for the area. A further provison was that the system would take "full advantage of U.S. practices and equipment capabilities".[1] Copies of neither the earlier DPU-feasibility study nor documentation for the subsequent review were available, and hence we could not examine the extent to which these issues as well as alternate systems designs were considered.

The DPU-feasibility study had concluded that the existing rate structure was not consistent with project efforts to expand usage and therefore proposed a revised schedule. The proposed schedule included higher rates in rural than urban areas, consistent with the higher costs of distribution from central station grids to these areas. ENDE accepted the level of rates but not the specific schedule. A simpler schedule was to be developed.

<u>Project Implementation</u>

No formal evaluation of the Santa Cruz project was undertaken prior to the second rural electrification loan. The CAP for the 1973 rural electrification loan stated that the construction work was accomplished on schedule and with no difficulties. The system was energized in 1970, and because of efficiencies in the project there were sufficient

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1. 1966 CAP, page 8.

funds to add another 3,300 KW generating unit. CRE membership expanded from the 5,566 consumers prior to the loan to 18,000 in 1973. The project report however included no discussion of the urban/rural, residential/productive characteristics of these users. The project was deemed to be a success in terms of the completion of contruction as specified in the project purpose statement. A 1968 audit of the project covered only the construction phase and corroborates the earlier finding that the project was well managed and was functioning smoothly. There was some concern regarding adequacy of water and gas supplies but these were apparently resolved.

Second Rural Electrification Project (Phases I and II)

Pre-project Need Assessment

No documents ascertaining the extent to which there was a need for rural electrification and for this project were obtained. The 1973 CAP indicates that justification for the loan was based partly on an apparently persistent shortage of delivered energy in Bolivia, the apparent success of the first loan, and an increasing demand for electrical services. It was also anticipated that this loan would complement other AID activities in rural and agricultural development.

Project Design and Feasibility

Prior to loan approval by AID, NRECA undertook an engineering and economic feasibility study of three of the six sub-project areas -- Santa Cruz, Cochabamba and La Paz.

The engineering and technical aspects of the proposed subprojects followed standard Rural Electrification Administration practices and covered required inputs and costs, etc. Environmental effects were mentioned but not analyzed in depth. The basic conclusion regarding anticipated environmental impacts was that adverse effects would be minimal and the anticipated economic and social benefits outweighed any such effects. Meters were to be used because of the ease of disconnecting for nonpayment, weatherproofing design, and easy installation. These advantages were thought to outweigh any initial cost burdens to consumers (although no evidence was provided that such costs had been estimated).

Finally, the system capacity was based on the number of projected consumers and their total estimated usage the tenth year, the general REA practice. This estimation was made despite the recognition that the Cochabama area already had excess capacity and needed new markets.

With system capacity a function of projected consumption, the significance of determining potential demand was important. Reference in the report was made to a power market survey in the Santa Cruz area undertaken by CRE in 1971 but no copy or further information on it was available. The NRECA report did indicate that industrial consumption increased at an annual rate of 33.4 percent between 1965 and 1969 -- a period of electricity shortage (before CRE project energized). Between 1969 and 1971 industrial consumption increased at a rate of 234 percent, and a growth rate of 230 percent was expected for the period between 1972 and 1975. Hence projected growth was 388 percent for period 1975-1985.[1] In addition, a list of large industries and their

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1. When operations anticipated to begin.

current usage was provided. No projections were provided for residential customers or other sub-project areas.

The feasibility study also proposed new rate schedules and set out rate criteria necessary to insure financial viability of sub-borrowers. The minimum monthly bill of $1.00 was also derived but not compared to income of residential customers.

Socioeconomic analysis was based on a cursory profile of three sub-project areas (Santa Cruz, Cochabamba and La Paz) prepared by James Ross in 1972.

Although the NRECA feasibility study did not contain any cost/benefit analysis, such analysis was provided in the CAPs. The estimated benefit cost/ratio was 1.85 for the aggregate of all six sub-projects and was based on the World Bank, Martin Selowsky model. Rural potential customers were classified into six groups each of which currently had some access to electricity -- two residential, two industrial and two irrigated farm -- and substitution of electric power for present energy sources was assumed. It was also assumed that rural residents were currently spending $7.50 a year for lighting (kerosene lamps) equivalent to 12 KWH. Projected electricity costs reduction for same amount of usage would range from 8 to 62 percent. The greatest cost reductions were for industry and farm groups now using self-generated systems, who would convert to central station electricity. The smallest cost reduction was for residential/commercial groups who now use only kerosene and who would convert to electricity.

According to the CAPS, the main beneficiary of the CRE and ELFEC sub-projects was intended to be the lesser privileged rural occupants and initially it was assumed that power would supply two 60-watt light bulbs drawing 18 KWH per month.

Baseline Evaluation Data

The DAI-designed methodology for collecting baseline data to be used ultimately for impact assessment appears to have been applied to only one of the six sub-projects, the socioeconomic evaluation of the Sucre district by CESSA in 1977-78. This study divided the region into three types of settlement as determined by size, and surveyed through the use of the DAI-developed questionnaire the social, occupational, and economic characteristics of the residents. It also surveyed their daily and special uses of light fuels and electricity. The respondents, some of whom expected to join the cooperative and others of whom did not, were asked such questions as how such money they spent on lighting, the number of sockets their residences had, and their specific uses of electricity. Unfortunately, information on the income levels of the respondents was not obtained hindering future efforts to determine how large a part of residential expenditure electrification might become and to what extent income might constrain electricity use.

Similar questionnaires were prepared for respondents from the agricultural, commercial and manufacturing sectors of the region. These questionnaires sought to determine whether electricity was being used, employment levels, duration of the economic entity's existence as well as several other factors. The findings for both the residential and business questionnaires are presented in a series of tables which comprise the bulk of the report. The research group also included and lower quality socioeconomic data derived from previous CESSA studies, regional development commissions and the Bolivian Highway Department.

The study recommends that the socioeconomic level of the residents of the region under consideration can best be improved through the application of rural electrification to small-scale agro-industrial production especially in zones less suited for agriculture and to some commercial projects where the potential for increased marketing is high.

This statement assumes that increased productive usage would increase employment and the standard of living, a hypothesis yet to be tested. If such social research is to be a valid means toward development, it must more clearly define the most important factors affecting peoples lives such as income levels, employment, availability of potable water, which most clearly address preproject needs. This document raises some issues but it only partially fulfills the need for socioeconomic baseline data. The study does not mention what the country's electrification program goals actually are or attempt to compare the Bolivian experience to rural electrification experiences in other countries.

Project Implementation

Policy Issues. The DAI evaluation was the only source of information on policy issues and the only sub-policy issue reviewed was rate structure. The rate structure for CRE - the only sub-borrower DAI reviewed - contained lower rates for irrigation than for residential, industrial and commercial usage. CRE had demand energy rates for industries and flat rates for other users. DAI did not believe that this rate structure impaired cooperative viability, as was the case in Nicaragua, possibly because the differences among the rates among the users were not as large as in the Nicaraguan cooperatives.

DAI also indicated that the setting (high growth rate) was particularly important for the growth of the cooperative because improved city infrastructure, including electricity, was highly supportive of government-development interests in the area.

Operations and Management Issues. Construction under Phase I of the second loan was somewhat behind schedule, according to a 1975 audit report, because of a delay by the Government of Bolivia in getting additional funds, changes and delays in construction plans, and slowness in getting contractors and a project manager. However, working relations among all the parties was considered to be good.

The Checchi and Company study of 1978 includes the most thorough analysis of the operations and management problems involved in the implementation of the CRE project. According to this study, the first of several delays which plagued the project concerned the project office building. Initial delays in the construction and the subsequent cost overruns caused the plan for the building to be abandoned, and its funding was shifted to other areas of the project.

The most serious problem of the entire program, however, concerned the supply of poles to support the transmission wires. This problem could be traced directly to the failure of the retained engineering firm Stanley-CONSA EDESA to obtain correct expert analysis as to the availability of hardwood trees. Subsequent attempts to substitute cement poles for wood poles when it was realized that there would be a drastic shortage of the latter met with only partial success. Delays attributable to the delivery of poles occurred from 1975 through May 1978 when production from two cement pole plants -- one was Peruvian owned -- managed to be brought up to the levels required.

The switch from wood to cement poles caused delays in the procurement of the hardware associated with the poles because new items had to be designed and contracted for. It is reported that due to the pole problem, hardware contractors demanded additional payments and that there were substantial delays in the delivery of power transformers and substation material. It is also reported that several changes in the transmission routing were required due to the very high growth rate of the Santa Cruz urban area which forced housing into rural areas where electric lines had originally been planned. This caused problems with property rights and the siting of new roadways, problems which took time to resolve. As of September 1978, it was believed that the poles would finally be set by January 31, 1979 and preliminary acceptance of the project by CRE would occur on April 30, 1979 (a 26-month delay from the date projected in the 1974 CAP). Further unexpected delays caused by bad weather made the work slow, as reported in an action memorandum drafted to the Assistant Administrator (LAC) from Marshall D. Brown (June 1979) who recommended an 8-month extension on the original 1973 CRE loan.

The Checchi study thus provides a detailed documentation of the construction aspects of project implementation in the Santa Cruz case. The document also clearly traces the legal status, organizational and staff history of CRE, favorably commenting on the administration and management of the cooperative. An Exhibit (V.1) shows the growth of CRE, as well as the growth of four of the other six sub-borrowers over the period 1967 through 1977. Another exhibit (V.2) shows selected statistics of generation and sales for these companies during 1979.

Less emphasis is placed in the report on policy factors and the important topics of rate policies and impacts and local participation in policy determination appear to be given little treatment. The cooperative organizational program was virtually nonexistent which DAI thought impeded project outreach.

Outreach and Impact. DAI estimated that despite the number of consumers in the CRE cooperative (27,200) there were still 50,000-60,000 people in the area with no electricity in 1977. About 23,000 of the CRE members were urban residents of the city of Santa Cruz. Most of the others were members of five smaller towns. Therefore, there was a real question as to whether the cooperative was in fact rural. Even by 1985 it was expected that there would be three times as many urban as rural members.

Despite the limited rural expansion the cooperative had grown rapidly in the urban area partly due to growth of the city itself.

Most of CRE's consumers were residential -- 82 percent at the time of the DAI visit. Commercial establishments comprised the second highest group, or 14 percent of number of consumers. Large and small industries were third. A similar distribution applies to proportion of energy consumed and of total revenues.

The financial viability of CRE appeared to be good for profits had attained or exceeded the 9 percent limit set by DINE each year. The healthy margin was attributed to the fact that the CRE rates were the highest in Bolivia. No comparisons between CRE and the other sub-borrowers of the second loan could be made since the other sub-borrowers were not reviewed.

Recommendations

Bolivia offers some of the most promise for ultimately determining project effectiveness. However, in order to determine the effectiveness of the second Bolivian loan, considerable evaluative information is still required for all the sub-borrowers, including CRE. The evaluations provide information for still too few relevant issues.

It is recommended that the Bolivian sub-projects be included in any inter-country project comparisons for testing broader hypotheses regarding AID rural electrification project effectiveness. This can only be done if evaluations of the project cover the full range of issues relevant in this conceptual framework. DAI designed an evaluation system for the second Bolivian loan which was to have provided baseline information for follow-up studies. This evaluation system was used in the CESSA 1978 which provided the first baseline data on rural socioeconomic conditions prior to electrification projects. Further information should be obtained on the status of any other applications of this system as they occur. If no further baseline data are collected using this or an alternate design, then the opportunity for assessing project effectiveness will be lost. It is also important that follow-ups analyses are rationally persued or close the benefit of the evaluation system development and the CESSA study will be lost.

AID IN RURAL ELECTRIFICATION PROJECTS IN COLOMBIA

AID has provided one rural electrification loan and undertaken two grant-funded rural electrification studies in Colombia. The loan was approved in May 1964 and consisted of the construction of distribution lines, plants and buildings for rural electric cooperatives in three areas -- Sevilla - Caicedonia (SECA), Palermo and Tibu-- provision of technical assistance by NRECA and consumer credit to cooperatives. The total estimated project cost was $1.3 million with the AID loan in the amount of $1 million. The borrower of the loan was the Instituto de Aprovechamiento de Aguas y Fomento Electrico (Electraguas), a nationwide power authority charged with the responsibilty of bringing power to parts of Colombia not served by other suppliers. Electraguas on-lent funds to the regional power authorities, Corporation Autonoma Regional Del Cauca (CVC) for SECA and Centrales (an affiliate of Electragruas), for the other two project areas. Construction of the distribution systems was the responsibility of CVC and Centrales who then loaned funds and supplied the power to the cooperatives. Electraguas also contracted with NRECA to provide a rural electrification specialist to supervise and advise on matters concerning the cooperatives up to one year after the establishment of the cooperatives. Lines, once energized, were to become the property of the cooperatives.

According to a 1969 AID audit report, construction was completed for all three cooperative areas by that date, but only the SECA cooperative had been established. No reason was given for the failure to establish the other two.

The first AID-granted study was conducted through the period of 1965-68 by American Institutes of Research. The Phase I effort was to plan the scope of research, including the collection of data and selection of sites, etc. Peace Corps volunteers were solicited to assist in data collection efforts. The purpose of Phase II was to determine the social, economic and psychological impacts of the introduction and use of electricity generators in small rural villages and to delineate the factors which influence their impacts. The focus of the research changed from observation of the socioeconomic effects deriving from the simple introduction of these small electrical generators to the experimental determination of particular motivational, organizational and educational factors which could lead to effective local development when generators were made available.

In 1973, a second AID grant was provided to Dr. James Ross of the University of Florida to evaluate the effects of rural electrification on economic and social change in Costa Rica and Colombia. The area studied in Colombia was near the commercial center of Cali, selected for its comparability to the Costa Rican areas. However, despite baseline data already collected by Dr. Ross for the three cooperative areas financed in the AID loan, the study focused on the state-owned (CVC) electric distribution system of Colombia. It then contrasted the educational, employment, income and other socioeconomic characteristics of persons who had adopted or used electricity with those who chose not to use the system and those who were inaccessible to the system. Although primary emphasis was on the CVC system in Cali, a cursory attempt was made to document some effects of rural electrification through the cooperative distribution system in Sevilla-Caicedonia, the AID-financed project. Project implementation information covered the financial viability of the cooperative as determined in 1972, urban/rural distribution of cooperative members, comparison of proposed retail rates with actual rates, and a brief discussion of non-residential electricity use. However, only 20 of the original 50 households surveyed in 1965 were located, and only half (10) were the persons interviewed eight years earlier. The sample was considerably too small to yield any generalized results.

Colombia was selected for inclusion in this case study analysis because it was hoped that the two evaluation studies -- one by the American Institute for Research (AIR) between 1965 and 1968 and one by James Ross in 1973 with baseline data collected in 1965 -- would provide substantial evaluative information. However, the failure of either of the two project implementation studies to relate to the experience of the AID rural electrification project meant that there was virtually no information on the AID project after the loan was approved and no basis from existing documentation to determine project effectiveness.[1]

Given the existing documentation, there is only sufficient information to summarize one of the three subprojects of the AID loans -- SECA.

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1. In early September 1979 we reviewed quarterly progress reports written by NRECA advisers covering the period 1966-1969 for the SECA cooperative. This information has been integrated into this chapter.

Documentation Collected

The following documents and their sources were assembled for the Colombia case study analysis:

Pre-Project Need Assessment	Source
1. Preliminary Report of Field Survey Teams on the Generation and Utilization of Power in Rural Areas of Developing Countries, by General Electric Company, September 1962.	AID Reference Center
2. Field Survey Report -- Colombia-Peru-Chile by General Electric Company, March 1963.	AID Reference Center

Project Design and Feasibility	Source
3. Investigation and Organization of Two Pilot Demonstration Electric Cooperatives -- San Francisco and Sevilla -- by Louis Strong for NRECA, April 1963.	NRECA
4. Engineering and Economic Feasibility Study, Palermo, March 1963.	AID Reference Center
5. Minutes of Executive Committee on Capital Development, September 1963	Retired Files
6. Memorandum for the Executive Com mittee Development re: Colombia Rural Loan Application September 16, 1963	Retired Files

Pre-Project Baseline Data for Future Evaluation	Source
7. Cooperative Rural Electrification--Engineering: Its Implications for International Development, by James Ross, April 1966.	Files of Fred Lowell, retired engineer

Project Implementation		Source
8.	AID Audit, July 1969	AID Auditor General Office
9.	AID-Supported Rural Electric and Agricultural Cooperatives in Ecuador, Colombia...etc; August-September 1971 by Gordon Roth	AID Reference Center
10.	NRECA quarterly reports on SECA, 1966-1969	AID Retired Files

The first two documents do not relate to the AID project *per se*, even to the extent that the AID project areas are not covered in the field surveys. However, they do offer insights into the status of existing rural electrification efforts and raise some critical questions about the ultimate design of rural electrification projects in Colombia. There is no evidence that either of these documents was reviewed as part of the survey undertaken by NRECA prior to the AID loan.

The third item is really a pre-feasibility report in which NRECA assisted in organizing the AID-financed cooperative (SECA) before the AID loan was approved or implemented. It was felt that the prior existence of the cooperative before the loan was approved would be necessary for AID loan justification.

The fourth document is a feasibility study for a second cooperative in Palermo. Unfortunately, we have no information on why the cooperative was never organized or, if organized, why it failed. The sixth and seventh documents provide insights into some of the issues considered by AID before approving the loan.

The seventh document is a profile of the Sevilla-Caicedonia, Palermo and Tibu project areas before the loan was approved. Although excellent baseline data are provided, no broad follow up studies of any prominence were undertaken; thus, the significance of these characteristics on project effectiveness were never assessed. Neither the AID audit nor the Roth report provides much insight into project effectiveness issues.

Sevilla-Caicedonia Sub-Project Structure

Goals and Purposes

In the absence of a CAP, it was not possible to determine the intended goals and purposes of the AID rural electrification loan. However, Ross' 1973 evaluation report indicates that on the basis of the feasibility study --which also was not available -- the cooperative was developed "to electrify a region of intensive farming of coffee, bananas, oranges, yucca and related products" and to serve the needs of its consumers through "a self-help project." This suggests a significant production as well as residential use orientation.

Intended Inputs, Outputs Users and Types of Users

Intended inputs and outputs (the amount of electricity to be provided) cannot be determined from existing documentation. However, according to the 1966 James Ross study, it was envisioned at the time of the field survey (1965) that within three years after energization, cooperative membership would be 9,000 -- 1,700 rural and 7,300 urban. No reason was given for this distribution. It appears there was an assumption that all members would be users.

Despite the apparent production emphasis in the goal and purpose statements, James Ross's pre-electrification survey found that all 50 respondents surveyed emphasized residential over productive usage. Lighting, was their first choice and appliance usage -- i.e., radios, televisions, washing machines, refrigerators and pressure for water -- were intended uses of electricity. However, this emphasis is partly a function of the residential bias in the questionnaire. On-farm use was also centered on residential as opposed to productive use. As exceptions three persons intended to purchase motors; but only one for dispulping coffee, and the other two for radios. Other productive uses mentioned were related to sugarcane operations.

Issues Analysis

Pre-project Need Assessment -- The Setting

Area and Population. Information for this section was provided in the 1966 Ross study. The project area is 287 square miles with about 70 percent of the area in Sevilla and the rest in Caicedonia. Population in 1964 was 44,395 in the Sevilla municipio and 28,117 in Caicedonia municipio. The rural population accounted for about 40 percent of the population of each area.

Production and Income. Because of favorable soil and climate conditions, agriculture and particularly coffee production were the major economic activities. Other principal crops were corn, sugarcane, plantain, and yucca.

Livestock was also important. Roughly 50 percent of farms were 5-20 hectares; 3-4 percent were over 100 hectares and 25-30 percent were 1-5 hectares. Most farms were owner-operated, and agricultural laborers made up the majority of the population. The average wage was $1.75 a day with about 240 days worked a year for an annual income of $420. Since the majority of laborers did not work every day, a more likely annual income estimate was $350.

Availability of Electricity. There was very little electrification on farms before the AID cooperative was established. Only one farmer in Sevilla used electric energy; 10 in Caicedonia were users. Sevilla was served by a municipally-owned hydroelectric plant with 450 capacity and a diesel generator of 720 KW. However, in 1963 CVC extended its transmission lines to Sevilla so the city supplemented the locally-produced energy with power from the CVC grid. CVC power was used during the day; locally produced energy was the source at night. However, the Sevilla system was quite antiquated and a safety hazard, which caused several fires each year.

Caicedonia originally used energy from two diesel generators owned by CVC until a new system was installed in 1964. Almost all electricity was used for lights, radios and television. There was very little productive use.

Fuel Costs. Among the fuel prices, oil was the most expensive in both areas, then kerosene in Sevilla and diesel in Caicedonia.

Transportation. The principal road system in the area was the Pan American Highway which passed through both Sevilla and Caicedonia.

Politics. Rural areas of Sevilla and Caicedonia had been distinguished by considerable violence and unrest for many years. Initially the violence was a reflection of political struggle between conservatives and liberals but a political coalition ultimately was established, and banditry took over partly as a function of the low level of living. The army had suppressed violence but there was still social unrest. The 1966 Ross study indicated that politics may therefore have been a principal factor in locating the cooperative in this region.

Project Design and Feasibility. Louis Strong of NRECA examined in 1963 the feasibility of starting a cooperative. However, most of Strong's report focused on the organizational steps required to establish a cooperative rather than an analysis of the technical and economic feasibility. Strong substantiated a need for a project based on a fairly large concentration of potential users (total population) and currently high cost of electricity with poor quality service. He did not indicate how the electricity cost compared with other energy costs in relation to incomes. Since farm costs would be higher than city costs, a composite rate for town and farm users was recommended in order to reduce the burden on rural consumers. Without the CAP, the feasibility criteria for the subproject could not be ascertained.

The two AID memoranda during its consideration of the loan indicated that the following principal issues were considered -- local contributions, organization of the cooperatives, priority of rural electrification in Colombia, precedent for such a project, and ultimate impacts on rural communities. One spillover effect of the loan was to "force the Colombians to think more positively about rate structures within the country."[1] The substance and views expressed any of these issues were not revealed in the documents.

According to the September 16, 1963 AID memorandum, the rate structure for electric power in Colombia was theoretically tied to cost. However, in setting rates economic needs, sound conditions and other factors were to be considered. No further information was provided on the rate structure and its relationships to project viability.

The 1966 Ross study, excerpting material from the loan application, did indicate that the AID project design, based on standard REA specifications, would imply financial viability for the cooperatives for the first year. Ross also derived an estimated net present value of the increase in value of output of 4.4 assuming (1) consumers utilized the energy as they stated they would in the survey; (2) the discount rate was 14 percent; and (3) the projected life of the loan was 35 years and original investment was C$1.00. The cost of C$1.00 invested in rural electrification represents the value of goods and services which might have been used for alternative purposes, i.e., opportunity cost.

<u>Project Implementation</u>. Information on the project implementation phase was brief. No evidence of a formal evaluation was identified in the search. The SECA cooperative was legally established[2] in December 1964, seven months after the loan was approved. Opposition to dissolving the old municipal system, a requirement of the loan, delayed the

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1. Minutes of the Executive Committee on Capital Development, September 23, 1963, pg. 2).
2. Organization occurred prior to the loan.

financing and construction which was completed in 1969. An audit report in 1969 suggested that the AID project in Sevilla and Caicedonia had modernized old distribution lines in urban areas leading to more equitable rates among the majority of users (7,000). The project expanded electrification to rural zones (25 miles of transmission line and 187 miles of distribution line) and contributed to development of existing communities (not specified further). Emigration from project areas was said to have been discouraged although no supporting evidence was provided.

The last of the NRECA quarterly reports covering the period from July through September, 1969 summarized the status of SECA at that time. A new coop mananger had been selected and appeared to be capable. He was working well with the Board of Directors and had been an active participant in meetings. The cooperative headquarters were moved to Sevilla and several key personnel had been hired - an electrification specialist to supervise the wiring program, and a bookkeeper assistant.

Energy sales were running five percent higher than expected and revenues were six percent higher. As of August 31, 1969 there were 6,182 consumers (of which only 48 percent were cooperative members).

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1. Minutes of the Executive Committee on Capital Development, September 23, 1963, pg. 2.
2. Organization occurred prior to the loan.

The following table summarizes consumer classification, sales and revenues.

Classification	No. of Consumers	January 1 - August 31, 1969 KWH	PESOS
Industrial	23	78,924	35,206.41
Commercial	1,076	1,162,819	445,137.78
Residential	4,800	2,033,529	765,754.76
Rural	171	42,076	16,517.85
Official Entities	48	262,642	73,982.20
Public Lighting	4	218,820	63,020.62
Others	-	-	2,608.20
TOTALS	6,182	3,798,810	1,402,227.82

Although no cooperative was established in either Tibu or Palermo by June 1969, there were 180 electricity users in Tibu and 2,250 in Palermo according to the audit report. The Tibu and Palmero installations were larger than planned due to other financing. No indication was given of users as a proportion of the population in the region nor was any profile of users provided in terms of their income, previous experience with electricity, rural/urban distribution or range of uses.

James Ross, in his 1973 study, devoted about 10 pages to a discussion of SECA. He attempted to evaluate the effects of the cooperative on the area since the cooperative had been founded. The aim was to compare the post-project and pre-project status.

The first 3 1/2 pages reviewed the history of the cooperative. The principal source of Ross' discussion of the project implementation phase was a 1972 study undertaken by CVC.[1]

1. CVC, "Situation Actual y Restructuration Futura de al Cooperatives Sevill-Caicedonia." This document was not available to RRNA.

Policy Issues. The proposed retail rates in the feasibility study (1.7 cents per kwh for city residences and 1.9 cents per kwh for rural residences) were lower than the actual rates. By February 1973 the rates were 2.7 cents per kwh and 3 cents per kwh respectively in constant 1964 dollars. However, the exchange rate had increased over 50 percent so that the rates in 1973 dollars were about 1.5 cents per kwh -- less than the original rates. The rates for industrial usage were less than residential and commercial. As the following section explains, the resulting rate structure appeared to have contributed to financial viability problems for SECA.

Operations and Management. The CVC report placed heavy emphasis on the questionable financial viability of SECA which was attributed to poor management and changes in the exchange rate. The cooperative had been unable to make loan payments on schedule which was attributed to the hiring of too many employees (number not specified) and their distribution between Sevilla and Caicedonia; inappropriate accounting procedures; increasing line losses; and the policy of the cooperative sale of electrical appliances. The exchange rate increase between 1964 and 1973 meant the cooperative had to repay CVC 150 percent of the equivalent Colombia pesos it had borrowed to build the system. CVC recommended that it (CVC) get more involved directly in management of the cooperative; the cooperative should contract with private firms for lengthy secondary extensions; and the appliance section, tying up capital in inventories, should be eliminated. It is not known whether any of these recommendations were implemented.

Effectiveness Rural/Urban Outreach. Membership in the cooperative was projected to total 9,000 -- 1,700 rural and

7,300 urban -- by the third year of energization. Actu energization occurred one year late in 1969; thus the syst had been operating about three years when the 1972 Ros survey was undertaken. The Ross survey indicated tha membership was 8,000 -- 5,000 original cooperative members and 3,000 who became members when the cooperative took over the private system in Sevilla. About two/thirds of the members were urban and one third rural, somewhat less than the projected breakdown.

Residential vs. Productive Consumers. Between 1964 and 1971, residential consumers increased substantially due to the extension of distribution to the Sevilla municipality in 1969. However, the number of commercial and industrial users was limited; the number of commercial users declined by one half, and industrial users increased from 24 in 1969 to only 36 in 1971. In contrast the number of residential consumers had increased five or six-fold.

Productive Uses. Two industries had been surveyed to assess usage. One of the five sugar factories served by the cooperative had maintained its own hydroelectric power plant prior to the AID project. When the cooperative electricity was made available, the sugar factory used the cooperative electricity for its cane chopper and lighting for the owner's residence, but the owner retained a large water wheel to operate the extractor. However, the Ross study did not reveal to what extent the cooperative electricity was being substituted for the hydroelectric plant. It could be that the plant simply did not have enough power for the cane chopper and other operations so that cooperative electricity supplemented, rather than substituted, the original power source.

The second sugar factory had a diesel motor to operate its extractor (it was not near water power) but the owner complained of the high cost of electricity, especially the demand charge when the plant was idle. The plant only operated about eight months a year.

Intended vs. Actual Uses. Only 20 of the original 50 households surveyed regarding their intended use of electricity were located in 1973. Only half (10) of these could be re-interviewed. About 50 percent of those interviewed had used cooperative electricity for less than two years and another 20 percent were not using it. The follow-up survey indicated that intended uses of small appliances and electric motors had exceeded actual usage; intended and actual purchases of lights and large appliances (TVs and refrigerators) were about the same; and intended purchases of blenders, record players, heaters and office equipment exceeded actual purchases. In 1965, 20 respondents indicated they would purchase 18 electric motors for dispulping coffee and cutting sugar cane. Actually only two had made such purchases. Thus, productive use was not as great as anticipated.

AIR Study Pre-project Need Justification

As a research rather than an operational project, the needs for the project centered on attempting to identify impacts and to determine their explanatory factors based on the introduction of small electric generators in small communities. An anthropologist had conducted a pre-project feasibility study, but no separate economic or engineering assessment had been made. Such assessments were deemed unnecessary since the results were intended to determine the social and economic feasibility of introducing small-scale generator systems into areas isolated from centralized grid systems.

Data were collected on organizational, motivational and economic resources and potential of the rural towns in which the generators were installed. Thus information was collected on production, consumption, time use, skills, attitudes, and consumer preferences, as well as other factors bearing on economic and educational practices related to electrical power use.

The aggregate population of all the towns or villages was 6,100. The smallest village had 166 persons or 28 households and the largest had 1,300 persons or 209 households. Family sizes ranged from 4.85-7.72 persons among the towns. Educational levels were low; 95 percent of the people in each village had less than six years of formal education and 56 percent had none. Agriculture was the principal economic activity and centered mostly on crop production -- yucca, banana, tomatoes, corn, coffee, sugar cane, and potato. Fish, tobacco and milk production also existed in a few areas. Agricultural activity was low with little potential for expansion, often because of the remoteness of area.

About 52 percent of the total number of households in all the villages already used electricity derived from small generators of 5-20 kilowatts. There was wide variation among the towns; in one, only 12 percent of the population had electricity, while in three or four, 94 percent had electricity. The former figure reflects the use of electricity for one school and teachers' homes.

Electricity was used for lighting and, in a few instances, for flat ironing. The existing electricity appeared to have had little economic impact on the towns since they had similar economic and social characteristics despite different levels of electric usage among them.

Project Design and Feasibility

Originally, the project simply entailed the installment of 15 generators, one in each town. AID distributed the generators, street lights, fixtures and wires to each town. Electrificadoras in each department installed the equipment in return for titles to generators and supplies. The townspeople took responsibility for administering and operating the system, i.e., hiring, paying and supervising operations, collecting fees, and buying fuel with the Electrificadoras providing training. The populace was also to pay for installing the wire, meters and approving monthly rates. USAID enlisted Peace Corps volunteers who carried out two surveys, one in early 1965 to get baseline data and a second in 1966 to identify impacts.

Evaluation of Project Effectiveness

Project effectiveness was discussed on the basis of a comparison of responses among non-users and users to questions regarding the economic and social impacts of the electrical generators. A set of hypotheses had been drafted which were tested on the basis of the results of the surveys. These hypotheses focused on the expected rate of electrical use, determinants of use-perceived benefits and ability to pay, and spillover effects on social organization in the towns, changes in attitudes, etc.

Results

There appeared to be little change in the duration of service with the introduction of the generators. Electricity was available about four hours a day, between 6 and 10 P.M. About the same number of households used electricity after the generators were installed as did before -- 53 percent compared to 52 percent before the project. By town; the range of subscribers as a percent of the town population varied from 24-91 percent. No electricity was used for productive purposes; that is, no existing economic enterprise used it during the two-year period, and no new enterprises used it. Individual farmers or businesses could not afford to pay the total cost of a generator required for productive purposes. In almost all towns, there were administrative and mechanical problems with the generator systems so that the generators worked only about 50-60 percent of the time. In four of the fourteen towns, generators did not function most of the time after service began; however, in four other towns, they worked at least 90 percent of the time. Finally, the financial viability of the systems was precarious in almost all instances. If all consumers paid on time, costs would have been covered in only three towns. The average size of deficits was 136 pesos per month. Costs to subscribers averaged 10 pesos per month (equivalent to a full day's wage). Cost per generator ranged from 180-775 pesos per month with higher figures attributed to frequency of breakdowns and type and efficiency of oil usage.

A variety of reasons was provided to explain constraints on the availability of electricity. When the generators failed, the citizens lacked funds to repair them and sometimes felt it was not their responsibility. They were unable to undertake the repairs, primarily because training provided by the Electrificadoras had been poor. The citizens often could not even correctly diagnose the problem. The costs of the light bulb was also high in relation to family income (one bulb cost a full day's wage). After several outages led to the bulbs being burned out, the people decided they could not afford to replace them and lost interest in whether the generators worked or not. Some townspeople felt since they did not own the generator they were not responsible for maintenance.

Profile of Users and Non-users Over the Project Period

Users were generally more affluent than non-users, a distinction that remained virtually consistent before and after the project was implemented. This was associated with the lack of any economic use of the electricity and the higher initial socioeconomic status of users relative to non-users. Non-users continued to identify cost as a barrier to participation.

In towns where there were numerous problems with the generators, class distinctions between users and non-users seemed higher. Users did not want to subsidize poor persons who had access but could not afford to pay; long standing rivalries were exacerbated in some instances. However, where the system operated more smoothly, there was some evidence of more social interaction, and more recreational activities became available. In both instances new social organizations developed. The only infrastructure changes were those directly involving the electrical system.

Migration from the area seemed to be stimulated for both users and non-users although the total change could not necessarily be attributed to electrification. Both users and non-users sought economic advancement opportunities, which they viewed as requiring emigration from the area but for different reasons. The non-users, being poor, wanted to leave out of disenchantment; the users wanted better opportunities.

Conclusions

The designers of the project realized that insufficient attention had been paid to facilitating the economic use of the electricity. In fact, personnel of Electrificadoras had pointed out that the site selection criteria should have emphasized areas of agricultural and economic potential. Unfortunately, selecting sites which were not planned for inclusion in the national grid system, implied that sites with some of the least potential were chosen.

To correct this error, market demand surveys were undertaken. It was determined that in six of the towns generators could potentially contribute to development with minor additions of capital inputs ($2,000-3,000 total capital investment required). No such potentials, however, were ever realized because the generators, without regard to economic potential, did not directly or indirectly contribute to improving the economic condition of the towns.

The study provided a definite indication of the need for a training component and an organizational structure for even the introduction of a relatively simple technology. Without these supporting characteristics, the mere introduction of technology is inadequate for yielding positive social and development changes. These elements were also criteria for the economic and financial viability of the technology to make it affordable for a large group of low income users. However, the nature of the technology did seem to be consistent with the grass-roots efforts to link community and economic development. The more directly focused the training and management functions at the community level are, the more likely the public is to sense a personal commitment to follow through and the less destructive the lack of cooperation or absence of inputs from other entities such as Electraguas. It was concluded that projects designed to include the above recommendations were possible and positive impacts achieveable.

Finally, while the intended results were not necessarily achieved in this project, the critical constraints appeared to be characteristics of the setting and inappropriate project design rather than a failure of the technology *per se*. The most general conclusion was that electricity in and of itself is a necessary, but not sufficient, input to economic and social development. Therefore, it is to be viewed as part of a broader organizational and substantive system.

Recommendations

Since CVC has now taken over the SECA cooperative -- the other two were never established -- and the project has already expired with no plans to revive it, there does not appear to be any opportunity or rationale for attempting to improve the information base necessary to ascertain further the project effectiveness. Therefore, no further action is recommended.

The AID loan was a discrete project which ceased over 10 years ago. There is no possibility of following up this activity after so long a period has lapsed.

AID RURAL ELECTRIFICATION PROJECTS IN COSTA RICA

Evolution of AID Rural Electrification Activities

Between January 26 and March 8, 1963, two NRECA representatives, accompanied by the director of AID's International Cooperative Development Staff, undertook Survey Trip A, visiting "those countries in Latin America which appeared to have a more immediate need for technical assistance in rural electrification, as indicated by the USAID Missions" ([11],[1] p. iii). These included Brazil, Uruguay, Argentina, Chile, Peru, Bolivia, Colombia, Panama, Costa Rica, and Nicaragua. This preliminary trip was designed to establish contacts among various potentially interested parties.

In Costa Rica, these included members of the USAID Mission, the U.S. Ambassador, representatives of the Costa Rican Instituto Costarricense de Electricidad (ICE), the National Bank, and various agricultural and dairy cooperatives.

In November 1964 a feasibility study, based on a project to establish three rural cooperatives in the regions of Guanacaste, San Carlos and San Marcos, was submitted to USAID by NRECA. This was followed by a Capital Assistance Paper in June 1965, signature of the loan in October and

1. Number refers to references listed on pages CR-2 to CR-3.

energization of the three cooperatives between June 1968 and June 1969.

There have been no further AID rural electrification loans in Costa Rica. It is believed that there are currently five functioning rural electric cooperatives in Costa Rica, one predating the AID loan and a fifth having been funded by the Inter-American Development Bank (IDB). The bulk of subsequent rural electrification development in Costa Rica, which has been considerable, has been implemented directly by ICE.

Documents Assembled and Sources

Fourteen documents relating to AID Loan No. 515L015, Rural Electrification, were assembled. They include one NRECA multicountry survey, the NRECA engineering and economic feasibility study, the Capital Assistance Paper, and eleven assorted "evaluative" documents ranging widely in coverage and depth. These are listed as follows:

Source	Costa Rica Bibliography
ARC 1.	Ellis, Clyde T., and James Ross, "Latin America Rural Electrification Survey Trip 'A'," NRECA, 1963.
ARC 2.	Benjamin, Glen R. (NRECA), Phase III Report, Engineering Economic Feasibility Study of Three Pilot Electric Cooperatives - Guanacaste, Tres Amigos, and Los Santos, Costa Rica, Central America, November 11, 1964.

CE/L 3. Capital Assistance Paper, Costa Rica: Rural Electrification Loan, AID-DLC/P-339, June 14, 1965.

ARC 4. Moon, Gilbert F., (NRECA), "The First Three Rural Electric Cooperatives in Cost Rica," final report, October 20, 1969.

ARC 5. Summary - "Capital Projects Effectiveness Evaluation - Past Evaluation of Completed Capital Projects, Electric Power Project - Three Rural Electric Cooperatives in Costa Rica," September 8, 1971.

ARC 6. Roth, Gordon, "AID-Supported Rural Electric and Agricultural Cooperatives in Ecuador, Colombia, Costa Rica, Nicaragua, Honduras and Guatemala," Cooperative Development Service, AID, February 8, 1972.

NRECA 7. Ellis, Clyde T., "Impact and Needs of the Rural Electric Cooperatives in Latin America," Report to NRECA and AID, October 29, 1971.

GWU/Lib. 8. Ross, James E. Cooperative Rural Electrification: Case Studies of Pilot Projects in Latin America, Praeger/NRECA, 1972.

ARC 9. Davis et. al., Rural Electrification: An Evaluation of Effects on Economic and Social Changes in Costa Rica and Colombia, University of Florida, August 31, 1973.

NRECA 10. Lay, James D., "Evaluation Report of Coopelesca R.L.," NRECA, 1976.

NRECA 11. Hood, Joan, H. "Rural Electrification Visit to Costa Rica," NRECA, December 1977.

NRECA 12. Hood, Joan H., "Evaluation Pertaining to Customer Use and Understanding - Coopelesca, R.L.," Costa Rica, NRECA, July 1978.

NRECA 13. Lay, James D. and Joan H. Hood, Evaluation Report: Rural Electric Cooperative of Guanacoste, R.L. and Rural Electric Cooperative of San Carlos, R.L., NRECA, October 1978.

NRECA 14. ----------. Evaluation Report: Rural Electric Cooperative of Los Santos, R.L., NRECA, November 1978.

Profile of AID Projects

Goals and Purposes

The CAP states, "The Costa Rican Country Assistance Plan (FY 65) includes a project in Rural Electrification which addresses itself to the general goal of accelerated rural development." ([3], page 1). The purpose of the loan is "To provide facilities for the distribution of electricity by member-owned cooperatives for domestic, agricultural, commercial and industrial uses, and to provide transmission of power to the cooperative organized in the Tres Amigos area." ([3], page i).

Structure of Projects

The borrower for this loan was the National Bank of Costa Rica (BNCR). Since 1948, the Department of Cooperatives of that bank had been charged by law with promoting, financing and providing technical assistance to the cooperative movement in Costa Rica. At the end of September 1964, this department was providing such assistance to 79 cooperatives, including agricultural marketing, savings and loan, one electric cooperative, and others. ([3], page 7).

Power was to be distributed in all three cooperative areas by member-owned cooperatives, with generation and transmission undertaken by the ICE.

Inputs

Inputs included an AID loan of US $3,256,000 (to cover $2,288,000 in foreign exchange costs and $968,000 in local costs) plus a contribution by the Borrower equivalent to $818,000. Terms of the loan were: 40 years including 10-years grace period, 1 percent interest during the grace period, and 2 1/2 percent thereafter. The borrower was to provide sub-loans to the cooperatives on the same terms provided by AID.

The loan would finance construction of 502 miles of primary distribution lines, 18 miles of transmission lines, two substations, related equipment and buildings.

The loan also covered the cost of house wiring, a meter, a cutoff switch, three drop lights, and three outlets for each domestic consumer, all to be the property of the respective cooperatives ([2], page 2).

Technical assistance would be provided by the BNCR, ICE and NRECA.

Outputs, Users, Uses

The Capital Assistance Paper [3] contains no detailed information on the planned distribution of power among users or uses. It contains only financial projections for the three cooperatives, a detailed itemization of project hardware inputs, a project cost summary, an engineering and construction schedule, and a brief description of the project areas specifying population, number of homes, and type of existing and potential manufacturing and processing activities in each.

This information is contained in the feasibility study, however, ([2], Annex U, pages 1-6) and is reproduced below for years 1 and 10 of operation.

We find that at year 10 the Guanacaste Cooperative's sales were projected to be 75.5 percent residential and 19 percent industrial; the San Carlos Cooperative, 41 percent residential, 57 percent industrial; and the San Marcos Cooperative, 57 percent residential, and 38 percent industrial.

In Guanacaste few industrial users were planned for year 1. By year 10, however, it was projected that five saw mills, one feed mill, five mechanics shops, six ice plants, one crop drier, 15 irrigation pumps, two rice mills, and one municipal water system would be connected. The largest users, in descending order, were expected to be the irrigation pumps, the ice plants and the saw mills.

In San Carlos, by year 10, 12 saw mills, 25 cane presses, four sugar mills, three coffee processors, four rice mills, two rock crushers, one starch plant, two mechanics shops, one milk plant, 62 dairies, one wood box factory, one crop drier, one feed mill and one concrete block factory were to be connected. About 89 percent of their combined consumption was expected to be consumed by the four largest user classes -- the sugar mills, the dairies, the saw mills, and the coffee processors.

Table CR-1. Projections of Connections and Consumption, Years 1 and 10.

	Guanacaste Yr. 1	Guanacaste Yr. 10	"Tres Amigos" (San Carlos) Yr. 1	"Tres Amigos" (San Carlos) Yr. 10	"Los Santos" (San Marcos) Yr. 1	"Los Santos" (San Marcos) Yr. 10
Residential and Small Commercial Consumers	3,094	4,534	2,286	3,834	4,407	5,767
Average Annual Consumption (MWH)	480	900	960	1,800	720	1,200
Annual Residential and Small Commercial Sales (MWH)	1,485	4,081	2,195	6,901	3,174	6,920
Street Lighting (MWH)	190	295	285	441	380	589
Industrial (MWH)	39	1,029	4,037	9,588	1,984	4,527
Total Annual Sales (MWH)	1,714	5,405	6,517	16,930	5,538	12,036

In San Marcos, it was expected that 11 coffee processors, one rope factory, three saw mills, two dairies, three mechanics shops, two cane presses, two ice plants, and one feed mill would be connected by year 10.

The rope factory was expected to account for 53 percent of industrial sales in year 1, and 47 percent in year 10. The coffee mills would account for 39 percent and 45 percent of sales, in those respective years.

Projects Analysis

The first evaluative document reviewed is an end-of-tour report [4] prepared in October 1969 by Mr. Gilbert F. Moon, Rural Electrification Specialist for NRECA and consultant to BNCR.

This report notes problems relating to the assurance of continuing technical assistance and continuing long-range financing to the cooperatives. "One cannot expect BNCR," it notes ([4], page 4), "to provide all of the technical assistance since their Cooperative Department has very little knowledge and even less interest in electric utility operations. From the inception of the program, BNCR has looked upon the project as a banking transaction only...."

Although data on the progress of connections and construction of the three cooperative systems are presented, they are of little relevance because of their very short periods of operation at the time the report was written.

A number of implementation problems are described: One revolved around the issue of local participation in materials supply. Apparently, Costa Rican concrete pole manufacturers were interested in bidding on the project, only to learn upon purchase of the bid books that the materials specifications limited the offer to wood poles. "Fortunately," Mr. Moon writes ([4], page 21), "ICE had prepared a study in 1964 on the economics of wood vs. concrete poles which was based on prices submitted by the concrete interests and which clearly showed a cost advantage."

One wonders whether that economic study shadow-priced the value of foreign exchange or whether the indirect multiplier and employment benefits of supporting the development of local supply sources were incorporated. Mr. Moon concludes that, "the controversy points up the necessity for extreme care when design criteria are being selected which preclude local participation".

Unfamiliarity with the complex and time-consuming Costa Rican procedures for the evaluation of bids occasioned "another major surprise." In Costa Rica, this was "a procedure which takes ninety days if there are not complications." ([4], page 22).

A local construction contractor submitted the low bid, and, although this was done with trepidation due to the inexperience of the firm in building distribution systems, it was awarded the contract. The report notes, "In spite of nine months of rain during the construction program, unbelievably complicated communications and transportation problems, material shortages which were not the responsibility of the contractor, inexperience of the cooperatives, ICE, and BNCR in contractor relationships and delays in payment. EDICA LTDA. accepted an eighteen month obligation and finished within the terms and conditions of the contract. It was an admirable achievement for the record." ([4], page 25).

The only remaining major problem noted by Mr. Moon had to do with delays in project implementation due to AID regulations and inadequacies among the USAID staff.

The following citations are from page 30 of his report.

> Early in the development of this project in Costa Rica, it became evident that no one in AID/Costa Rica had any familiarity with rural electric cooperatives and was lacking in familiarity with AID Capital Project Development procedures. Since neither the Loan Agreement nor the Implementation Letters made reference to particular AID regulation, and particular requirements were not brought to the attention of the borrower, the NRECA specialist, Mr. Moon, was forced to rely on past experience and copied Rural Electrification Administration procedures. At the time of presentation, these procedures were fully accepted by the then employed AID/Costa Rica staff. Upon replacement of many of the AID staff during the fall of 1967, the same procedures became a source of major controversy.
>
> For example, the construction contract was fully approved by AID/Costa Rica and then, after this change in personnel, it was classified to be in violation of alleged AID policy and AID refused to make payments under this contract.

Other examples of bureaucratic problems are cited. In early 1968, the project was subjected to further delays as a consequence of staff changes including the director, assistant director, loan officer, controller, program officer, and engineer. Mr. Moon continues,

> Since the new staff, like the old, was unfamiliar with the United States Rural Electrification Program, it was difficult to establish full communications in project conferences. For example, it was most difficult to establish "the scope of the project," "working capital,""dollar vs colon budgets," and "local contributions required".

Reference [5], the summary of a Capital Project Effectiveness Evaluation conducted in late 1971, has the following things to say:

> There has been no power use program, membership cultivation, community cultivation, director training or any of the essentials to successful rural electric cooperative existence and growth.
>
> This is reflected in members energy consumption being lower than forecast...
>
> It is also reflected in the general absence of new industrial loads.
>
> As an institution the cooperatives will gradually drift into being subsidiary of or a part of ICE. ([5], p. 7)

Conclusions speak of the need for continuing technical assistance, new capital infusions and improvement of AID and Mission records on the system.

> The feasibility study ([5], p. 9) was wholly inadequate in economic and financial aspects and its projection of achievements were out overblown misleading and inadequate. ([5], p. 9)

The Roth report [6] (February, 1972) answers the criticisms of the previous evaluation [5] in terms of inadequate member education and power use promotion, too little time having elapsed, and inadequate power supply. It states that several cooperative managers informed him that the demands of the new members were taxing the existing power capacity. ([6], CR-p. 2).

He answers criticisms regarding the solvency of the cooperatives in the following manner:

> Assuming even the worst, that the electric coops are so under financed and poorly managed that they may go under. At least this becomes a democratic tragedy. Nobody, rich or poor, is deprived the use of bankrupt electricity -- if it's any different than solvent electricity -- because nobody will have the temerity to turn off the electric power for the poor people just because the company is broke. ([6], p. 3)

With respect to household consumption, he states:

> So far the change has been more in the state of mind than in the use of household appliances. (ibid).

With respect to productive uses, the study contradicts the finding of the AID/W evaluation [5], stating that new saw mills, carpentry shops, welding shops, bottling plants, crop driers, and irrigation pumps had been installed since energization.

The Ellis report ([7], October 1971) reflects the author's deepseated personal convictions regarding the priority of rural electrification in the global development scheme. To quote from his memorandum of transmittal:

> This great electric cooperative program, if permitted to spread throughout the rural world, where most of mankind still exists, just possibly <u>could</u> yet mean part of the difference between <u>man's</u> survival or not on this earth.
>
> Therefore, I have given this Memorandum of Transmittal the subtitle that I feel deep down. "Man's Survival or Extinction".

His report on Costa Rica takes the form of what appears to be tape transcripts of conversations held with various individuals interspersed with a series of personal observations and comments.

For example:

Peter Kreis, Acting USAID Mission Director:

> The electric coops are doing well in Costa Rica. I am not dissatified with the electric cooperatives. (I am not satisfied with them either). They could engage in marketing and do better, but marketing is complicated ..... Any training in marketing (power use techniques) should be initiated by NRECA.
>
> I would not want to re-open the rural electrification program here. We've now really left rural electrification expansion to the World Bank. But the World Bank has no field personnel. ([7], p. 14)

Nuggets of information are contained in this report as are, for example, reports from managers as to the number of consumer members and the other management observations relating to operations and load building. However, the report is in no way analytical, and most statements are not substantiated. It is difficult therefore to give much credence to the conclusions.

In 1972, Mr. James E. Ross published a book of case studies of pilot rural electrification studies in Latin America [8]. It contains a ten-page chapter entitled "Costa Rica: Electrification and Rural Diversification." This chapter is a review of a study on rural electrification in Costa Rica performed in 1969 by Mr. Galen C. Moses for the USAID Mission, supplemented by Mr. Ross' personal experiences during the organization and construction phases of the cooperatives and by data from a follow-up report prepared by the manager of the San Marcos cooperative. The objectives of the Moses study were: (1) to establish social and economic benchmark data, through surveys, for the three cooperative areas; (2) to determine the effects of socioeconomic characteristics on present and expected uses of electricity; (3) to compare the cost of electricity with alternative energy sources; and (4) to analyze the attitudes of members with regard to electricity and the cooperative form of organization ([8], p. 204).

Unfortunately, we were unable to obtain the Moses study; however, the principal findings and conclusions as presented by Ross are as follows:

1. The physical, climatic and socioeconomic conditions of the San Carlos area indicated greater potential for the productive application of electricity than the San Marcos and Guanacaste areas.

2. In the San Marcos area, the mountainous terrain and poor soils generally limited

agricultural production to coffee and other permanent crops. In turn, the lack of diversified agricultural production reduced the possibilities for the development of agriculturally related industries utilizing cooperative power.

3. In Guanacaste, considerable potential existed for the application of electric pump irrigation, but apparently this had not developed to any great extent.

4. At the household level, light bulbs and irons were the most common expected purchases of electrical items in all areas.

5. The average monthly cost of electric service to households was estimated to be about ¢20 ($3.00) for an average consumption level of 67 kwh. This cost was lower than the cost to those using private generating plants or kerosene or gas-operated appliances such as refrigerators. However, electric service from the cooperatives would require higher expenditures for energy by those ("primarily peons") using only candles and small quantities of kerosene. ([87], p. 208).

6. Regression analysis revealed that the only variable which was statistically significant in explaining expected household consumption in all three areas was income. Analysis of pooled data from all three coops indicated the importance of income and education in explaining household consumption of electricity. This indicates the importance of the income-generating aspects of rural electrification, which permits the purchase of appliances from which the domestic benefits of electric service may be realized.(ibid).

7. Only limited success was obtained from the Moses surveys in analyzing the attitudes of coop members toward the use of electricity and the cooperative form of organization.

8. The idea of productive application of rural electrification cannot be a reality to the peon without land or steady employment. Unless the cooperative takes a real role in improving the economic condition of the poorer members, the old complaint of development projects -- that they only create a greater economic and social stratification -- may arise. ([8], p. 209)

The University of Florida study [9], conducted by Messrs. Davis, Saunders, Moses and Ross in 1972-73, is in many respects similar to the MORESCO study done in the Philippines (see page P-34) in 1975 by a group from Xavier University. In fact, it appears that much of the methodology adopted in the MORESCO study was developed by Davis, et al. Both studies were based on household surveys conducted in the cooperative areas, and both attempted to correlate electricity-use status with a series of indices constructed to reflect household levels of living and satisfaction with life. In fact these appear to be identical indices in the case of both studies. Unlike the MORESCO study, however, Davis et al. did not attempt to measure household income in the San Carlos area of Costa Rica.

In San Carlos, a sample of 452 households was taken, and, interestingly, the above indices appeared to be significantly more powerful as differentiators among users, inaccessibles and non-adopters in Costa Rica than was the case in the Philippines. For example, scores for the level of living index (excluding electricity-related items) were 3.4 for users, 2.6 for inaccessibles and only 2.1 for nonadopters. This index was constructed from scores awarded according to such things as home ownership, quality of construction materials, number of rooms in the house, etc. As such it can be expected to correlate rather closely with income, as was the case in the Philippines. In Costa Rica scores on the satisfaction with life index SIT PRES averaged 3.4 among users, 3.2 among inaccessibles and 2.7 among non-adopters. Although these numbers do group around the value 3 (indicating a respondent perception that his life situation is about the same as that of his neighbors), they also exhibit a greater dispersion and clearer pattern than was the case in the MORESCO area.

Other findings of this study include the following:

1. Electricity users tended to own larger farms than non-adopters.

2. No association was found between electricity use or non-use and age of the household head, migration, home industry or use of leisure time.

3. Electricity use in the household, for the vast majority of respondents, was primarily for lighting and ironing. Ownership of refrigerators, television sets, electric stoves and other larger appliances was concentrated among those in higher socioeconomic positions.

4. Although adoption of the use of electricity is not necessarily a function of economic means, data indicated that the level of average monthly electric consumption is related to economic means.

5. In San Carlos, Costa Rica, average monthly expenditures for candles, kerosene, bottled gas, and electricity was estimated at US $2.49 for electricity users. The cost of candles, kerosene and gas for all non-users

was $1.05. The difference in energy costs was largely due to a comparative direct cost advantage of candles over electric lighting. The cost comparison does not take into consideration the quality, dependability and convenience of electricity, however.

6. In San Carlos the most significant productive farm use of electricity was dairy farms. Most sugar and coffee mills were utilizing private hydroelectric energy sources and comparative economic benefits of central station electricity were limited.

7. Central station electricity, except for a few small rural industries, had not yet been effectively utilized to create substantial new employment. One of the greatest income equalizing effects from rural electrification is for small merchants who could afford to refrigerate soft drinks and compete with larger merchants who previously owned private generators. ([9], pp. xvii-xxi).

Although one advantage of the cooperative form of ownership was due to apparently lower power loss through theft, the report states that the cooperative systems in Costa Rica did not appear to have generated the spin-off benefits usually attributed to that form of ownership. Cooperatives had little significance to their members other than that of being the supplier of energy. ([9], p.35).

In early 1977 NRECA specialist James D. Lay prepared an "Evaluation Report of Coopelesca R.L." [10] which is the corporate title of the San Carlos cooperative.

He found that, by this seventh year of operations, the cooperative was performing very close to NRECA feasibility study projections for that year. It had, in fact, slightly exceeded the number of residential and small consumer connections projected for that year, although consumption (sales) was slightly below expectations. Also, by that date, he found that 147 dairy farmers were receiving electricity as were 22 coffee mills, 17 saw mills, five cinder-block plants, two cassava plants, four sugar refineries and one milk processing plant. Only three of these agro-industries were new to the area and about half of the dairy farms had had electricity prior to energization of the cooperative. ([10], p. 11). These were 407 commercial establishments, mostly restaurants, hotels, bars and recreation halls, receiving electric service. In August 1976, 77 educational centers, 22 health clinics and one hospital were receiving service although no data were available on the existence or electrification status of these establishments before energization of the cooperative.

Although the author noted that the lack of baseline data made impact assessment difficult, it appeared clear to him that a great many benefits were being shared by the rural people of the area served. ([10], p. 12)

By May 31, 1978 according to Joan Hood's report [12] the number of connections served by the cooperative had grown in 22 months, to 6,289 from the 4,892 served approximately two years earlier. Average residential consumption per month had grown from about 80 KWH to 105 KWH. There were 258 mechanized milking operations being served as were 81 schools and two new hospitals. There appeared to have been no change in the number of other health centers served, however, and unfortunately no data were presented on the growth of agro-industrial usage.

The same author reported on a visit to the Guanacaste Cooperative undertaken in December 1977 [11].

As of November 30, 1977, the cooperative had connected 6,212 residential, 1,014 general, 46 industrial, and one cooperative customer, as well as 72 public lights, and thus appears to have been performing quite well in relation to feasibility study projections. By far the most prevalent residential uses of electricity were for lights and irons, and residential power use beyond these applications appeared to be stagnant ([11], p.3). In the opinion of the evaluator this was due to two factors: (1) lack of customer information for proper use; and (2) the generally low levels of household income prevailing in Guanacaste.

Unfortunately, no information on the productive uses of power in this area was developed.

The most recent NRECA evaluation [13] indicates that, unlike what appears to be the general case, consumption figures for the Guanacaste cooperative far exceed feasibility study projections. Indeed, in 1977 (year nine of operations) total sales reached 18,824 MWH, approximately 350 percent of feasibility study projections for year ten ([13], page 14). The authors attribute this primarily to average residential consumption which was almost twice anticipated values, and connections of about 130 percent of the number of residences forecast. Agricultural utilization remained minimal ([13], page 20), but the growth of industrial usage was impressive. Industrial sales to 47 consumers reached 4,898 MWH in 1977, over four times feasibility study projections for year ten. Tourism had also developed considerably in the area, adding to the unanticipated growth in electricity consumption.

The same study also reports on the San Carlos Cooperative (Coopelesca). Here again, residential connections were above projections (about 130 percent for year nine), but, while Guanacaste, average residential consumption did not vary much from projections. Residential sales figures were certainly favorable nonetheless. Industrial and agricultural use, however, had not developed as projected although the shortfall at year nine was only on the order of ten percent ([13], page 39). Many potential industrial users, such as large sawmills, apparently continued to use their own hydro-electric plants which predated cooperative operations. The impact of the energy crisis on cooperative generating costs was felt to be a factor in stemming the anticipated shift from these plants to central-station electricity ([13], page 46). Nevertheless, about 43 percent of the cooperative's sales were directed at industrial and agro-industrial uses, which, making some allowance for commercial and agricultural sales which are not reported separately, indicates a high degree of productive use of the electricity provided.

Although the contents of this report certainly indicate success of these cooperatives in terms of having met the specified targets and in having maintained financial solvency, they are not, as noted in the report itself, sufficient for the purposes of impact evaluation. Indeed, the "lessons learned for future NRECA program planning and implementation," is described in the report, revolve the report, revolve principally around evaluation methodology, and are reproduced below.

1. Evaluation methodology must be built in from the inception of the program.

2. Some assurance must be given that Evaluations will follow that methodology, a methodology that will include Key Performance and socio-economic impact indicators that will stand the test of time, and not be subject to the idiosyncracies of either the individuals undertaking the evaluations or the "in thing" of the moment.

3. At the inception of any evaluation, all parties concerned with the evaluation must agree to the extent possible what they are looking for and the expected depth of analysis necessary.

4. To restate items 1 and 2 a little differently, we in NRECA must complete our model builing of a socioeconomic impact evaluation instrument that will produce the kind of impact data needed by all parties concerned, that will provide us with a system for improving our program planning and implementation, and which will be useful to the on-going program of rural electrification.

The last document in our possesion [14] reflects the NRECA evaluators' attempt to develop and field test such an evaluation instrument in the case of the San Marcos cooperative.

Although we fully support NRECA with respect to the above cited lessons to be learned regarding evaluation methodology, in our opinion the proposed NRECA evaluation instrument in its present form is not adequate to the proposed analytical tasks. This judgment is reached on conceptual rather than empirical grounds, as the report itself notes that, as regards the San Marcos cooperative, "one percent of served customers is not a statistically significant number to constitute a valid evaluation." ([14], page 12). Because of the importance of developing a suitable evaluation instrument, however, a brief description and comments on the NRECA draft instrument will be presented below.

Ultimately, such instruments must establish some measure, or measures, of welfare which will discriminate in a consistent manner among groups at a given time and between observations of the same groups over time. Income has traditionally been employed as the most reliable measure of welfare and, although it is recognized that certain aspects of welfare are inadequately measured by income, there does exist a consistent body of economic theory relating the aggregate, "income," to individual preferences and to consumption. This body of theory is often referred to as "price theory."

Because of the difficulty of directly measuring income through surveys, there have been numerous attempts to devise alternative measures, composed of more readily observable elements than income itself, but which correlate closely to income. The series of indices developed by Davis et al. [9] are attempts to develop such measures, as is the draft NRECA evaluation instrument.

This instrument is composed of two parts, one which assigns points according to a household's energy use, the second being based on points presumably related to household "level of living." Aggregates of the totals of these points are compared across adopter, non-adopter and inaccessible groups in an attempt to establish a connection between electrification status and welfare. Presumably this process would be repeated over time. Unfortunately, there is no reason to presume that the scores generated by this instrument would have any significant correlation to income or welfare, or that changes in the values of these scores over time would be related meaningfully to changes in welfare.

Space does not permit the full reproduction of the NRECA draft instrument in this document (the reader is referred to [14], Appendix B). A simple observation, however, should be enough to illustrate the argument. Two points (of the total which makes up a households score) are awarded when a households energy expenditures per moth rise from $2 to between $2 and $3.99. Two points are also awarded for each of the following:

1. having a latrine with a wood floor, as opposed to sanitary facilities consisting of an "open air place."

2. having quality carpeting instead of tile floors.

3. eating meat once a month instead of "on rare occasions."

4. having exposure to a magazine.

5. reading and writing.

6. having the opportunity to vote.

7. having a stereo/cassette (portable) as opposed to just a radio.

8. having a truck or automobile instead of a motorcycle.

9. showering with a gourd, inside, instead of showering with a gourd, outside.

10. listening to a radio.

Clearly we are in an apples and oranges situation here. Two points should be made here.

1. Income works (albeit crudely) as a measure of welfare because the implied levels of consumption measured are weighted by prices, which, theoretically at least, are measures of the value people place on different items of consumption.

2. Although, there are difficulties involved in accurately measuring income, there are also considerable difficulties involved in constructing meaningful proxy measure of income.

We fully concur, however, with NRECA's emphasis of the importance of designing and implementing suitable evaluation methodologies for rural electrification projects.

Recommendations

Cooperative rural electrification does not appear to have taken hold in Costa Rica. In fact, it seems that authorities there have opted for alternate models of rural electrification development. It would not appear, therefore, that further research on the San Carlos cooperative would offer much of relevance for future Costa Rica country programming, unless that programming is broadened to include other forms or organization.

Because of the apparent lack of baseline data for the other two cooperative areas in Costa Rica, it would appear that any such research would probably have to concentrate on San Carlos. Even there, baseline income data are lacking. Nonetheless, it would appear that a worthwhile purpose would be served in attempting a comprehensive post-project impact evaluation of the San Carlos cooperative. Such an evaluation is possible due to the baseline data which have been collected. It would be useful in the context of AID's sectoral programming in rural electrification in that it could provide a test of Galen Moses' predictive model, or of other models that could be developed. It will be recalled (see [8], p. 206) that Moses had predicted in 1969 that the San Carlos cooperative would be the most successful of the three Costa Rican projects, on the basis of a formal model incorporating such variables as agricultural productivity, agricultural and agro-industrial diversification, income, education, costs of electricity vs. alternative forms of energy, etc. The further development and generalization of such a model might well contribute to ensuring that proper emphasis is given to the required preconditions when need justification is being established for future RE projects, and that, at the project design stage, alternate designs will be more systematically appraised.

AID RURAL ELECTRIFICATION PROJECTS IN ECUADOR

AID has funded three rural electrification loans in Ecuador -- two in 1964 each totalling $700,000[1] and one in 1970 (signed 1972) totalling $3.6 million.[2] These expenditures together represent 3 percent of the value of AID loans to Ecuador between 1962 and 1977 under the Foreign Assistance Act.

The first loan provided for the expansion of generation, transmission and distribution facilities of two private electric power companies (sub-borrowers) in Cuenca[3] and Santa Elena. The second loan covered the construction of electric power generation, transmission and distribution facilities; technical assistance; and extension of consumer credit for the development of the Santo Domingo rural electric cooperative. The third loan, approved after a favorable evaluation of previous loans, consisted of the planned expansion of two existing electric cooperatives (Santo Domingo and Daule) and six existing private electric companies and the organization and development of three new rural electric cooperatives. These activities would be provided

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1. Originally one loan was approved for $1.6 million, but 1 1/2 years later $900,000 was deobligated because of reduced project scope.
2. AID had already funded several grants and donations for rural electric cooperatives in Santo Domingo and Daule. These funds covered three diesel-electric generators from government line materials and U.S. cooperatives, and AID financed technical assistance from NRECA.
3. This part of project was eliminated in December 1965.

through the construction of electric generation, transmission and distribution facilities and technical assistance from NRECA for organizing and operating a rural electric cooperative department within the implementing agency. However, subsequent to loan signature, the Ecuadorean Institute of Electrification (INECEL), the borrower, altered its focus from local-oriented to regional-oriented systems so the loan was revised in 1975 to provide for the construction and distribution of networks in 11 rural areas. These systems would ultimately be integrated into a national system. New cooperatives would not be formed, but the Santo Domingo and Daule cooperatives would continue as sub-borrowers.

Documents Collected

A list of the documents collected and the source of each is provided below:

Documents	Sources
A. Pre-Project Need Assessment	
James Ross, Cooperative Rural Electrification Study, 1966	Central Engineering, Files of Fred Lowell, Retired Engineer
B. Project Design and Feasibility	
1. Feasibility Study - Santo Domingo Cooperative, April 1964	AID Reference Center
2. CAP, Rural Electrification Loan, June 1970 (third loan)	Central Engineering, Fred Lowell files

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1. Ultimately even the Daule cooperative was taken over by INECEL.

C. Project Implementation

1.	Final Report of NRECA Electrification Specialist, John Taylor, June 1966	AID Reference Center
2.	USAID Evaluation Study of Rural Electrification in Ecuador by Jack Nixon March, 1970 (covers Santo Domingo/Daule cooperatives and Santa Elena electric company)	AID Reference Center
3.	USAID Final Evaluation Report on 1970 loan, August 1977	LA/DR Files
4.	1966 Ross study - progress report 18 months after Santo Domingo cooperative organized	Central Engineering Files of Fred Lowell
5.	AID Supported Rural Electrification and Agricultural Cooperatives - by Gordon Roth, August-September 1971	AID Reference Center

The 1966 Ross study outlines some socioeconomic conditions of the Santo Domingo area before the cooperative was established as well as 18 months after the cooperative was organized. NRECA conducted an engineering and economic feasibility study of the proposed Santo Domingo project in 1964 which provides some insight into project design even though the CAPs could not be located. The 1970 CAP and the 1970 evaluation of the 1964 loans provide some insight into project implementation phases of the first two loans.

Scope and Structure of AID Rural Electrification Projects in Ecuador

Goals and Purposes

The goal and purpose statements of the three loans emphasize construction and institution building activities. However, the institutions to be developed differ in the loans. The stated purpose of the 1964 Santa Elena was "to improve the borrower's (INECEL's) capacity to plan and implement the development of electric power systems in Ecuador."[1] The purpose of the third loan was "to give an impulse to the rural development of Ecuador through rural electrification and to expand and strengthen the cooperative movement, thus achieving economic development effects as well as rural development objectives implicit in the cooperative movement."[2] Therefore, cooperative development became a more pronounced issue by the 1970 loan. No information was provided about whether this shift in emphasis reflected satisfactory achievement of organizing INECEL in the earlier loan or whether it simply reflected more emphasis on grass roots organizations. Ironically the 1970, loan was not entirely focus on cooperatives--only five of the 11 sub-borrowers were to be cooperatives. In the end, none of the three cooperative sub-borrowers were even organized. Neither purpose statement serves as an adequate measuring stick for subsequent project evaluation nor are they useful for facilitating interproject comparisons.

In all three loans, the INECEL is the borrower. INECEL is a semi-autonomous agency created in 1961 under the Ministry of Industries and Commerce. The Ministry is responsible for the planning, implementation and supervision of

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1. 1966 Ross Study, page 3.
2. CAP, 1970, page ii.

electrification programs in Ecuador, and INECEL is responsible for carrying out these programs. More specifically, INECEL is responsible for elaborating national electrification plans; promoting realization of plans; encouraging establishment of private power companies; negotiating loans to execute electrification programs, including training of technicians and skilled engineers; and assisting electric power firms in their operations.

Despite the different purpose statements among the three loans, the structure of the sub-projects is similar. INECEL lends to the sub-borrowers -- either private electric companies or cooperatives. Each sub-borrower then contracts for the construction of transmission and distribution systems and installations of any generating units. There are no differences between INECEL's treatment of the private electric companies and its treatment of the cooperatives. INECEL must also approve managers of sub-borrower entities and provides accounting and audit services to them.

Outputs, Users and Uses

Without the CAPs in the first two loans, we cannot determine the intended amount of electricity to be provided as a result of the project, nor can we determine the intended uses. Output information is also not delineated for most of the sub-borrowers in the third loan.

Before the loan was approved for the Santo Domingo cooperative, these were had 374 members in the urban areas and none in the rural areas. At the time of the loan (1964), it was estimated that by 1973 the cooperative would have 4,000 members -- 2,000 rural and 2,000 urban. The third loan was expected to provide electricity to reach about 49,000 consumers distributed among the sub-borrowers as follows:

Intended Number of Consumers by 1980

Existing Cooperatives		New Cooperatives		Existing Electric Co.	
Santa Domingo	3,000	Quininde	620	Santa Elena	4,420
Daule	3,500	Tena	1,060	Esmeraldus	4,000
		Macas	2,930	Los Rios	8,000
				Malagro	9,300
				Cuenca	9,500
				El Oro	5,950

No distinction was made between rural and urban consumers, nor by income class. There is no description in the CAPs of the rural or urban setting of each sub-borrower project area.

The kinds of uses to which the electricity was to be put are specified for only three of the sub-borrowers.

Share of MWH Sales (percent) - 1980

Companies	Street Light	Residential/ Commercial	Industry
Esmeraldus Electric Company	77	12	11
Santo Domingo Cooperative	74	7	19
Macas Cooperative	78	6	16

Pre-project Need Assessment -- The Setting

Existing documentation (Ross 1966 study and CAP for third loan) provides useful information on the pre-cooperative setting of Santo Domingo and existing electrification in the area prior to the initiation of the third loan in 1970. Some additional pre-project insights are provided from subsequent evaluations on the Daule and Santa Elena project areas. Because of inadequate pre- and post-project information on the other sub-borrowers in the third loan, these areas cannot be covered in this analysis.

Santo Domingo

Santo Domingo is located 78 miles west of Quito in the coastal region. Population in 1964 when the AID loan for the Santo Domingo cooperative was approved was estimated at 20,000; half were was residents in the town and the remaining half in rural areas in a 25-mile radius of the town. There were about 2,000 homes in the area, 85 percent of which had tin roofs and wood floors. Surface transport was good because of a modern two lane road completed in 1963 and financed by AID. There were telephone and telegraph systems and three radio stations. About 50 percent of the population was literate, and there were five schools in the area.

Agriculture was the principle economic activity, with bananas, coffee, cocoa, pineapples, fruits and vegetables serving as the main crops. Livestock was also herded and forestry was important. The typical annual income was $275 for a family.

Electricity prior to the 1964 loan was supplied by the Municipality of Quito and operated by the Quito-based Empresa Electrica from 2,150 KW diesel generators. Electricity was available to only 1/4 of the homes from 6 PM to 2 AM, and lighting and small appliances were the only uses.

The Santo Domingo cooperative was organized with NRECA assistance prior to the 1964 AID loan. In fact, it is an outgrowth of a savings and loan cooperative established by 35 local businessmen who could not get commercial loans from the local bank. Their interest in an electric cooperative was also stimulated by activities of some 50 agricultural cooperatives in the area. The President of the savings and loans thus went to USAID to request assistance. USAID engaged an NRECA specialist who indicated in his field trip report in January 1963 that there was a severe shortage of power throughout Ecuador, and most generated power was at very high cost (not further documented). Since people were skeptical of government-sponsored activities, he recommended development of a cooperative. About 20 persons were selected from all economic sectors to organize this cooperative and recruit members. USAID provided one-week training and two NRECA specialists arrived to help organize the cooperative and conduct engineering and feasibility studies. They surveyed several areas and selected Santo Domingo as the site for the pilot project.[1] On March 20, 1964, the cooperative obtained ownership of the municipal facilities in Santo Domingo (after opposition from the municipality) and began operating the diesel engines 24 hours a day and expanding operations with materials donated by U.S. rural electric cooperatives. Because the system required extensive repairs for which the municipality had been unwilling to pay, leaders in the community collected money and sought legal status. There were 400 members, 374 of whom were receiving power, at the time of the energization in March 1964. There

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1. No indication was given as to why Santo Domingo was selected.

was a need for more electric power according to the Ross study and so a 200 KW generator was leased. No further examination of project need was provided.

Project Design and Feasibility

The project design was technically very much like the other rural electrification projects. Standard REA construction and engineering design was provided assuming the establishment of centralized grid systems and accompanying distribution lines. Materials, except for poles, were to be imported from the United States, a positive impact on U.S. economy. By 1973 system demand was projected to be 1,653 KW (compared to 244 KW in 1964). The lines would have the capacity to serve 3,259 consumers at an average of 125 KWH/month for at least 10 years. Power would be distributed to residential and commercial establishments with 70 percent of the total accounted for by residences in 1964 and 82 percent in 1973.

Engineering services were to be performed by INECEL, and construction was contracted out. However, the cooperative was to furnish all materials and contractors were to provide labor and equipment. The cooperative was to have a more direct role in the implementation of the project than in other country rural electrification loans because of its status and experience prior to the loan approval. An NRECA specialist was to be directly assigned to the cooperative for the purpose of training and supervising management personnel, assisting the cooperative in signing up members, and coordinating engineering and construction activities. A U.S. engineering consultant was to be assigned to INECEL for management assistance in that institution.

Economic feasibility was based merely on the identification of possible agro-industrial uses of the power; projected high rate of population growth and production because of immigration in the area through an IBRD-financed colonization project; availability of capital for agriculture and industry; and availability of raw materials. The setting in terms of infrastructure, location and cooperative spirit was deemed supportive.

Financial projections were made which indicated a favorable financial viability, but no cost/benefit analysis was undertaken. The meter versus flat rate issue was examined, and it was concluded that metering every consumer was the most advantageous solution to guarantee viability of the cooperative and to discourage waste; by issuing all electricity usage was appropriately measured and could be changed because equipment was available from U.S. cooperatives at reasonable cost. The method was deemed simplest for billing and bookkeeping, and it was more equitable than flat rates. Alternatives considered but not selected were to institute a fuse which would disconnect in the event of overload or to charge a flat rate to lower usage customers. The latter was deemed to be the least expensive way of obtaining revenues, but it was inequitable for users with less consumption, encouraged waste, and the high cost and rate schedule might lead to possible consumer dissatisfaction. Also it was difficult to enforce.

Alternative design systems were not considered. Rate structure favored residential rather than commercial consumption without justification.

The 1970, or third loan, provided for the expansion of the Santo Domingo system. At the time of this loan, the cooperative had 2,100 members with maximum demand of 1,100 KW. A new 100 KW unit was on order in 1970 to replace the 460 KW unit which had been damaged; meanwhile the third loan was to enable the cooperative to reach 3,000 additional consumers along existing distribution lines by installing a 1,500 KW diesel electric generator in 1972 and another in 1976, as well as construction of additional distribution lines. lines.

By 1970, Santo Domingo project area was one of the best irrigated areas of the country. Agriculture and commerce had grown faster than anywhere else in the country; major highways were converged; there was much immigration because of the colonization program; and people were generally receptive to the change. Much (but exactly how much was not indicated) of the area was electrified. However, not all changes could be directly attributed to electrification. More precisely, electrification, because of AID and INECEL assistance, never appeared to be a constraint on the rapid growth and development. In addition, most of the direct beneficiaries were still primarily urban, as opposed to rural, but no information was provided on what proportion of each was, in fact, low income.

Project Implementation

Compared to most of the other country sub-projects, there is more information available on what happened to three of the Ecuadorean sub-projects (Santo Domingo, Daule, and Santa Elena) after they were implemented. The 1966 Ross study, the 1966 end-of-tour report of the NRECA specialist John Taylor, the 1970 CAP and two evaluations in 1970 and 1977 provide the basis for the following discussions.

Santa Domingo

The first evaluation insights into the Santo Domingo sub-project were provided in the 1966 Ross study, 18 months after the cooperative was organized. The major policy issue was the existing rate structure which allowed such lower rates for industries that the cooperative was selling at a loss, which then required subsidization by the smaller industries and residences; many of these were low income. There was no indication of additional employment generation in these industries which might favor the rural poor, while the financial viability of the cooperative appeared to be threatened.

There were also considerable delays in the construction schedule because of negotiation problems between INECEL and the cooperative, yet the cooperative was still planning to construct the system even though the distribution line had not yet been built. The cooperative also suffered from the poor performance of its first manager and delays in getting a second manager approved, but NRECA technical assistance in training, administration and accounting helped keep the cooperative operational. Meanwhile, INECEL personnel also lacked experience and decision making took a long time, impeding purchasing. The board of directors of the cooperative was functioning, meetings were regularly held, and 15 employees were working full time.

The initial connection cost was found to be high -- estimated at about $46 per customer which covered membership fees, and shares which were required so the cooperative could meet its 20 percent local capital requirement. Still membership was growing. From the original 400 members, 963 were signed up by October 1965. Of these, 200 were in rural areas compared to none originally. However, not all of the members were actually connected; 631 were getting electricity, 322 were waiting. About 15 consumers were non-members. Approximately half of the members were commercial and the other half residential. No information was provided on income classification of members. The system had not been extended to villages; therefore, no farm electrification had been established.

The new service was considered to be remarkably better than the old system; and a number of commercial enterprises, almost all of which had had some electrification previously, were connected.

Although some persons complained, costs were not out of line with costs in other areas of the country according to the report. Electricity costs were less than other energy costs (not documented). Appliance use, especially irons, had increased and some persons had converted from kerosene refrigeration to electric. A vocational school was using electric tools it would not have had without electricity; a hospital bought X-ray machines made possible with 24-hour electric service; a new restaurant was able to open; and a water cooperative was requesting more service. Of 14 leaders in cooperatives, five had assumed leadership positions in the community and were working to promote social projects such as paving streets and improving schools. Employment generation seemed confined to the increase of 12 jobs in the cooperative itself. The viability of the cooperative was marginal but outlook was optimistic, particularly with a retail rate increase in 1965 and declining costs with more efficient generation put in place.

John Taylor pictures a very similar situation in his "end-of-tour" report in June 1966. Generation capacity had been increased 60 percent; sales and output were up 40 percent and length of line increased from 1.1 miles to 7.5 miles. There were 1,015 members and 725 consumers. Energy losses averaged only 20 percent.

The Nixon evaluation of the Santo Domingo cooperative in 1969 focused on outreach and impact as opposed to policy and operations issues. Even this coverage was not extensive but his insights were informative.

By October 1969 cooperative membership had increased to about 1,730, from 374 in 1964. About 74 percent (1,272) of these members in 1969 were urban and the remainder (458) rural. AID had estimated that by the end of 1973 the cooperative would have 4,000 members, 2,000 rural and 2,000 urban. Therefore, substantial progress remained to be seen particularly in the rural areas.

Efforts to expand membership were partly constrained by generation capacity. The original capacity estimates were inaccurate, so the cooperative had experienced problems with sudden drops in voltage during peak hours. Loans were underway to install two more generators by 1973. The cooperative would be financing these itself.

The financial viability of the cooperative was estimated by Nixon to be good. Yet the accounting records seemed deliberately to underestimate profits in order to avoid payment of legal contributions (not taxes) and dividends so that monies could be reinvested for further construction.

The major complaint among consumers was high cost -- 2.5 cents per KWH for industrial users, 5.0 cents per KWH for residential users and 6.3 cents per KWH for businesses. The average retail sale price was 4.7 cents per KWH, which represented a small loss to the cooperative but was compensated by other cooperative fees. Nixon argued that these costs were comparable to other parts of the country and that the cost in Ecuador was high relative to many countries because of the predominance of thermal generating plants. However, the consumer is more influenced by cost relative to his income in order to decide whether or not to use electricity, and no such analysis was provided.

Despite this complaint, Nixon argued that most members were satisfied with the cooperative, evidenced by the fact they did not feel compelled to attend cooperative meetings. It was usually the dissatisfied who did attend. No substantiation of this was provided.

Nixon's evaluation of usage was very cursory. He argued that residential usage was growing in town and rural areas; thus, "as a consequence of it the residents are now able to use many household appliances which have raised their standard of living."[1] The linkages between residential consumption of electricity, appliance usage and standard of living were not examined or tested.

For commercial usage, Nixon identified two hotels which had to have electricity to attract tourists and which would have had to incur higher costs to buy and install generators if no cooperative electricity were available. No effort was made to determine proportion of commercial establishments which were users.

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1. USAID, Nixon Evaluation Report, March 4, 1970, p. 41

Industrial usage was limited, according to Nixon, by the fact that most industries had their own generators. If they used cooperative electricity it was for lighting of employee houses.

Public lighting was a major share of electricity consumption; however, the municipality had refused to pay although obliged by law. This contributed to financial problems for the cooperative.

Finally, Nixon viewed the major impact of the loan as the contribution to the growth of the cooperative as a big business by multiplying its growth potential, facilitating the establishment of a strong, financially self-sufficient organization able to keep up with demand in a fast growing area. Nixon noted that INECEL had plans utimately to integrate the Santo Domingo area into its hydroelectric system, which would substantially reduce generation and sales costs.

The final evaluation report in 1977 indicated that by January 1, 1973, the Santo Domingo cooperative had 3,069 users, less than the 4,000 projected in the feasibility study. However, by the end of 1976 the cooperative had continued to grow to 7,313 members for a growth of 71 percent between 1973 and 1976. This growth rate was slightly lower than the average for the 11 sub-borrowers in the third loan, but only three other areas had surpassed it in terms of absolute number of additional users. Thus by 1976, users in the Santo Domingo cooperative represented 29.5 percent of population in the area compared to a 14.9 percent coverage in 1972.

The 1972 Nixon evaluation included a series of interviews[1] held with residential owners and owners and managers of industries and businesses in all three areas to compare the extent to which there were noticeable economic benefits in each sub-project. Roughly comparable proportions of persons interviewed (43-57 percent) reported they had expanded, modernized or improved their industries or businesses because of availability of electric power. About 30 percent of interviewees in Santa Elena reported increased output in sales (compared to 9 percent in Santo Domingo and 14 percent in Daule), but the relationship of this to availability of electricity was not established. Only 18-20 percent of interviewees in each area said that they had started their business because of availability of electricity.

About 13-25 percent of interviewees (25 percent in Daule) among residences claimed income increases due to availability of electricity, but no further specific details were provided.

Daule Cooperative

Pre-AID project (third loan) information on the Daule cooperative was provided in the 1970 Nixon evaluation report. Daule is located 45 km south of Guayaquil and because of its closeness to a major urban area, resources had tended to shift out of it, leaving a declining or stagnant economic base. The population of the town was 3,000 and of the canton 30,000. The area was best known for rice production and cattle raising. The close Guayaquil market was advantageous for agriculture, but the distribution of land was very unequal. Most rural people were renters or sharecroppers with low incomes, and there were few economic prospects for improving their lot in the area.

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1. No indication was provided of number of interviews, nor the extent of representation in each area.

Electrification prior to the formation of the cooperative was provided by the municipality. There were two 60 KW GMC generators but each was in poor condition. A few small towns also had generators. No information was provided on existence of electrification outside the town areas. The town service provided power between 6 PM and 10 PM when the generators were operating and there was adequate fuel. No indication was given of frequency or duration of outages. The municipal budget had a line item for repairs but some persons doubted monies were spent for this purpose, nor did the municipal government appear interested in improving the situation.

Therefore, a group of citizens appealed to INECEL and USAID for assistance in establishing a rural electric cooperative after learning of the experience of the Santo Domingo cooperative. AID engaged 2 NRECA advisers to survey the area[1] and they recommended that a cooperative be formed. USAID was also interested in providing assistance because of the failure and consequential hard feelings after a previous unsuccessful project in the area. In October 1964, efforts to organize a cooperative, planned to cover eight "major" towns, were initiated and USAID provided training directly to cooperatives in organization and development. NRECA and INECEL, as well as local members of a membership committee, enlisted new members by giving talks and surveying the towns to determine the number of inhabitants and potential demand for electric service. No indication was provided as to whether or not this survey examined the possible cost burden or ability of inhabitants to pay[2] or the prospects for

1. Unfortunately these surveys were not among the documents available to us.

2. Members had to pay an admission fee of $1.50 plus at least three contribution certificates. Low-income members had to pay an initial fee of $1.10 and the remaining upfront costs were reapplied to month bills. No meter deposit was required.

productive versus household use. However, by mid-December 1964, 1,171 members had been enlisted. Persons signing up, however, were not committed to actually pay, and by the following year 87 percent of the entrance and contribution certificate fees had not been collected.

Apart from training which USAID continued to provide to the elected board of directors, AID did not get involved with the financing of the cooperative until 1971 in the third loan. Meanwhile the citizens of Daule struggled, ultimately successfully, to take over the municipal system and INECEL provided loans for constructing a new system and extending distribution lines among the eight towns. INECEL also provided technical assistance to the cooperative through its newly established cooperative division. Electric service to these areas was not provided on a full 24-hour basis. INECEL's interest stemmed from its national plan to serve the area ultimately by a hydroelectric plant, but no date had been set for even building the plant.

By September 1965 the cooperative's new electric system was installed and it was able to provide 24-hour service to 470 consumers in Daule. Because we do not know how many of the original 1,200 enlisted members were in Daule, we cannot determine what proportion did become actual consumers. The only indication provided regarding the reliability of this service was mention of suspension of the service for 13 days in October 1969 because of defects in the equipment. This situation led to demonstrations and community protest. Power losses averaged only 14 percent because the system was new and well constructed.

Despite a rate structure with lower rates for residential use and substantially higher rates for large businesses and industrial use, the predominance of residential usage caused the cooperative to operate under deficits through 1969. The major reason given for these deficits was low amount of power use per member. The average payment was $1.38 a month but without some understanding of incomes, particularly among low-income persons, the extent to which this constrained demand cannot be assessed. No discussion was provided regarding cost of other energy sources and possibilities for substituting electricity for these other sources. The evaluation, however, did indicate:

> The deficit incurred by this cooperative highlights the importance of careful prior analysis of the minimum local demand which will pay for electification on the planned scale and of the potential existence of that demand.[1]

To improve its financial viability, the cooperative tried to obtain more consumers by extending the lines, but this required further loans from INECEL and continuation of deficits and losses. The cost of maintenance and repair was increasingly becoming a burden on operating costs.

Despite the service provided by the electric cooperative between 1965 and 1969, there was no noticeable change in the community. The number of buildings receiving electricity increased only from 50-65 percent even though distribution lines and public lighting were all over the town. The fishermen and agricultural day labor sections of the town received virtually no power. However, local small commercial activity did grow, but this could not all be attributed to electricity. Eight small industries became

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1. Nixon Evaluation Report, page 60.

consumers, but these were a negligible proportion of the total number of establishments. Only three of 200 rice mills became consumers because the others had their own relatively new generators.

Despite the financial problems and slow growth of the cooperative in the area, Daule was included in the 1971 Ecuador loan. In February 1976, INECEL took over the cooperative and is now managing it. The 1977 evaluation indicated that the population coverage remained low -- only 12 percent by 1976 growing by only 12 percent since 1972 when the proportion of users to population was 7.5 percent. About 1,800 users were added between 1972 and 1976 for a growth rate of 45 percent, less than the average growth rate for sub-borrowers in the third loan. The addition of 4,000 new consumers had been anticipated in the loan document. No profile of the users and non-users was provided.

Santa Elena

Unfortunately, we have virtually no information on the Santa Elena setting prior to its first AID electrification loan in 1964. This makes it very difficult to compare pre-project with post-project situations and to assess the contribution of the project to the local citizens of the area.

Santa Elena is located 125 km west of Guayaquil. Oil drilling and tourism, rather than agriculture, have been its major economic activities. Almost all local employment opportunities are in the tourist, rather than the petroleum, industry.

The total population of the area in 1969 was estimated to be 74,500 plus an additional 18,000-20,000 tourists between December and May. By October 1969, 572 consumers were served in Santa Elena and Ballenita; 1,503 in Libertad, Anconcita and Muey; and 1,337 in Salinas -- for a total of 3,512 consumers or about 4 percent of the population of total area. This represents a growth of 29 percent over the number of consumers in January 1968 (2,716) when service was first initiated. Much of the increase in consumers, however, was attributed to the consumption of electric power in hotels, restaurants and other commercial establishments. Because of the demand structure and its growth, the profit situation had been acceptable, but there was a real question about the proportion of benefits going to local poor people -- rural or urban -- either directly through consumption of electricity or indirectly through employment in these establishments. The evaluation did not examine this issue.

Prior to 1964 each town in the area had a thermal plant -- which was in poor condition -- supplying power at night if it were operational and fuel were available. Many private residences, hotels and business had their own generating units, indicating a relatively high income area. In 1964 INECEL rented 2,350KW thermal plants which did improve the situation, but power was still available only at night. In 1966 the Santa Elena Power Co. was founded and service began in January 1968.

The 1964 AID loan provided part of the cost for constructing and housing generator plants and substations, transmission and distribution lines among four major towns -- Santa Elena, Libertad, Ballenita and Santa Rosa. In Phase B of this project area, coverage was extended to Playas, Anconcito, Punta Blanca towns. An EXIMBANK loan also contributed to this project.

Between 1964 and 1970 the project area prospered, although no attempt was made in the 1970 evaluation to attribute all of this to the rural electrification project.

There had not been adequate communication between local people and the company. At the beginning of operations, people opposed the company because it substantially increased the charge of electricity over what the municipality had charged. The personal safety of company employees was threatened, but the situation calmed down as the service improved.

The evaluation also indicated that while power demand was still low, its growth prospects were bright and new industries would be attracted to the area. The construction of nine buildings was provided as justification of this trend. The principal demand source continued to be the hotel and tourist industry, not the rural residents. In fact, rural residents seemed to be considered only to the extent they were located along the distribution lines linking the towns.

By 1976, after implementation of the second loan, users accounted for 39 percent of the population in the area as compared to 24 percent in 1972. This proportion is greater than the average of 29 percent for all the sub-projects, but it is highly probable that most of these users were among the more economically advantaged.

<u>Other Sub-projects in 1977 Loan</u>

The 1977 evaluation provides very little project implementation information on the remaining sub-projects. Their setting prior to the loans is not profiled at all. The general observations, often not supported in any detail, are that project outreach was progressing satisfactorily in terms of planned numbers of users (three sub-projects had already exceeded these projections for 1980 in 1976); the employment situation was improving although not all could be attributed to this loan; and there were complementary programs funded by AID and the Government of Ecuador where electric energy would be very supportive.

Recommendations

Ecuador was included in this case study analysis because its design included cooperative and noncooperative sub-borrowers, both of which had been evaluated and considered useful to compare. There was sufficient information to provide a summary profile of the loans and insight into some of problems of rural electrification projects, but inadequate coverage and information to ascertain project impact. Were the loans on-going, there might be ample scope for fuller evaluations but since the loans have ceased no further evaluation activity is recommended.

AID RURAL ELECTRIFICATION PROJECTS IN GUATEMALA

AID has provided two rural electrification loans to Guatemala. The first loan, for $7 million, was approved in 1971 and involved the construction of a transmission line and associated sub-stations to take power from surplus to deficit areas of Guatemala. This loan also involved the construction of distribution facilities in three Indian highland areas --San Marcos, Los Verapaces and Huehuetenango-Quiche. The second loan, granted in 1978 at $8.6 million[1], covers the expansion of sub-transmission/distribution systems in target areas in seven departments of the country. Efforts will be attempted to improve field service management and technical capabilities of Instituto Nacional de Electrificacion (INDE), the implementing agent. A monitoring and evaluation system is also built into the project.

The total AID cost of the loans, $16 million represents about 15 percent of the value of AID loans to Guatemala between 1962-77 under the Foreign Assistance Act.

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1. The project was authorized by the AA/LAC on June 30, 1978. A new project authorization was required, however, because it was not possible to sign the loan agreement by September 30, 1978. A change of government in Guatemala and the institution of new project review procedures within AID prevented this. The second authorization was signed May 9, 1979.

Documents Collected

The following table summarizes the reports and studies compiled on the two AID rural electrification loans in Guatemala.

Document	Source
Pre-Project Need Assessment	
1. Searls, Dean L., "Exporting the REA Pattern - Guatemala Phase I Country Survey," NRECA, May 4, 1964.	ARC
2. Embry, B. L., "Rural Electrification Used for Irrigation," Annex III to Rural Electrification II Interim Report, n.d.	LA/DR
3. Converse, James, "Observed Increase in Efficiency of Rural Enterprises Due to Electrification," Annex IV to Rural Electrification II Interim Report, n.d.	LA/DR
4. Poynor International, Inc., "Village Electricity Utilization Study," Annex II to the Rural Electrification II Interim Report, April 24, 1977.	LA/DR

5. Carroll, Alf L., "Review of Proposed Rural Electrification Plan II for Guatemala," Report to USAID/Guatemala, July 20, 1977. CE/F

6. Project Review Paper, "Rural Electrification II," copy, n.d. CE/F

Project Design and Feasibility

1. Capital Assistance Paper, "Guatemala - Rural Electrification Loan," June 3, 1971. CE/F

2. Project Appraisal Report, Loan No. 520-L-019, Rural Electrification I, January 28, 1977.

3. Project Paper, "Guatemala - Rural Electrification (Revised)," June 12, 1978. LA/DP

Project Implementation

USAID/Guatemala, Capital Project Evaluation (Annual Report), Loan 520-L-019, July 9, 1974. LA/DP

The information on the project implementation phase is as yet too scarce to make any conclusions on the effectiveness of the first loan, and the second loan has not even been implemented. Yet, Guatemala was included in the case study analysis for several reasons. First, it has a built - in evaluation system, including a pre-project study, to obtain baseline data. It can therefore be contrasted with the older projects because it reflects some of the changes in project design and scope particularly in keeping with new directions which have been made in the past few years. Second, it is the only example of a rural electrification project with no NRECA involvement and a somewhat different organizational structure (no sub-borrowers for the distribution phases).

Profile of AID Rural Electrification Projects

Goals and Purposes

There is an important difference between the first and second loans regarding their stated goals and purposes. No distinction was made between goals and purposes in the first loan. Its purpose or goal was "to provide, for the first time, the ample, reliable, electrical power essential to the development of mechanized village industry, to the implementation of modern agricultural practices, and to a rapid improvement in the standard of living in these heavily populated rural centers."[1] In the second loan, however, the goals and purposes were differentiated. The goal was to improve the quality of life of rural Guatemalans by increasing small farmer incomes and increasing employment in the rural areas. Goal achievement was to be verified by measures of the average incomes of users which were expected to increase more rapidly than the average incomes of non-users. The purpose of the project was "to increase the number of electric connections in low-income rural areas and to improve INDE's capacity for continuing the extension of local power services to additional low income rural areas."[2]

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1. CAP, June 1971, p. 1.
2. Project paper, June 1978, p. 43.

Achievement would be measured by the connection of 70,000 users in low income areas to INDE's distribution system by 1982 and a plan for financing the connection of at least 10,000 additional low income users each year thereafter.

The goal and purpose statements, however, still pose problems for future project evaluation, particularly if a goal achievement approach is utilized. In both instances it will be very difficult, if not impossible, to measure the extent to which the project alone contributes to an improved standard of living. First, how are words such as ample, reliable and essential to be defined and measured in the first loan? Second, the goal and purpose achievement indicators in the second loan are also inadequate, as stated in the project paper. Unless the non-users have basically the same characteristics as users before the project, comparing the economic status of users and non-users after project execution is not a proper indicator of the project's contribution. Project users may be involved in other projects or activities which contribute to their income growth more, less, or as much as this project. Users may begin with higher incomes than non-users and thus might be expected to have higher rates of income growth and higher income status related to non-users, irrespective of this project. Third, the problem with the indicator of the purpose statement is that many of the 70,000 users to be connected may not themselves be low income, particularly in relation to that community. The indicator does not make clear that all or part of the 70,000 cases will be of the rural poor target group.

The goal may also be inconsistent with aspects of the project design. There is no necessarily direct connection between increasing rural incomes and employment of small farmers and the mere provision of electricity, particularly when 95 percent of the power is designed for residential use and only a small part of that would involve home artisan activities. Such a causal connection has never, to our knowledge, been established in any studies of rural electrification projects, and the project paper did not indicate on what basis such causality could be presumed.

Project Structure

Unlike the other Latin American rural electrification projects, the Guatemala loans do not focus on sub-borrower participation. In both loan instances the implementing agency, INDE, is responsible for not only the construction of the distribution systems but also for distributing power directly to target groups. INDE is an autonomous public entity owned by the Government of Guatemala to produce, transmit and distribute electrical power throughout the country. It is further responsible for the contracting of engineering and construction work, the training of skilled technicians and other personnel, the analysis and determination of electricity rates, and the maintenance of a monitoring and evaluation system for the second loan and similar relevant responsibilities for the first loan.

Outputs, Users and Uses

Outputs are not explicitly described in the first loan; in the second they refer to the number of lines and transformers, substations, wiring built and installed, training and technical assistance and an evaluation system. In fact, these are more aptly described as functions to be performed in the contract and the output becomes the amount of electricity provided. Using this latter definition, the amount of electricity projected for year 12, and the number and kinds of users are indicated for both loans in the following table:

Locale	Type of Use	Total KWH (billions)	Number of Users
Las Verapaces	General	8.98	27,159
	Industrial	1.71	130
	Public Lighting	2.73	136
	Farms	4.11	122
	Other	.45	189
Huehuetenango-Quiche	General	9.17	24,292
	Industrial	--	--
	Public Lighting	2.22	196
	Farms	--	--
	Other	.89	375
San Marcos	General	1.03	3,299
	Industrial	.40	22
	Public Lighting	.27	25
	Farms	.75	8
	Others	.14	58

About 70,000 consumers are to be reached in the second loan by 1982. The distribution of users between residential and commercial is 95 percent and 5 percent respectively and this proportion holds constant over the life of the project.

Of the 66,500 residential users, 5,000 residences are work places for artisans. About 37,000 of the projected new users currently live in towns already electrified but they are supposedly not receiving electricity because of installation costs. About 33,000 users live in areas not yet electrified. Of the 33,000 new connections 6,000 will be in towns of fewer than 500 inhabitants. Also, in the early years of the project it is expected that previously electrified towns will receive the bulk of project investment while later there will be six connections in every newly electrified town to every four connections in previously electrified towns. The intended users are to be low income families living in project areas.

Project Analysis

The 1964 NRECA Phase I report cited above is the first known effort to plan systematically for rural electrification development in Guatemala. With respect to the cooperative mode of rural electrification, however, the assessment of the NRECA was mixed. On the one hand, low farm income, the unavailability of low-cost wholesale power, and rural illiteracy were determined to be major deterrents to the immediate establishment of rural electric cooperatives. On the other hand, the government's attitude towards cooperatives judged to be favorable. Principal actions recommended in this report were:

1. That in 1966 (two years later) further check be made to determine the proper time for carrying out Phases II and III of the NRECA/AID program in an area known as La Maquina.

2. That improved service from existing municipal power generating and distribution systems be secured through the assignment of a properly educated and experienced Peace Corps man to train power plant personnel in efficient operation of their systems. Such improvements could be secured in this manner "almost immediately."

3. That AID provide financial and technical assistance to the village of Jacaltenango in Huehuetenango where the people were "inspired and determined to develop an electric cooperative despite many problems."

Mr. Searls describes INDE as an agency responsible for the promotion, unification and, to a great extent, the control of the power industry in Guatemala. As such, it was permitted to generate, transmit and distribute, as well as buy and sell electric energy.

At the time, INDE was proceeding at a rapid pace with studies aimed at developing the hydroelectric generation potentials of the country. Mr. Searls concludes that:

> If adequate financing can be arranged, INDE should go far in bringing electric power at reasonable rates to the villages, town and cities of Guatemala. This will be the agency that rural electric cooperatives must look to for their power supply.[1]

This scenario was conditioned on the development of low-cost hydropower, however, which was then unavailable. In 1964 Mr. Searls considered that the high cost of fuel made large-scale thermal generation prohibitive. Such

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1. Searls, p. 7.

generation was not considered to offer any cost advantage over the existing small diesel or hydro plants operating, albeit erratically, in some of the small towns, villages, and farms.

Prospects for cooperative development in Guatemala appeared dim. Mr. Searls cites the following reasons for the lack of understanding of cooperative principles in that country, and the poor progress of the few which had been established.

1. Recent political events creating misunderstanding and distrust of organizations called cooperatives.

2. High percentage of illiteracy.

3. Communal nature of groups and tendency not to participate in community activities and associations.

4. Feeling of distrust of other people because of previous exploitation by others.

5. Lack of imagination for a better tomorrow.

6. Lack of competent management and leadership.[1]

An interesting result, which must be attributed at least in part to this forthright NRECA assessment, is that neither of the two AID rural electrification loans in Guatemala (1971 and 1978) has involved rural electrification

1. Searls, p. 15.

cooperatives. This is a unique case among other AID loans we have reviewed which have all included some cooperatives among the sub-borrowers charged with implementation and subsequent operation of AID-fiananced distribution systems. In Guatemala, in both cases, INDE assumed responsibility for all aspects of design, construction, and operation of these systems, including the system planned under the first loan to provide service to Jacaltenango and 36 other towns in the Department of Huehuetenango. Most of the power distributed by the systems financed under both loans was expected to be used for household illumination,[1] although it was expected that this power would be used, in small amounts, for household, farm, artisanry and commercial productive purposes. The Project Paper supporting the second loan is explicit in stating that about 95 percent of the expected 70,000 new connections in 1982 would be residential. Approximately 80 percent of these consumers were estimated to have annual family incomes below $400 in 1969 dollars. Residential sales in dollar terms were projected to comprise about a constant 86 percent of total sales through the first ten years of the project, increasing slightly thereafter.[2]

The CAP for the first loan specifies that construction among the three systems proposed would include 398 km of transmission lines, and 1,333 kms of distribution lines serving 67 towns as well as intermediary farms and villages.[3] It would appear, from brief reference made to this project in the Project Paper for the second loan, that construction targets were not met. That document states

1. See CAP, p. 22 and p. 5.
2. PP, Annex K, exhibit 4.
3. CAP, pp. 11-12.

that under the first loan, INDE constructed 479.4 kms of transmission lines and only 495 kms of distribution lines serving 34 highland communities.[1] This construction benefited approximately 35,000 customers, but it is difficult to tell how many customers would have been reached if the full system had been constructed.

It was learned that an evaluation of the first loan had been planned for early 1977. We were not able to locate this evaluation, however, nor were we even able to establish whether or not it had been conducted. No reference to it is contained in the Project Paper for the second loan, submitted in late May of 1978. Reference is made to this evaluation in a Project Appraisal Report dated January 28, 1977, which itself contains little information beyond construction data reported above.

We were, however, able to obtain a copy of the 1974 audit report of the first loan. According to the report, as of March 31, 1974, $2.5 million (56 percent) had been committed in foreign currency and $2.0 million (80 percent) in local currency. It also expressed satisfaction with the progress of the program. It indicated that the 69KV transmission line from Guatemala to Huehuetanango and the line from Guatemala to Sanarate were almost completed, leaving only 70 km of transmission line from Sanarate to San Tulian to be completed. Progress in other areas of the program was also reported to be satisfactory. Nevertheless, several recommendations were made to enhance the effectiveness of

1. Project Paper, p. 36.

project implementation. They can be listed as follows:

1. The Mission should require INDE to determine a realistic 90 day revolving fund requirement and the fund should be adjusted accordingly.

2. The Mission should:

   a. Require INDE to comply with prescribed reporting requirements;

   b. Assure that its (Mission) information needs are included in INDE's monthly progress reports;

3. The Mission should require INDE to maintain accounting records on a current basis in order to properly monitor project activities; and

4. The Mission should request INDE assurance of contractor's compliance with all contractual obligations prior to final payments.

The second Guatemala rural electrification loan is, of course, too recent for any performance assessment to have been conducted. Certain features of the Project Paper, reflecting the quality of preparation as well as design implementation and evaluation plans contained in it, are worth mentioning.

The loan is designed to finance the construction of subtransmission lines and distribution systems to serve 37,000 new connections in 333 partially electrified villages and 33,000 connections in 309 newly electrified villages. This much is to be accomplished by 1982. Thereafter, it is projected that INDE will add new connections within the project areas at a rate of approximately 6,000 per year. Technical assistance, training, maintenance equipment and vehicles will also be financed in order in order to strengthen INDE's administrative and outreach capabilities.

Considerable project-area-specific research appears to have been undertaken prior to submission of this Project Paper, and considerable baseline data collected. Studies include a rate study; the Village Electricity Utilization Study conducted by POYNOR International; a study of current irrigation usage of rural electrification; a study of the uses of electricity in small scale rural enterprises; an econometric analysis conducted by INDE on the determinants of rural electric consumption; an anthropological study of target sub-groups; review of an IBRD assessment of INDE performance; a survey of 378 households in 22 project area villages (defining socioeconomic characteristics of users and non-users); as well as what appears to be a rather conscientous financial and economic cost-benefit analysis of the project.

For example, Table 2 shows the weighted average annual income and the monthly cost of electricity of the low income user group as well as the weighted average annual income and monthly costs of fuel for lighting and batteries for radio of the non-user (target) group. As the table indicates, average income is higher for the user group than the target group; and users also commit a larger portion of their incomes to energy. However, it should be realized that the higher level of income of the user group is not necessarily the result of the availability of electricity supply. The table illustrates, to a certain extent, the strong demand for electricity.

It is estimated that the average monthly cost of electricity for the target group could range from $2.29 to $2.79 for the first four years and from $1.85 to $2.35 after four years when the housewiring charge is dropped.[1] According to the AID survey, families that do not have electricity expressed a strong desire for it and indicated that they could afford to pay an average of $2.00 per month for the service. It is clear that cost of energy will be somewhat higher for the target group when electricity becomes available.

Table 2
Comparison of Income, Electricity and Fuel Costs, by Users and Non-users

	Users[a]	Non-users
Weighted average annual income	406.06	343.35
Weighted average cost of electricity-monthly	3.48	N/A
Weighted average cost of fuel for lighting and battery for radio-monthly	N/A	1.51

NA - Not applicable
a. Low income users.

Source: Computed from USAID/Guatemala, Interim Report For Rural Electrification II, June 1977, Annex II, p. 10.

Economic internal rates of return developed in the cost-benefit analysis are presented below, with and without consumer surplus benefit estimates, and with and without inclusion of generation investment costs. (This is presumably incremental and project-related generation investment.)

It is interesting to note the considerable impact of inclusion of project-related generation investment on rate-of-return estimates, particularly considering the predominately large-scale hydroelectric nature of this investment in Guatemala, and how this observation may relate to the analysis and interpretation of rates of return on small-scale autogeneration projects.

The project paper is particularly thorough in its presentation of information which relates the rural electrification project to other GOG, AID and other-donor programs in the proposed project aeas. In fact, it states:

> The justification for the program essentially lies in providing a very basic element of rural infrastructure at a favorable cost which will complement and reinforce many developmental efforts directed toward the target group.[1]

Also,

> USAID is not asserting that lack of electric power in rural areas is a major constraint at this time to increasing incomes (although levels of well-being would certainly be improved).[2]

Among the complementary programs and activities mentioned are agricultural diversification; irrigation; small farm animal production; produce storage and processing; employment creation through support of artisan, agro-industrial, and other rural enterprises; water systems development; and other-donor generation and transmission projects.

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1. PP, p. 29.
2. Ibid.

Planning for evaluation of the project indicates that two distinct approaches will be followed.

Yearly progress evaluation will be conducted as a basis for discussing:

> Targets for output achievement vs. actual performance, timeliness of AID and GOG inputs; INDE contracting procedures and AID approval processes; and, any implementation problems that are affecting output achievement. In the later years of the project, these annual evaluations will monitor improvement in INDE's institutional capability to continue to extend electrical service to rural areas as well as the completion of physical project outputs.[1]

An impact evaluation, to be conducted upon project completion in 1982-83, will focus on documenting and analyzing the rate of adoption of electricity for productive purposes by low income rural residents and on assessing the direct impact on their productivity.

The data collection process will be designed to fit into INDE's normal operations to the maximum degree possible in order to minimize data collection costs. Baseline data will be collected on variables such as income, present productive activities (farming, cottage industries, service sector occupations), production volume and processes, and intention to adopt electricity in production processes.

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1. See "Impact Evaluation Plan," PP, p. 139.

The evaluation design will match these users against families that do not desire electricity and those who live in villages that will not be electrified under the program for control purposes. Comparisons will also be made with families who were INDE customers before the project began.

V. Recommendations

1. The Project Paper for the most recent rural electrification loan in Guatemala has quite properly emphasized the potentially important complementarities which exist between rural electrification and other sector/regional programs and developments. The impact of rural electrification cannot, therefore, be properly assessed unless the progress and impacts of these complementary program and developments in project areas are suitably controlled for. This is true even when impact assessment is limited, we think quite reasonably and to good purpose in this case, to assessing the impact of electrification on the productivity of low income rural residents.

   It is strongly recommended that evaluation plans for this project be coordinated with evaluation and data collection plans relating to other sectoral/ regional programs which will affect the rural electrification target group. This need not place undue additional burdens on INDE's data collection capability, as their principal additional requirement would be to identify and distinguish those rural electrification beneficiaries who are also the beneficiaries of other specific programs from those who are not. Data relating to these other programs would presumably be collected independently. USAID's function would then be to coordinate these various data collection activities and ensure their timely availability to the rural electrification impact evaluation team.

2. It is also strongly recommended that data relating to the impact of electrification on the availability and utilization of public services by the target population be routinely assembled. Principally we are referring to the development and accessibility of potable water systems; systems for the storage, processing, and distribution of perishable foods; preventive and curative health maintenance facilities; formal, informal and vocational education establishments; and the corresponding health and education related indicators among the target population.

   The potential magnitude and more general availability of these kinds of indirect beneficial impacts of rural electrification on AID target populations would appear to fully justify any minor additional resource allocations and expenditures of effort which may be required.

AID RURAL ELECTRIFICATION PROJECTS IN NICARAGUA

AID has funded three rural electrification loans in Nicaragua which total $14.9 million, or 8.6 percent of the $172.3 million AID loaned Nicaragua between 1962-77 under the Foreign Assistance Act. The first loan, granted in 1964 for $400,000, provided for constructing and equipping a rural electric cooperative in Tisma, Nicaragua (Cooperative A). The second loan, in 1968, valued at $10.2 million, covered the cost of organizing and constructing required facilities for three additional rural electric cooperatives (Cooperative B, C, D). The third loan, signed in 1971 for $4.3 million, provided funds covering the cost of organizing and constructing facilities for a fifth cooperative (Cooperative E), plus as much as $1 million for financing the foreign cost of material and equipment for the four older cooperatives so they might extend their distribution facilities, expand power sales, and increase the number of customers served.

Documents Assembled

The following documents were collected to form the basis of the case study analysis of the AID rural electrification efforts in Nicaragua:

Pre-project Need Assessment	Sources
1. Tour of Duty report by Earl Smith on Rural Electrification in Nicaragua, May 1962	Central engineering files of Fred Lowell

Pre-project Need Assessment	Sources
2. Profile of 3 Cooperative Areas before AID project implemented by James Ross - Book in 1972 and Report in 1966	Central engineering files of Fred Lowell
3. Memorandum on Rural Electric Cooperative activities in Nicaragua, July 1962	Central engineering files of Fred Lowell
Project Design and Feasibility	**Sources**
4. Engineering & Feasibility Report by William Mast for NRECA (first Cooperative)	Central engineering files of Fred Lowell
5. Engineering and Economic Feasibility Study by ENALUF of Madriz-Nueva Segovia and Esteli areas, March 1971 (fifth Cooperative)	Central engineering files of Fred Lowell
6. CAP, Nicaragua Rural Electric Cooperatives II, June 1968	Central engineering files of Fred Lowell
7. CAP, Nicaragua Rural Electrification III, June 1971	Central engineering files of Fred Lowell and AID Reference Center
Project Implementation Phases	**Sources**
8. Evaluation of Performance of NRECA by Development Alternatives, Inc., with section on Nicaragua, January 1977	DAI and DIS
9. Project Paper for Proposed Project on Rural Electric Cooperatives Management, August 1976	Central engineering files of Fred Lowell
Project Implementation Phases	**Sources**
10. AID Audit Reports, March 1972 and April 1, 1975	AID Auditor General Office
11. Gordon Roth Review of Agricultural Cooperatives, 1971	NRECA

Other evaluative documents were identified in the 1976 project paper, but could not be obtained. Supposedly, there have been evaluations of the second and third loans, two reports by U.S. cooperative specialists, an NRECA management consultant report, and a rate and reevaluation study. These should have greatly increased the information base for this study.

Profile of AID Rural Electrification Projects in Nicaragua

In the absence of the CAP for the first loan, it appears that the purpose of this loan, according to the CAP for the second loan, was to construct and equip a rural electric distribution cooperative in Tisma, Nicaragua. The purpose statements for the second loan were "to improve the welfare and standard of living of a large proportion of Nicaragua rural population and to provide an important input, electrical power, for expanded agricultural production."[1] The purpose of the third loan was "to continue efforts to electrify rural Nicaragua"[2] and "to provide electricity to a rural area in the North Central part of Nicaragua."[3]

The purpose statement for the first loan implies that completion of the construction program is sufficient for determining project success. This emphasis is in keying

1. CAP, 1968, page ii.
2. CAP, 1971, page ii.
3. CAP, 1971, page 10.

with the primacy of engineering factors among evaluators within AID at that time. No mention was made of intended impacts which would serve as a basis for future evaluations. This particularly complicates evaluations using goal attainment approaches.

The purpose statement for the third loan is the only statement among all projects which indicates that electric power is but one input required to affect various purposes or impacts (i.e., expanded agricultural production, increased incomes, etc).

Project Structure

The structure of the projects is virtually the same for all three loans. The Empresa Nacional de Luz y Fuerza (ENALUF), the implementing agency, is a public power company solely owned by the Government of Nicaragua. ENALUF onlends to sub-borrowers, which in the first loan was the Tisma cooperative;[1] in the second, three more cooperatives; and in the third loan, a fifth new cooperative plus some lesser funds for the first four. The cooperatives then signed contracts with ENALUF for the necessary engineering services. (The cooperatives would also contract with private firms for the construction, but ENALUF would supervise and inspect the work.) ENALUF was also responsible for implementing the Government of Nicaragua portions of the project. Implementation within ENALUF was to be provided by a rural electric department founded as part of the second loan. The CAPs do not provide much descriptive information

1. Originally, the implementing agent in the first loan was "Commission," but ENALUF ultimately assumed the responsibilities.

on the cooperatives, except that when construction was completed the cooperatives would own the distribution and transmission facilities. In addition to supplying electricity, cooperative staff, assisted by ENALUF, would also educate members in the use of electricity for both consumption and production uses. The cooperatives were also expected to serve as catalysts for other development programs.

Outputs, Users and Uses

By loan the project output, users and uses for the tenth year are summarized in the following table:

	Output KWH	Types of Uses	Number of Users
Rural Electrification Loan I			
Cooperative A			
	1,220,400	Not Known	Not Known
Rural Electrification Loan II			
Cooperative B			
	11,269,922	Residential	13,310
	656,407	Commercial	122
	10,756,520	Industrial	76
	307,203	Government	32
	676,692	Pumping	17
	12,323,132	Irrigation	75
Cooperative C			
	8,095,460	Residential	8,278
	1,329,630	Commercial	83
	5,461,920	Industrial	52
	673,970	Government	85
	670,554	Pumping	17
	10,825,000	Irrigation	47

Cooperative D

25,272,636	Residential	16,000
534,750	Commercial	71
3,024,170	Industrial	66
241,725	Government	27
434,500	Pumping	22
9,993,528	Irrigation	91

Rural Electrification Loan III

Cooperative E

22,581,501	Residential	18,657
673,320	Commercial	124
6,450,500	Industrial	97
591,600	Government	51
1,440,000	Pumping	24
4,748,739	Irrigation	47

Neither CAP specifies the users any further, either by rural versus urban, or by income class. However, the rural urban breakdown of the project area population was provided.

Pre-projected Needed Assessment

No formal survey was undertaken in proposed rural electric cooperative areas to determine the extent to which a need existed. Even more seriously, there appears to have been no independent objective assessment of the existing situation, analysis of an alternative energy power development source, opportunity cost of rural electric investments or alternative project designs. Smith's visit to Nicaragua in 1961 might have included discussions of such issues, but his report provides very little insight into any such analysis. Rather, he basically assumes that there is a need for electricity in the homes, on farms, etc. and that "current power supply was ample for needs."[1] He raised the issue

1. Smith, Earl, "Rural Electrification in Nicaragua Tour of Duty Report, "May 1968, p. 6.

about private company service but he never analyzed the service itself. Smith found support for his ideas among ENALUF employees and agricultural extension agents but he did not provide any clear indication of other local support. He was, however, able to hold meetings with some local leaders. In a table at the end of his report, Smith indicates there were 783 applicants for cooperative membership in Zone A and none in Zone B.

Most of the information was presented descriptively rather than analytically so that no definitive answer regarding the extent of need was provided. Instead a brief profile of the communities in terms of current and projected population, agricultural activities, supporting infrastructure and possible uses of electricity was given.

The only statement directly focused on project need in any of the pre-project documents was in the CAP for rural electrification loan III. "USAID determined Rural Electrification III was justified because of need for electric power in rural Nicaragua and reported favorable achievements of 4 existing cooperatives."[1] No supporting information is provided to indicate how the need for electric power -- particularly as opposed to other energy sources -- was established and what the "favorable achievements" of the previous cooperatives were.

The Setting for Nicaragua Cooperatives

The discussion of the setting of cooperatives was similar in each of the CAPs.[2] The area covered, including

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1. Because we did not have CAP for first loan, information was obtained from Ross' (1966) study for cooperative A in Tisma.
2. Because we do not have the first loan's CAP, information was obtained from Ross' study (1966) for cooperative A in Tisma.

population decomposed into rural and urban; number of houses, list of agricultural and industrial activities and value of outputs; profile of local and physical infrastructure -- schools, roads, health centers, communications facilities and water and sewerage facilities -- was all discussed. Cursory information on available electricity was also provided. For summary purposes, rural population accounted for 70-80 percent of project area; agriculture was the principal economic activity in all areas, but irrigation was more important in cooperative B, C and D areas. There were many schools, mostly rural, and a few health centers; roads were in good condition. Most industrial activities were small; and farms were primarily owner-operated. Prior to cooperative power, ENALUF provided available electricity to towns, though systems needed repair, and service was poor. No estimate of the extent of autogeneration systems was provided, nor were the relative costs of central station electricity versus autogenerated electricity assessed, especially in rural areas.

Project Design and Feasibility

The engineering and economic feasibility studies for two of the cooperatives and the CAPs served as a basis for discussion in this section. There is a definite omission of any consideration of alternate engineering designs, capacity sizes and structures. The designs in each instance were based on standards followed by REA and no modification appears to have been made to the local context. This is a common failure among all types of project studies started during the 1960s.

Economic feasibility seems to be defined primarily in terms of projected financial viability of projects. Cash flow and income balance sheets were thus derived for each cooperative and the implementing agency, ENALUF. No benefit/cost analysis was undertaken. The projected sales for electricity were indicated in terms of the number of potential consumers alone and their ability to pay -- income -- and relative price parameters were ignored. Social benefits and costs were not analyzed, but some of the intended social benefits were mentioned.

For the third loan, no analysis was made of the financial viability of the previous cooperatives which could have provided insight into avoidable problems.

<u>Evaluation - Baseline Data</u>

In order to evaluate a project, baseline data on setting, project design and expected results are needed, as well as an appropriately accountable record of what actually occurred. James Ross provides some baseline data on the Tisma community. While much of the material is very informative, his sample is far too small and therefore possibly unrepresentative. He surveyed ten persons to gain a sense of their intended uses of electricity -- independent of income constraints -- and then projected costs and income changes as a result of these intended uses. Although the purpose of the newly formed cooperative was to acquire, distribute and supply electric power to members for agricultural and industrial use, most interviewees stressed residential, non-productive uses among their first applications of electric power. This inconsistency, however, may be a function of residential bias in the questionnaire. More than half of the persons interviewed already had electric power from small generators.

Project Implementation

Two audit reports, one virtually useless because there was little or no information on the projects; a section on Nicaragua in the 1977 DAI report on NRECA a project paper for a 1976 loan proposed, but never funded; project and the CAPS for the second and third loans serve as the basis for examining the project execution phase. As such, no formal program evaluation or impact assessment was available, although the first loan in Nicaragua was the first rural electrification loan AID ever funded. It was noted in two documents that a program evaluation had been undertaken in 1975, but no copies could be obtained. The documents offer relatively little insight into the policy and political issues, but there is better coverage of the operations and management issues and some of the impacts.

Policy Issues

The principal policy issue examined in the documents was the extent to which rate policies and purposes of ENALUF conflicted with the financial viability of the cooperatives. The rate structure in Nicaragua -- determined by ENALUF -- was designed to increase agricultural production by providing incentives for irrigating pasture and farmland, water pumping in towns, villages and rural industries through lower rates for electricity use. However, the design of the cooperatives, with predominately residential usage, implied that in those cooperative areas where irrigation electricity usage was being maximized, residential consumers might be subsidizing the productive consumers, if revenues from distribution to each group were not commensurate with distribution costs to each group. Actual residential usage, which was less than projected, would threaten the financial viability of the cooperatives. Both the DAI evaluation report and the 1976 project paper document this problem, particularly for cooperatives B, C, and D, which had the largest irrigation usage. The cooperatives, in an effort to establish a healthy financial position, redirected their efforts to high-density consumer centers, and the rural intent of the projects became threatened. Some argue that the principal problem was management, but DAI rules this out without further analysis.

The DAI evaluation questioned the extent of local support and attributed lack of involvement in the cooperatives by the local population to the education and sales promotion sections of the cooperatives. Local participation may also be constrained by incomes, but DAI did not analyze this relationship.

Operations and Management

The audit documents focus directly on the scheduling, contracting and procurement of materials for the construction phases. There were considerable construction delays -- a year or more -- for each project attributed to such reasons as inexperience and administrative weaknesses of implementing agencies and cooperatives; high electric rates; too few consumers identified; and failure of suppliers to deliver materials and equipment on a regular, timely basis. Construction in the second and third loans was also adversely affected by world inflation, particularly because most materials, even poles, were imported.

The audit reports emphasized the need to improve cost and budgeting, and maintenance and repair functions as carried out by the cooperatives and ENALUF.

Outreach and Impacts

Area Coverage

The DAI evaluation indicates that based on its cursory survey of three cooperative areas, no more than 1/2 of households accessible to cooperative electricity were connected. There remained large parts of the areas where no lines were distributed and people could not get access. The coverage (60 percent of potential customers but not of all population in area) appears to be best in the cooperative A (Tisma) area, which is the smallest, and least in cooperative D (25-33 percent) which has the largest and least dense project area. Non-users (accessible but not adopting) gave their inability to pay the minimum monthly charge; high installation and membership fee; and lack of knowledge about how to apply as principal reasons for non-participation. No analysis of the relative cost of electricity _vis-a-vis_ other energy sources was provided.

Rural vs. Urban

No document provides any indication of rural vs. urban breakdown of consumers; nor was such distinction made in project design documents for projected usage. Therefore, rural intent cannot be determined or evaluated.

Income of Users vs. Non-users

The DAI evaluation suggests that users appear to be more economically advantaged than non-users. Some non-users indicated that they could afford electricity but many others said they could not. DAI estimated the median income of users' households to be $700 per month compared to $400 for non-users. No information was provided on economic status of users prior to the project to indicate the extent the project contributed to higher economic status of users, or whether initially users were more economically advantaged. Even then, it is difficult to separate project contributions to income improvement from the effects of other income-related projects in which users may be involved.

Actual vs. Projected Number of Consumers

The DAI evaluation provided information on the number of consumers by class in December 1975. These can be compared to the projected numbers of consumers for four of the five cooperatives[1] although it is not a reliable basis for measuring project success in its outreach. The projections may, in fact, have been overestimated because of inadequate assessment of demand factors in the pre-project planning phases.

In December 1975, irrigation usage was exceeding or close to projected usage; government usage was also much higher, and residential usage was 21-83 percent of projected usage. Small commercial usage had the lowest proportion of project usage. These proportions are more favorable than percentages indicate because the projections were for 1978 for cooperatives B, C, and D and 1981 for cooperative E. Thus, by 1975 the project outreach was expanding consistently with project progress.

Residential vs. Productive Usage

The projected distribution of users indicated that residential use was to be dominant both in terms of number of consumers and output. Residential consumers comprised

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1. Because we did not have CAP for Cooperative A first loan, we did not have projected figures available.

90-95 percent of projected consumers and 70 percent of project output.

Cooperative Members vs. Consumers

No distinction was provided between cooperative members and actual users, nor how long members had to wait before they got connected.

Productive Impacts or Uses

Industrial users, comprised mostly of grain-drying and storage facilities servicing small and medium farmers, used electricity for most processes. Drying, which was designed to run off diesel generators, was an exception. Large farmers had their own facilities. Other private industrial users -- rice mills, cotton gins, milk-cooling facilities, and dairy operations -- used electricity in processing but also had their own source of energy, diesel generators for supplementary and emergency use. Electricity generally appeared to complement rather than substitute for other energy forms.

Agricultural uses were confined to the largest, most capitalized farms. Electricity was used for fencing, milkers and coolers as well as irrigation. No small or medium-sized farms were using electricity for production purposes.

These industries were not new to the area, and no evidence was provided to determine whether availability of electricity was a factor in starting new productive activities.

There were some new industries -- a chick hatchery, dairy farms, etc. -- but this did not necessarily imply that these enterprises began because of electricity. Indirect employment generation effects could not be determined even though some of the new industries had meant new jobs. Electricity improved productivity in milking cows and consequently there was less demand for this kind of labor. Except for homes selling soft drinks, there was no evidence of small scale self-employment derived from the use of electrical equipment (i.e., sewing machines).

Household Usage Impact

Household usage was confined almost entirely to lights and small appliances (electric iron). Some households had TV sets and phonographs. The impact of this usage on education, leisure time, etc. was not assessed.

Social Impacts

Social impacts were not assessed except to indicate that those which might have accrued were confined to larger towns where hospitals, clinics and social centers were located. One rural school had obtained electricity, but could not afford to keep it.

RURAL ELECTRIFICATION IN THE PHILIPPINES

I. Evolution of AID Rural Electrification Activities In the Philippines -- Preproject Need Assessment

In April 1964 a survey team from the National Rural Electric Cooperative Association (NRECA) visited the Philippines. This was the first survey effort of the NRECA outside of Latin America.[1]

The 1964 NRECA survey report -- covering Korea, Thailand, Japan, and Taiwan, as well as the Philippines -- described the state of the power industry in the Philippines as follows:

1. Manila was served by the Manila Electric Co. (MERALCO), a private utility possessing, the greatest generating capacity of the Philippines systems.

2. The National Power Corporation (NPC), a public corporation, was engaged in generation and transmission on the large islands of Luzon and Mindanao.

3. Approximately 300 small private utilities and 100 municipal systems existed, some purchasing power from the NPC, others generating their own. These served the smaller town and village centers. No data on their combined generating capacity or on their coverage of population were presented.

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1. NRECA began providing technical assistance to a rural electrical cooperative in Nicaragua in 1965, after surveying several Latin American countries where the potential for AID assistance in rural electrification seemed to exist.

NRECA specialists noted the fragmented and relatively high-cost nature of the power supply system as it existed in the rural areas. Many rural systems had independent diesel generation capacity and were able to provide service only 6-12 hours a day. High operating costs, low rates of return and the inability to obtain favorable financial assistance made it unlikely that private utilities, on their own, could afford to extend much service to low density areas. Representatives of the Philippine Electric Plant Owners Association (PEPOA) met with the NRECA and thought that the rural areas could be served best through subsidies to the power companies.

The Electrification Administration (EA) had been organized in 1962 to administer the Government of Philippines' (GOP) power development program. The EA was authorized to administer low interest loans to private and municipal utilities to encourage their extension into rural areas. NRECA noted: "It was thought that these favorable terms would encourage electric plant operators to undertake extensions of lines in the poorer rural areas, but it has not happened... So far, no loan funds have advanced."[1]

While the NPC had a 10-year plan of development which would include some villages, it was also noted that "nothing in the plan envisages an area-coverage program."[2]

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1. NRECA, Far East Region Rural Electrification Survey, June 1964, p. 22.
2. *Ibid*., p. 19.

The NRECA team concluded that reliable low-cost electrification would be impossible to achieve with this fragmented system.

Having learned of plans for a nationwide survey of the Philippines electric power system the following year, and of USAID's involvement in that survey, NRECA strongly suggested that two rural electrification specialists participate. The suggestion apparently met with considerable enthusiasm from USAID and Philippine authorities, and two NRECA specialists did participate in the national survey. Their recommendations, as incorporated in the body of the power survey report, were to have substantial bearing on the initiation and development of rural electrification in the Philippines.

A few passages selected from among the observations and recommendations of the Power Survey Team should be sufficient to give the flavor of the report's conclusions.

With respect to the existing operations of small private and municipal systems:

> The companies are usually individually or family-oriented and interest rates on borrowed funds are often equal to the allowed rate of return and sometimes exceed the actual rate of return being earned. Therefore, the principal problem of the small independent operations lies in the areas of securing capital for expansion on terms which can be met in the operation of small electric utilities. Very few of them are able to invest personally or corporately the funds required for adequate expansion of properties to provide for new business and new service areas.

The report continues:

> ...the weighted average rate of return would be 6.8% for some 26 privately-owned companies. This is below a 12% return, presently approved by the Public Service Commission, which return may not provide adequate earnings to enable the group to secure capital for expansion and extension; 14% or more may prove necessary. (p. 2.23)
>
> The cost of operating these plants is high. Because of the high operating cost coupled with the small amount of electricity used during light load periods, the owners find that it is not profitable to operate the plants during these periods and, therefore, electric service is often supplied only 12 hours per day. (p. 2.23)
>
> A vehicle that has been used and proven successful in other countries is the rural electric cooperative. Historically, cooperatives in the Philippines have not been successful for various reasons. We are advised, however, that in recent years at least a few cooperatives have been developed which give promise of successful operation. ([2], p. 505)
>
> After a careful study of the problem and a full evaluation of the possible solutions, the Power Survey Team concluded that the Government of the Philippines, acting through the Electrification Administration with the assistance of National Economic Council and the National Power Corporations, should inaugurate a series of pilot cooperative projects similar to those sponsored elsewhere under the NRECA-USAID cooperative program. The location of these projects should be chosen in areas where the likelihood of success is the greatest and also to cover as great a variety of agricultural pursuits as possible. (p. 5.05)

Some difference of opinion within the Power Survey Team may be reflected in the phrasing of the summary recommendations which are at variance with the above quotation with respect to an exclusively cooperative mode of implementation. Recommendation No. 15 says that the study: "Recommends a long-range program of rural electrification development with initial subsidization by providing lowcost capital to rural cooperatives, existing and future private developers and municipalities for this purpose." (p. 102)

The body of the report, however, contains the following:

> A number of small village installations is now under way directed by the EA. The Power Team recommends that the number of these small units be limited and that the available resources be diverted wherever possible to larger units of long-range program that promises the essentials of good management and operation and opportunity for continous service. (p. 2.21)

Perhaps to reinforce a positive view of cooperatives (despite their admittedly poor track record in the Philippines at that time), the study quotes a speech by then President Macapagal as follows:

> While the family-owned and family-financed corporations have played a prominent role in our past industrial development, the requirements of our future growth are growing beyond the capacity of such family enterprises to handle. As sources of finance, and as sources of managership, the family is fast ceasing to be a meaningful unit. (p. 8.35)

Whatever controversy may have existed regarding cooperatives, the study strongly recommended that the Philippines embark on a long-range rural electrification development program. As stated in the summary, the study:

> Estimates expenditures required for rural electrification in addition to normal development to be ₱ 242,000,000 in the ten-year period 1965 to 1974, inclusive, and ₱728,000,000 for 1965 to 1984. Forty percent of all households are estimated to be served in 1984. (p. 102).

The prevailing exchange rate in 1965 was ₱4 = 1US$; therefore, these estimates translate to $182 million 1965 US dollars in order to achieve 40 percent coverage of households in rural areas by 1984.

The study recommended initiation of the program through development of one or two pilot projects selected from among the following five areas: Victorias in Negros Occidental, Santiago in Isabela, Tiwi in Albay, Marinduque Island, or Cabatuan in Iloilo. This and subsequent development was to be carried out through "units of organization ... large enough to support a good managerial and operating staff, and generating stations with large equipment designed for dependable 24 hour operation." (p. 5.05)

Subsequent to loan feasibility and engineering studies conducted by NRECA in 1967, two AID-financed pilot projects were selected and approved in late 1968. These were the Victorias Rural Electric Service Cooperative (VRESCO) and the Misamis Oriental Rural Electric Service Cooperative

(MORESCO). In support of both projects combined, AID provided \$3.4 million out of total estimated project costs of \$4.14 million. VRESCO involved the expansion of generation and distribution installations of an existing rural electric cooperative while MORESCO involved the distribution only of NPC hydropower by a newly formed cooperative. Construction financed through these projects was completed by late 1971.

At about this time, and prior to any formal evaluation of either VRESCO or MORESCO, approval was sought for loans 492-H-027 (Rural Electrification Consulting Services, \$600,000) and 492-H-028 (Rural Electrification, \$19.4 million). The purpose of 492-H-028 was to assist the Government of the Philippines through the National Electrification Administration (NEA, successor agency to the EA) in initiating its long-range rural electrification development plans. It would finance the foreign exchange costs of establishing 36 geographically dispersed rural electric cooperatives. In addition, 492-H-027 would finance the long-term consulting services of NRECA and Stanley (engineering) consultants to the NEA.

In succession, AID approved loans 492-T-034 (Rural Electrification II, 1974); 492-T-036 (Rural Electrification III, 1974); 492-T-043 (Rural Electrification IV, 1976); and 492-T-047 (Rural Electrification V, 1977). With 492-T-047 AID is discontinuing its practice of lending for rural electrification in the Philippines because support in this area will continue through other donors.

A detailed examination of the characteristics of these loans and projects, their design, implementation and evaluation as reflected in the available documentation, will be presented in the following sections. To introduce these sections, and to complete the summary description of the evolution of AID Rural Electrification activities in the Philippines, the following background is provided.

Over a 10-year period (1968-1977) in eight separate loans beginning with VRESCO and ending with Rural Electrification V, AID has committed $91.8 million in loan funds for rural electrification in the Philippines. These represent about 23 percent of total project costs which have been estimated at about $387.5 million. The $91.8 million represents about 27 percent of all AID economic assistance loans to the Philippines -- actually 45 percent excluding Food for Peace -- over the entire FAA period from 1962 to 1977. Rural electrification is a massive undertaking in the Philippines and AID has participated on a substantial scale.

According to a recent AID project paper regarding a grant for the establishment of rural electrification training centers in the Philippines,

> ...as of June 1978 there are 106 registered cooperatives scattered throughout rural Philippines, 84 of which are energized, delivering electrical power to over 4.5 million rural residents; thus, the Philippines has the most successful rural electrification cooperative program in the developing nations of the Asian world.[1]

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1. AID Project Paper, Philippines, "Rural Electrification Training Centers," August 1978, page 1.

Rural electrification has certainly been a large and comprehensive program. It has also been costly. A careful review of the existing documentation concerning the program can identify experiences and help to complete a framework whereby the effectiveness issue can eventually be conclusively addressed.

II. Document Sources Assembled and Sources of these Documents

A complete bibliography documenting AID rural electrification lending in the Philippines upon which this case study analysis is based is presented below. The bibliography is presented in chronological rather than alphabetical order, with the source of individual documents noted in the right-hand margin.

Forty reports, including two surveys, 11 loan feasibility and engineering study reports, 13 capital assistance and project papers, three loan agreements, six evaluative studies and five audit reports were assembled. In addition, four items of interest, among the materials contained in AID retired files #220-189 and #220-169, are referenced.

Collectively these documents provide an adequate basic record on the evolution and scope of AID Rural Electrification activities as well as scattered, but nonetheless valuable, insights with respect to the processes of project identification, design, implementation and evaluation.

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III. Profile of Aid Projects

1. VRESCO and MORESCO (AID loans No. 492-H-025 and 492-H-026)

A. Goals and Purposes

Although these loans predate the logical framework, fairly explicit statements analogous to goal and purpose statements are contained in the respective Capital Assistance Papers (CAP). The objectives for VRESCO are:

1. To demonstrate the success of large-scale area coverage for the Philippines, through an electric power cooperative.

2. To demonstrate the financial viability of large-scale area coverage electrification where investment in generating capacity must be made to provide a source of power.

3. To stimulate the formation and activities of public and private sector institutions which would advance rural electrification in the Philippines through technical, managerial, organizational and financial assistance to rural systems.[1]

The introductory summary sheet of the CAP summarizes (and changes) these statements as follows:

> PURPOSE OF THE LOAN: This is a pilot demonstration project to initiate a program of rural electrification in the Philippines, with the following objectives:
>
> a. To demonstrate the economic feasibility of rural electrification,

b. To demonstrate the benefits to the regional economy from the introduction of electrification to rural areas of substantial population,

c. To develop public sector support for a nationwide program including sale of power, technical assistance and financing.[1]

Elsewhere, under "Place of the Project in the Development Program," the CAP states: "The project is intended to accelerate economic development, improve the standard of living in rural areas of the Philippines and develop democratic institutions."[2]

Goals and purposes are stated in identical language in the case of MORESCO (although funded separately both projects were developed at the same time and both CAPs bear the same date) with the exception of language referring to the financial viability of projects involving investment in generating capacity. Unlike VRESCO, MORESCO only distributed power bought wholesale from the NPC. The analogous statement in the case of MORESCO is: To promote electrification on the Island of Mindanao and utilization of the low-cost hydropower source of the National Power Corporation (NPC) at Maria Cristina.[3]

Purpose statements also have an inherent promotional purpose in such language as "to demonstrate the success of large-scale area coverage through a cooperative," and "to

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1. Op. cit., page 1.
2. Op. cit., page 4.
3. AID Capital Assistance Paper, "Philippines: Misamis Oriental Rural Electric Service Cooperative," AID-DLC/P-720, June 14, 1968, page 5.

develop public sector support for a nationwide program."

The major problems with these statements for evaluation purposes, particularly using logical framework, are that they suffer from problems of specificity (beneficiaries, impacts), definition (success, viability), measurability, and inconsistency (economic feasibility in the summary vs. success in the text; benefits to the regional economy vs. financial viability).

B. Structure of Projects

In both cases, the rural electric cooperative was the vehicle chosen for implementation at the operational level.

VRESCO had been organized prior to the loan by a group of large sugar planters in association with the Victorias Milling Co. (VMC). At the time of the project planning, the cooperative had 156 members, of whom 53 were receiving service. Although the cooperative had a small independent generating capability, it was largely dependent on excess power made available from VMC's bagasse-fired steam generation facility. Service was subject to interruption for about six weeks of the year when the VMC shut down and periodically throughout the year during maintenance operations.

The project would provide VRESCO with increased generation capacity and distribution facilities.

MORESCO, on the other hand, was a newly established cooperative which would handle distribution and management functions only. Relatively inexpensive hydropower was to be purchased from the NPC.

In the words of the CAPs,

> The Electrification Administration will provide local currency funds for the project and the funds will be deposited with the Development Bank of the Philippines (DBP). The DBP will borrow the dollars for the project from AID and will provide both the dollars and the pesos to the cooperative on the terms made available by EA and AID, plus a fee of 1 1/2 percent on the dollar loan. The fee will cover the cost of administration and also compensate for the risk of loss in the event of default by the cooperative. The National Power Corporation will undertake technical supervision of the project under an agreement with DBP.[1]

Terms of the AID loans were 25 years with a 5-year grace period on repayment of principal and with interest on outstanding principal of 3 1/2 percent per year.

EA's role was limited to financing the local currency cost of the project. USAID questioned EA's capability to serve as implementing agent. Differences in philosophy regarding rural electrification may also have been a factor. The CAPs state:

> Funds available to EA are inadequate to support a substantial nationwide program. The direction of funds has been influenced by political judgments and emphasis has been placed upon a wide distribution of funds to induce recognition from a large number of people. Small generating plants have been authorized, and most lack the capacity and feasibility to help the economy of the rural areas. Many projects have never been completed.

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1. Op. cit., page 2.

> President Marcos recognized the inability of EA to mobilize and support a successful nationwide program for electrification...Therefore, the GOP has endorsed a role for EA, limited to financing the local currency cost for this project.[1]

The NRECA/Power Survey Team recommended that EA's small-scale electrification program should be phased out and remaining funds channeled to the area-coverage, rural electric cooperative development program concept. In 1969, in time for the first of the major AID rural electrification loans (492-H-028), Republic Act No. 6038 abolished the EA and established the National Electrification Administration (NEA) to take its place.

An AIDTO telegram indicates considerable controversy over the issue of Development Bank of the Philippines' charging a fee on the reloan of AID dollars to the cooperatives. The cable states:

> See no reason why we should support any significant spread of these projects. We are not bankers seeking GOP guaranty for private project; we are assisting GOP in support GOP national program. Do not understand why there should be more than minimal spread to DBP and even question reimbursement NPC its administrative costs if GOP seriously support this project. Basic problem is that not only has GOP not provided effective institutional channel, but has indicated by these actions unwillingness lend support these programs.
>
> Suggest considering spread one half percent if exchange risk passed cooperative, somewhat higher if exchange risk assumed.

1. Op. cit., page 6.

The DBP did not assume the risk of exchange rate fluctuations. It did reduce its fee, however, from the 2 percent originally requested, to 1 1/2 percent.

C. Inputs

Foreign exchange, local currency ($2,000,000 and $475,000 respectively for VRESCO; $1,100,000 and $569,000 for MORESCO), technical supervision in the design, construction and initial operating phases are the inputs listed in the respective CAPs. For this project most material inputs, including poles, were to be incorporated.

D. Outputs, Users, Uses

VRESCO. The VRESCO cooperative at the time of project initiation had 156 members, 53 of whom were receiving service.

The pilot project was to expand initially the generating capacity of the VMC-VRESCO pool and to extend distribution lines to service 7,000 connections -- 6,350 were to be workers' houses on the sugar plantations. These homes were projected to consume 158,750 KWH per month during the first year of operations while only 260 connections at planters' and overseers' dwellings were projected to consume nearly as much -- 139,000 KWH/month. Three municipalities were to receive power from the cooperative in the amount of 111,000 KWH/month, while the VMC and two other large consumers would receive 60,000 KWH/month. A total of 90 connections at commercial establishments (50), schools and churches (30), and irrigation pumping facilities (10) were together projected to consume a combined total of 34,250 KWH/month.

By year 10, 7,585 worker houses were projected to be consuming 493,025 KWH/month, while 654 planters and overseers would be consuming more -- 690,340 KWH/month. Commerce, schools, churches, and irrigation were to be receiving 121,350 KWH/month by year 10.

Agreements were reached whereby the planters would finance housewiring costs, as well as pay a minimum monthly consumption charge to the worker of ₱5.00 ($1.27) monthly. Consumption in excess of 20 KWH/month would be paid by workers.

To quote the CAP:

> At the end of ten years of operation the average worker family will consume an average of 70 KWH (per month) at a cost of ₱14.20 ($3.63). This corresponds to a charge of 9.00 ($2.36) per month to the worker (₱14.20 less ₱5.00 minimum charge paid by the planter). While this represents a significant cost to the worker family, the low capital goods consumption level of the worker's mode of living should be considered. For example, the typical Nipa hut which provides shelter for the worker family had a capital cost of about ₱800 (slightly more than $200).[1]

Elsewhere the CAP states that average income of this group (sugar cane workers) was ₱1,500/annum ($357) per family.

A declining block rate structure was adopted for residential, commercial, and irrigation end-use consumption

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1. AID Capital Assistance Paper, Philippines: Victorias Rural Electric Service Cooperative, AID-DCL/P-731, June 14, 1968, Annex S page 3.

classes. (Irrigation usage during off-peak hours was provided with a minimum preferential rate, but would be charged commercial rates if conducted at other times.)

The rate structure adopted is reflected in Table 1 below, which projects, for the first year of operations, average electricity costs per KWH by the several consumer classes to be served. It will be noted that workers' costs per KWH are approximately double those to planters and overseers; and recalled that consumption in excess of 20 KWH/month was to be paid by the workers.

Flat, rather than metered, rates to small residential consumers were rejected on the grounds of potential pilferage.

The CAP states that approximately 30 schools and churches existed in the cooperative's initial service area; the population numbered approximately 40,000 people. Assuming that 50 percent of this population was under 15 years of age, and that half of these facilities were schools, one could establish a very rough estimate that over 1,300 school age children attended each available school. Other social infrastructure in the area -- certainly housing and probably health facilities -- would appear to have been seriously deficient in the project area.

Many issues are raised by a review of the VRESCO project design documentation. These involve the proper assessment of social opportunity costs, appropriate technology, production and income generating potential, as well as the

Table 1. Average Cost, Consumption and Monthly Charge Projection by User Category

Class of consumer	Average cost per KWH (centavos/cents)	No. KWH per month	Monthly charge (dollars)
Landowner-Planter	11.2c (.0286)	1100	123 (31.38)
Overseer	14.3c (.0265)	350	50 (12.70)
Worker	25c (.0638)	20	5 (1.27)
Commercial	20.8c (.0531)	125	26 (6.63)
Schools and Churches	19.0c (.0485)	100	19 (4.85)
Irrigation	8c (.0204)	2500	200 (51.02)
Large Power	9.9c (.0253)	20,000	1,990 (507.65)
Other Utility	9.4c (.0240)	37,000	3,485 (889.03)
Security Lighting	24c (0.612)	50	12 (3.06)

distribution of both that potential and direct project benefits. These will be addressed somewhat more fully later in conjunction with information available from evaluative documents.

For now, a final note on VRESCO involves the language of the CAP in the justification of consumption projections for planter households. During the first year, these were expected to consume 1,100 KWH/month each vs. 25 KWH/month for worker huts. The CAP states:

> The load forecast estimate of 1100 KWH per month for this class of customer was taken from existing records of the Cooperative. The Cooperative is now serving 48 haciendas and on each hacienda the owner has his residence, which is modern with many conveniences. Upon receiving electricity the owners will install a variety of electric appliances. The main house will be air-conditioned, electric ranges installed, water pumps, electric irons, and many other small appliances purchased. It is expected that all new customers in this rate classification will do as their neighbor -- go all electric.[1]

MORESCO. The MORESCO service area is markedly different from VRESCO. According to available documentation, MORESCO was selected by the NRECA feasibility team for three reasons: (1) availability of a low cost power source; (2) no conflict with existing franchise holders; and (3) a sizeable population anxious to support the formation of a rural electric cooperative.

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1. Op. cit., Annex 5, page 3.

The CAP elaborates:

> The MORESCO service area is mostly agricultural with average land holdings of 5 to 10 hectare size. Principal crops are coconut, corn, rice, tobacco, citrus and pineapple, and row crops. Fishing is a major occupation. A considerable number of residents work part-time, and some full-time, in the adjacent cities. Some agri-business development, mostly small operations, has spread from the cities to the area. Shipping is available through barge service from ocean-going vessels anchored off shore. Consideration is being given to establishment of one or more coconut processing plants in the area. Adequate alternative vehicle service exists along the coastal route throughout the service area.
>
> Family income levels are around $450/year, about average for the Philippines. The average monthly cost of power per customer will vary from ₱7.00 ($1.78) initially to ₱13.75 ($3.51) per month in the tenth year of operation, whereas the current cost of kerosene for house lighting is about ₱5 ($1.27) per month. Discussions with community leaders have supported the recommendation of the NRECA team that these levels of expense can be supported by individual users.[1]

Table 2 on the following page presents projections of users and average consumption by user category for years 1-10 of MORESCO operation.

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1. AID Capital Assistance Paper, "Philippines: Misamis Oriental Rural Electric Service Cooperative," AID-DLC/P-730, June 14, 1968, page 7.

Table 2. Projected Users of MORESCO Power[a]

A - Domestic
B - Small Commercial
C - Schools and Churches
D - Municipal
E - Security Lights

Numbers of Users by Classification

Year	A	B	C	D	E [1]
	6,363	221	88	31	100
2	6,750	240	90	32	115
3	7,150	255	92	33	130
4	7,550	270	94	34	145
5	7,950	285	96	35	160
6	8,350	300	98	36	175
7	8,750	315	102	37	190
8	9,150	330	104	38	205
9	9,550	345	106	39	220
10	10,000	360	108	40	235

Average KWH/month consumption

Year	A	B	C	D	E
1	40	125	100	125	50
2	45	135	105	135	50
3	50	145	110	145	50
4	55	155	115	155	50
5	60	165	120	165	50
6	65	175	125	175	50
7	70	185	130	185	50
8	75	195	135	195	50
9	80	205	140	205	50
10	85	215	145	215	50

1. _Op_. _cit_., pp. 8-9.

MORESCO clearly seems to have been more strongly oriented towards small-scale consumption than VRESCO.

Rates, as in the case of VRESCO, were designed to decline with increased consumption. These rates were slightly higher than those charged by the private utilities at neighboring CAGAYAN and ILIGAN for consumption levels below 400 KWH/month, lower above 400 KWH. The CAP argues that these utilities enjoyed higher density loads than MORESCO and therefore, that "these comparisons are not really fair ones".[1]

IV. Projects Analysis

1. VRESCO

Two audit reports, Dr. Denton's social analysis[2], and his recent book are the principal evaluating materials regarding VRESCO which could be identified.

The first audit report, dated October 16, 1970, predates the completion of project financed construction. The only interesting observation it contains is that "our examination disclosed that the financial support to be provided to the project by the AID loan and especially the RP is presently inadequate due to the passage of time since the loan agreement date and a closer defining of project requirements." These shortfalls were estimated at $130,000 and ₱1,711,868 or 6.5 percent and 92 percent of original AID and GOP commitments, respectively.

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1. Op. cit., Annex 8, page 5.
2. Denton, F. H., Philippine Rural Electrification: Social Analysis.
3. Denton, F.H., Lighting Up The Countryside ..., 1979.

The second audit report, dated June 21, 1972, reports as follows. The basic VRESCO system was completed in December 1971 with a maximum generating capacity of 5,200 KW and 360 miles of new distribution lines. As of March 31, 1972, VRESCO was serving over 8,000 consumers with plans to add an additional 3,000 consumers by the end of 1973.

The cooperative was unable to pay its first interest installment of ₱300,548 ($44,858), due March 1972, on its loan from the DBP. This is attributed to project slippage, increased construction and operating costs, devaluation of the peso, inflation, and the 5 percent interest charged by the DBP (3 1/2 percent had been assumed in the feasibility study).

The Denton social analysis mentions that at some unspecified date VRESCO had 13,066 members and had achieved 100 percent collections on billings.

This book[1] provides some information on VRESCO as of mid-1976. Average residential consumption at that date was about 64 percent of feasibility study forecasts. Overall KWH sales, however, were approximately in accord with feasibility study estimates, partially due to an unanticipated rate of growth in the number of residential consumers which then exceeded projections by approximately 11 percent. The remaining balance was accounted for primarily by growth in industrial consumption which was also larger than anticipated. Unfortunately, little more detail on the operational experience of VRESCO is provided.

1. Op. cit., pp. 133-152.

Annex B-4 to the Rural Electrification V project paper [23] states that in December 1976 VRESCO had achieved 15,000 house connections and was projected to achieve 81,200 connections -- 87 percent of the potential connections in its service area -- by the end of 1984. Annex B-8 states that 11,026 consumers were receiving service. The same annex reports that VRESCO was operating at a sizeable deficit over a 12-month period presumed to be recent (end of 1976, early 1977). The cooperative had been projected to generate positive net income (after taxes, depreciation and interest payments) by the fourth year of operations.

The recently conducted national rural electrification survey [35] sampled the VRESCO area. Only nationally aggregated figures were published however.

In addition to these evaluative documents relating to VRESCO, our focus must be essentially restricted to preproject planning and design documentation.

The NRECA feasibility study and the ensuing AID Capital Assistance Paper reflect reconnaissance and assessment of the list of issues identified in the conceptual framework as being relevant to preproject assessment and project design. A perspective taken today raises questions regarding the nature of that design. These are important because, in one sense at least, the VRESCO pilot project may be inferred to have achieved one of its objectives: its realization was undoubtedly influential in developing public sector support for a nationwide program.

The principal questions which might be raised today regarding the VRESCO design would include the following three issues.

1. Were the opportunity costs ensuing from the foregone benefits of alternative development assistance possibilities -- to which AID and GOP monies might have been directed -- properly assessed? Descriptions of the structure of project area production, employment, earnings levels, and infrastructural endowment contained in the documentation can be read to suggest that ample scope existed in the area for projects directed towards health, education, housing and the creation of off-farm employment.

2. With regard to the distributional issues relating to designed project outputs -- electric power - two questions might be raised: (a) the distribution of power between consumption and productive uses; and (b) the distribution among households of power destined for consumption.

The following enumerates projections contained in the CAP for the tenth year of VRESCO operations.

Category	Number of connections	KWH projected avg. monthly consumption	Total KWH projected consumption
Landowner-planter	154	2,210	340,340
Overseer	500	700	350,000
Worker	7,585	65	493,025
Commercial	73	215	15,695
Schools and churches	39	145	5,655
Irrigation	40	2,500	100,000
Large power	12	25,000	300,000
Other utilities	3	102,000	306,000
Security light	250	50	12,500

Excluding VRESCO sales to other utilities whose sub-distribution is not known, 74 percent of power sales in year 10 were destined for consumption by planters, overseers, workers, and security lights. Ninety-five percent of the power destined for productive uses (schools, churches and commercial establishments) was projected to go to 12 large power consumers and 40 irrigation installations presumably located on the large sugar plantations.

Looking at projected private consumption uses (i.e., excluding security lighting) we find that 8 percent of the users (planters and overseers) were projected to consume 58 percent of the power sold for these uses -- at an average cost, it will be recalled -- of less than half that charged the remaining 92 percent of household consumers.

While the workers were undoubtedly pleased to be getting lights, and the poor majority might perceive some indirect employment and wage benefits from the potential productive utilization of the power on the sugar farms and mills, the distributive features of the VRESCO design would, it is believed, today raise serious questions as to its suitability for concessional development assistance.

3. The CAP for VRESCO mentions that a justification for the cooperative structure is the potential for developing democratic institutions. The NRECA feasibility report notes, however, that five of the seven VRESCO board members whose occupations are described (there were nine board members in all) were sugar planters or officials of the VMC. Annex B-5 of the RE V PP states that only two turnovers occurred on the VRESCO board between 1973 and 1977. Given the planter-worker relationship and the dominance of the planters in the VRESCO area, little potential for democratic management of the cooperative actually existed from the onset.

2. The MORESCO Study

Considerably more evaluative material exists for MORESCO. This includes, most importantly, a study published in 1976 by the Research Institute for Mindanao Culture, Xavier University, entitled "An Evaluative Study of the Misamis Oriental Rural Electric Service Cooperative" [30]. This is currently identified as "The MORESCO Study."

In addition, important references to MORESCO are made in Development Alternatives, Inc.'s report on the NRECA [31] and in the Denton study [34].[1] Luken's environmental assessment [33] draws heavily on "The MORESCO Study" in its treatment of social and economic issues. As in the case of VRESCO, the National Survey Report [35] is known to be based in part on MORESCO data, but these data are not disaggregated to the individual cooperative level.

Audit reports [37,38] as well as information contained in the RE V project paper [23] supplement the above materials.[2]

Principal results of the MORESCO study are based on a sample survey undertaken in August 1975 in the MORESCO area. While an ad hoc preliminary sample had been taken, the probability sample providing the basis for statistical inference about the project area included the survey of 253 households. Questions were designed to provide information about the utilization of cooperative electricity, income,

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1. The Denton book [45] draws primarily on "the MORESCO study [30] in its discussion of this cooperative.
2. The Madigan study of the Alubijid-Logiulo Irrigators' Association, ALISA (see reference 46) reorts extensively on the socioeconomic progress of that association's membership. It also reports, however, that the two-electric irrigation

and satisfaction with life characteristics of project area residents, users and non-users of electricity alike.

The survey reports that:

> ...approximately 95 percent of the population in this area earns an income of less than two hundred twenty-five dollars per capita per year or less than one hundred fifty dollars at 1969 prices.[1]

Approximately 21,000 households resided within the ten municipalities of the MORESCO area.[2]

Exhibits D and F from the report provided survey results on percentage distribution of cooperative coverage, and mean per capita income among these households as follows.

Category	Percent of households	US$ mean per capita income
Current users	32.4	100
Applied for connection	2.0	78
Requested disconnection due to road widening	5.5	78
Inaccessibles	43.5	53
Non-adopters		
financially related	12.3	41
non-financially related	4.3	54

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pumps installed with MORESCO's financial assistance were supplanted by the renovation of the area's traditional gravity-flow irrigation system after only one year's use. This study is not relevant, therefore, to the evaluation of MORESCO.

1. Herrin, et. al, "An Evaluative Study of the Misamis Oriental Rural Electric Service Cooperative," Research Institute for Mindanao Culture, Xavier University of the Philippines, 1975, page 2.
2. *Ibid.*, page 23.

Approximately 7,000 households were being served in 1975; the majority were individuals who, by survey estimates, earned less than the AID poverty benchmark.

Apparently, inaccessibles and non-adopters in the area were considerably poorer. These groups made up the majority of households within the service area.

The study remarks:

> ...the users had a somewhat higher average than any of the other households. Does this indicate that use of electricity has added to their incomes, and is the cause of the difference?
>
> The data do not permit one to answer this question.[1]

Undeterred, the study group proceeded with the construction of a series of indices, designed to complement the income data.

The first of these was a level-of-living index. Aggregated scores were given on the basis of "house construction materials, rooms in home, cooking facilities, facilities for storage of perishable goods, type of illumination, source of cooking and drinking water, toilet facilities, means of transportation, improvements in house, and house ownership."

In fairness, it must be said that a revised version of this index excluded items potentially related to the availability of electricity in the home, such as type of lighting, and facilities for food storage. Not surprisingly,

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1. Ibid., page 32.

users scored a higher average level-of-living index value than any of the other categories.

A series of five "satisfaction with life" indices were also constructed. These are perhaps best summarized in tabular form.

SIT PRES (situation present) asked the respondent to compare his situation with that of his neighbor.

SIT PAST A	compare with 5 years ago
SIT PAST B	compare with your father's household
SIT FUT A	compare expectations 5 years from now
SIT FUT B	compare with expectation for your children
SIT TOT	simple average of above

Respondents were asked to scale their responses from 1 to 5, with 1 being 'much worse', 2 'worse', 3 'about the same', 4 'better', and 5 'much better'.

Table 4 reproduces survey results with respect to these indices.

Mean Scores for Respondents of Satisfaction

With Life Situation Indexes By User Category

User Categories	Satisfaction With Life Indexes: SIT PRES	SIT PAST A	SIT PAST B	SIT FUT A	SIT FUT B	SIT TOT
User	3.187	3.202	3.315	3.305	3.222	3.246
Non-Adoptor	2.923	2.873	2.966	3.076	3.127	2.993
Inaccessible	3.100	2.925	2.975	3.175	3.225	3.080
Disconnected	2.930	2.880	3.000	3.220	3.160	3.048
Total	3.078	3.041	3.144	3.217	3.187	3.133

Table 5. Mean Household Income as Reported in the MORESCO and Recoop II Studies of the MORESCO Co-op Area for three Different Years

MORESCO 1974	RECOOP II 1973	RECOOP II 1976
P2,726.39 (assuming 5.233 persons in a family)	P4,715	P7,806
P3,141.11 (assuming 6.029 persons in a family)		

All responses, for all indices, by all categories, are closer to an average 'about the same' response. In making inferences about the service area population on the basis of this sample, one would have to allow for sampling error though no estimates of such error are presented. Assuming a standard error of .2 for these estimates (implying a coefficient of variation less than 10 percent, more than adequate for an approximately 1 percent probability sample), no estimate is significantly different from 3 at the 90 percent confidence level. The results certainly do not support conclusions such as those reproduced below.

> Summing up these indices, they indicate that since electrification user respondents had reason to feel that their life situation had improved, while other respondents felt that theirs had degenerated.[1]

or,

> Taken together, these indices furnish rather strong support for the view that electrification has already improved the standard of living of users, at least in the estimation of the users themselves, who in the last analysis are probably the best judges on the question.[2]

or,

> In view of these findings, which show that the main target of the MORESCO cooperative has been the majority of the people who are poor in terms of economic goods, and that such people have been substantially benefited in increasing

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1. Op. cit., page 38.
2. Op. cit., page 39.

> the quality of their social and economic life situations, the Research Institute for Mindanao Culture concludes that to a very substantial and highly satisfactory degree the MORESCO project has been realizing the goal and objectives which have been set for it, namely, improvement of the quality of life of the rural poor.[1]

Exhibits S and T of the MORESCO study, reproduced on the following pages, document the growth in numbers and consumption of the various user categories served by the cooperative.

During the period of installation of a new system, growth rates in the number of connection are high across all categories. These growth rates taper off between 1974 and 1975. Although it is not being suggested that these indicate a reversal of the trend, reductions in small commercial and irrigation connections did take place. In 1975, commercial and industrial establishments were consuming 38.5 percent of power sales, irrigation 2.5 percent, water systems 5 percent; the remainder were distributed among private and public consumption uses.

Respondents were asked to cite the most important uses of electricity. Of 203 respondents, 198 mentioned lighting, 51 the use of appliances, 46 the ability to do household chores at night, 33 enhanced water supply, 24 entertainment facilities and 10 the ability to do agricultural processing and other night work.

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1. Op. cit., page 5.

Exhibit S. Average Number of Electricity Users by Year, by Category of Users and Indexes of Growth

Category of users	Average number of consumers				Index (1972-100)			
	1972	1973	1974	1975[a]	1972	1973	1974	1975[a]
Residential-Poblacion	1,450	1,965	2,124	2,167	100	136	146	149
Residential-Rural	1,907	3,082	3,685	3,993	100	162	193	209
Schools/churches municipal sales	193	245	268	271	100	127	139	140
Commercial-small	273	332	355	345	100	122	130	126
Commercial-large and industrial[b]	1	2	5	15	100	200	500	1500
Irrigation	2	11	17	15	100	550	850	750
Water system	4	12	14	25	100	300	350	625
Security lighting	284	417	434	433	100	147	153	154
All Users	4,114	6,066	6,901	7,269	100	147	168	177

a. For nine months only.

b. The industrial users referred to are three in number. These are the saw mill (Timber Industries of the Philippines), the galvanized sheet steel plant and the sorghum cube plant. The three industrial users are lumped with large commercial users.

Exhibit T. Average Annual KWH Consumption by Category of Users

User category	Average annual KWH consumption				Index (1972-100)			
	1972	1973	1974	1975[a]	1972	1973	1974	1975
Residential-Poblacion	42,173	55,253	75,681	86,692	100	131	179	206
Residential-Rural	43,157	60,911	81,339	95,479	100	141	188	221
Schools/churches municipal sales	12,158	9,616	12,866	16,078	100	79	106	132
Commercial-small	41,601	54,522	69,067	65,321	100	131	166	157
Commercial-large and industrial[b]	5,387	31,943	50,220	93,882	100	593	945	1743
Irrigation	411	5,017	7,842	10,256	100	122	191	250
Water System	1,321	7,942	10,634	20,652	100	601	805	1563
Security lighting	15,749	24,081	25,106	24,939	100	153	159	158
All Users	161,957	249,285	332,776	413,299	100	154	205	255

a. For nine months only.

b. The industrial users referred to are three in number. These are the saw mill (Timber Industries of the Philippines), the galvanized sheet steel plant and the sorghum cube plant. The three industrial users are lumped with large commercial users.

3. Other Evaluative Materials

Development Alternatives, Inc., in the course of their evaluation of the International Program Division of the NRECA [31], visited the Philippines and reviewed some documentation on the rural electrification program there. Included in that documentation were the MORESCO study -- which we were also able to review -- and a study entitled RECOOP II, conducted by the Asia Research Organization, and submitted to USAID/Manila in January 1976. We have not been able to obtain this second study and, therefore, merely cite DAI observations regarding it.

With respect to the MORESCO study, however, DAI reports that "the final report of the study is vulnerable to criticisms that it attempted to document more than the data would support." "This is particularly true," DAI continues, "of suggestions that MORESCO is representative of, or even a reasonable approximation of, benefits which flow from NEA cooperatives."[1]

Noting the many benefits of rural electrification cited in the MORESCO study, DAI observes, "Many of these findings are undoubtedly true, but unfortunately, they reflect the unique situation in this area of Mindanao in which electric rates are the second lowest in the entire NEA system, due to cheap hydropower from NPC. DAI has calculated that the

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1. Development Alternative, Inc., "An Evaluation of the Program Performance of the International Program Division of the National Rural Electric Cooperative Association (NRECA)," Annex A, Rural Electrification in the Philippines, 1977, p. A-27.

MORESCO rates in August 1976 were 1.5 standard deviations below the mean, and a whopping 6.7 times lower than the highest electric rates."[1]

The RECOOP II study apparently conducted two surveys of the MORESCO service area, one in 1973, the other in 1976. DAI compared the RECOOP II income estimates to those derived from the MORESCO survey conducted in 1974. These were as follows:

DAI observes, "if the samples were drawn from the same population, there are flaws in the data collection/sampling techniques. Changes in mean income values in all likelihood do not represent real differences, but collection, sampling and aggregation error."[2]

One might also note, with reference to the RECOOP II figures, that the consumer price index for the Philippines, as reported by the World Bank, rose by 56.5 percent between 1973 and 1976. Thus, even if the two RECOOP II observations are mutually consistent, one finds that, in 1973 prices, mean household income had only risen to ₱ 4988 by 1976. This implies a real growth rate of 1.9 percent, a far more reasonable figure for a poor rural area than the 17 percent rate implied by the use of current prices.

Again citing the RECOOP II study, DAI observes that "in the MORESCO area, many of the paid and registered members in the electric cooperatives do not know they are in a cooperative. Only three percent indicated they were cooperative

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1. <u>Ibid</u>., page A-29.
2. <u>Op. cit</u>. page A-33.

members compared to 43 percent who acknowledged receiving electricity from the cooperative." [1]

This last observation is somewhat at variance with an observation made by Dr. Frank Denton (Social Analysis, [34]), to the effect that "in a survey of 240 members in 6 cooperatives, about 40 percent indicated regular attendance and only 15 percent said they seldom or never attended meetings."[2]

There is little conclusive about on this subject on the basis of these reports. It is worth noting, however, that DAI reports that "NEA has provided nearly 50 percent of all general managers on loan to the rural cooperatives. This is a commentary on both the closeness with which NEA holds control, insisting that any candidates for general manager be approved by the national headquarters, and the complexity of managing the rural cooperative."[3]

The Denton report, as well as DAI, comment on the competence and relatively high educational achievement among cooperative staffs.

Denton notes that in the MORESCO area approximately 400 new jobs were created as new industries established activities there after energization. These jobs, to the extent

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1. _Op. cit._, page A-13.
2. _Op. cit._, page A-9.
3. _Op. cit._, page A-14.

that they can be attributed to electrification, are estimated to benefit approximately 2,500 family members, or about 2 to 3 percent of the area's population.[1]

Following an informal survey, Denton states that "at least 40 percent of respondents, when asked an open question on the value of electricity, replied "it permits me to work at night."[2] (The MORESCO study reports only about 5 percent of respondents answered their survey in a similar manner.)

Audit report No. 8-492-71-45, [37] dated October 31, 1970 states that, like VRESCO, cost-overruns had been encountered. These amounted to 21 percent on dollar requirements and 42 percent in peso requirements, respectively. Interestingly, the report states that "the examination also disclosed that the clearing of the right of way for the project is requiring considerable effort due to the refusals by a number of residents to allow their coconut trees to be cut down for establishment of the distribution lines."[3]

Audit report No. 492-11-220-189 [38] noted that MORESCO also had been unable to meet its interest installment due March 7, 1972.

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1. Denton, F.H., Philippine Rural Electrification Social Analysis, no date (ca. 1976), p. 28.
2. <u>Ibid</u>., p. 31.
3. Office of the Auditor General, East Asia, Audit Report No. 8-492-71-25, October 16, 1970, p. 3.

The Project Paper for RE V [23] noted in Annex B-4 that, as of December 1976, MORESCO had achieved 8,700 house connections and, through the yearly addition of 2,100 connections through 1984, was scheduled to achieve 25,500 house connections (or 123 percent of the potential house connections in its service area -- 20,800) by that year. MORESCO had achieved a positive gross margin on sales, in contrast to the deficit position characterizing VRESCO [23].[1]

V. The Rural Electrification Loans; I-V

1. Goals and Purposes

A. Rural Electrification - 1972

As stated in the CAP [18]:

> Program Goal. The goal of AID's Rural Electrification Assistance Program is to further the welfare of the people in the rural areas and to increase income and employment opportunities in the rural areas by making electric power available at reasonable rates for both household amenities and increased production.
>
> This goal is among the highest priorities of the government of the Philippines and USAID/Manila.

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2. AID Project Paper, Philippines: Rural Electrification V, November 21, 1977, Annex B-8, p. 12.

Purpose of the Loan. In the context of AID's overall rural electrification program goal, the immediate objectives of the loan are twofold:

a. to assist the GOP in the implementation of an initial stage rural electrification program that will provide for establishment of an initial group of economically, administratively and technically viable rural electric cooperatives systems geographically dispersed throughout the Philippines. These systems will provide reliable and economic service for domestic, agricultural and industrial uses in areas inhabited by about 5 million people, at a total cost in the vicinity of ₱ 600,000,000 and resulting in an estimated 36 cooperatives. This will be accomplished by the end of FY 1976; and

b. to develop the institutional capability of the NEA through the experience gained in the implementation of this first phase program, through utilization of technical assistance provided that under this loan and other related loan and grant assistance; and through the self help measures agreed to by the GOP as conditions and convenants under this loan.

B. RE II - 1974

The only loan-related purpose statement contained in the CAP [20] appears on the summary sheet as follows:

Purpose: To assist the GOP in its efforts to improve the economic and social conditions of rural areas by providing continuous, dependable and economical electric service on a self-supporting basis.

NEA program objectives are also described as follows:

1. Provide a backbone distribution system (in areas of population concentrations) which will be capable of future expansion;

2. Enable the sub-beneficiaries and implementing agencies (Rural Electric Cooperatives) to acquire the technical capability and financial resources necessary for sustained, financially viable operation and future expansion;

3. Promote economic development of rural areas by providing energy for more intensive agriculture through electric pump irrigation, agro-industrial use, and for small-scale use industrial development;

4. Generally improve the quality of rural life by bringing electric service to individual member homes of the cooperatives, increasing employment opportunities and improving food supplies.

C. RE III - 1974

This is the first CAP [21] reviewed to have adopted the logical framework project design summary. It states:

Program on Sector Goal

The goal of the project is to further the welfare of the people in the rural areas and to increase income and employment opportunities particularly among the lower 50 percent income group in the rural areas. This goal is among the highest priorities of the government of the Philippines and USAID.

Measures of Goal Achievement

1. Increase in number of rural households electrified by 1980.

2. Increase in employment in rural areas by 1980.

3. Increase in per-capita purchasing power in real terms for lower 50 percent income group of rural areas by 1980.

Project Purpose

To make electric power available in selected rural areas at reasonable rates for both household amenities and increased production.

End of Project Status

1. Approximately 12 new rural electric coops operating satisfactorily by 1978.

2. These coops have an average of 7,000-7,500 customers each by 1980.

3. Use of some project inputs for assistance to existing coops by 1978.

D. RE IV - 1976

Program on Sector Goal

An improved standard of living for rural people.

Measures of Goal Achievement

1. Average rural family real incomes in coop areas increased by 20 percent between 1975 and 1980.

2. By 1980, at least 20 percent of residents of coop areas realizing incomes from jobs that did not exist before electricity.

3. By 1980, at least 40 percent of coop area residents having ready access to social services.

Project Purpose

Increased production and improved daily amenities made possible by reliable electric power available at reasonable rates in rural areas.

Objectively Verifiable Indicators

1. Electric power available 24 hours a day to one-third of the rural population.

2. Agricultural production (especially rice) increased by 20 percent in coop areas; and actually doubled in areas where electric pump irrigation systems have been installed.

3. All connected households having at least one labor-saving or convenience electric appliance, and 30 percent having three or more. [22]

E. RE V - 1977

Program or Sector Goal [23]

An improved standard of living for rural people.

<u>Measures of Goal Achievement</u>

Identical to those for RE IV.

<u>Project Purpose</u>

Increased production and improved daily amenities made possible by reliable electric power available at reasonable rates in rural areas.

<u>EOPS</u>

Identical to objectively verifiable indicators presented for RE IV.

Measures of goal achievement presented in these documents are wholly inadequate for evaluating the effectiveness of these rural electrification projects. First, average real income growth, job creation, or the availability of social services cannot be <u>a priori</u> attributed directly to the provision of electricity. These might well occur within a project area for reasons totally unrelated to the electrification project. Even in the best of circumstances, variations could only partially be attributed to electrification. This is certainly the case for social services whose provision depends on activities beyond electrification.

Second, the income growth target specified is so low, implying a yearly compound growth rate of only about 3.5 percent. This target might conceivably be met in the absence of <u>any</u> project intervention.

Third, these measures ignore the problems of measuring secular changes in agriculture which is inherently subject to wide year-to-year variability.

Indicators of purpose achievement suffer from similar problems of attribution. Incomplete definition of the rural population (which is not in all cases the same as cooperative service area populations) and the neglect of indicators of off-farm and nonagricultural production are further problems.

2. Structure of Projects

In each of these five major loans, the National Electrification Administration (NEA) had been designated as beneficiary and implementing agency of the loan projects. The Government of the Philippines, acting through the National Economic Council (RE I), in an unspecified manner (RE II), or through the National Economic Development Authority (RE loans III-IV), was in each case designated as Borrower.

Terms established for loans I-IV were for 40 years, including a 10-year grace period with an interest rate of 2 percent during the grace period and 3 percent through the remaining life of the loan.

RE V was negotiated at 20 years with a 10-year grace period and the same interest rate arrangements as loans I-IV.

Drawing on the experience acquired through the implementation of the VRESCO and MORESCO pilot projects, substantial modifications were introduced into the organization of these projects.

Foremost is the considerable "softening" of terms on which AID made foreign exchange assistance available.

This was reflected and enhanced in the NEA's relending policies to the individual cooperatives. Two basic cooperative "models" were recognized and developed in terms of NEA's financial planning. Self-generating cooperatives were to be granted 2 percent NEA loans, while cooperatives purchasing power would be charged 3 percent. Maximum grace and repayment periods of 5 and 35 years respectively were established for both types of cooperatives; it was planned that self-generating cooperatives would, on average, receive longer term loans than those purchasing power.

The momentum for a nationwide electrification program had been building since the days of the National Power Survey and its initial recommendations. The NEA was created to conduct a program leading to the eventual total electrification of the Philippines on an area coverage basis. USAID had, since its initial involvement in the pilot cooperatives, declared its intention of helping to develop public sector support for a nationwide program. From the outset, therefore, the Philippines -- with AID support -- had embarked on a highly ambitious and widely publicized nationwide electrification program whose success carried with it considerable high-level political prestige, notably that of President Ferdinand Marcos.

Rather novel systems were devised to carry forward the tasks of site selection, feasibility analysis and design, and cooperative organization.

The first of these was the Provincial Electric Cooperative Team (PECT). In September 1970 the NEA organized these teams -- one to a province -- and provided their members with two weeks training. Each team was composed of representatives of the NEA, the Presidential Arm on Community Development (PACD), the Department of Education, the Cooperative Administration Office, the Office of the Provincial Governor, the League of Municipal Mayors of the province concerned, as well as representatives of active civic and religious organizations. Their function was to select and recommend to the NEA a small number (3-6, usually) of potential sites in their provinces for a rural electric cooperative.

NEA/NRECA feasibility teams assessed the sites, recommended one for project implementation, and conducted the preliminary engineering design and financial plan.

Because of the large number of such feasibility/design studies to be conducted, NEA/NRECA quickly adopted standardized systems and procedures. In the case of the evaluation of alternative sites for RE cooperatives, points were awarded to each area, on the basis of population density, road density, farm ownership, the existence of franchise concessions in the area, and the potential for connection to central station generation as measured by the distance of the closest municipality in the study area to an existing NPC or MERALCO transmission line.

Having selected a site for service by a cooperative, fairly standardized engineering design and financial planning procedures were followed. These included, beginning with RE I, the specification of domestically produced poles for the distribution system.

Cooperative organization, where required, was accomplished by the PECTs and NEA with NRECA guidance.

AID Project related rural electrification was in every case distributed through cooperatives. Little mention is made in the project documentation of NEA activities in support of developing and extending existing private and municipal systems in rural areas. Such support was clearly within the scope of the NEA's charter, as indicated by the language of R.A. 6038, but little can be said, on the basis of AID documentation, about the extent or effectiveness of such activity.

3. Outputs, Users, Uses

The outputs of these projects are typically specified in terms of project accomplishments rather than amount of electricity provided as in the following terms:

1. Viable electric cooperatives
2. Backbone systems
3. A capable National Electrification Administration
4. Qualified A & E firms and construction contractors

Objectively verifiable indicators presented in relation to these outputs were:

Connection and Consumption Projections by User Categories for 10 Cooperatives
Organized under the Philippine Rural Electrification Program

	Houses				Small commercial				Wells				Public buildings				Security lights				Large commercial and special contract				Total	
	Year 1		Year 10		Year 1		Year 10		Year 1		Year 10		Year 1		Year 10		Year 1		Year 10		Year 1		Year 10		Year 1	Year 10
Cooperatives	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Number
RE I																										
CAGAYAN:																										
Connections	12,830	96	28,576	93	299	2	1,006	3	1	--	113	1	224	2	914	3	249	n.a.	313	n.a.	2	--	38	--	13,350	30,825
Consumption[a]	375	89	2,143	68	10	2	106	3	2	--	426	20	6	1	44	2	14	3	37	--	13.0	3	187	6	425	3,163
NEGROS ORIENTAL:																										
Connections	9,594	95	22,619	92	164	2	1,122	5	20	--	174	--	263	3	461	3	315	n.a.	290	n.a.	2	--	15	--	10,063	24,615
Consumption[a]	288	79	1,698	73	6	2	112	5	40	11	354	15	7	2	46	2	12	3	24	--	12.7	3	174.3	7	366	2,400
CEBU:																										
Connections	11,064	95	21,814	95	177	3	865	4	1	-	94	--	254	2	472	2	184	n.a.	213	n.a.	3	--	21	--	11,696	23,004
Consumption[a]	429	65	1,987	76	15	3	99	4	2	--	190	7	6	1	33	1	10	3	12	--	19.6	4	307.8	12	671	2,627
ILOILO:																										
Connections	9,590	92	18,402	91	109	4	869	4	39	--	250	1	367	3	550	3	174	n.a.	193	n.a.	1	--	12	-	10,390	19,736
Consumption[a]	364	74	1,647	66	16	3	99	4	54	12	500	21	9	2	39	2	10	2	11	--	12	3	110	5	449	2,414
RE II																										
ZAMBOANGA DEL NORTE:																										
Connections	6,727	84	18,743	88	195	10	1,635	7	6	-	66	-	503	6	872	4	115	n.a.	176	n.a.	6	--	24	--	8,035	21,340
Consumption[a]	235	75	1,499	71	28	9	144	7	13	4	132	6	13	4	61	3	7	2	10	--	25.3	8	288.2	13	320	2,114
PANGASINAN:																										
Connections	7,493	98	16,323	97	41	1	228	1	1	-	44	-	89	1	220	1	145	n.a.	171	n.a.	2	--	16	--	7,668	16,829
Consumption[a]	225	89	1,224	81	3	1	24	2	2	1	88	6	2	1	15	1	8	3	9	--	11.5	5	153	10	252	1,511
NUEVA VIZCAYA:																										
Connections	8,019	95	17,461	95	244	3	486	3	9	--	58	-	151	2	291	2	157	n.a.	189	n.a.	5	--	37	--	8,620	18,315
Consumption[a]	281	80	1,397	78	9	3	51	3	16	5	118	6	4	1	21	1	9	3	10	--	29.6	8	187.3	10	351	1,782
OTHER LOANS																										
LANAO DEL NORTE:																										
Connections	14,098	89	35,601	90	1,017	6	2,206	6	12	-	105	-	737	4	1,414	4	106	n.a.	378	n.a.	3	--	24	--	16,667	39,357
Consumption[a]	596	83	3,561	80	41	6	265	6	24	3	218	5	18	2	99	2	17	2	21	--	31.0	1	264.6	6	718	4,421
ALBAY:																										
Connections	12,747	95	27,730	95	450	3	886	3	11	--	136	--	256	2	537	2	249	n.a.	298	n.a.	9	--	20	--	13,473	29,309
Consumption[a]	362	77	2,080	77	14	3	93	3	33	6	272	10	8	1	18	1	14	3	16	--	55.2	11	194.3	7	495	2,695
NORTHERN SAMAR:																										
Connections	7,803	96	18,779	96	211	1	476	2	--	--	66	--	170	1	269	1	135	n.a.	207	n.a.	5	--	17	--	8,187	19,537
Consumption[a]	235	82	1,405	80	7	2	43	2	--	--	92	5	1	1	19	1	10	1	11	--	29.9	10	196	11	285	1,766

a Consumption based on 1,000 KWH/month.
Source: Total System Load Forecasts, Section 3.9 of NEA/NRECA Load Feasibility and Engineering Studies, Bibliography reference numbers 4-13.

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1. At least one viable rural electric cooperative established in every province (there are 73 provinces in the Philippines) by 1977, except for several of the small provinces.

2. Within each cooperative area, a backbone system electrically linking all municipalities and major poblaciones completed by 1980.

3. The personnel of NEA trained and experienced, capable of administering a national program without regular outside technical assistance by 1980.

4. Qualified A & E firms and construction contractors constructing error-free distribution systems by 1980.

RE I was to provide for the establishment of 36 cooperatives, RE II for 15 more, RE III for 12, and RE IV and V for an additional but unspecified number.

Ten of the NEA/NRECA loan feasibility and engineering studies were available to us. A review of these projections provides an idea of the distribution of intended users and uses of cooperative electricity.

Of the ten cooperatives, Cagayan, Negros Oriental, Cebu, and Iloilo were funded under RE I. Zamboanga de Norte, Pangasinan, and Nueva Viscaya were funded under RE II. Lanao de Norte, Albay, and Northern Samar were funded under subsequent unspecified loans.

Table 6 enumerates projections of numbers and monthly consumption of the various consumer classes for these 10 cooperatives in their first and tenth years of operation.

Summarizied in terms of averages taken over all 10 cooperatives, one finds that:

1. The average cooperative was designed for about 11,000 initial connections and scheduled to increase to about 24,000 by year 10 of operations.

2. In the initial year, 93.5 percent of connections were designed to be residential, with virtually no change (93.2 percent) by year 10.

3. Approximately 86 percent of sales was directed at consumption uses (houses, public buildings, security lights) in year one, with residential use averaging 95 percent of this subtotal.

4. By year 10, consumption uses were projected to decline to 77 percent of total sales.

5. Irrigation uses accounted for 4 percent of sales in year one and were projected to grow to 10 percent by year 10.

6. Large commercial and special contracts (mostly industrial) were expected to consume about 6 percent of sales in year one, 9 percent by year 10.

7. Small commercial sales were expected to average a constant 3.5-4 percent, years one through 10.

All feasibility studies reviewed were prepared during 1971 and 1972. By year one of operations, these 10 cooperatives together were planned to have connected a total of 100,605 houses. By December 1976, according to Annex B-4 of the RE V Project Paper, these 10 cooperatives together had made 40,700 house connections. Four of the cooperatives had not yet been energized, so that the average level of house connections accomplished by the energized cooperative was about 6,800. Clearly, some slippage and/or change of plans had taken place.

VI. Projects Analysis

We have briefly noted some policy changes which resulted from experiences with the two pilot projects, VRESCO and MORESCO. Important organizational changes also took place, as did continued policy modifications, over the lives of RE I-V. This section will begin by highlighting a few as reported in the project documentation.

Prior to agreement on RE I, AID had secured the services of NRECA specialist J.B. McCurley to conduct what was essentially an evaluation of the NEA. This report, entitled "Rural Electrification in the Philippines" (August 1971, [32]), notes the following.

The NEA, founded in 1969, had inherited both the assets and the liabilities of the defunct Electrification Administration (EA). It continued under the same administrator until the fall of 1970 when he was replaced by Col. Pedro Dumol, who is described as "one of a group of experienced GOP technocrats who have been assigned to tackle high priority problems in the Marcos administration."

Although Col. Dumol's abilities are described as being highly developed, the then current operations of the NEA were criticized on several grounds. First, insufficient delegation of authority resulted in too many routine decisions requiring the attention of Col. Dumol. "Without him," the study states, "the organization could easily fall apart."

Secondly, there was general agreement that more than one half of the employees are considerably less than fully employed. This included some members of the feasibility team, although the workload clearly existed.

Third, regulations at the NEA, limiting pay to about 50 percent of prevailing wages in the private sector and in certain government organizations, were a serious personnel problem. A real question was raised about the capability of the organization to carry out -- on schedule -- the feasibility, organizational A&E, and construction aspects of implementing the 36 cooperative systems then planned for RE I.

Fifth, no organizational unit within NEA promoted load growth, consumer power-use education, or industrial expansion in the cooperative areas.

Numerous recommendations from the McCurley report were developed into an NEA reorganization program which was included as a condition precedent for the RE I loan. These included:

1. New legislation allowing NEA direct access to foreign loans, thus bypassing the participation of the DBP and the split administrative and funding responsibility that participation had implied

2. Adoption of a new organizational framework

3. Relief from wage and salary restrictions

4. Technical assistance for institutional development at the NEA and the cooperatives

5. Participant training for NEA and supporting agency employees

6. Engineering assistance.

By late 1974, further experience had resulted in more changes. The most important was a departure from, or modification of, the concept of area coverage. The subsequent development of the program should be structured around "core" or "backbone" systems which would initially serve the more densely populated areas. Expansion to less dense and outlying areas was planned for later phases of implementation.

An inflation in construction and fuel costs caused cooperatives requiring the installation of self-generation facilities to be de-emphasized. These had made up about half of the cooperatives funded under RE I.

Political conditions had deteriorated in the Philippines, resulting in the imposition of martial law in September 1972. The CAP for RE II states that the NEA had made an effort in planning the implementation of this loan to cover all the major Muslim areas, thus reflecting the perhaps inevitable reemergence of the political element in site selection, for which the old EA had been severely criticized.

In the environmental impact section of that CAP, it was recognized that the larger energy consuming and polluting type of industries had located and would continue to locate in areas where large sources of cheap hydropower were available. Electric rates in the rural electrification zones, it continued, would not be attractive to the larger power-consuming industries.

However, by mid 1973, the NEA had begun to exert itself in the area of power use promotion. In coordination with other agencies such as the National Irrigation Administration, the Development Academy of the Philippines, and others, the NEA had begun to develop projects in irrigation, rural industries and handicrafts.

NEA and cooperative rethinking on rate structures had begun. While the cooperatives in the past had followed the declining block rate system, rates were beginning to be developed which would "more or less correspond to current philosophy involving social equity and energy conservation."

By the time of RE V, the CAP could state,[1]

> NEA tariffs are socialized ... a single rate is charged per kilowatt-hour for each class of consumer. This is a compromise between traditional economic downward-sloping block rates and more radical upward-sloping rates which have been experimented with in the United States, and are presently used by the Manila Electric Company.

The RE II CAP states:[2]

> An attempt was made to compare the rate schedules of similar coop and private franchise systems.
>
> Comparing the Manila area (private) utility with a rural coop (first Bulacan) in the general Manila area shows that the Coop residential consumers are paying about 50% more for power than the Manila consumers (except for the 25% who consume over 200 KWH/month) while the coop's commercial/industrial users are paying about 1/4th less. The NEA recommended revised rate schedule for Bulacan, if adopted, however, contains a higher rate for all classes of consumers than the comparable current provisional rates for Manila consumers. The proposed Bulacan schedules would require most customers to pay at rates three times that of the

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1. AID Project Paper, Philippines' Rural Electrification V, November 21, 1977, page 23.
2. Ibid., page 23.

> provisional Manila rates and even at the highest consumption levels the Bulacan consumer would be paying about 50% more than his urban counterpart in Manila.

The study goes on to note that VRESCO and MORESCO consumers were paying only slightly more than comparable private franchise consumers. Other passages of the CAP allude to the need to raise VRESCO and MORESCO rates, however, due to their poor financial performance.

The RE III CAP [21] begins to reflect a growing concern with economic analysis and with the demonstration of developmental effectiveness of the rural electrification program. Feasibility studies as well as CAPs predating RE III, generally dealt summarily with the economic, as opposed to the financial and engineering, aspects of the program.

For the first time, rural electrification was explicitly presented in terms such as those contained in the following selected passages.

> The overriding objective is the utilization of electric power to promote productive enterprises with the attendant creation of increased income and employment.[2]

> Rural electrification is a key ingredient in the GOP program to create the

1. Ibid., page 23.
2. AID, Capital Assistance Paper, Philippines: Rural Electrification III, December 10, 1974, page 12.

> supporting infrastructure to sustain such a program. It is insufficient of and by itself, but other supporting programs to facilitate the productive use of the power are under development.[1]

A recognition that the RE program, as then constituted, may not have been reaching the poorest of the poor is implicit in the following statement:

> It is anticipated that the indirect beneficiaries will include a portion of the lower income population who may not yet be able to afford electric service or who do not receive direct service because they reside outside the immediate service area of the electric coop.[2]

Again generalizing, these types of issues, when they had been raised at all, were dealt with through a rather superficial optimism in previous documentation.

Perhaps most significant, this CAP makes the following strong assertions:

> Much additional survey and evaluation work needs to be done to better demonstrate the detailed impact of electrification on the rural areas served.
>
> An ongoing evaluation of rural electrification - institutionalized within the GOP itself - must be undertaken to provide GOP planners with meaningful

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1. Ibid., page 14.
2. Ibid., page 12.

> data on actual social and economic benefits achieved so that allocation of scarce capital between rural electrical, other parts of the power sector, and other priority sector requirements can sensibly be undertaken.[1]

For the first time, important mention is made of the complementarity of rural electrification with other AID priority projects such as rural roads, small-scale pump irrigation, integrated area development programs and related programs aimed at increased production and improved processing and marketing of agricultural products.

A final citation from this document is indicative of the main issues being grappled with at the time.

> ...the core system approach of necessity first serves the more densely populated areas where average income is higher. Over the long run -increased costs of extending systems into the less densely populated area may be as much of a constraint to direct service as income status. However both factors go hand in hand and there is no feasible way of starting on the low end of the spectrum.[2]

The RE IV Project Paper [22] states:

> It is difficult to judge if the accomplishments achieved by implementation through rural electric cooperatives could have been achieved had another method of implementation been selected. It is unlikely that the results could have been any better, however.[2]

1. Op. cit., page 32.
2. Op. cit., page 17.

It should perhaps be noted that the R.E. II CAP had stated that, as of June 1974, over 500 small municipal and private franchise holders were in operation, "but most of these are supplying less than 24 hour service."[1]

Unfortunately, no other data or assessment of their performance are presented, although this represents an approximately 70 percent increase in the number of such operations since the National Power Survey of 1965.

The RE IV CAP also contains an interesting, if not too conclusive, exercise in economic analysis. Using data obtained from the projections constructed in the NEA feasibility studies (which our sample suggests tended to overestimate load growth), Present Social Values (PSVs) were calculated for each of 94 cooperatives and the program as a whole, using AID's Capital Project Appraisal Guidelines. Using a discount rate of 12 percent, it was found that 80 of the 94 cooperatives had positive PSVs and that "on the whole, the NEA electrification projects have a positive PSV of about ₱ 2.24 million."[2] This is on an investment (VRESCO through RE III) in the neighborhood of ₱ 1 billion. No previous attempt to assess the value of the rural electrification program as a whole had ever been undertaken. Only isolated economic analyses of so-called "representative" cooperatives had been attempted up to that time.

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1. AID Capital Assistance Paper, Philippines: Rural Electrification IV, June 14, 1974, page 3.
2. AID, Capital Assistance Paper, Philippines: Rural Electrification III, December 10, 1974, page 52.

Perhaps because of the questions raised by the Senate Appropriations Committee in 1975 and their recommendations that large-scale infrastructure projects be funded by international funding institutions, both the RE IV and RE V project papers are rather defensive in tone.

For example, although the cooperatives are described as non-stock, non-profit institutions serving between 5,000 and 30,000 households, and the NEA is described as monitoring all activities including engineering construction, financing and management (in fact, until 1974 the NEA actually conducted all these functions on behalf of the cooperatives,[1] and to a large extent continued to do so in 1976), other passages continue to speak in the following glowing terms.

> The cooperatives thus offer electricity to their constituents, and through electricity more conveniences, more production, more employment opportunities and more services, but they also offer participation and responsibility and even ownership and control. By becoming a member of the cooperative, by speaking up and voting at local cooperative meetings, by serving on committees, by assuming the responsibility and the ownership and the control, these rural people learn to influence and even better control the events of their daily lives, their socio-politico-economic environment, their futures and the futures of their children.
>
> AID participation in this program through this project thus provides Juan de la Cruz (the Filipino common man) a bigger role in shaping his destiny.[2]

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1. Ibid., page 64.
2. AID, Project Paper, "Philippines: Rural Electrification V," November 21, 1977, page 15.

Another example of this type of overkill on unsubstantiated impacts is to be found in a passage from the RE IV PP describing the benefits of electrifying Rural Health Centers in the MORESCO area. The passage states that,

> One clinic representative stated that a primary use of better lighting was for IUD insertion (previously done with a handheld flashlight).[1]

One is overwhelmed by the vast appeal of family planning in this area; there were clearly not enough hours of daylight to accomplish all the insertions being requested.[1]

There were many real accomplishments made in areas outside household electrification, and these are documented. The RE V[2] reports, for example, that in April 1977, over 4,000 schoolrooms in approximately 600 public schools had been electrified and that 219 small industries were receiving power in 13 cooperative service areas. In December 1976, NEA was providing power to over 400 small-scale pump irrigation systems, providing water to over 34,000 hectares of rice paddies, etc. No indication, however, is provided regarding the proportion of previously existing enterprises these numbers represent.

Table 7, reproduced from the RE V, indicates that 41 cooperative systems were operating above expectations, while 35 percent were operating below expectations.

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1. AID, Project Paper, "Philippines: Rural Electrification IV," April 1976, page 42.
2. AID, Project Paper, "Philippines: Rural Electrification V," November 21, 1977, pp. 47-58.

Table 7
41 Cooperative Performances vs. Expectations

RATIO	GENERAL EXPECTATION	BASE COOPERATIVES	EQUAL OR BETTER	PERCENTAGE BELOW EXPECTATION
1. Plant-Revenue Ratio	12:1	39	51%	49%
2. Debt Service Coverage	100%	40	58%	42%
3. Consumer per Km. of Line	50-55	27	78%	22%
4. KWH Sales per Km. of Line	30-40,000	26	62%	38%
5. Investment per Consumer	P 1-2,000	41	85%	15%
6. Non-Power Operating Expense per KWH	P 0.10	41	56%	44%
7. System Loss	20%	41	66%	34%
8. Percent of Billings collected	90%	33	67%	33%

Source: ([23], p. 40)

Expectations for operating efficiency are admittedly relatively modest however.

Training also appears to have been a significant accomplishment of the NEA program. The project paper relating to the Rural Electrification Training Centers grant[1] reports that by June 1978 -- when 106 cooperatives had been registered -- approximately 33,000 persons had been trained or retrained in technical and administrative skill areas.

"A proper appreciation of the impact of rural electrification," the RE IV states[2]

> can perhaps best be achieved by looking back to the problems the program had to face and the solutions developed to surmount them in the course of program implementation.
>
> When it was started, the Philippine program for rural electrification faced a very difficult set of obstacles. These were mainly:
>
> 1. The history of failure of government spawned cooperatives.
>
> 2. The poor credibility of most government agencies.
>
> 3. The problem of assuring that the electric coop would be run professionally, and for the benefit of the majority of the people.

Additional problems and solutions are revealed by two

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1. AID, Project Paper Philippines: Rural Electrification Training Center, August 1978, page 1.
2. AID Project Paper, Philippines: Rural Electrification IV, April 1976, pp. 34-5.

audit reports (No. 9-492-75-96, issued 4/4/75; and No. 9-492-77-7, issued 2/8/77) which relate to the period corresponding to loans RE I-IV.

The first of these reports that "the NEA had diverted large quantities of excess property to parties other than the USAID-approved end-user."[1]

The report continues:

> We also found that four of the using agencies belong to the GOP's military organizations. The agencies involved are: National Intelligence Security Agency; First Philippine Constabulary Zone; North East Command, and 51st Engineering Battalion.
>
> In regard to the 18 excess property vehicles transferred by the NEA to the 51st Engineering Battalion, there is some additional significant information. The 51st Engineering Battalion, located in Lanao Del Sur Province of Mindanao, is using the vehicles in the construction by force account of the Lanao Del Sur Electric Cooperative. The security situation was such that private construction contractors would not accept work there.[2]

The second report states:[3]

> The Rural Electrification Project

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1. AID Auditor General Audit Report No. 9-492-72-96, Rural Electrification Project, April 4, 1975, page 2.
2. Op. cit., page 7.
3. AID Auditor General Office, Audit Report No. 9-492-77-7, The Rural Electrification Projects USAID/ Philippines, February 8, 1977, page 3.

> is approximately on schedule, or ahead of schedule, in achieving the quantified goals targeted for December 31, 1976. In perspective, statistics on accomplishments benefit substantially from the takeover by NEA of some existing electrical systems, as compared with the slower process of constructing new systems. And much remains to be done in transforming the present fledgling cooperatives into fully self-sustaining and efficient organizations.
>
> On balance, however, very significant progress has been achieved in what is a large and complex undertaking.

The report states that, as of September 30, 1976, there were 422,680 house connections.[1] It continues:

> Approximately 50 percent of current consumers are receiving electrical services for the first time. The other half was formerly served by 131 existing, privately-owned or municipal electric systems servicing 180 towns and 139 barrios. These existing systems were taken over and now constitute all or part of systems presently operated by 41 cooperatives originated under the GOP's National Electrification Program. The acquisition costs of these systems totaled ₱ 64,390,576.
>
> Under the original pre-martial law concept of the Philippines rural electrification program, new co-

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1. Ibid., page 8.

> operative sites were to exclude areas where municipal or private franchise systems already existed. Late in 1972, however, it became GOP policy under a National Electrification Program to consolidate and merge small franchises into larger, more viable units.
>
> Since takeover systems are located in more highly populated middle-sized urban areas, this change in program concept departed from the course of purely rural electrification development.[1]

RE V PP reports that as of December 1976, 82 cooperatives had been energized ([23], Annex B-4). Distinctions between takeovers and newly constructed cooperatives were not made, however. About $32 million of AID money had been disbursed and an additional $62 million of GOP and other-donor money had been spent by the NEA.[2] These total approximately $114 million. The prevailing Philippines exchange rates between 1973-1976 averaged about ₱7:$1. Thus, acquisitions costs related to the 41 takeover cooperatives were about $9.2 million.

Even assuming that an additional $15 million were spent on extending and improving the takeover systems, we might be led to infer that the 41 new cooperatives involved an average cost of about $2.2 million, while the takeover coops cost about $.6 million each. This is a somewhat different picture than that presented by the RE IV PP which states

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1. Ibid., page 10.
2. AID Project Paper, Philippines: Rural Electrification V, November 21, 1977, page 14.

that, "average projects currently cost slightly more than the equivalent of approximately 1.3 million dollars."[1] Perhaps this is an issue which should be addressed in evaluating the success of the Philippine program, and one which should be kept in mind in interpreting the findings of previous evaluations.

Project evaluation was also one subject covered in the 1977 Audit Report. A review of evaluation materials follows:

> Two evaluative (Phase I) studies were completed by research organizations in 1976 of certain aspects of the Rural Electrification Project. One of the two Phase I evaluations completed covered the Misamis Oriental Rural Electric Service Cooperative (MORESCO), the pilot and oldest cooperative established under the Philippine Rural Electrification program. The study indicated the benefits of electricity were reaching the rural poor and impacting favorably on various social and economic factors in the cooperative area.
>
> The other completed Phase I study covered both cooperative and noncooperative areas located in four provinces. This was a follow-on to a study made in 1973. While this voluminous study contains numerous tabulated statistics, we discovered no clear picture of improved social and economic conditions relatable

1. AID Project Paper Philippines: Rural Electrification IV, April 1976, page 19.

> to availability of electricity. A mixed pattern of gains and losses (increases and decreases) emerged for both cooperative and noncooperative areas. The study presents no conclusion."[1]

The second Phase I study referred to is the RECOOP II study discussed earlier in this report.

The auditors continue,

> We believe a meaningful project evaluation must measure progress achieved in areas cited as project objectives. These include increased agricultural production and real rural incomes, new employment opportunities, access to social services not previously available, and use of labor-saving or convenience electric appliances. These and other objectively verifiable indicators are set forth in the project logical framework matrix.
>
> The NEA, with the assistance of PASA experts funded by AID, has recently developed the framework and the methodology for an in-depth Phase II evaluation of the entire program. It is planned new comparative data will be collected and evaluated every 18 to 24 months. The project implementation plan anticipated completion of the initial Phase II evaluation in December 1976; however, as it

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1. AID Auditor General, Audit Report No. 9-492-77-7," The Rural Electrification Project USAID/Philippines, February 8, 1977, page 18.

> stands now, evaluation is expected to be completed in the first quarter of 1977.[1]

The results of that evaluation were in fact published in June 1978. A review of the document, entitled "Nationwide Survey on Socio-Economic Impact of Rural Electrification", will complete our survey of Philippine rural electrification project documentation.

The major findings of that survey effort are summarized as follows:[2]

1. Households served by cooperatives have a lower socioeconomic status than those served by other electric utilities.

2. Electrified households have higher socioeconomic status than non-electrified households.

3. Cooperative electric utilities are more successful than private electric utilities in terms of availability of service and the number of connections among those accessible to electricity.

4. Cooperative electric utilities are more successful than private electric utilities in penetrating remote areas and servicing "poor" people. They have also reached a significant proportion of food producers.

5. Rural households use electricity primarily for lighting.

6. The strongest perceptions of indirect benefits of electricity were in improved peace and order and increased educational activity.

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1. Ibid., page 18.
2. NEA, USAID, National Survey on Socio-economic Impact of Rural Electrification," June 1978, page 12.

7. In cooperative areas, neighborhood sharing is stronger and the benefits of electricity to non-electrified households are more widespread than in non-cooperative areas.

8. Approximately half of all electrified households feel that cost of electricity is high. The extent of this opinion, however, is less in cooperative areas that in non-cooperative areas.

9. Electrific service interruptions were common in both cooperative and non-cooperative areas.

10. Households in cooperative and non-cooperative areas have favorable attitudes towards electric cooperatives.

A composite of Tables II-2 and II-3 of the survey report[1] provides summary profiles of cooperative area electrified households, cooperative area non-electrified households, non-cooperative electrified and non-cooperative non-electrified households (See Table 8).

While this summary data support the assertion that cooperatives count a greater proportion of poor among their customers than do non-cooperative utilities, the most striking comparison is between the relative prevalence of poor households between electrified and non-electrified groups within the cooperative areas. It would appear that highly significant differences exist in the incomes of these two groups.

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1. Op. cit., pp. 15-16.

Table 8. Summary Profiles of Cooperative Area vs. Non-cooperative Area Households by Electrification Status, 1977

	Cooperative Electrified Household	Cooperative Non-Electrified Household	Non-Cooperative Electrified Household	Non-Cooperative Non-Electrified Household
1. Percentage with income below P4,000	28	65%	22	53%
2. Median educational attainment of household head	1st year H.S.	Grade 6	1st year H.S.	Grade 6
3. Percentage owning house and lot	48*	24	54*	34
4. Percentage with houses of strong/heavy materials	22	5	29	6
5. Mean number of household items owned	7	2	8	3
a. Percentage with less than 7 household items	56	99	43	96
6. Percentage with water from central water supply system or artesian well	87	64	89	65
7. Percentage of household heads employed one week before interview	82	88	79	87

* The survey reports no statistical difference between these two estimates

Survey Table B-9[1] reproduced below provides income distribution data taken from these categories.

These data permit one to estimate mean household net income for each group. Taking a weighted average of the midpoint income for each income class (with the exception of the highest class where a figure of ₱ 45,000 was used to avoid overstating the difference between cooperative electrified and cooperative non-electrified households), one obtains the following results.

Mean Net Household Income, by Cooperative and Electrification Status, 1977

Cooperative areas		Non-cooperative areas	
Electrified	Non-electrified	Electrified	Non-electrified
P10,322 $p.c.(232)	3,785 (85)	10,627 (239)	5,427 (122)

Approximate indicators of the dollar per capita equivalent of these income levels are based on a 1977 exchange rate of ₱ 7.40:$1 and on an assumption of an average of 6 household members.

1. Op. cit., page 51.

Table B-9 Percentage of Households: Net Income by Cooperative and Electrification States, 1977

	Cooperative Areas		Non-Cooperative Areas	
Income in Pesos	Elect.	Non-Elect.	Elect.	Non-Elect.
1 - 500	a	4	1	2
501 - 1000	2	10	1	5
1001 - 1500	4	11	2	9
1501 - 2000	5	9	3	9
2001 - 4000	17	32	14	29
4001 - 6000	16	17	19	18
6001 - 8000	13	8	13	9
8001 - 10000	10	4	9	6
10001 - 15000	15	4	19	9
15001 - 20000	7	1	9	2
20001 - 30000	5	a	5	1
30001 - 99997	6	a	5	1
TOTAL (Average)	100	100	100	100

a - Less than 1 percent

Average incomes are low across all categories by any objective standard, including the AID poverty benchmark of 150 1969 US dollars per capita. It would appear that, although the cooperatives have been serving more poor than the private utilities this difference in outreach is not dramatic. In both cases, the poorest majority appears to have been mostly bypassed by electric service so far. This is confirmed by Survey Tables III-1 and III-3.[1]

Table III-1. Percentage of Electrified Households: Households in Rural Areas; Households 5 Kilometers and Over from the Pobliacion; and Households in Remote Barrios by Cooperative Status, 1977

		Cooperative area	Non-cooperative area
1.	Rural Households	34	28
2.	Households 5 kms and from poblacion	22	9
3.	Households 2 kms or more from a provincial highway	26	2

1. Op. cit., page 19.

Table III-3. Percentage of Accessible Households: Electrified Households by Cooperative Status, 1977

	Coop area	Non-coop area
Electrified	53	32
Non-electrified	47	68
TOTAL	100	100

While the rural electrification cooperatives seem clearly to have outperformed other utilities in terms of rural outreach, it is nonetheless surprising to find that institutions so-named serve a clientele which is only 34 percent rural by their own definition. It should be recalled that these cooperatives had been created under a specific mandate and had been able to operate under far more favorable conditions than have other small-town utilities.

1. Op. cit., page 19.

Table IV-1[1] gives a distribution of monthly kwh consumption for cooperative and non-cooperative households. A similar procedure to that described above for the case of income provides estimates of mean consumption levels of 44 and 62 kwh/month for cooperative and non-cooperative households, respectively.

Table IV-1. Percentage of Electrified Households: Kilowatt-Hour Consumption per Month by Cooperative Status, 1977

Number of Kilowatt Hours	Cooperative Area	Non-cooperative Area
1 - 10	13	7
11 - 20	34	24
21 - 30	18	14
31 - 40	7	11
41 - 50	5	8
51 - 60	2	4
61 - 70	3	7
71 - 80	3	3
81 - 90	2	3
91 -100	2	4
101 -200	8	13
201 -997	2	3
TOTAL	100	100

Table IV-2[2] provides some information on the principal household uses of electricity. Use of electricity for lighting predominates for both categories of households, while use for cooking is negligible.

1. *Op. cit.*, page 22.
2. *Op. cit.*, page 23.

Table IV-2. Percentage of Electrified Households: Uses of Electricity for Household Conveniences by Cooperative Status, 1977

Household functions	Cooperative areas	Non-cooperative areas
Lighting	99	96
Ironing	45	64
Ventilation (Fans)	33	42
Refrigeration	20	34
Cooking	a	1

a. less than 1 percent.

Survey Table IV-6[1] indicates that expenditures on traditional sources of energy continue to outweigh those on electricity within both cooperative and non-cooperative households.

Judging from Table IV-1, median consumption levels are between 21-30 KWH/month for cooperative households, and between 31-40 KWH/month for non-cooperative indicating a slightly lower per KWH cost to non-cooperative households.

Survey Table IV-4[2] gives some information on the commercial uses of electricity in the survey areas. The category "others" includes businesses producing ice candies, native cakes, copra, pots and handicrafts, furniture, dried fish; and such industries as rice millers, drillers, photography studios and dental clinics. It would appear that purely commercial uses (variety stores/groceries) predominate

1. Op. cit., page 26.
2. Op cit., page 24.

Table IV-4 Percentage of Electrified Households: Commercial Users of Electricity by Cooperative Status, 1977

	Cooperative Areas	Non-Cooperative Areas
No. of Electrified Households	11,386[b]	8,641[b]
No. of Commercial Users	1,841	1,371
Percentage of Commercial Users	16	15
Commercial Users		
1. Variety Stores/Grocery	47	28
2. Dress Shop/Tailoring	7	12
3. Piggery/Poultry	7	10
4. Canteen/Restaurant	4	5
5. Auto Mechanic/Welding Shop	4	4
6. Recreation House	3	2
7. Beauty/Barber Shop	a	2
8. Wood/Carpentry Shop	1	a
9. Others	27	37
TOTAL	100	100
(Base)	(1841)	(1371)

a-less than 1 percent
b-weighted sample

Table IV-6. Median Monthly Cash Outlay for Power of Electrified Households by Cooperative Status, 1977

Sources of Power	Cooperative Areas	Non-Cooperative Areas
Electricity	P11.00	P14.00
Traditional Sources	24.00	27.00
Wood	6.00	10.00
Kerosene	5.00	8.00
LPG	28.00	28.00
Charcoal	2.00	2.00
Battery	5.00	5.00

in the cooperative areas, while proportionately greater use is made of electricity in non-cooperative areas for agricultural and cottage industrial production. Perhaps this could be explained by the relatively longer connection time and more urban character of the non-cooperative areas. This is pure speculation, however, as no data exist to substantiate such a hypothesis.

Cooperatives seem to compare favorably to other utilities in terms of their coverage of public facilities such as schools and hospitals, as is indicated by Tables IV-11 and IV-12.[1]

Table IV-12. Percentage of Respondents: Electrification Status of Nearest Hospital/ Clinic by Cooperative and Electrification Status, 1977

Response	Cooperative area		Non-Cooperative	
	Elect.	Non-elect.	Elect.	Non-elect.
Yes (Electrified)	93	86	92	55
No (Not Electrified)	6	12	6	44
Do not Know/No Response	1	2	2	1
TOTAL	100	100	100	100

Survey Tables V-1 and V-2[1] indicate that non-cooperative users feel more strongly about the cost of electricity than do cooperative households. This is somewhat paradoxical in view of indications that their cost per KWH is, if anything, slightly lower than that of cooperative users. Interpersonal comparisons of this sort are notoriously difficult to interpret.

Table IV-11. Percentage of Respondents: Electrification Status of Public School nearest Barrio by Cooperative and Electrification Status, 1977

Response	Cooperative Area Elect.	Cooperative Area Non-Elect.	Non-Cooperative Area Elect.	Non-Cooperative Area Non-Elect.
Yes (Electrified)	67	46	83	29
No (Not Electrified)	30	50	12	70
Do not Know/No Response	3	4	5	2
TOTAL	100	100	100	100

1. Op. cit., pp. 28-9.

Table V-1. Percentage of Electrified Households: Opinion on Cost of Electricity by Cooperative Status, 1977

Response	All areas	Cooperative	Non-cooperative
Low	4	4	3
About right	44	48	38
High	51	46	58
Do not know	1	2	1
TOTAL	100	100	100

Table V-2. Percentage of Electrified Households: Reaction to Doubling of Electricity Cost by Cooperative Status, 1977

Response	All areas	Cooperative	Non-cooperative
Disconnect right away	16	14	17
Reduce consumption	73	75	72
Not change consumption	6	7	5
Do not know	5	4	6
TOTAL	100	100	100

Reliability of service is usually presented as an important justification for central-grid rural electrification systems, which apparently characterized most NEA programs since the adoption of the core system (or modified area-coverage) concept. Survey Tables V-4 and V-5[1] provide information on the frequency and duration of power outages in cooperative and non-cooperative areas.

1. *Op. cit.*, page 31.

Surprisingly, it appears from these figures that co-operative areas averaged 4.8 outages a month, each lasting an average of 4.3 hours. Non-cooperative areas had 4.3 outages per month, averaging 3.9 hours apiece. While the latter were without power an average of 17 hours per month, cooperative areas had service interruptions averaging about 21 hours, or 23 percent longer, per month.

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1. Op. cit., page 33.

As indicated by Tables V-6 and V-9[1], cooperative and non-cooperative households rate quality of electric service about the same; non-cooperative electrified households overwhelmingly indicate a desire for cooperative service. This would appear to be a highly significant, if difficult to explain, result of the survey. One explanation might be "the glamour or favorable image currently surrounding co-operatives may tend to bias the result."

In summary, while the nationwide survey has developed useful information for the evaluation of the NEA Rural Electrification Program, it is not an evaluation. Crucial issues involving cost effectiveness or cost-benefit, including the proper economic evaluation of opportunity costs, are not dealt with at all. Operations and management of the program and the cooperatives, including the analysis of financial viability, are neglected. Design issues, including technological, organizational, operational and financial aspects as related to the generation and distribution of benefits and costs, are not treated. Although some correlations and statistics involving the distribution of benefits spatially -- across income groups, and across various consumption and productive uses -- are presented, this is insufficient to form the basis for causal inference.

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1. Op. cit., page 35.

TABLE V-5. Percentage of Electrified Households: Perception of Ususal Length of Electric Service Interruption by Cooperative Status, 1977

Length of Interruption	Cooperative Area	Non-Cooperative Area
1 hour or less	38	50
2 hours	17	18
3 hours	9	6
4 hours	7	4
5 to 6 hours	7	9
7 to 9 hours	6	2
10 to 12 hours	13	5
13 to 18 hours	a	1
19 to 24 hours	2	2
More than 24 hours	1	3
Don't know/No response	a	a
TOTAL	100	100

a = less than 1 percent

Table V-6. Percentage of Households: Opinion on Quality of Electric Service by Cooperative Status, 1977

Opinion on the Quality of Electric Service	Cooperative Area	Non-Cooperative Area
Request to request for repair service is PROMPT	60	59
Service is RELIABLE	73	70
Bill collection is REGULAR	87	85

Table V-9. Percentage of Households in Non-Cooperative Areas: Response to the question, "Would you like to have an electric cooperative serve your town?" by Electrification Status, 1977

Response	NON-COOPERATIVE AREAS Electrified HH	Non-Electrified HH
Yes	81	90
No	9	2
Don't know	10	8
TOTAL	100	100

Unlike the MORESCO study, this survey stops short of implying that electrification is responsible, wholly or partially, for observed differences in income among electrified and non-electrified households. Survey results do not present a sufficient basis for concluding any of following: (1) electrification has not resulted in significantly increased incomes among users; (2) the NEA/AID Rural Electrification program, as presently constituted, has not or will not have a significant welfare impact on the Philippine rural poor; or (3) rural electrification in general, no matter how designed or implemented, is not an effective or valuable program area for the implementation of a New Directions development strategy.

More work needs to be done to resolve these many issues satisfactorily and to permit a reasoned and objective judgment on the effectiveness of the Philippine rural electrification program. In fairness, it is probably also correct to say, as do many who have closely observed rural electrification in practice, that considerably more time will have to pass before such a judgment can be reached.

Time will pass. It is important that the lessons of the Philippine experience not be lost. That is to say, it is important that a comprehensive evaluation of the rural electrification program eventually be completed. Work is scheduled and progressing which will further contribute to that effort. This includes continuing survey work comparable to that performed during 1977. The recommendations which follow are intended to contribute to that process, in particular by noting what are felt to be important gaps in the existing documentation.

VII. Recommendations

A conceptual framework for the evaluation of rural electrification projects, similar in intent and coverage to the sample framework provided elsewhere in this document, should be refined and adapted to the scale and conditions of the Philippine program, and agreed upon by those parties who maintain an interest and will participate in continuing evaluation work in the Philippines. Such a framework would:

- Permit the development of an integrated and consistent methodology for data collection and analysis.

- Help to identify data requirements and potential data sources, including: existing records of the cooperatives, the NEA, and USAID; those data which might be collected on a routine basis by these various groups; and, those which will require doing supplementary survey work.

- Help to coordinate and schedule the efforts of the various participating groups.

- Permit the coordination of other sectoral, regional, or complementary-projects analyses. To paraphase John Westley[1], because the potential impact of rural electrification on rural development is so heavily dependent on the nature of complementary programs and on the stage of rural development in general, its assessment must proceed through the analysis of the contribution of electrification relative to other programs and developments in a regional or sectoral context.

It is recognized that there are too many rural electric cooperatives in the Philippines to analyze individually. Data aggregated to the national level such as that presented in the Nationwide Survey [35], how-

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1. Westley, J., Preliminary Draft, "Rural Infrastructure Policy Background Paper," AID/PPC, October 1978.

ever, will not be able to support conclusions or provide lessons to guide potential future AID participation in rural electrification development, either in the Philippines or in other developing countries. Such data must be complemented by specific micro-data from the individual cooperative level. Because of their length of experience as operating entities, VRESCO and MORESCO are good candidates for inclusion and evaluation at this level. Additionally, efforts should be made to select a group of cooperatives, reflecting the wide variety of operating conditions prevailing in the Philippines. These conditions include size of the cooperative, load density, structure of agricultral and industrial production and employment in the region, family income levels and their distribution, integration of rural electrification with other development projects, and rate structures.

A wealth of information and insight with respect to design, organization, and implementation alternatives exists in the collective experience of hundreds of small private and municipal utilities which operate in the Philippines. To recapitulate their history as gleaned from the documentation reviewed: (1) 300 such utilities existed in 1965; (2) about 120 were taken over by the NEA and consolidated into 41 cooperatives; (3) as of 1974, there existed approximately 500 such utilities, over 300 of which must have been established concurrently with the NEA program. Learning more about the conditions under which they were established and operate, the nature and variety of their services, policies, and procedures, might shed considerable light on alternative possibilities for AID involvement in rural electrification. For example, it seems reasonable to suppose that a possibly lower cost alternative might have worked as well as or better than the NEA program and might have involved the following hypothetical variant: (1) Power generation and transmission by the NPC; (2) Interest subsidy to privately financed private and municipal utilities to encourage their moderate expansion to achieve the "core" distribution systems now provided by the cooperatives; and (3) Concentration of foreign concessional and public resources on the development of service to the poor, low-density, low-growth areas, perhaps on an explicitly subsidized and developmental basis.

Research in this area, documenting the feasibility of autogeneration, low-overhead flat rates, interruptible service, etc. would most certainly complement the evaluation of the cooperatives, as well as other AID sponsored rural energy systems research such as that being conducted under the Philippines Nonconventional Energy Development Project [29].