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PLANNING RURAL ENERGY PROJECTS:

A Rural Energy Survey & Planning Methodology for Bolivia

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PREFACE

The PCI team would like to express its appreciation for help and support to INER and especially to Ing. Lucio Saal Morales who worked with us during the field work. Mr. Charles Morely, USAID/Bolivia, was also very helpful to us during the time we worked in La Paz.

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SECTION ONE

SUMMARY

During January, 1980, Practical Concepts Incorporated (PCI) undertook a consultancy to assist USAID/Bolivia and the Bolivian Government in the first stages of a process for developing village level energy projects.* During this consultancy, PCI's team developed a survey and planning methodology for assessing rural energy needs and village level energy resources in Bolivia.

The methodology PCI developed is designed to facilitate the selection of the most appropriate and effective ways for rural Bolivians to meet their energy needs in their own villages with local energy resources.

The survey portion of the methodology, when applied, will provide data on:

- Energy Uses in the Rural Areas. The survey is designed to secure information on all important or major end-uses of energy and energy consumption patterns in the rural villages, including an identification of the energy resources used to support these patterns and end-uses.

- Local Energy Resources. The survey data will identify and facilitate the categorization of village level energy resources. It will identify local resources that are currently in use as well as energy resources that are not being employed at present. Particular attention is paid to renewable energy resources.

- Socio-cultural and Environmental Conditions. The survey will identify important socio-cultural factors that affect the ways in which energy is used in the villages, especially those factors or patterns which could change (and be supportive or inhibitive) if the energy sources or energy technologies used by villages were altered.

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* The consultancy for AID's Bolivia Mission was carried out under a PCI contract with AID's Office of Rural and Administrative Development (DS/RAD). PCI's three-year engagement with this Office provides assistance to USAIDs, LDCs, and AID/Washington offices in addressing data gathering and analysis issues for rural development projects. Rural infrastructure projects and the impact of rural development efforts on beneficiary groups are areas that have received particular attention under this contract.

In addition, the survey data will facilitate the identification of important local environmental problems and the probable effects of a shift in the use of local renewable energy resources or energy consumption patterns.

- Village Level Energy Needs. The survey will provide data on village energy needs and show how these needs relate to energy uses (from the point of view of the local people). The survey will also provide a basis for identifying energy needs that may not be articulated by people in the villages, due to their lack of experience with specific energy applications.

The data analysis portion of the methodology is designed to use survey data in a process that matches a set of prioritized energy needs and local energy resources to facilitate the selection of appropriate energy conversion technologies. The methodology should also prove useful as a technique for identifying energy related research and development agendas. The methodology is not, however, meant to be used as a tool for compiling aggregate statistics on energy-use patterns or for determining the national resource potential of Bolivia.

The survey and planning methodology developed for USAID/Bolivia is designed for use in different communities over many years. PCI recommends that AID itself undertake the initial testing, translation and application of the instrument. Once such preliminary efforts are completed, PCI recommends that AID engage a Bolivian institution, such as INER, in the survey and analysis process, gradually transferring both the capacity and responsibility for the process to a local organization.

SECTION TWO

BACKGROUND & OBJECTIVES

In this section of the report PCI examines general background issues as well as USAID/Bolivia's specific expectations concerning the consultancy. The section covers:

- The nature and requirements of village level energy projects;
- The role of information in the design, implementation and evaluation of these projects; and
- The objectives and scope of PCI's consultancy for USAID/Bolivia.

A. THE NATURE & REQUIREMENTS OF VILLAGE LEVEL ENERGY PROJECTS

Energy, when defined as the ability to do work, is a means to an end. In its broadest sense, it is the means to plow and irrigate fields, to process goods, transport produce, light clinics and homes at night and facilitate other activities that enhance productivity and improve the quality of life.* In rural development programs, energy is a required input and not an end in itself. In Bolivia, as in other developing countries, it is expected that when energy resources are provided or expanded, higher level development benefits will follow, e.g., changes in productivity, health status, etc. Figure II-1 schematically displays some of the specific hypotheses that have been formulated over the past several years concerning the relationship between energy uses and socio-economic benefits.

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* Appendix One contains a short analysis of commercial energy use in Bolivia, prepared by USAID/Bolivia.

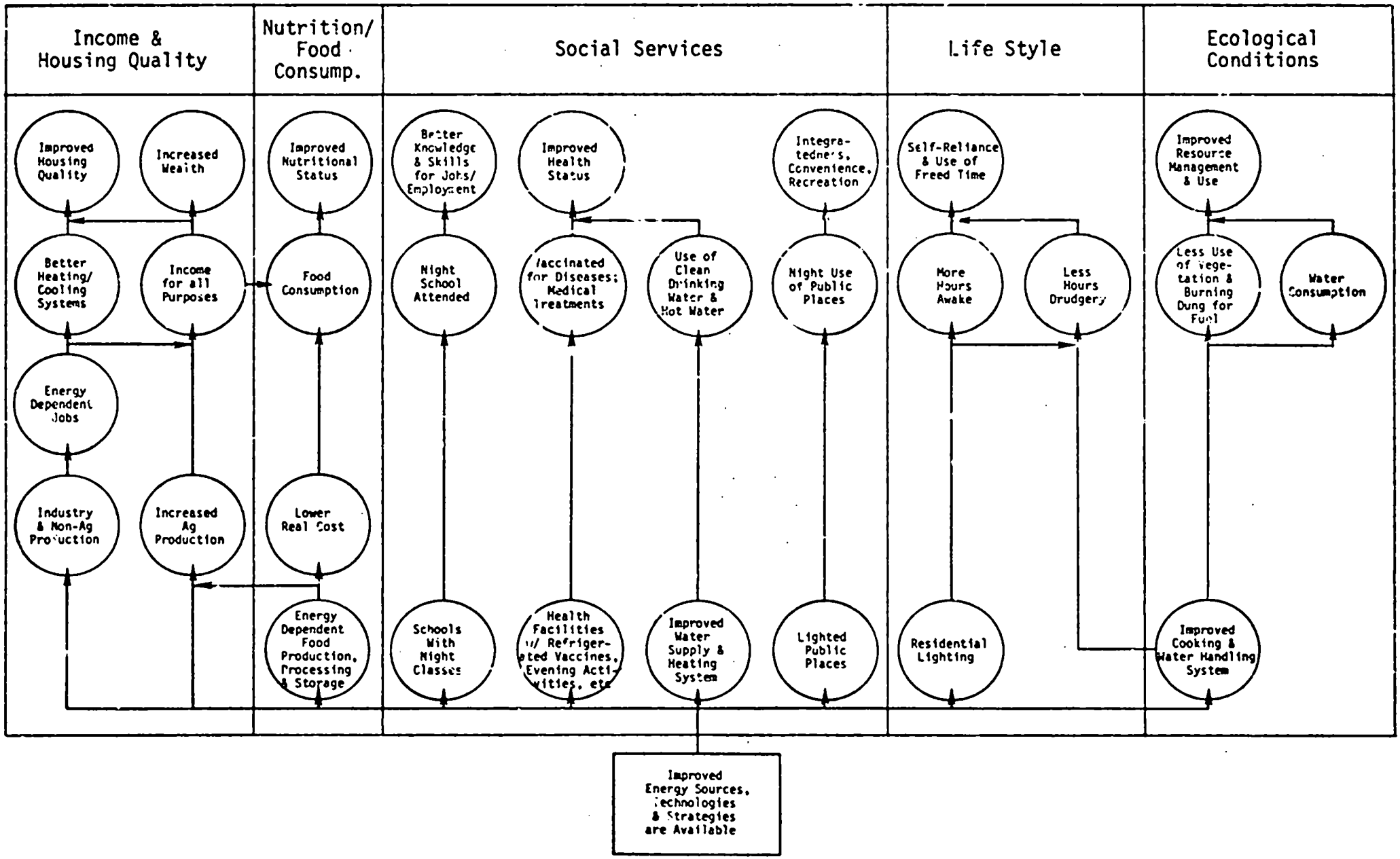

FIGURE II-1: OBJECTIVE TREE INDICATING LINKAGES BETWEEN ENERGY & DEVELOPMENT OBJECTIVES

As Figure II-1 and AID's guidelines for project development suggest, the optimal method for achieving any rural development objective is to begin by stating the specific objective that is to be achieved and then working backward (or down the objective tree) to determine what mix of resources (or inputs) are required. This type of systematic process for determining the inputs required to achieve specific rural development objectives can lead planners to the conclusion that energy resources are a needed element of an overall development program. Once AID or any other development organization identifies a general need for rural energy resources, a process must be undertaken that defines in specific terms what energy sources and technologies should be developed. Ideally, one begins the process for selecting specific energy resources by defining what type of work they are to facilitate and then determining, for a specific context, exactly what energy sources and technologies are best suited to the needs at hand.

Energy projects or energy strategies are of two basic types. There are those which simply introduce a different energy supply or technology to carry on an "end-use" activity that already exists in the area, e.g., replacing a rope and bucket system on a well with a wind driven pump. Second, there are those which provide energy for one or more new "end-uses", i.e., they make a new activity possible (e.g., by providing a pumping system for irrigation where fields have not previously been irrigated) or dramatically alter social and economic patterns with respect to an existing energy use. Many energy projects sponsored by development agencies are of the second type and, as such, require systematic planning.

A systematic process is needed which helps planners to (1) use information on rural development objectives to identify energy needs and (2) use information on village energy needs in the selection of appropriate energy technologies. AID, other donor organizations and the developing countries have not always followed this type of systematic process. In a number of recent projects, planners and project designers have started with an attractive

technology and looked for ways to apply it.* When the design process is inverted in this manner, the consequences can impede progress. First, an inversion of this sort can result in the installation of energy technologies and systems that are inappropriate, i.e., either the form of the energy output or the amount of energy produced by the project is inappropriate. Once created, these resources may go unused, be too expensive for the project's target group or require heavy subsidization for much longer than was initially anticipated. Because these "technology driven" energy projects are often patently inappropriate, they can impede progress in a second way: They can discourage the people in villages as well as government ministries and donor organizations from actively pursuing alternative and more appropriate rural energy projects.

If the overall planning process is "needs driven" as opposed to "technology driven", there is a much greater chance that the technologies selected and the energy supplied will integrate well into the communities for which they are chosen. In addition to assessing the appropriateness of alternative energy technologies for rural villages (in terms of the form and amount of energy output they provide relative to the amount and kind of work this energy is expected to do), AID and the Bolivian Government will need to consider implementation strategies for each alternative technology they consider. If projects are to be implemented locally, as well as used and maintained by local personnel after a development assistance effort is terminated, then the technologies selected for village level projects must be manageable at the village level.

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* Prior instances in which the existence of a technology has led to the development of energy projects in the developing countries suggest to PCI that AID needs to examine carefully: (a) Active marketing of AID and LDC personnel by technology design and production organizations that have a vested interest in seeing their particular technologies demonstrated in developing countries which are, in effect, potential new markets and (b) any tendency to use a "little knowledge" about technologies, combined with a general worldwide concern with energy, to quickly design and fund energy projects as a means of setting aside a pipeline of development funds for a country of region.

Village level capability, with respect to the operation and maintenance of energy supply facilities and the ability of the village to control its energy resources are two keys to the design and successful implementation of rural energy projects. Further, projects in which those who will utilize the energy provided by a development assistance effort can operate, maintain and control their energy resources are hypothesized to have a greater chance of becoming self-sustaining than projects which lead to increased dependence on outside personnel (e.g., government advisors, ex-patriate technicians, etc.), imported materials and equipment or non-renewable energy sources.

B. THE ROLE OF INFORMATION IN PLANNING RURAL ENERGY PROJECTS

Planners and managers of rural energy projects need information that can be used to establish the priorities among local energy needs; to analyze local resources, capabilities and existing end-uses of energy; and to match energy technologies with local constraints and requirements. Further, it is important from a planning and from an evaluation perspective to have information available concerning the status of the local population with respect to the social and economic conditions that are expected to change when energy resources are applied, e.g., nutrition status, housing quality, wealth, etc.

An information gathering approach for rural energy projects that focuses on the current end-uses of energy and the energy needs of local people has two benefits: It facilitates the matching of technologies to a specific situation and helps to ensure that intended impacts are not forgotten during the technical design phase of the project. Planners need a comprehensive picture of local development issues and plans, constraints, the energy implications of local conditions, and an understanding of present local energy-use patterns to develop a project design that is both appropriate and has a high probability of yielding its intended impacts.

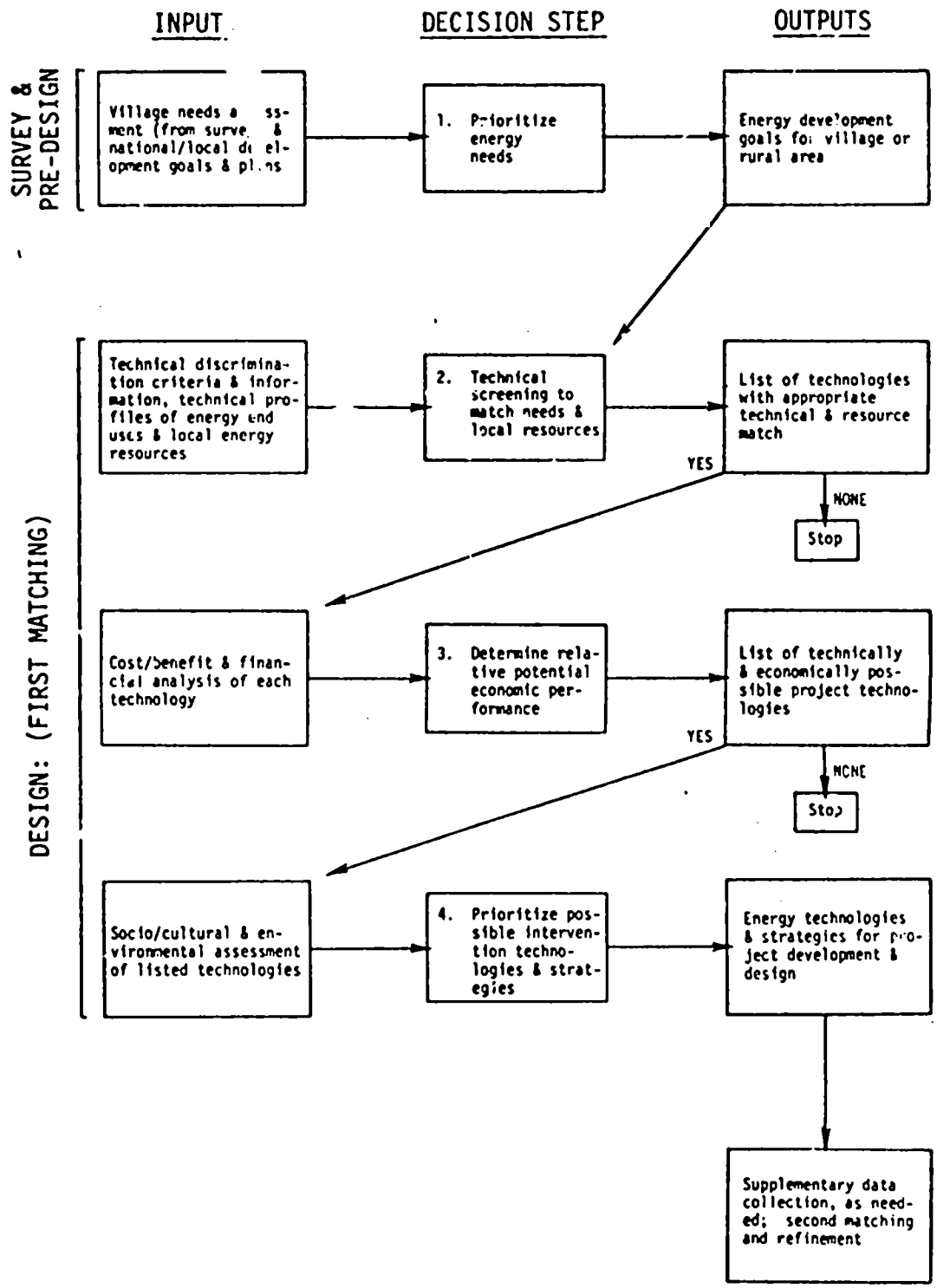
Information on the resources that are currently in use and those which are latent (i.e., could be brought into use) is also required. Without such information, planners run a high risk of introducing a strategy that will not work, is not wanted, cannot be managed by the local people, or has inefficiencies built in which negate the other potentially positive effects of an energy project. Further, planners and project designers need locally specific data to properly analyze and select appropriate fuels and conversion technologies.

The range of information needed to plan rural energy projects is perhaps best illustrated by a review of the analytic process required to match community level needs and resources with appropriate energy technologies. A selection process that matches energy needs with energy sources and technologies in a manner that is socially, culturally, economically and environmentally optimal will normally have a number of stages. The process begins, as USAID/Bolivia intends to begin, with the collection and analysis of locally specific data on the end-uses of energy as well as information on local development objectives that depend upon energy inputs. Figure II-2 displays the multiple states of a process that should, if properly used, lead to the selection of optimal energy sources and technologies for meeting rural energy needs. The first step in the process (shown at the top of the figure) is the phase of pre-design information gathering.

Based on the information generated by this pre-design data gathering phase, government officials and donor organizations can begin a process of matching energy resources to supply needs. This process leads to the identification of plausible energy sources and technology options. There are several reasons for undertaking a screening and matching process of the type suggested by Figure II-2, including:

FIGURE II-2:

THE DECISION-MAKING PROCESS* FOR MATCHING ENERGY NEEDS & ENERGY TECHNOLOGIES



* This chart is based on previous work done by Dr. George Burrill; and by John Ashworth and Jean Neundorffer in "A Process for Matching Village Level Needs & Renewable Energy Systems", published by SERI, Golden, Colorado, 1980.

- The importance of matching the form of energy need or end-use in a village (e.g., energy for irrigation) with the form of energy output from various candidate technologies to achieve high orders of efficiency in energy production. Some end-uses can be served by applying any of a number of energy sources and technologies. Where such choices exist, a matching process forces a complete review of the efficiency of each option and facilitates selection of an optimal approach for the specific situation.

- The fact that renewable energy technologies vary in the quality and timeliness of their outputs; they rely on resources that are themselves variable, e.g., the sun, wind and biological processes. When renewable technologies are considered, a screening and matching process that examines the inherent variability of the energy source and technology in conjunction with the quality and timing requirements of the local situation is needed.

- From prior experience with energy projects as well as other types of development projects, AID has reason to believe that the acceptance and adoption of a new technology will be most rapid and complete when it has been closely matched to the social, environmental and economic conditions in a project area.

- Finally, there may be some instances where the screening and matching process suggests that there is no readily available and desirable technology to address an energy end-use identified by a pre-design data collection effort. The matching process thus informs AID when the appropriate response to a situation is not to construct an energy producing facility.

While the information collected with this methodology will sometimes be sufficient to narrow the range of potential energy source and technology options at the point of the first "matching", it will often be the case that additional information is required to make final energy source and technology selections. Thus, planners may need to gather additional data on local conditions (e.g., resource availability, village organizational capability, etc.) in the villages a project will assist. During such "second-round" village data collection efforts, planners will have an opportunity to actively involve the local population in their deliberations concerning energy source and technology options. Discussions with the village people about specific

options can provide planners with information and insights that could not have been secured during pre-design data collection efforts (when specific options had not yet been identified). Village level feedback on candidate energy sources and technologies can provide planners with a complex of information that relates to twin issues of village capabilities and a village's ability to control its energy resources.

Additional economic, social and environmental data from villages is only one of the types of information planners may need to make final energy source and technology decisions. They may also need supplementary technical data on the various technologies they are considering. Some of the candidate technologies under consideration may not yet be fully developed and ready for village installation. They may, however, be options that are highly desirable and warrant a shift toward a research effort or an experimental project design. Given the evolving state of many renewable energy technologies, AID and the developing countries may on occasion find that the best approach, from a long-term perspective, involves a staged or phased beginning. Where it appears that the optimal approach for providing energy resources involves a technology that is still experimental, plans can be scaled back to allow for a pilot (or experimental) phase in a project.

The need to "test" an energy technology in a project area is often just as great when an older technology is selected. There are several reasons for this, including:

- Even where a technology has proven effective elsewhere, such adaptions as are required for a new situation will need to be identified and made.
- Energy interventions are organizational as well as technical in nature. The organizational aspects of an approach usually benefit from some form of testing and adaptation.
- Where a technology is to be used in diverse sections of a country, as is the case in Bolivia, testing is needed to determine the differences in the technical requirements as well as organizational capacity and constraints in specific areas of the nation.

Thus for Bolivia, as well as for other developing countries, it is PCI's judgement that rural energy projects are best developed as phased efforts that include (a) "pilot tests" of the approaches that are expected to be optimal, (b) an evaluation of the "tests", and finally (c) the broad application of "proven" approaches. The questions to be answered by the first stage of such projects include:

- How well does a given device perform technically given the physical conditions of the village?
- What are the real costs associated with the installation and operation of the technology, and how do these costs compare to the benefits received and to traditional or other means of accomplishing the same work?
- How well does the technology integrate with the local culture and with the social organization of the village and family?
- How appropriate is the technology for the village institutions or individuals who could own, operate, and maintain it?
- What can be learned about the best ways of transferring or adapting the technology to village settings?

These questions can normally be answered during a "pilot test" phase of a rural energy project. However, if the questions are to be answered by "pilot tests" additional information which can only be gathered during the course of such experiments will be needed. This, in turn, suggests the need for project-level information systems that yield the data required to answer the questions listed above. The information from such a system can be used in two productive ways: (a) To examine the questions and hypotheses related to a "pilot test" phase of a project and (b) to provide feedback to those who can act upon the system's information. A key level at which feedback from such an information system should be provided is the village itself. Information provided to the villagers from rural energy "pilot tests" can serve to stimulate acceptance and adoption of a technology. To a certain extent, the information needed at the village level is the same information that USAID and the Government of Bolivia will need to make decisions concerning the widespread replication of

their experiments. This data can also be used by planners in other countries as a guideline for the conduct of field "pilot tests" elsewhere. A design for securing the type of evaluation data required for these purposes is suggested in The Role of Evaluation for Renewable Projects in Africa by Dr. George Burrill.*

C. THE PCI CONSULTANCY

As a first step in the process of developing rural energy projects, USAID/Bolivia hopes to assess the current uses of energy in Bolivian villages and determine for specific villages what types of supplementary energy resources could be productively used. Pursuant to USAID/Bolivia's plans for developing village level energy projects, the Mission requested the assistance of Practical Concepts Incorporated, through DS/RAD, in developing a village level survey methodology that could be used to examine energy needs in rural Bolivia.

In January 1980 Dr. George Burrill, a rural energy specialist, Dr. Sylvia Forman, an anthropologist, and Dr. Enrique Gomez, an economist, began work in Bolivia on a survey instrument that could be used to identify rural energy needs as well as energy resources and current energy end-uses in the villages of Bolivia. The initial work of this consultancy was carried out in the United States, where the methodologies developed for use in energy surveys on other continents were brought together and examined by Dr. Burrill. This review provided a framework of experience that could be applied and modified to fit the needs of the Bolivia situation.

During the first week of the consultancy in La Paz, Dr. Burrill worked with USAID/Bolivia to clarify the purposes of the survey and to identify the special areas of AID and GOB interest.** In this same week, Dr. Burrill developed a preliminary outline of the data categories for the survey and a

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* Cited in the Bibliography for this report (Appendix Two).

** Appendix Three identifies the places visited by the team and the individuals contacted in the Government of Bolivia.

basic approach for developing the full survey and planning methodology. In the second week of the consultancy, Dr. Burrill and Dr. Forman visited rural villages in Sucre, Santa Cruz and the Altiplano to begin identifying the types of data their survey instrument would need to collect.* In the final week of the consultancy, the full team worked in La Paz developing draft survey instruments in Spanish and English, and preparing a draft report on its consultancy for USAID/Bolivia. The present volume is a final version of that report.

* Appendix Four presents the case materials prepared during these visits.

SECTION THREE

INFORMATION FOR PLANNING RURAL ENERGY PROJECTS

This section of PCI's report discusses the framework for a village level needs assessment developed by the consultancy team. It also presents a listing of the specific types of data that PCI's team concluded are required if USAID/Bolivia is to undertake the analyses necessary to design projects which utilize energy sources and technologies that are appropriate for rural Bolivia.

A. THE NEEDS ASSESSMENT FRAMEWORK

There are four factors associated with needs that comprise the "givens" underlying PCI's approach to a needs assessment in rural Bolivian villages.

1. As has already been noted above, energy is not an end in itself, but rather a means to diverse end-uses. Therefore, PCI's approach, which endeavors to identify energy needs in a rural and developing context, also anticipates that most needs will be expressed as end-use needs and not directly as energy needs.

2. Conditions may exist in the rural setting which strike an outside observer as constituting a "need" without being perceived or expressed as a need by local people.

3. Perceived and expressed needs can vary across segments of a community. This is the probable situation in rural Bolivia where needs may also vary by sex, educational level, wealth level, religion, ethnicity, locale of land holdings, type of employment and other social, cultural or environmental parameters.

4. Local people have reasons for their behavior, reasons for the ways they perceive and define needs and reasons for preferring specific solutions for addressing those needs. The perceived and expressed needs of a village must be comprehensive enough to capture the implications of village values and preferences as they pertain to choices about energy sources and technologies.

Given points 1. to 4. above, the PCI team developed a set of guidelines for the conduct of energy needs assessments in Bolivia. The more important of these guidelines are presented below and constitute the foundation of several aspects of the proposed data gathering methodology (Section Four) and of the design for the matching needs and energy producing options through an analytic process (Section Five).

1. Needs Assessment Guidelines

In order to determine perceived needs and the reasons for them, field researchers, analysts and planners must first collect and "listen to" the entire range of needs that members of a rural community are willing and able to express. Analysts can then examine individually articulated needs and their interrelationships in connection with energy end-uses and options concerning energy sources and technologies.

Because perceived and expressed needs can vary across segments of a community, it is necessary and desirable for field researchers to elicit expressions of need from diverse segments of a village population. A broad view of needs is essential for project development. This broad view should capture both the full range of needs and such variance as is found when data from different segments of a community are examined. This broad information base can facilitate a matching procedure and enable planners to avoid (a) creating projects that address the needs of only a small segment of a population and (b) run contrary to the needs of some portion of the community.*

Since local people have reasons for their behaviors and preferences, an energy needs data collection approach should incorporate observation of the local conditions as well as interviews designed to elicit articulated needs. The combined observational and interview data should be used in a needs-

* In connection with this, see pages 4 to 6 in Thomas Graham, Critical Issues for Designing Energy Surveys in Africa, a report to the Overseas Development Council, Donovan, Hamester & Rattien, Washington, D.C., 1979.

oriented data analysis. Members of a local population fail to define certain conditions for a number of reasons, including lack of knowledge, habituation and/or cultural rules. An outsider may view local conditions in useful ways that differ from local statements. This may, of course, occur when an outsider is inattentive, biased, or simply makes a mistake in his observations. When expressed needs of preferred solutions differ from the needs or solutions perceived by outsiders, the presumption of "rational behavior" at the village level suggests that a deep, careful exploration of local ideas and reasoning is required before a course of action is selected.

Because energy is often a means to several end-uses, descriptive data that provides specific details about energy needs can be of great value to planners. For example, inadequate cooking facilities may reflect concern with irritation from cooking fire smoke rather than a firewood shortage; or a statement to the effect that irrigation is inadequate may suggest a number of possibilities--lack of a power source, a lack of water, or control by an elite over the water resources.

Finally, the probability that expressed needs will vary by community segment and the presumption that villager behavior is "reasonable" suggest that it is important to know the reasons behind statements about needs and priorities as well as the segments of a population represented by a person who is expressing needs or ranking their priority. Through careful observation and from interview data, planners can learn the position of the person within the scheme of social and economic stratification of a community and whether this person is speaking as an individual, a member of a particular household, a member of a special interest group, or a community leader.

2. Needs Data from the Survey

Following these guidelines, the survey methodology is designed to produce information on needs in the following ways:

- Direct Elicitation. In one section of the questionnaire, responses are elicited from household members about their perceptions of the needs of their household and of the needs of their community. In another section of the questionnaire, community leaders are asked about community level needs. In both cases, these questions are followed by questions inquiring about solutions considered for the expressed needs and about the kinds of contributions villagers might make toward a proposed solution.

- Indicative Data. At many points in the questionnaire, queries are posed about the adequacy or availability of a resource currently used. Analysis of the responses to these questions may point to unexpressed needs or may enable the analyst to provide a quantified or distributional picture of factors related to expressed needs or to identify certain expressed needs with certain sub-groupings of the population.

- Observational Data. In addition to administering the questionnaire, the field interviewer is instructed to undertake observation of the community and its environment. Observations of matters such as pasture and forest conditions, quality of housing, types of productive technologies, and kinds of cooking and equipment are to be recorded. These observations may point to unexpressed needs (e.g., contaminated water sources) and/or may provide the analyst with additional information on expressed needs or on the characteristics of people expressing certain needs.

3. The Analysis of Needs Data

The information discussed above can be used directly by analysts and planners to examine the energy-related needs of villages and for identifying project approaches for meeting specific needs. Data elicited through direct questions and by observation should be compared in terms of their range and consistency and should be weighed in conjunction with other available social, environmental and economic data as well as national or regional policy goals. Judgment and some appreciation of local conditions and lifestyle, as well as systematic analyses, are required in this process. Doubts about needs, in the face of ambiguous or contradictory findings, should be referred back to and discussed with the community members. Ideally, the results of a needs assessment will be brought back to the villages and reviewed with villagers as a means of double-checking the validity of the results and as a way of securing village reactions to and agreements with the assessments conclusions.

In connection with a needs analysis, planners should recognize that Bolivian villagers may not be any more "rational" in their decision-making or priority setting than is the planner in everyday life. Factors such as bodily comfort, prestige, advertising, personal values and tastes affect the perceptions and decisions of the rural poor as well as of the urban middle class. Such factors must be considered realistically (and even sympathetically) in a needs analysis. With needs assessment data and an analysis of needs in hand, planners can begin to screen out inappropriate energy sources and technologies and to tentatively match energy end-use needs to realistic options. If there are no identifiable energy-related needs revealed in a needs assessment, the project development process should automatically stop. If, as is more likely, one or more energy-related needs are identified, planners should proceed (past Step 2 in Figure II-2) to the next step in matching needs with technologies, i.e., determining the feasibility and the economic return of each candidate technology.

Planners should realize from the outset that pre-feasibility analyses are only one use of the data from a needs assessment. Planners will need to return the basic village level needs data and related needs assessment issues in one or several ways during the formal preparation of a project. At minimum, the expressed needs of villagers and their priorities among needs should be explored in greater depth with direct reference to a proposed technology and its end-uses. At this point, it may be necessary to provide villagers with information about the candidate energy sources and technologies to enable them to understand the needs/sources/technology matches that are being assessed. Villagers' responses to specific needs/sources/technology matches may provide information that leads to a decision to modify one or more technologies so that they better fit local capabilities and sensitivities.

If the needs identified by a needs assessment are not articulated by the villagers, (i.e., if they come from observational data), planners may find that it is necessary to educate a community before seeking its reactions. In this situation, educational or promotional efforts may have to precede or accompany any further exploration of a candidate needs/source/technology match.

Another roadblock to effective communication with villagers about proposed needs/source/technology matches may relate to the time period in which an energy project could be expected to yield benefits. (Several years may need to intervene between the discussions with villagers and the first energy production from a new village facility.) Planners should be prepared to discuss questions concerning the time frame of a project and should attempt to determine the villagers' sense of urgency about fulfilling their expressed needs and the relationship of a candidate needs/source/technology match to current possible future needs.

A final, and somewhat disheartening, note about needs and needs assessments is in order. AID and the Government of Bolivia must be advised that it is possible (and even probable) that the expressed "greatest need" of a community is a direct reflection of the "weakest link" in that community's technological/social/environmental system. When this is true, it may not be feasible or even possible to address the "greatest need" directly. Any project preparation process for a community where the "greatest need" cannot be addressed should certainly include explicit feedback to local participants on why a lesser need, rather than the perceived greatest one, is being treated.

B. THE SPECIFIC DATA TO BE GENERATED IN A NEEDS ASSESSMENT PROCESS

This subsection of the report presents the PCI team conclusions concerning the data required for a needs assessment in Bolivia. The analytic framework in which the specific data elements are presented builds on a paper entitled Africa Energy Survey Methodology, prepared in 1979 by Donovan, Hamester and Rattien, Inc., a Washington, D.C. based firm.

The data required for a needs assessment in Bolivia are listed in English and Spanish in Tables III-1 and III-2 at the end of this section. In these tables, the data are divided into three levels: Data classes, a grouping which clusters large segments of the data requirements; data categories, which cluster smaller segments within classes; and data elements, or individual

bits of information. This taxonomy is designed to facilitate the needs analysis process described in the preceding subsection. Energy utilization activities are put together in logical groupings as are energy resources. Social, cultural, economic and organizational data requirements are also appropriately grouped into the analytic framework. The data base summary in Table III-1 is set up so that the planner or analyst can easily extract required information in the clusters or aggregations of interests.

PCI's survey instrument (which is discussed in Section Four and presented in Appendix Five of this report) does not follow exactly the sequence of the data base summary. The survey is, however, cross-referenced with the data base so that the analyst will know where to look in the survey for information on a specific data category or element. Table III-3 at the end of this section shows the cross-references between the data lists and the survey instrument. In the following pages, PCI presents an explanation of data classes and a discussion of the important characteristics of each data class. The discussion is presented in outline form. It elaborates upon, justifies and explains the sources for specific data elements:

- Class I. It will not always be possible to obtain data on household make-up through the field survey and independent sources of information may have to be used to estimate household size and composition. Data elements pertaining to schools and education, language, religion and communal work traditions are especially important for the socio-cultural feasibility analysis.

- Class II. It will not always be possible to obtain detailed data on disposible income or income brackets through the field survey. People in many parts of Bolivia simply will not give out income or wealth information. Observations and estimates are useful in such instances and, where possible, data from other studies should be used to provide estimates of these levels (see Section Four, A. on additional data gathering).

- Class III. Although the survey includes some questions on wind, rivers, rainfall patterns, and water table levels, much of the quantified data of all the data elements in this class should be compiled from national or regional data sources before the survey is conducted (see Section Four, A. on additional data gathering).

- Class IV. Organizational capacity is a crucial variable in socio-cultural feasibility. Moreover, in some communities, organizations, rather than private individuals, may be major energy consumers or producers.

- Class V. Fuel for cooking constitutes one of the greatest uses of energy in rural areas. Further, some of the household's level consumption of energy resources will be "consumption" that is used in productive processes, such as food processing. Information on labor patterns (e.g., time spent hauling water) is also needed for feasibility and impact analysis. Information on fuel and production costs contributes to compilation of the overall economic picture of the community.

- Class VI. Data elements in this class provide a general energy profile. These data elements are important because they may indicate areas where increases in production are possible.

- Class VII. Agriculture is the predominant field of productive activity in Bolivia. Therefore, a detailed view of agricultural tasks, procedures, products, time and energy use patterns, productive potentials and points at which new end-uses and energy technologies might be introduced are covered by the survey.

- Class VIII. Motorized vehicles which only pass through a community are not treated under this category; they are treated elsewhere for the purposes of determining accessibility of the village to external markets.

- Class IX. Electricity is treated separately from other existing energy sources because it is the only real centralized energy source in rural Bolivia except for gasoline or kerosene which are brought into the village from outside. Electrification also seems to stand out as a unique category in the minds of rural people.

- Class X. No plans for renewable energy projects can be formulated without information on site-specific availability of relevant energy resources. Some of this information will be provided in survey results; some of it will have to be compiled from geographic, agricultural and other more general sources.

- Class XI. Ecological problems both help in the determination of needs and point to constraints on the introduction of new energy technologies or new end-uses. Data on potential ecological problems also feed into the impact assessment analysis.

- Class XII. Although perceived needs appear last in the set of data classes, they should be understood to be fundamental to the entire methodology, which is "needs driven" rather than "technology driven". The data elements here include needs currently expressed by people in the village as well as data on future needs or perceived as preferred solutions.

USAID/Bolivia and the Government of Bolivia should note that some data classes or data elements which have been found useful elsewhere have not been included here because (a) they focus on the national rather than the community level or (b) the end-uses they facilitate, e.g., space cooling, are not immediate, high priority problems in rural Bolivia.

TABLE III-1: DATA REQUIRED FOR A NEEDS ASSESSMENT

DATA CLASS	DATA CATEGORY	DATA ELEMENTS	
		Family	Village
I. To measure household and village demographic and social indicators	1. Demographic	a. Number of people in in household b. Number of people in outside work c. Level of education	a. Number of people in village b. Number of families in village c. Number of children in school d. Percent of people in outside work e. Percent of literacy f. Number and type of schools
	2. Social		a. Communal labor traditions b. Land tenure system c. Access to external transport d. Percent of population non-Catholic church affiliation e. Percent of population non-Spanish speaking
II. To measure household and village economic indicators	1. Income, wealth, and economic activities	a. A list of productive activities b. Level of disposable income	a. A list of productive activities b. Percent of population in high- or low-income brackets c. Wage levels of different occupations and seasonality of work d. Sale prices of products
III. To measure geographic and climatic indicators	1. Local climatic and geographic conditions		a. Wind speeds and daily/seasonal variations b. Seasonal and daily solar radiation profiles c. Seasonal rainfall patterns d. Seasonal and daily temperature profile e. Rivers: Distance from village and seasonal variations f. Level of water table g. General topography
IV. To measure organizational indicators	1. Organizations and purposes		a. List of organizations at village level with percent of participation b. Size of organization c. Purposes of organization
	2. Organizational effectiveness		a. Who are the leaders b. Organization's length of time in existence and its accomplishments c. Local perception of organization
V. To identify and quantify household energy consumption patterns	1. Cooking and heating water		a. Cooking methods and facilities b. Types of fuel used c. Amounts of fuel used

TABLE III-1 continued

DATA CLASS	DATA CATEGORY	DATA ELEMENTS	
		Family	Village
V. To identify and quantify household energy consumption patterns--CONTINUED	1. Cooking and heating water--CONTINUED		d. Source of fuel and who in the family obtains it e. Costs of fuel f. Types of cooking utensils and vessels g. Time spent cooking h. Amounts of water heated for non-cooking purposes i. Time of day when meals are prepared
	2. Lighting		a. Means used for lighting b. Type and amount of fuel c. Method of obtaining fuel d. Fuel costs and availability e. Times when lighting is used
	3. Heating		a. Is there any heating now? If so, what? b. Type and amounts of fuel and availability c. Source of fuel and cost d. Times of day and year when heating is used
	4. Water lifting and transporation (domestic only)		a. Where is water obtained and how far is it transported, by season b. How is water lifted and transported c. Time spent in lifting and transporting water d. Who in the family gets the water e. Does obtaining water involve major social interaction f. Control or ownership of water source; charges g. Amount of water used
	5. Food grinding (both mechanical and hand)		a. Types of food ground and time spent b. Devices used to grind food, number of devices c. Types and amounts of energy used d. Cost of energy
	6. Food drying and processing		a. Types of food dryed or processed by season b. Methods used c. Energy type and amount used d. Time required for process e. Energy costs f. Production levels and losses

TABLE III-1 continued

DATA CLASS	DATA CATEGORY	DATA ELEMENT	
		Family	Village
V. To identify and quantify household energy consumption patterns--CONTINUED	7. Food and medicine refrigeration		a. Type of cooling, device b. Energy source and cost c. Daily or seasonal variations
VI. To measure village energy consumption in industry, commercial sales, government, and communications	1. Industry and manufacturing		a. Listing of each artisan, repair, or manufacturing type and an energy use profile for each, including at least: 1. energy inputs--type and quantity of fuel 2. fuel availability 3. fuel costs 4. ownership of energy source 5. types of processing technology 6. types of products produced; quantity and prices obtained on sale
	2. Commercial sales and restaurants		a. Listing of each commercial sales or restaurant establishment and energy use profile for each type, including at least: 1. energy inputs--type and quantity of fuel 2. fuel availability 3. fuel costs 4. overall value of sales per time unit
	3. Government and village organization offices		a. Listing of each government/office operation with an energy use profile for each, including at least: 1. energy inputs--type and quantity of fuel 2. fuel availability 3. fuel costs
	4. Communications		a. Type of system and operator or owner b. Energy demand patterns
VII. To measure energy consumption in agriculture	1. Crops and work task patterns		a. Type of crops and cropping patterns b. Average area of cropped land and plot size by household c. Calendar of agricultural crops and work tasks d. Tools and devices used e. Type and amount of energy required to power mechanized devices or carry out tasks f. Human and animal time required for tasks g. Labor availability and costs h. Land availability
	2. Animals and livestock		a. Types and numbers b. Uses made of each type c. Who herds and how much time spent herding

TABLE III-1 continued

DATA CLASS	DATA CATEGORY	DATA ELEMENTS	
		Family	Village
VII. To measure energy consumption in agriculture--CONTINUED	3. Fertilizer		a. Type of fertilizer used b. Quantity of fertilizer used c. When and on what crops d. Costs and availability
	4. Irrigation (if it exists)		a. Area of land under irrigation, crops, and farmer's perception of water adequacy b. Source of water c. Location of water supply d. Devices used to lift water e. Fuel used (type and quantity) f. Fuel availability and cost g. Reliability and seasonality of water source
	5. Crop, dairy, and other agricultural product processing		a. Types of items processed b. Technologies or processes used c. Energy sources and amounts used d. Energy costs and availability e. If processing is done outside the village, who does it, who owns it, and could it be done in the village?
VIII. To measure energy use in transportation	1. Motorized vehicles (owned in the village)		a. Types of vehicles b. Number of each type c. Average number of trips per year by type and distance d. Vehicle use (reasons) e. Fuels used and where obtained
	2. Animals		a. Type of animal b. General transportation purpose c. Distance and frequency of trip types
IX. To describe electrical energy supply	1. Electricity production (non-central grid)		a. How is electricity produced? b. Number and ownership of generators c. Fuel use, cost, availability, and trends d. Electricity availability, reliability
	2. Electricity distribution (any source)		a. Electricity prices, distribution, and allocation patterns b. Price trends
X. To identify and quantify village renewable energy resources	1. Energy and fuel types; e.g., wood, charcoal, dung, bagasse, agricultural wastes, potential biofuel crops, etc. (Wind, water, sun, and electricity are already covered.)		a. For each type of fuel: 1. amount available per season or year 2. who owns and distributes 3. location and present uses

TABLE III-1 continued

DATA CLASS	DATA CATEGORY	DATA ELEMENTS	
		Family	Village
X. To identify and quantify village renewable energy resources--CONTINUED	1. Energy and fuel types, e.g., wood, charcoal, dung, bagasse, agricultural wastes, potential biofuel crops, etc. (Wind, water, sun, and electricity are already covered.)--CONTINUED		4. Prices 5. Resource trends 6. Local plans for resource development
XI. To identify ecological and environmental problems (deforestation, loss of soil, overgrazing, contaminated water supply, etc.)	1. To identify and list major existing ecological or environmental problems previously known or found during this survey		a. Describe each problem as quantitatively as possible b. Same as a. above
XII. To identify energy-related perceived needs, problems, and plans	1. Identify and list each need or problems a. b. etc.		a. For each need and problem, identify important social, cultural, economic, and environmental elements. b. For each need and problem, identify local plans or conceptions for solutions

TABLE III-2: DATA REQUIRED FOR A NEEDS ASSESSMENT (SPANISH VERSION)

DATOS DE CLASE	DATOS DE CATEGORIA	DATOS DE ELEMENTOS	
		Familia	Aldea
I. Para medir indicadores demográficos y sociales de familia y aldea	1. Demográfico	a. Número de personas por familia/casas b. Número de personas que realizan trabajo fuera de la comunidad c. Nivel de educación	a. Número de personas por aldea b. Número de familias/casas por aldea c. Número de niños en la escuela d. Porcentaje de personas que realizan trabajos fuera de la comunidad e. Porcentaje de alfabetismo f. Número y tipo de escuelas
	2. Social		a. Costumbres de trabajo comunitario b. Sistema de posesión de tierras c. Acceso al transporte externo d. Porcentaje de la población de otra religión que no sea católica e. Porcentaje de la población que no habla castellano como su idioma principal
II. Para medir los indicadores económicos de familia y aldea	1. Ingresos, riquezas y actividades económicas	a. Una lista de actividades productivas b. Nivel de ingresos disponibles	a. Una lista de actividades productivas b. Porcentaje de población de ingresos de categoría baja o alta c. Niveles de salarios de diferentes ocupaciones y temporada de trabajo d. Precios de la venta de sus productos
III. Para medir indicadores geográficos y climáticos	1. Condiciones locales climáticas y geográficas		a. Velocidades del viento y variaciones diarias o de temporadas b. Perfiles de radiaciones solares diarias o por estaciones c. Patrones de temporadas de lluvias d. Temperaturas diarias y por estaciones e. Ríos: distancia de la aldea y variaciones por estaciones f. Nivel de la capa acuífera g. Topografía general

TABLE III-2 continued

DATOS DE CLASE	DATOS DE CATEGORIA	DATOS DE ELEMENTOS	
		Familia	Aldea
IV. Para medir indicadores organizacionales	1. Organizaciones y propósitos		a. Lista de organizaciones a nivel de aldea con porcentaje participación b. Tamaño de la organización c. Propósitos de las organizaciones
	2. Efectividad organizacional		a. Quiénes son los líderes b. Tiempo de duración de la organización y sus realizaciones c. Percepción local de organización
V. Para identificar y cuantificar prácticas de consumo de energía por familia	1. Prácticas de cocinar y calentar agua		a. Métodos y facilidades para cocinar b. Tipos de combustible utilizados c. Cantidades de combustibles utilizados d. Fuente de combustible y quién en la familia lo obtiene e. Costo del combustible f. Tipos de utensilios y ollas utilizados para cocinar g. Tiempo utilizado para cocinar h. Cantidades de agua calentada para otros propósitos fuera de cocinar i. Horas del día en que se preparan las comidas
	2. Luz		a. Medios de iluminación b. Tipo y cantidad de combustible c. Método de obtener el combustible d. Costo del combustible y su disponibilidad e. Horas que se usa la luz
	3. Calefacción		a. ¿Tienen calefacción ahora? ¿Cuál? b. Tipo y cantidad de combustible y disponibilidad c. Fuente de combustible y costo d. Hora del día y tiempo del año en que se usa la calefacción

TABLE III-2 continued

DATOS DE CLASE	DATOS DE CATEGORIA	DATOS DE ELEMENTOS	
		Familia	Aldea
V. Para identificar y cuantificar prácticas de consumo de energía por familia - CONTINUA	4. Levantamiento y transportación de agua (uso doméstico solamente)		a. Dónde se obtiene el agua y desde qué distancia se la transporta por temporadas b. Cómo se levanta el agua y cómo se la transporta c. Tiempo usado en levantar y transportar el agua d. Quién en la familia recoge el agua e. El proceso de obtención del agua ¿incluye mayor interacción social? f. Control o propiedad del recurso del agua, precios g. Cantidad de agua utilizada
	5. Molienda de alimentos (Mecanizado y manual)		a. Tipos de alimentos molidos y tiempo empleado b. Dispositivo utilizado para moler alimentos, número de dispositivos c. Tipos y cantidades de energía usada d. Costo de energía
	6. Secado y procesado de los alimentos		a. Tipos de alimentos secados o procesados por temporadas b. Métodos utilizados c. Tipo de energía y cantidad usada d. Tiempo que requiere el proceso e. Costo de energía f. Niveles de producción y pérdidas
	7. Refrigeración de alimentos y medicinas		a. Tipo de dispositivo para enfriamiento b. Recurso de energía y costo c. Fluctuaciones por día o estación
VI. Para medir el consumo de energía por aldea, en la industria, comercio, gobierno y comunicaciones	1. Industria y manufactura		a. Enlistar cada tipo de artesanía, reparación o manufactura, y tipo de energía utilizada en cada una, incluyendo por lo menos: 1) Tipo de energía usada incluyendo tipo y cantidad de combustible. 2) Disponibilidad de combustible. 3) Costo de combustible 4) Propietario de fuentes de energía 5) Tipos de tecnología de procesamiento

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TABLE III-2 continued

DATOS DE CLASE	DATOS DE CATEGORIA	DATOS DE ELEMENTOS	
		Familia	Aldea
VI. Para medir el consumo de energía por aldea, en la industria, comercio, gobierno y comunicaciones (CONTINUA)	1. Industria y manufactura (CONTINUA)		6) Tipos de productos producidos; cantidades y precios de productos vendidos
	2. Ventas Comerciales y Restaurantes		a. Enlistado de cada establecimiento de ventas comerciales o restaurantes y perfil de energía utilizado para cada tipo, incluyendo por lo menos: 1) Tipo de energía usada incluyendo tipo y cantidad de combustible 2) Disponibilidad de combustible 3) Costo de combustible 4) Valor de ventas que abarca, por tiempo-unidad
	3. Oficinas de Organizaciones Gubernamentales y de la aldea		a. Enlistado de cada oficina gubernamental con un perfil de la energía utilizada en cada una, incluyendo por lo menos: 1) Tipo de energía usada incluyendo tipo y cantidad de combustible 2) Disponibilidad de combustible 3) Costo de combustible
	4. Comunicaciones		a. Tipo de sistema y operador o dueño b. Patrones de demanda de energía
VII. Para medir el consumo de energía en la agricultura	1. Cosechas y patrones de faenas o trabajos		a. Tipos de cosechas y patrones de siembra b. Area promedio de tierra bajo cultivo y tamaño de parcela c. Calendario de cosechas de agricultura y faenas d. Herramientas y máquinas utilizadas e. Tipo y cantidad de energía requerida para derivar potencia a las maquinarias o completar las faenas. f. Tiempo requerido de personas y animales para estas faenas g. Disponibilidad de mano de obra y costo h. Disponibilidad de tierras
	2. Animales y ganados		a. Tipo y números b. Usos dados a cada tipo c. Quién pasta y cuánto tiempo se utiliza en pastar
	3. Fertilizantes		a. Tipo de fertilizantes usados b. Cantidad de fertilizantes usados c. Cuándo y en qué tipo de plantaciones d. Costo y disponibilidad

TABLE III-2 continued

DATOS DE CLASE	DATOS DE CATEGORIA	DATOS DE ELEMENTOS	
		Familia	Aldea
VII. Para medir el consumo de energía en la agricultura (CONTINUA)	4. Riegos (Si existen)		a. Area de tierra bajo riegos, tipo de cultivos y percepción del agricultor de la adecuada cantidad de agua b. Recurso del agua c. Ubicación del recurso de agua d. Dispositivos utilizados para el levantamiento del agua e. Combustible utilizado (tipo y cantidad) f. Disponibilidad de combustible g. Confiabilidad y temporadas del recurso del agua
	5. Cosechas, lechería y procesamiento de cultivos, leche y otros productos agrícolas		a. Tipos de elementos procesados b. Tecnologías o procesos utilizados c. Fuente de energía y cantidades utilizadas d. Costos de energía y disponibilidad e. Si el procesamiento es hecho fuera de la aldea, quién lo hace, a quién pertenece, y se podría hacer en la aldea?
VIII. Para medir energía usada en el transporte	1. Vehículos motorizados (que pertenecen a la aldea)		a. Tipos de vehículos b. Número de cada tipo c. Número promedio de viajes por año diferenciados por tipo de viaje y por distancia d. Uso del vehículo (razones) e. Combustible usado y dónde se obtiene
	2. Animales		a. Tipos de animales b. Propósito general de transporte c. Distancia y frecuencia de viajes, por tipo
IX. Para describir el abastecimiento de energía eléctrica	1. Producción de electricidad (red no centralizada)		a. Cómo se produce la electricidad b. Número y propiedad de generadores c. Uso de combustible, costo, disponibilidad y tendencias d. Disponibilidad y dependencia de electricidad
	2. Distribución de electricidad (cualquier fuente)		a. Precios de electricidad, distribución y patrones de alocación b. Tendencias de cambios en los precios

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TABLE III-2 continued

DATOS DE CLASE	DATOS DE CATEGORIA	DATOS DE ELEMENTOS	
		Familia	Aldea
X. Para identificar y cuantificar los recursos de energía renovable en la aldea	1. Tipos de energía y combustible, ejemplo: leña, carbón, estiércol, desperdicios agrícolas, bagazo, combustible biológico, etc. (Viento, agua, sol y electricidad han sido cubiertos ya)		a. Para cada tipo de combustible: 1) Cantidad disponible por estación o por año 2) A quién pertenece y quién distribuye 3) Lugar y usos en el presente 4) Precios 5) Tendencias de cambios en la disponibilidad de recursos 6) Planes locales para el desarrollo de recursos
XI. Para identificar problemas ecológicos y de medio ambiente (deforestación, pérdida de tierra, sobresaturación de los pastos, recursos de agua contaminada, etc.	1. Identificar y enlistar los mayores problemas existentes de medio ambiente o ecológicos, anteriormente conocidos, o encontrados durante este estudio 2. Otros problemas potenciales, particularmente con relación al recurso de energía que se utiliza		a. Describa cada problema lo más extensamente en términos cuantitativos a. Igual que (a) arriba citado
XII. Para identificar necesidades percibidas relacionadas con energía, problemas y planes	1. Identificar y enlistar cada necesidad o problemas a) b) etc.		a. Para cada necesidad y problema identificar los elementos de importancia, social, cultural, económica y de medio ambiente b. Para cada necesidad y problema identifique planes locales o conceptos de soluciones

TABLE III-3: CROSS-REFERENCES BETWEEN DATA LISTS & SURVEY INSTRUMENT

DATA LISTS	SURVEY INSTRUMENT
I.1. Family a, b & c	3-a-137 or 3-a-130 to 136
I.1. Village a & b	2-2 to 2-4
I.1. Village c	2-12
I.1. Village d	2-42 2- 2-44, 2-c & 3-a-132 or 3-a-137
I.1. Village e	2-12 to 2-13
I.1. Village f	2-9 to 2-11
I.2. Village a	2-31 to 2-36 & 2-39 to 2-41
I.2. Village b	2-37 to 2-38 & 3-b-3 to 3-b-7
I.2. Village c	2-28 & 2-55 & part 3-e & all questions on fuel in parts 3-a & 3-d
I.2. Village d	2-5
I.2. Village e	2-6 & 2-7
II.1. Family	3-a-133 to 3-a-136 or 3-a-137 & 3-a-108 to 3-a-115
II.1. Family b	None
II.1. Village a	2-42 to 2-44 & 2-c
II.1. Village b	By extrapolation only
II.1. Village c & d	2-42 to 2-44 & 2-c & 3-b-29 to 3-b-30 & 3-d-15 & 3-d-24 & 3-f-10
III.1. Village a & b	2-14 to 2-16
III.1. Village c	2-19 to 2-20 & 2-25 to 2-26
III.1. Village d	None
III.1. Village e	2-a
III.1. Village f	2-25 to 2-26
III.1. Village g	None
IV.1. Village a	2-b & 2-50 & 3-b-66 to 3-b-67
IV.1. Village b	2-b
IV.1. Village c	2-b & 2-50
IV.2. Village a	2-b & 2-1
IV.2. Village b	None
IV.2. Village c	2-b
V.1. Village a	3-a-2 to 3-a-11
V.1. Village b, c, d & e	3-a-15 to 3-a-46
V.1. Village f	3-a-2 to 3-a-11
V.1. Village g	3-a-8 to 3-a-9
V.1. Village h	3-a-12
V.1. Village i	3-a-8
V.2. Village a	3-a-47
V.2. Village b, c & d	3-a-49 to 3-a-66
V.2. Village e	3-a-48
V.3. Village a	3-a-67
V.3. Village b & c	3-a-69 to 3-a-71
V.3. Village d	3-a-68
V.4. Village a, b, c & d	3-a-A
V.4. Village e	3-a-84
V.4. Village f & g	3-a-A
V.5. Village a, b, c & d	3-a-B
V.6. Village a-f	3-a-92 to 3-a-100 & 3-a-C
V.7. Village a, b & c	3-a-116 to 3-a-129 & 2-61 to 2-63 & 3-d-19 to 3-d-31
VI.1. Village a.1-4	3-d-A
VI.1. Village a.5	3-d-1
VI.1. Village a.6	3-d-1 & 3-d-A
VI.2. Village a.1-3	3-d-17 to 3-d-23 & 3-d-B
VI.2. Village a.4	3-d-24
VI.3. Village a.1-3	3-d-C
VI.4. Village a & b	2-51 to 2-54
VII.1. Village a	3-b-1 to 3-b-2 & 3-b-A
VII.1. Village b	3-b-3 to 3-b-4 or 3-b-5 to 3-b-7
VII.1. Village c & d	3-b-A
VII.1. Village e	3-b-B
VII.1. Village f	3-b-23 to 3-b-30
VII.1. Village g	3-b-29 to 3-b-30
VII.1. Village h	3-b-31
VII.2. Village a, b & c	3-b-C
VII.3. Village a, b, c & d	3-b-39 to 3-b-50
VII.4. Village a-g	3-b-51 to 3-b-65 & 2-A
VII.5. Village a-e	3-a-92 to 3-a-100 & 3-a-C
VIII.1. Village a-e	3-e-A & 2-55
VIII.2. Village a, b & c	3-b-C
IX.1. Village a, b, c & d	3-f-A & 2-57 to 2-60
IX.2. Village a & b	2-56 & 3-a-62 to 3-a-66
X.1. Village a.1-6	3-a-15 to 3-a-46 & 3-a-98 to 3-a-100 & 3-a-111 to 3-a-115 & 2-a-B
XI.1 & 2. Village a & b	Part 3-c & Part 4 observation
XII.1. Village a & b	Part 3-c & Part 4 & 3-b-31

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SECTION FOUR

DATA COLLECTION METHODOLOGIES

In this section of the consultancy report, PCI presents the methods proposed for securing the data required for an energy needs assessment in Bolivia. The first portion of the section addresses the collection of data from centralized sources. The remainder of the section is devoted to a description of the village survey instrument developed by PCI's consultancy team. This later subsection also discusses the selection of survey respondents and the management of survey teams. The survey instrument discussed in this section is presented in Spanish and English in Appendix Five.

A. DATA FROM CENTRALIZED SOURCES

In addition to observational and interview data from the Bolivian villages, the needs assessment methodology requires data from several other sources. Some of these sources have data that is absolutely necessary if the proposed methodology is to be employed correctly. Other sources are not so critical, but by using them, USAID and the Government of Bolivia will augment and improve their data base. The data that needs to be secured from centralized sources and an indication of where this type of additional data can be found is presented below:

- Physical Data on Climate, Sun, Wind, and Geography. The Servicio Nacional de Meteorologia e Hidrologia maintains data on each of these conditions. They also maintain the U.S. Military N-summaries data. The Empresa Nacional de Electricidad S.A. (ENDE) and the Instituto Nacional de Electrificacion Rural (INER) both have solar radiation data, and INER has been developing a good general solar expertise. As part of its regional planning efforts, the Regional Planning Office in the Ministry of Planning is currently carrying out a study that examines most of these factors. One result of the study will be a series of maps of Bolivia classified according to climate, physical geography and hydrology.

- General Economic Data. The Instituto Nacional de Estadistica has published results from the 1976 census. They contain information on demographic and occupational characteristics of the urban and rural population for each department. Two documents prepared by Clarence Buvekas and published by RDD/AID in 1977 are also sources: Rural Income Distribution in Bolivia: A Summary and Evaluation of Quantitative and Qualitative Information and Unemployment and Underemployment in Bolivian Agriculture: A Critical Survey of Literature.

  The most reliable source of economic data on production and income in agriculture will be the data from the 1978 MACA/AID survey "Encuesta Sectorial Agropecuaria 1978". It should be relied upon for much of the background data and statistics needed in income and economic analysis.

- Social/Economic Background Studies on Specific Local Areas. There are a number of institutions conducting socio/cultural and economic studies in specific local areas and which maintain data on those areas. The most important ones are probably:

  - Centro de Investigacion y Promocion Campesina (CIPCA);
  - Centro de Informacion y Documentacion (CIDOB); and
  - Accion Cultural Loyola (ACLO).

- Technical Data on Various Technologies. The bibliography in Appendix Two of this report contains a representative listing of books and reports on various technologies mentioned in this energy survey report. Depending on the background of the planners and analysts, these materials will be required to complete a technical analysis of potential renewable energy technologies. Part of the recent Appropriate Technology report to the USAID/Bolivia Mission by Volunteers in Technical Assistance contains an energy section by Steve Blake. In it he reveals climatic data and the organizations and individuals he found doing renewable energy work in Bolivia. These groups and individuals could supply good field information on specific technologies.

B. VILLAGE LEVEL DATA GENERATED BY INTERVIEW & OBSERVATION

The survey methodology discussed in this subsection has been designed to provide data necessary for the selection, development and successful implementation of renewable energy projects in rural Bolivia. Many specific features of the methodology can be taken as valid or useful only in the rural Bolivian

context. The methodology does not address national level energy-use patterns or energy needs. PCI has assumed throughout that projects based on application of this methodology will be "needs driven", not "technology driven". The methodology addresses the collection of accurate and valid descriptive data at the community level. It is not designed to collect representative data for use in estimating national conditions or trends.

PCI anticipates that it will be possible to adopt the methodological approach for studies in urban areas of Bolivia or for rural and urban studies in other countries. When such alternative uses of the methodology are to be made, PCI recommends that careful and detailed modifications, especially of the questionnaire instrument, be made prior to using the approach outside of the rural Bolivian context.

The survey methodology, when applied, should provide data on:

- Energy Uses. An identification of all important or major energy end-uses and energy consumption patterns in the village or rural area being surveyed, including identification of the energy resources used for these end-uses (stated in terms of types of energy used, sources, costs, supply trends), key characteristics of affecting energy-use patterns and the energy-use patterns of distinct social and economic groups.

- Local Energy Resources. An identification and categorization of all current and possible future local energy resources (stated in terms of market prices, quantity, ownership, and local development plans and trends as necessary). Particular attention is paid to renewable energy resources.

- Socio-cultural and Environmental Factors. An identification and description of important socio-cultural factors which affect the ways in which energy is used in the village, especially those factors or patterns that would change (and be supportive or inhibitive) if the energy source or energy technology were altered. In addition, the data will identify important local environmental problems and impacts of present energy patterns. This will also include initial consideration of those impacts which might result from a shift in the use of local renewable energy sources or of consumption patterns.

- Needs Assessment. An identification of village needs that relate to energy use, as perceived by the local people. The survey will

also provide a basis for identifying needs that may not be perceived at the present time by people in the village due to a lack of experience or a lack of awareness and understanding of potential benefits.

Following guidelines in Part A of Section Two, the survey methodology is designed to produce information on needs in the following ways:

1. Direct Elicitation. In Section 3-c of the questionnaire, responses are elicited from household members about their perceptions of the needs of their household and of the needs of their community. In Section 4 of the questionnaire, community leaders are asked about community level needs. In both cases, these questions are followed by questions inquiring about solutions considered for the expressed needs and about the kinds of contributions villagers might make toward a proposed solution.

2. Indicative Data. At many points in the questionnaire, queries are posed about the adequacy or availability of resources currently used (e.g., 3-a-18, 3-a-22, 3-a-66, 3-a-95, 3-b-31, 3-b-50, 3-b-53). Analysis of the responses to these questions may point to unexpressed needs or may enable the analyst to provide a quantified or distributional picture of factors related to expressed needs or to identify certain expressed needs with certain sub-groupings of the population.

3. Observational Data. In addition to administering the questionnaire, the field interviewer is instructed to undertake observation of the community and its environment. Observations of matters such as pasture and forest conditions, quality of housing, types of productive technologies, and kinds of cooking and equipment are to be recorded. These observations may point to unexpressed needs (e.g., contaminated water sources) and/or may provide the analyst with additional information on expressed needs or on the characteristics of people expressing certain needs.

In summary, the proposed information gathering and planning methodology is meant to be used in Bolivian villages or rural areas where actual projects are envisioned or contemplated. It is meant to be used as a planning and decision-making tool that will facilitate the efforts of development planners and local people to determine the most appropriate and effective way for rural Bolivians to meet their energy needs in their own villages with local energy resources. It is not meant to be a tool for compiling aggregate statistics on energy-use patterns or for determining the national resource potential of Bolivia.

1. Characteristics of the Survey Instrument

The survey instrument, provided in Appendix Five, is more open-ended than many survey tools. It is not pre-coded nor does it present "forced choice" formats. PCI chose to develop this type of instrument for several reasons:

- Our primary methodological concern is with descriptions of energy-use patterns, energy resources, and energy needs for a single community at a point in time.
- There is insufficient existing data on rural energy use to validate design of a closed, forced choice questionnaire.
- PCI expects that Bolivian villagers are more likely to respond fully and accurately if approached with open-ended questions that allow them to respond freely concerning their lives and ideas.

PCI's survey instrument is meant to be used under certain defined conditions:

- It is meant to be used in the primary language of the community being studied.
- It requires prior training of interviewers and a modicum of common sense and judgment by the interviewer.
- It is not short; rather, it is meant to be used by interviewers who spend one to two weeks in a community.
- It calls for observations as well as direct questioning of the villagers.

The instrument is divided into several sections and application stages. This has been done to avoid unnecessary data collection and to ensure that data are collected from the appropriate people in a community. In using the instrument, strict attention should be paid to the prescribed stages of the survey, the order of the questions within a section and to securing

data on each section from the type of community respondents called for. An outline of the application stages and survey instrument sections is presented in Table IV-1.

2. The Selection of Respondents

The selection of respondents to be approached using the methodology takes place at two different levels: The selection of villages and selection of households, etc. within a village. Applying the survey methodology in villages selected on the basis of exogenous factors is possible. However, it is worthwhile to first use the survey in a set of villages that will reveal variations in energy-use patterns by region. If it is decided to undertake this sort of initial study, the following procedure for selecting communities to be surveyed is recommended.

First, the country is divided into regions (10 to 20) on the basis of ecological distinctiveness. Next, those regions are subdivided as necessary according to variations in one or more of the following factors: Population density, ethnic composition of the rural population, major productive activit (farming, livestock, mining, forestry), proximity to major urban centers, and accessibility by road.

When this step is completed, a decision is made as to which of these sub-regions warrants immediate attention. Selection of at least two communities in a sub-region should ensure that both commonalities and range of variation will be presented in survey results.

Once villages to be surveyed have been selected, the selection of response units within the community follows rather different guidelines. Roughly 10 percent of the households in a community should be surveyed using sub-questionnaires 3-a, 3-b, 3-c and sometimes 3-d, 3-e or 3-f. When the communit

TABLE IV-1

DIVISIONS OF THE SURVEY INSTRUMENT*

STAGE	SUBQUESTIONNAIRE	RESPONDENTS & OTHER INFORMATION
1		This is a short, preliminary interview with a community leader meant to introduce the survey and to acquire data for sample selection.
2	2	An extensive interview with several community leaders meant to provide a general profile of the community and information on specific energy-user types; it also involves further introduction to the leadership of the purposes and nature of the survey.
3	3-a	This is a subquestionnaire on household energy use and is meant to be administered on an adult woman or several household members simultaneously. The last part of it is on household composition and is meant to be administered to both the husband and wife.
	3-b	This subquestionnaire treats agricultural uses of energy and is meant to be administered to an active farmer.
	3-c	A household level inquiry about perceived needs and their solutions meant to be administered to a household set of people.
	3-d	A subquestionnaire with more internal subdivisions that examines energy use patterns in industries, shops, stores, hotels, restaurants, and offices. The businesses are arranged by type, and the questionnaire is to be administered to an owner or manager.
	3-e	This subquestionnaire covers energy use by motorized vehicles and also transportation patterns. It is to be administered to vehicle owners.
	3-f	A subquestionnaire on local electricity generation administered to owners of generators
4	4	A final interview with village leaders, focused on perceived community needs and solutions.

* It is presumed that questionnaires 3-a, 3-b and 3-c will be administered to the members of the same households; 3-b may be administered before 3-a. Questionnaires 3-d, 3-e and 3-f can be administered interchangeably with each other and with the three household level questionnaires.

involved is small, a minimum of 12 to 15 households should be examined. The following sliding scale identifies the proper number of household response units for the survey.

24 or fewer households in community --	50% or more
25 to 49 households	40% to 50%
50 to 74 households	30% to 40%
75 to 99 households	20% to 30%
100 to 124 households	15% to 20%
125+ households	10% to 15%

If the Stage 1 interview indicates no differences in religion or ethnicity (language) in the community, the interviewer should select the specific households to be surveyed by the outward appearance of the house (size, condition, decoration). Selection should be made that covers and reflects the apparent range of variation in household scale and wealth in the community.

If the Stage 1 (or later the Stage 2) interview indicates the presence of differences in religion or ethnicity in the community, the interviewer (with aid from community leaders) should select households to be interviewed to reflect the proportion of people in different religious or ethnic categories. Within these categories, some attention should still be given to variations in wealth evidenced by differences in house size or condition.

Because our map-making or census-taking prior to the survey is not feasible, given the probable cost constraints on village needs assessments and because wealth differentiation will be evident from the survey results, the selection process described above represents the best selection approach given the goals of the survey.

Industries, businesses and offices will be interviewed unless there are so many of any one type that time becomes a consideration. In such a

situation, the interviewer is to select at least two representative establishments in each class for examination.

3. Management of the Village Data Collection Process

Management of the collection of data using the survey methodology will involve a number of tasks. Since the methodology is to be used in different communities over many years, an ongoing management capacity is probably desirable. The PCI team recommends that such a management capacity is probably desirable. The PCI team recommends that such a management capacity be developed within an existing institution--such as INER--for both data collection and data analysis. AID should directly expend funds for (and manage) the pre-test and translation of the methodology (see below) and oversee the initial use of the survey in several regions. AID should then engage INER or another institution in the survey process and data analysis and transfer the capability to manage future surveys to that institution.

a. Pre-test and Translation

The first management task will be to conduct a pre-test of the survey instrument. The pre-test should be conducted in communities that recently received or carried out an apparently successful development project, or in communities where an energy project might be undertaken in the near future. In the latter case, it should be realized that flaws in the instrument or in preliminary interviewer training may mean that additional survey work will have to be done in the same community before a real feasibility analysis can be undertaken.

The instrument can, and probably should, be pre-tested in its present format. Adjustments in format--i.e., space to write responses, placement of instructions to interviewers, placement of charts, etc.--can be examined through the pre-test.

One of the most important reasons for conducting a pre-test of a questionnaire is to verify the wording of the questions, i.e., do respondents understand the questions as they are phrased? Are they able to respond directly to them? Do their responses provide the type of information wanted? Does each question get at distinct information?

In addition to checking wording and format, the pre-test should also include an examination of issues such as length of interview (Do respondents show signs of boredom or fatigue before a subquestionnaire is completely administered?); simplicity of the questionnaires from the viewpoint of the interviewer (Do questions flow logically? Are instructions clear?); questions that respondents refuse to answer; unnecessary redundancy in the information elicited; and the degree to which respondents regularly offer data that is not directly elicited.

A large number of pre-test applications of the instrument is unnecessary. However, undertaking the pre-test in several different regions is desirable because factors such as respondent attitudes toward interviews and key vocabulary items may vary regionally.

The individuals who organize the pre-test, train interviewers and analyze the results of the pre-test should not only have general skills in survey design, but should also clearly understand the development, internal logic and purposes of this instrument. Any substantive changes (e.g., wording of questions) made as a result of the pre-test should then be tested again.

After the pre-tests of the Spanish language version of the instrument have been completed, the instrument should be translated into Aymara and Quechua (and maybe even Guarani). Each translation should then also be subjected to at least a limited pre-test before actual use.

b. Personnel Selection

Two types of personnel will have to be selected by the survey managers: Field interviewers and data analysts.

(1) The Selection of Field Interviews

The skills and commitment of field interviewers are critical for successful administration of the survey. Therefore, more than ordinary care ought to go into their selection and training. Each candidate for an interviewer position, after being screened for basic background, should be interviewed by a member of the management team. Employment should be made conditional upon satisfactory performance during training.

The most important criterion for interviewers is their willingness and personal ability to work comfortably with villagers in rural settings for extended periods of time. Among other things, this implies that the individual does not display disrespectful condescending attitudes toward villagers.

Interviewers who are to work in Indian populated areas of the country must be fluent in the appropriate Indian language. All interviewers must be willing and have the ability to follow instructions carefully and to exert sound judgment in matters such as the selection of households or adjustments of interview procedure to fit unusual circumstances.

Potential sources of interviewers include university students (especially those in social sciences or regional development), existing staff members of regional development agencies (INER, etc., including extension workers), and local institutional personnel (high school teachers). Familiarity with the area in which the survey is to be carried out is desirable, but not a necessary qualification for interviewers. In most instances, interviewers should not be members of the communities that are to be surveyed because

villagers may be less likely to reveal sensitive information to each other than to an outsider.

(a) The Selection of Analysts

Planners will need to have three sets of skills available to complete a thorough analysis of the energy survey data. These skills sets are (1) expertise in the specific energy technologies to be utilized, (2) expertise in economic and financial analysis (including sensitivity analysis), and (3) expertise in socio-cultural analysis combined with knowledge of Bolivian rural life. A fourth skill area--environmental analysis--may be needed, depending on the particular local energy needs planners are trying to address and/or the types of technologies selected given information on the site-specific environmental situation. Judgments in this last area can only be made once the matching and analysis process has identified a set of candidate technologies.

If planners have a general background in the energy technologies under consideration and are capable of developing a technical system profile of these technologies, then there may be no need for further technical expertise. If planners do not have this type of general background, then a local or outside specialist in renewable energy resources and technologies should be selected to do the technical feasibility analysis.

An economist who understands the nuances of local economic data, and especially the components of sensitivity analysis, should be selected. Unless the economic feasibility assessment is done with some sophistication as well as common sense, the economic conclusions will not be at all helpful and may even be misleading.

Ideally, the socio-cultural analysis should be carried out by someone familiar with the local areas that are being examined. This will be especially

important for analysis of data collected in the Altiplano. At a minimum, the person must have the social science skills to analyze the interaction of identified needs, village stratification and organizational capacity, and to identify likely socio-cultural impacts of every technology and other proposed interventions.

An environmental analyst should have specific experience in analysis of the ecological impacts of renewable energy systems and familiarity with local ecological conditions.

(b) Interview Training

The survey management team will be responsible for planning, organizing and conducting the training for field interviewers. As noted above, adequate preparation of the interviewers is essential for the successful conduct of the survey. Interviewer training should include the following components:

- A briefing on the background and development of the survey, the model of analysis and survey purposes;
- In-depth orientation to the format and contents of the questionnaires;
- General instructions on personal conduct while conducting the survey and specific instructions on how to handle survey interviews; and
- Field practice in administering the survey.

The training of interviewers will probably require four to five days. It should be conducted by a member of the survey management team who has some training experience and who fully understands the survey methodology. Training is likely to be most effective if it is conducted in a participatory, rather than classroom, manner that encourages trainees to air questions and draws on the diverse skills and experiences of the set of trainees. Listed below are instructions for the trainees:

- Never speak in a condescending manner to villagers; this includes not using the "tu" or "vos" forms.

- Always explain what you are doing and what you are not doing (i.e., no promises about projects) as fully as possible to interviewees.

- Never correct respondents nor argue with them about their answers to questions.

- Do not assume you know anything about how interviewees live, work or think; do not interpret the answers you receive.

- Always try to get the fullest possible response to a question; do not stop a respondent from speaking fully on a topic.

- Check over responses each evening, looking for gaps in information and for contradictions; ask discreetly about contradictions.

- Don't interview children.

- If you are a man, be especially careful of your behavior when interviewing women; don't present any threats to local customs of cross-sex interaction.

- Stick as closely as possible to the order of the questionnaire; but if it seems really necessary to you to change the order of questions (e.g., the interviewee leads into another topic) or to skip a section of questions (e.g., the interviewee refuses to answer or does not know the answer), always include notes on how and why you have made changes in procedures.

- Always include your observations and your own reactions to interview situations, but keep them separate from respondents' answers.

- Do not suggest answers to interviewees, but do always probe for more complete answers, as necessary.

- Whenever a question asks quantity, duration or cost, specify the answer by unit (e.g., 3 litros/semana; 3 dias/la carga), and if necessary, describe the nature of the unit.

- While in the village, undertake as much observation as possible of local conditions (landscape, work patterns, housing quality, water sources, public meetings or public conflicts) and keep careful notes on these observations.

(c) Survey Logistics

The survey managers will, of course, be responsible for the logistics involved of conducting the survey. Wherever possible, management would do well to coordinate logistical support with a regional or local institution (such as the regional development corporations or extension services). The managers might also be able to help interviewers make the initial contacts in a community. At a minimum, logistical support will include arranging transportation, housing, expense advances and reimbursements, paying that interviewers' salaries, etc. PCI strongly recommends that the time prescribed for the survey not be reduced, i.e., it would be a mistake to burden the interviewers with the logistical aspects of the work, thereby effectively reducing real interview and observation time.

Survey logistics, or the work of the survey management team, will also include spot checking on the work patterns of interviewers (especially new ones) and arranging for regular receipt of completed surveys from interviewers.

SECTION FIVE

THE ANALYSIS AND USE OF ENERGY NEEDS ASSESSMENT DATA

As PCI's diagram of the process for matching village level needs and appropriate energy sources and technologies in Figure I-2 suggested, planners will need to undertake several analytic tasks before reaching conclusions concerning the optimal approach for providing energy resources to rural Bolivian villages. The first analytic tasks require only the needs data identified in Table II-1. (The remaining analyses will normally be undertaken following the completion of an initial screening and matching process that produces a short list of candidate sources and technologies. Additional data may be required from the villages along with data about the state of development of specific technologies, to complete these later analyses.)

In this section of the consultancy report, PCI describes the analytic procedures that planners should undertake once village level energy needs data and other pertinent data have been collected.

A. GENERAL COMMENTS ON THE ANALYSIS OF NEEDS ASSESSMENT DATA

Once the village surveys are completed, planners should review the survey data and other information called for in the analytic framework for accuracy and completeness. The PCI team expects that these data will not normally be aggregated or summarized for each village or for a group of villages. Rather, planners will work with the survey data and other data for each village in the basic form in which the field interviewer has provided it. Planners and analysts will use raw data to prepare the descriptions, profiles, etc. called for in the analytic framework.

Ideally, this will suggest to planners the relative priority of various energy needs. Once rough priorities are established, analytic personnel with specific

expertise can begin to assist the planners as they move through the decision-making and feasibility analyses described below.

B. DETAILED ANALYSES DESIGNED TO IDENTIFY OPTIMAL ENERGY SOURCES & TECHNOLOGIES

In this subsection PCI describes four analyses that USAID/Bolivia and the Government of Bolivia need to undertake in connection with the development of village level energy projects. These are:

- A Technical Feasibility Analysis
- An Economic Analysis
- A Socio-cultural (or Social Soundness) Analysis
- An Environmental Analysis.

While each of these analyses is discussed separately, it is worth remembering that an energy source or technology which proves to be unacceptable in terms of any one of these analysis should automatically be considered inappropriate.

If a number of specialists are to assist in preparing these analyses, planners might consider some overlap in their timing. Because the feasibility analyses are time-sequenced for effective decision-making, the use of other experts should largely follow the same sequence.

Finally, after each step of the data analysis is completed by the planners or other experts, concise written reports detailing the contents of data inputs, descriptive profiles, analysis and outputs of the decision step should be prepared.

C. TECHNICAL FEASIBILITY ANALYSIS

Once village needs and an energy demand profile have been determined, an initial feasibility analysis can be carried out. A technical analysis at this point

can eliminate those clearly inappropriate technologies or strategies for a village. This may leave planners with no possibilities, or one, or several. The technological analysis will also clarify where certain site specific information is inadequate and what additional information is needed before a specific technology can be selected. For example, if the depth to the water table in the area has large variations, then more specific technological information might be required to learn general sizing needs for specific technologies and whether various wind or solar technologies could supply the energy for pumping.

The matrix on the following page, Table V-1, indicates the range of end-uses likely to be found in rural areas of Bolivia and matches these with possible technologies for meeting those energy needs. While the matrix can be used as an initial first guide, a series of "end-use characterization" criteria should also be applied to any technology taken from the matrix.

To carry this additional analytic process, planners should have a general technical understanding of the technologies involved and the capability and background to secure the additional technical profile information required to match a technology with the technical demands of energy end-use characterization criteria explained in Table V-2. Planners can make a tentative list of all the possibilities by using the matrix in Table V-3. They will then need to match each of the possible technologies against the seven end-use characterization criteria.

After matching the possible technologies to the end-use characterization criteria, planners will have identified those technologies and variations which technically have a high degree of potential in the villages under consideration. Planners will also have a good idea of sizing requirements for various options.

TABLE V-1

LOCAL RENEWABLE ENERGY TECHNOLOGY MATRIX

RENEWABLE ENERGY TECHNOLOGIES	ENERGY END-USES															
	Water Pumping	Lighting	Cooling	Communications	Spinning	Sawing	Grinding	Desalination	Drying	Transport	Fertilizer	Cooking	Space Heating	Hot Water Heating	Cultivation	Threshing
Solar Cells	+	0	0	+	0	-	0	-	-	-	-	-	-	-	-	-
Flat Plate Collectors	0	-	0	-	-	-	-	+	+	-	-	0	+	+	-	-
Concentrating Collectors	+	+	+	-	-	-	-	+	-	-	-	+	-	-	-	-
Box Collectors	-	-	-	-	-	-	-	-	+	-	-	-	+	+	-	-
Tent Collectors	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-
Stirling Engines	+	+	+	0	0	0	0	-	-	-	-	-	-	-	-	-
Rankling Engines	+	+	+	-	+	+	+	-	-	-	-	-	-	-	-	-
Geothermal	0	+	+	+	+	-	+	-	-	-	-	-	-	-	-	-
Wind Mechanical	+	-	-	-	+	0	+	-	-	-	-	-	-	-	-	0
Wind Electrical	+	+	+	+	+	0	+	-	-	-	-	-	-	-	-	-
Hydro Electrical	+	+	+	+	+	+	+	-	-	-	-	0	-	-	-	-
Hydro Kinectic	-	-	-	-	+	+	+	-	-	-	-	-	-	-	-	0
Hydraulic Ram	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biogas) Methanol) Ethanol) Bio Conversion	0	+	0	0	0	0	0	-	0	+	+	+	-	-	+	+
Draft Animals	+	-	-	-	-	-	+	-	-	+	+	+	-	-	+	+

Key to the Symbols:

+ = applicable

0 = potentially applicable

- = not applicable

TABLE V-2

ENERGY END-USE CHARACTERIZATION CRITERIA

Criteria	Explanation
1	Form of Energy. The form of energy (electricity, heat, shaft power, etc.) that can satisfy the end-use being considered is very important. The fewer conversions in energy form, the greater the energy efficiency, and generally as close a match as possible should be attempted. Depending on the technology chosen, some end-uses can employ several energy forms. Table V-3 lists likely technologies and the form of energy output for each.
2	Level of Demand. There are two aspects of level of demand. First, what is the absolute level of kinetic or thermal energy required by the end-use? For example, the degrees centigrade required for heating hot water for bathing is much lower than the level required to fire a kiln. Second, what quantity is required of this absolute level? To answer this second aspect, it may be necessary to apply criteria 4, 5, 6 and then come back to arrive at the total level of demand.
3	Spatial Distribution. Energy must be delivered to the site where it is to be used, but the conversion technology may or may not be needed or required at the site. For example, irrigation to farmers' fields might be supplied by individual stand alone systems or by a large centralized pumping irrigation system. The site specific nature of the end-use as described by data from the energy survey will allow for an analysis of various technology options.
4	Seasonal Variations. End-uses often have seasonal fluctuations and demand more energy at one time than at other times of the year, even when they may not be ongong. Seasonal end-use variations must be matched with the potential seasonal variations in energy output characterizing the technology under consideration. For example, wind in adequate amounts must be available at the site during the time of year when water is needed for irrigation if wind pumping is to be feasible.
5	Daily Variations. Energy must be supplied at the time of day it is needed to perform the work. If the time of day when an adequate amount of energy is being produced is different, then the technology will not be feasible without some type of energy storage system.
6	Duration. If the end-use task must be performed a certain number of hours per day, then the technology must be capable of providing that number at a certain minimum level of output, with or without storage capability. This duration period and minimum level relate back to the total level of demand outlined above.
7	Sensitivity to Interruption/Fluctuation. The length of time that an end-use task can be either reduced or halted must be matched with the variability and reliability of the technology's output. Again, storage systems can help correct a match that is not exact.

TABLE V-3

POTENTIAL LOCAL ENERGY TECHNOLOGIES & STRATEGIES & FORM OF ENERGY OUTPUT

TECHNOLOGY	
1. Energy Conservation Strategies	
a. Energy Storage	Thermal (mechanical, electrical)
b. Stoves (earth & metal) Cookers (pressure)	Thermal
c. Passive solar building design (houses, greenhouses)	Thermal
2. Indirect Renewable Energy Production Strategies	These are indirect in that they must be further converted, except in the case of direct biomass combustion
a. Improved forest management	
b. Tree planting	
c. Non-wood crop planting and harvesting	
3. Direct Renewable Energy Production or or Conversion Technologies	
a. Solar cells	electrical
b. Flat plate solar collectors	heat (water or air)
c. Concentrating solar collectors	heat (liquids or steam)
d. Box and tent collectors	heat (water or air)
e. Solar stirling engines	mechanical, electrical
f. Solar rankling engines	mechanical, electrical
g. Geothermal	heat (steam)
i. Wind-mechanical	mechanical
j. Wind-electrical	electrical
k. Hydro-electrical	electrical
l. Hydro-kinetic	kinetic
m. Hydraulic ram	kinetic
n. Biogas (methane)	Bio Conversions: combustible gas and
o. Methanol	Bio Conversions: liquid fuels
p. Ethanel	Bio Conversions: kinetic, biomass
q. Draft animals	Bio Conversions: kinetic, biomass

A technology profile which will be needed in the rest of the feasibility decision-making steps should also result from this analysis. Planners will have identified particularly weak data elements on which more data gathering or analysis will be required before a final decision can be made about an energy system's technical feasibility. For example, in cases where wind speed, rates of water flow, or other physical data have never been measured in a village, measurements of this sort may have to be made before a final conclusion can be reached about the site specific feasibility of a particular technology.

1. Economic Feasibility Analysis

At this point, planners may have identified one or more technologies that seem to be technically feasible. Once it is shown that certain technology applications are technically feasible, the next step is to determine their economic feasibility or performance. The following questions need to be answered:

- Will the benefits be superior to the efforts involved in the application of this technology for the person or group of persons who will use the new technology?
- Will the costs and benefits be reasonable from the perspective of private investors, as well as for the society or national economy whose interests are represented by the institutions that will attempt to introduce the new technology?

To properly carry out these analyses, the analyst team must include at least one well trained economist capable of capturing the peculiarities that a particular village might have in relation to the parameters to use in an economic and financial analysis.

To evaluate the desirability of an investment, the expected benefits should be compared to the expected costs. This small task contains a number of difficulties that may appear only as the procedure is implemented; e.g.,

comparison of the investment costs incurred in the first years with the expected benefits in later years. Clearly, the value of money invested today is higher than the same amount of money delivered in the future, even in the absence of price inflation. In other words, future benefits or costs must be discounted if they are to be compared with current benefits and costs. Therefore, to compare a time series of expected benefits with a string of future expected costs, it is necessary to calculate their present value.

There are two methods of calculating the net worth of a project: Net present value and internal rate of return. They both apply to financial and economic analyses. Net present value is simply the present value of the benefits minus the present value of the costs. If the value of the benefits exceeds the value of the costs, then the investment may be worthwhile. Internal rate of return is the discount rate that gives a net present value of zero for the investment by equating the present value of the benefits to the present value of the costs. In the following paragraphs PCI discusses the application of these approaches to the analysis of energy technology options.

In undertaking an economic analysis, it will also be important for analysts to understand and remember that village values may differ from the values the analysts hold; e.g., poorer villagers may make decisions based on risk avoidance in situations where the analysts themselves might make decisions based on potential gains.

a. Comparing and Ranking Investments

An internal rate of return is the proper tool if a group of investments is to be ranked. If budget constraints force a choice between two investments of different size, then the net present value method should be used in a comparason. When two investments produce identical benefits, the procedure is simpler. It is sufficient to select the one with the lower discounted costs.

b. Financial Analysis

In this type of analysis, all of the inputs or labor required are valued at market prices or wage rates prevalent in the area. This also applies to the outputs that result from the investment, even if they are consumed by the private investor rather than being sold in the market. If the project results in a net increment of labor input from the buyer or members of his family, or if alternatively, it provides them with additional free time by releasing them from tasks previously performed, then this labor must be valued at a wage rate reflecting the value that the buyers attach to their labor. As a first approximation, something between 50 to 100 percent of the prevailing wage rate for work should be used.*

When these prices are extrapolated to the future, allowances must be made for expected changes due to price inflation. Usually no changes in relative prices are assumed, but if there are clear indications of such a tendency, it should also be considered in projecting future prices.

It is extremely difficult to decide which discount rate to use in this type of analysis. The internal rate of return method has an important advantage here because it does not require a discount rate. However, a point of reference is still needed for comparison and that is the discount rate of the investor.

A good starting point is the interest rate charged for credit in the area. In rural areas this should be the rate charged for unsubsidized credit. In

* It has been argued that even in conditions of total unemployment, there is a loss of leisure time involved in working and, therefore, a certain opportunity cost. In addition, people might be more willing to perform certain tasks over other tasks, even if they receive the same amount of money. In other words, people might attach different values to their labor according to the task to be performed. The analyst will probably find it difficult to collect quantitative information on this matter, but it is something that should not be overlooked.

practice, this rate is likely to vary widely, even within a given area. World Bank data show that in most countries, the annual real rates charged for commercial agricultural loans are between 20 and 66 percent, the average being at about 32 percent.* Because a financial analysis includes price inflation effects, these real rates should be adjusted upwards. For example, if a 30 percent real discount rate is estimated for the private investor, and a 20 percent annual inflation is expected, the adjusted discounted rate will be 56 percent.**

If credit will be available to the private investor, disbursements should be introduced as benefits and the loan payments as costs. If the rate of interes charged is considerably lower than the discount rate and the internal rate of return, then the availability of credit will enhance the financial feasibility of the investment.

In many cases it will not be possible to obtain reasonably accurate estimates on physical parameters because technologies not previously tried in the area are to be introduced and there is a lack of good quality data or data on economic parameters such as future prices, discount rates, and devaluation of the currency. In these cases, sensitivity analysis will assist in providing a range of answers that incorporate possible outcomes on important variables.

A financial analysis should examine whether the private investor can provide t flow of resources and cash outlays required by the project. If the analysis indicates that this will not be the case, a credit program should be incorpora ted into a project's implementation package.

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* Agricultural Credit: Sector Policy Paper, IBRD, Washington, D.C.

** To adjust for inflation use the equation:

$$1 + n = (1 + r)(1 + i)$$

where:

n = nominal or adjusted rate
r = real estate
i = inflation

c. Economic Analysis

This analysis measures expected benefits and costs from the society's perspective. In the presence of barriers to perfect competition (such as taxes, subsidies, price controls, and monopolies) market prices and wage rates do not measure the value of energy resources to society as a whole. Therefore, it is often appropriate to apply "shadow prices" that attempt to measure the returns and costs of a project from the national perspective. The issues covered by shadow pricing usually include traded and untraded goods, exchange rate, labor costs, and discount rates. Traded goods are valued at the price the country would be paid when exporting these goods or what it would pay when importing it. No export or import taxes or subsidies should be included here. Untraded goods should be valued at their market price. If their prices are controlled, an attempt should be made to estimate how they would change if controls were eliminated. Such changes should be considered in a sensitivity analysis.

It is not uncommon for developing countries to arbitrarily fix their exchange rates at levels that overstate the purchasing power of their currencies. In the case of Bolivia, however, this factor should probably be ignored. The current practice in the economic evaluation of projects is to attribute a unit shadow price to foreign exchange or, at most, consider it only in the sensitivity analysis.*

The shadow wage rates measure the cost to an economy of diverting its labor resources away from their current occupation to the new investment. If laborers were totally unemployed, the social cost should be zero. In the rural areas of Bolivia this cost should be set somewhere between zero and the market wage rate, depending on the type of skill, sex and age of the laborers, season, and geographical area. In general, the higher the rate of unemployment, the lower the shadow wage should be. In extrapolating the future economic value of benefits

* As was done in the feasibility study for the Misicuni and San Jacinto multipurpose project.

and costs in an economic analysis for a project, (unlike a financial analysis) the future impact of price inflation should be ignored. Only expected change in relative prices should be entered in the analysis.

In theory, the economic discount rates should approximate the interest charged for commercial loans in the country, after a downward adjustment using the expected rate of inflation. To reflect the perspective of society as a whole, which uses a larger time horizon than do individuals, and in valuing future benefits at a lower discount rate, the shadow rate should be adjusted downward again. In practice, it is difficult to calculate this rate following the procedure outlined above. The current practice in Bolivia for World Bank or IDB loans is to use 11 percent as the economic discount rate.

In undertaking an economic analysis, it will also be important for analysts to understand and remember that village values may differ from the values the analysts hold, e.g., poorer villages may make decisions based on risk avoidance in situations where the analysts themselves might make decisions based on potential gains.

d. Social Costs and Benefits

A final point to be considered in an economic analysis is social benefits or costs directly related to the project. In the case of energy systems, social costs (such as the provision of extension services or use of communal or public resources) might arise. Social benefits, such as environmental improvements, may also result from a project.

If the introduction of the project requires the provision of extension service or technical assistance, the cost of these activities should be considered as a project cost. Similarly, if common resources, not privately owned, are used, an effort should be made to estimate their economic value to society.

If the project has an environmental impact, such as a reduction in firewood collection that ultimately results in the control of land erosion, its economic benefits should be estimated and included in the analysis.

e. Secondary Effects

A project can impact on other activities not directly related to it. For example, an irrigation scheme for increasing agricultural production in an area can also increase activities that transport goods to and from the area. In practice, the measurement of such secondary effects is a complex task. In comparing alternative investments, these effects are usually ignored on the assumption that the different alternatives generate equivalent amounts of economic benefits and that their inclusion in the analysis would not alter the relative ranking of investments.

f. Sensitivity Analysis

Estimating certain parameters in the economic and financial analysis may involve uncertainty and a lack of accuracy. Rather than seeking a single figure that assesses a project, it will be appropriate to accept the existing constraints in our knowledge and provide a range of values for the economic or financial worth of the project when convenient. The only way to deal directly with uncertainties encountered in project analysis are: Discount rate, price and wages and length of implementation period. Thus sensitivity analysis can be an important tool for financial as well as economic analysis.

g. Conclusion

Cost-benefits analysis is a valuable mathematical tool for evaluating project interventions comparing alternative investments. It can also be used to determine alternative ways to increase the financial or economic impacts of the

project. Nevertheless, the usefulness of the results will depend heavily on the accuracy of estimates of future project benefits and costs. Analysts should be extremely careful to avoid introducing personal biases in favor of or against the project when evaluating its benefits and costs.

2. Socio-cultural Feasibility Analysis

A socio-cultural feasibility analysis for an energy project in a village or rural area is the fourth step in the screening/matching procedure. The two general questions posed at this step are:

- Does the socio-cultural system of the community manifest features that would be more likely to facilitate a successful project than features that would mitigate against success?
- Would the overall impact of an energy project contribute, on balance, a positive rather than in a negative way to the social and cultural conditions of life in the community?

In the screening phase of the socio-cultural analysis, both of these question must be answered "yes" or "no". If the answers are no, project planning should be halted or drastically modified. If the answers are yes, then in the matching component of the socio-cultural analysis procedure should be use to address identifying means of coping with mitigating features of a communit social system and for identifying methods of minimizing the foreseeable negat impacts of a project.

The survey results and other data (from other surveys, enthographic studies and project reports) will provide bases for evaluating a community's position with regard to the critical parameters discussed below. In undertaking a socio-cultural feasibility assessment, analysts and planners should first utilize the survey and other data to describe the community situation in term of the parameters outlined. Next, they will need to weigh the factors involv against each other, i.e., examine supportive against obstructive socio-cultur

features and positive against negative impacts. This type of complex weighing process should be undertaken once the findings of a needs assessment are known and when the technical and economic analyses are underway. Analysts can answer the two general questions in the socio-cultural feasibility assessment only by consideration of the socio-cultural aspects of a community.

a. Assumptions

Planners should recognize the number of assumptions underlying the formulation of PCI's analytic approach to socio-cultural analysis. All of the assumptions derive from a view that "feasibility" must be assessed in a holistic way, i.e., context cannot be ignored in attempting to evaluate feasibility and impacts.

The first set of assumptions involves the socio-cultural factors involved in managing a proposed project: PCI's approach assumed that all aspects of the project, at the local level, will be carried out in the appropriate language(s). To obtain accurate survey data and reasonable responses to project actions participants must be able to respond in their native language. It is further assumed that project field personnel will possess the personal characteristics (e.g., respectful behavior with the villagers) and training (e.g., in fieldwork techniques, communication, etc.) to carry out their roles in an effective and socially non-disruptive fashion. It is further assumed that all project personnel--from planners to field operators--are committed to working with the local people. No matter what the nature of the local socio-cultural system, the feasibility of a successful project will be significantly lower if these assumptions about the socio-cultural interaction of interviewers and local population are not met.

The second set of assumptions concerns the policy foundations of the project. In line with the current general policy positions of USAID and other development agencies, it is assumed that projects should (a) address basic human needs, (b) help the poorer segments of populations and lead toward greater, rather than lesser, social and economic equity, and (c) work toward decreasing

rather than increasing social and economic dependences at all societal levels. This set of assumptions has significant implications for the impact component of the feasibility analysis.

The nature of rural and peasant societies (especially those in Latin America) constitutes the third set of assumptions. These assumptions are based on anthropological and sociological research. It is assumed that the socio-cultural system present at any one moment in a rural community represents the current phase of an active and on-going process of adaptation, by that community and its members, to environmental, social and economic conditions. Negative views of peasant society (e.g., that it is backward, traditionalisti apathetic, comprised of historical leftovers, etc.) inhibit an understanding how changes can occur in rural, developing areas. The adaptative model subsumed in our assumption above provides a means for understanding the processe of change in peasant communities: Change comes about through systemic interactions between a group of people and the conditions (ecological and societal surrounding their existence. Clearly energy sources constitute one of those kinds of conditions.

One derivative of our first assumption about the nature of society is that while patterns of socio-cultural adaptation can be identified as each communi interacts with and adapts to specific local ecological, social and historical conditions, each community can also be viewed as uniquely linking such factor This assumption has two implications for energy projects in Bolivia: (1) a socio-cultural feasibility analysis must be based on site-specific informatio as is provided for in the survey methodology, and (2) different communities, even in the same region, may vary significantly in terms of their pertinent socio-cultural features and, hence, in their potential to accept, integrate a benefit from a project.

b. The Screening Model

The last point above suggests a "threshold" model for analysts and planners to use in considering the economic and socio-cultural feasibility of intervening in a specific locale with a specific sort of project. This model envisions a continuum of community types. Where a community falls along this continuum at any moment in time is a function of the particular mix of socio-cultural characteristics it exhibits, in terms of the parameters to be discussed below. Examination of this continuum of community types in light of a particular kind of project--technology level and type, organizational requirements, economics, etc.--enables planners and analysts to divide the continuum into three sections, e.g., "pre-threshold", "threshold", and "post-threshold".

The pre-threshold communities would be those whose socio-cultural and economic characteristics do not match critical project variables and/or have inadequate resources to initiate or sustain required project costs or activities. Threshold communities are those whose socio-cultural and economic characteristics match, within some range of tolerance, project variables and requirements. Post-threshold communities are those which might find the project acceptable and which could initiate and sustain project costs and activities. However, one might expect that post-threshold communities are already functioning with a set of adaptations that are in some sense beyond the level optimally addressed by the potential project. For example, in a fully grid-electrified community it might be less than appropriate to consider installing a small-scale hydroelectric generator.

During the screening/matching procedure, analysts and planners should apply the threshold model as one step in their feasibility judgment after describing the characteristics of a community.

c. Critical Socio-cultural Parameters

The parameters listed below are not the only socio-cultural parameters to be considered in a feasibility analysis, but are the most important ones for assessing the feasibility of energy projects in rural Bolivia.

- Degree and type of organizational capacity. This facet of the socio-cultural system of a community can be examined in several ways. Many rural Bolivian communities have one or more existing organizations--clubs, cooperatives, school associations. Such organizations can provide information on the general capacity for structured, coordinated activity in the village. Moreover, one or more of them may offer a pre-existing channel for project introduction.

  In addition to special interest organizations, Bolivian rural communities have at least a nominal political organization for the entire community. The level of integration and operation of the formal political organization should be examined in terms of its capacity to organize the population for collective activity and in terms of the internal and external communication ability of its leadership.

  The survey includes many questions on organizations and their effectiveness. The responses to these should receive careful analysis since organizational capacity may be the single most important socio-cultural variable for assessing the feasibility of energy projects in the rural Bolivian context.

- Level of education and of intellectual openness. This parameter is less significant than organizational capacity for screening communities, but it is crucial in terms of matching project inputs with the profile of a community. It is also likely to be highly correlated with the next parameter, motivation.

- Level of motivation to fulfill perceived needs. Assessing and describing the level of motivation that characterizes a community is very difficult. To some extent motivational level can be extrapolated from responses to questions about needs and plans, and from a history of change efforts. The field interviewer can also assess motivation from the manner in which people interact with him, the questions they ask, and the general tone of their response to the survey. But even with such information at hand, additional efforts to assess motivation should be included in the project preparation stage.

- Type and effect of social diversity. Four types of social diversity are distinguishable in the rural Bolivian context. They are based on: (1) Differences in religion (Protestant versus Catholic); (2) ethnic differences; (3) differences in wealth (and social status and power) which may be recent and rather strictly economically determined or which may be based on past socio-economic relations such as those of hacendado and peons; and, (4) differences in regional background associated with lack of kinship and similar social bonds in newly colonized communities. Obviously, it is possible to find many communities in which two or more of these types of social diversity exist and cross-cut each other.

  Social diversity needs to be a factor which mitigates against the feasibility of a successful project, although sometimes it will be. However, it will always be an important factor to consider in matching project components with community characteristics.

  In small, rural communities, the existence of differentiated groups often means the existence of rather closed sub-populations whose members manifest distinctive levels of education, motivation and organizational capacity. Communication between groups and the ability to organize projects on a community-wide scale may be limited. Under the worst of circumstances, diversity may be a cause of active conflict in a community. In these cases, the introduction of projects may exacerbate conflict and make success doubtful. On the other hand, diversity sometimes offers the opportunity to work with a sub-population in a way that leads to wider benefits and future possibilities for other groups.

- In carrying out a socio-cultural feasibility assessment, analysts should pay attention to the sources of diversity in a community, the relative proportions of the population in different sub-groups, and the level of communication or conflict among groups. Information from the survey will indicate whether important social diversity exists. If a notably diverse community is being considered for a project, additional study of the effects of diversity may be called for.

- Cultural preferences and taboos. Cultural preferences and taboos that may facilitate or obstruct a project can take myriad forms. For example, food cooked in a solar cooker may not meet taste and texture preferences, or culturally defined views of hygiene may not permit the handling of fecal matter necessary for a biogas generator. It is essentially impossible to identify such cultural factors by survey means, When possible, planners might turn to ethnographic literature for help on this parameter. Otherwise, secondary phases of project preparation should include careful investigation, with the local population, of their reactions to specific features of a proposed technology or end-use. PCI realizes that cultural taboos are not likely

to constitute a significant problem in rural Bolivia. However, preferences may cause serious difficulties.

- Daily, seasonal and annual work and activity patterns. The survey will provide extensive information on activity schedules and work calendars. Analysts need to consider the degree of fit between these and the activity patterns required by the project technology. This analysis should also assess the degree of behavioral change required in a community by specific technologies. The greater the changes required, the more difficult it may be to integrate a technology into a community.

- Sexual and age division of labor, and task/prestige hierarchies. Again, the survey will provide data on division of labor by age and sex, and the analysts should consider the match between existing patterns and the requirements of the project, particularly with respect to the tasks of women and the implications of new technologies on the patterns of their lives. The prestige associated with different kinds of work will not be clearly revealed in the survey and should be explored at a later stage. In particular, the planner should be aware of attitudes among some members of a community that physical/manual labor is beneath their station in life.

- Marketing habits, existing constraints to marketing and market demand. In projects aimed at increasing production of marketable commodities, the survey data on existing marketing practices should be examined for fit with proposed changes. Prior market knowledge may be restricted to local fairs or weekly markets and may not be appropriate for larger scale operations. Similarly, constraints to marketing, such as poor roads, may be an intervening variable in some communities.

d. Critical Impact Factors

Not all impacts that may result from changes in energy-use patterns and energy technologies can be foreseen. However, planners should endeavor to consider some of the more significant potential socio-cultural impacts in answering the second screening question and in the course of matching technologies to local conditions.

Procedurally, this effort is probably most effectively carried out with a cross-impact matrix. In the impact matrix, Table V-4, the critical areas

TABLE V-4: CROSS-IMPACT MATRIX FOR SOCIO-CULTURAL IMPACTS OF ENERGY PROJECTS

Variables of Energy Project	1. Employment Level	2. Division of Labor	3. In & Out Migration	4. Wealth Differentiation	5. Female Dependency	6. Regional Dependency	7. Health	8. Nutrition	9. Social Conflict	10. Other
End-Use Changes 1.										
2.										
3.										
4.										
etc.										
Technology Requirements 1.										
2.										
etc.										
Information & Training 1.										
2.										
etc.										
Activity Patterns 1.										
2.										
etc.										

Key: Reading across form each energy variable, indicate for each socio-cultural variable a positive (+), neutral (0), or negative (-) quality of impact.

of impact are noted across the top. For a specific proposed project, analysts or planners would fill in the technology variables and end-uses down the side and then complete the matrix by assessing the positive, neutral or negative impacts for each cell. After completing the matrix, a planner should form an overall judgment about impact and identify the key positive and negative effects that need to be addressed in the matching process.

e. Notes on Impact Matrix

To determine the nature of an impact (positive, neutral or negative). reference should be made to the assumptions discussed above regarding regional and national policy goals and to the overall socio-cultural and economic profile of the community. While some general guidelines can be formulated for examining the quality of impacts, specific situations may have characteristics that call for modifications in these guidelines, i.e., different judgments concerning the quality and nature of a specific impact.

Listed below are a series of rough guidelines that may assist planners in reaching impact judgments using the matrix:

Item 1. Increased employment would be positive and vice versa.

Item 2. Impact on the division of labor is most important if it means an increase in the share of work done by a particular segment of the population (e.g., women and children) or if it changes the status aspects of tasks so as to affect differentiation.

Item 3. In or out migration might be positive or negative depending on a range of internal and external variables.

Item 4. Increases in wealth differentiation would be negative.

Item 5. Greater dependency of women on men for livelihood and security would be negative.

Item 6. Increased dependency on outside sources or wider market, especially for food or fuel would be negative.

Item 7. Indirect and direct impacts on health should be examined.

Item 8. Same as 7.

Item 10. This is left open for other factors specific to a site.

3. Environmental Feasibility Analysis

When new energy resources are utilized or a new way of delivering energy is brought to a village, there will almost always be some new interactions with the environment. Changes in a community's patterns of using local energy resources will change their impacts; new technologies may also affect human and animal behavior. These effects may be positive, neutral, negative or mixed. In all cases, some real attempt should be made to determine how the energy intervention will affect the environmental situation in the village or region.

Environmental impacts can be divided into two special types:

- Those impacts that may occur at the physical site of the technology installation; and
- Those impacts that may occur in the general region of the village or area.

Energy interventions should be checked against both types of environmental impact. The only way to determine what potential impact the intervention will have is to identify and examine the implications of any changes that may occur due to an energy project intervention. The following matrix (Figure V-1) provides a conceptual way of organizing the appropriate questions and ensuring that no major area is omitted. If planners use this matrix, a comprehensive review of the interaction between (1) change brought about by the technology and (2) connections between potential areas of environmental impact will emerge. The quality of accurateness of the review and the validity of the implications drawn will depend heavily on the knowledge and background of the analyst.

Across the top of the matrix are the physical environmental categories in which impact is likely to occur. Down the side of the matrix, planners should list all the identifiable changes in physical surroundings and in human and animal behavior that a technology is likely to bring about. The implications of various interactions can then be drawn.

Technology Caused Change Element	Impact Areas					
	Animal, Aquatic Life	Water Quality	Water Availability	Vegetation	Air Quality	Soil Quantity
1.						
2.						
3.						
etc.						

FIGURE V-1: ENVIRONMENTAL IMPACT MATRIX

For example, if the energy project under consideration is a wind water pumping system that is to be installed on a central village water supply (where previously people had carried domestic water a distance of 4 km), the change elements might be:

1. A 125 meter well drilled at a central spot in the village;
2. A windmill installed over the well;

3. A cement storage holding tank next to the well;

4. 100 people coming daily to the well to meet the needs of 550 people;

5. An average of 250 domestic animals per day coming to the well for water; and

6. 100 people no longer going 4 km every other day with donkeys to get water.

Given expert knowledge, the site specific information available on the village from the survey, and a technical profile of the whole system, it will be possible to draw some conclusions about the potential environmental impact of each of these changes on the immediate and on the broader physical area.

Once these implications are identified, it should be possible to compare the probable environmental impact of an energy project with the traditional way of carrying out a specific task or type of work, and with any other technological or energy intervention strategies that are being considered.

If this type of analysis suggests that serious negative environmental impacts will occur, analysts should return to earlier stages in the overall feasibility analysis to recalculate the costs, benefits and impacts of alternative energy project interventions.

APPENDIX ONE

BOLIVIAN ENERGY SITUATION:

(Prepared by USAID/Bolivia)

I. COMMERCIAL ENERGY DATA FOR 1977*

A. Composition of Production, Exportation, and Internal Consumption

Primary Energy Source	Gross Energy Production	Energy Exports	Internal Energy Consumption
Oil	27.0% (a)	28.1%	54.9%
Natural Gas	61.8% (b)	71.9%	8.6%
Bottled (LPG) Gas	0.9%	0%	3.2%
Hydroelectricity	1.6%	0%	4.4%
Wood	6.0%	0%	19.6%
Bagasse	2.7%	0%	9.3%
Total	100%	100%	100%

(a) Since 1977 Bolivia's oil reserves and production have decreased and internal consumption increased to the point that there is now serious concern that the country will soon become a net importer of oil.

(b) Of gross natural gas production in 1977, 50% or more was excess that had to be burned, vented, or reinjected for lack of a market.

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* Based on 1977 Bolivian Global Energy Balance prepared by the Ministry of Energy and Hydrocarbons.

B. Internal Energy Consumption by Type and Economic Sector

Direct Energy Source	Trans-portation	In-dustry	Domestic	Mining	Misc.	Total
Oil	64.5% (a)	24.4%	11.1% (b)	-	-	100%
Natural Gas	-	100.0%	-	-	-	100%
Bottled (LPG) Gas	-	-	100.0%	-	-	100%
Electricity(c)	-	24.6%	23.7% (d)	40.0%	11.7%	100%
Wood	-	7.3%	92.7% (e)	-	-	100%
Bagasse	-	100.0%	-	-	-	100%
Total	36.2%	30.4%	30.4%	2.3%	0.7%	100%

(a) The use of oil (diesel and gasoline) for transportation is increasing between 10% and 15% each year.

(b) Domestic use of oil is mainly in the form of kerosene for lighting, heating, and cooking by the poor in the urban areas and by all social levels in the rural areas. The rural areas also count heavily on diesel and gasoline to drive electric generators and pumps.

(c) Includes all electricity sold commercially of which approximately 67% was produced by hydroelectricity, 12% from oil (diesel), 14% from natural gas, and 7% from wood and bagasse. Electricity from all sources accounted for only about 6.6% of total energy sold internally.

(d) Almost all domestic use of electricity is in and near Bolivia's eight largest cities and towns. Most other rural towns and areas are located too far away to be served by line extensions from large existing and planned hydroelectric and natural gas powered generating plants.

(e) Almost all domestic use of wood for energy is in the rural areas. The use of dung (used extensively where wood is not readily available, mainly on the Altiplano) is not included in these energy data

Even though Bolivia has abundant natural gas and renewable energy resources, energy problems are seriously impeding its development. This is especially true for rural areas where the unfortunate trend during recent years has been to adopt diesel, kerosene and gasoline as the modern primary energy source.

Bolivia's basic energy problem is continued dependence on rapidly depleting oil reserves (for gasoline, diesel and kerosene) when natural gas and fairly well distributed renewable resources--such as hydro, solar, wood, etc.--are much more abundant. In 1977 almost 55% of the internal commercial energy requirements were supplied by natural gas and 4.4% by hydroelectricity. Firm data are unavailable, but it is believed that the dependence on oil is worse now than then.

If the current use trends are allowed to continue, Bolivia will soon become a net importer of oil and a competitor with other LDCs and the industrial nations for the limited amount of oil available on the world market. Such an occurrence will impact most heavily on the urban and rural poor.

Recent and expected future price increases for gasoline, diesel, and kerosene may dampen their consumption growth rates but, together with higher transportation costs, will also seriously aggravate energy problems of the rural sector. Many rural communities and individuals who use diesel and gasoline to generate electricity, pump water, cultivate land, drive saw mills, etc. will have to turn back the development clock by limiting their operations or by simply turning off their machines. Many individuals who have to depend on kerosene for heating, cooking, and lighting will have to go back to the use of wood, dung, candles or see energy consume an ever-increasing share of their income.

The expected move back to the use of the traditional energy sources will cause more environmental degradation, especially accelerated consumption of natural forests, which is already a problem in some parts of Bolivia. At the world level, forests have shrunk at an estimated 15% between 1963 and 1973, and the trend continues unabated.

Bolivia's commercial energy needs are likely to increase exponentially as its growth leads to industrialization and urbanization which require a shift from the use of traditional fuels.

Bolivia, like most LDCs, is not sufficiently aware of its energy resources and needs. It also lacks the financial resources, institutional structures, and trained manpower that are necessary to explore and quantify all its energy resources, analyze its energy needs, and develop sound short-, medium-, and long-term energy plans.

To attend the needs of the urban centers and nearby rural areas, Bolivia is planning and making efforts to expand the use of natural gas and is actually installing large hydroelectric plants as fast as financing can be found. Little is being done, however, in the area of reactivated and new energy technologies that are needed to supply the energy needs of the very large rural areas and numerous rural towns and communities that are too remote to be connected to national natural gas and electric grids. It is to those areas and the needs of the rural sector that the majority of AID's attention and resources for energy should be directed.

APPENDIX TWO

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APPENDIX THREE

PLACES VISITED AND INDIVIDUALS CONTACTED IN THE GOVERNMENT OF BOLIVIA

Major Activities and Persons Contacted During Consultancy

A. January 14 to January 19

1. Briefing with USAID officials.
2. Outlined scope of work.
3. Identified and interviewed priority people in GOB
4. Set up schedule of field trip and organized logistics
5. Designed analytical framework for energy survey data base.

B. January 21 to January 28

1. 1/21--traveled to Sucre and visited with CESSA personnel and then traveled to Redencion.
2. 1/22--visited with community leaders and some farmers in Redencion. Then went to Mojocoya where we had a community meeting, visited some community leaders, farmers, and several households. Returned to Redencion for a community meeting and visit to cooperative.
3. 1/23--further discussion with CESSA in Sucre. Traveled to Santa Cruz, met with CORDECRUZ and CRE personnel.
4. 1/24--visited community of Achiras, talked with farmers and community people, and visited several households.
5. 1/25--visited community of Yapacani and talked with farmers.
6. 1/28--visited Tahari (Aymara Village) on Altiplano and village of Compi next to Lake Titicaca, talked to farmers and villages and visited household.

C. January 29 to February 5

1. Prepared final report
2. Consulted with GOB officials
3. Debriefing with USAID officials

Persons Contacted

Nombres y Apellidos	Ocupacion	Institution
LA PAZ		
Ing. Ricardo Maldonado V.	Director Ejecutivo	INER
Ing. Lucio Saal Morales	Ing. Electricista	INER
SUCRE		
Ing. Aramando Lara	Gerente General	CESSA
Ing. Eduardo Majon	Superintendente	CESSA
Sr. Rene Zarate	Relacionador Publico	CESSA
SANTA CRUZ		
Sr. Adalid Rivero Retor	Director Comunicaciones	CRE
Ing. Ernesto Lichtenstein	Jefe Electrificacion	CORDE CRUZ
Ing. Ebert Cruz	Ing. Electricista	CORDE CRUZ
Lic. Javier Mendez P.	Jefe Dto. Promocion	CORDE CRUZ
Lic. Jesus Bolivar	Planificados	CORDE CRUZ
Sr. Rolando Fernandez	Tecnico Electricista	CORDE CRUZ
Ing. Edgar Montero Q.	Jefe Dto. Hidraulica	CORDE CRUZ
Ing. David Pacheco Roman	Jefe Unidad Proyecto	CORDE CRUZ
Ing. Elfio Cabrera	Dto. Hidrogeologia	CORDE CRUZ

APPENDIX FOUR

MATCHING KEY ENERGY NEEDS WITH POSSIBLE ENERGY TECHNOLOGIES IN THE THREE VILLAGES VISITED BY THE PCI TEAM

The PCI team spent six days traveling to villages in Bolivia (see Appendix 3). The purpose of these field visits was to determine whether the data summary framework was comprehensive enough, included only those data elements that were necessary, and was structured in the most appropriate manner. The field trips were to refine and develop the analytical framework for the survey; this was accomplished.

In the process of refining the framework, the PCI team also developed the best approaches for the survey questionnaire. While doing this, a general impression was gained of each village, some of their expressed needs, and resources. Naturally this was only a cursory impression, as we were in these villages only a few hours. However, below is a brief account of an impression, especially in regard to energy end-uses and possible local solutions to perceived energy problems.

VILLAGE CASES

Case One: Redencion Pampa (about 160 km from Sucre)

Redencion is a new community, found about 20 years ago and having experienced rapid growth over the last decade. Its current population is about 1,500. It is clearly a "laid out" town: Wide streets, no trees, a large school and a colegio, a parochial house, a hospital, and a couple of plazas. However, most of the residents are still campesinos (small farmers, many of them Quechua-speakers). We were told that 95% of the inhabitants work in agriculture; many of them have farms at some distance from Redencion and live on their farms during key agricultural work periods.

Redencion is located on a large plateau. Much of the land around it is level; the climate is mild. The major crop produced is wheat, which is produced for commercial as well as subsistence purposes. Local farmers also produce some maize, potatoes, peaches, and grapes. They say they could grow anything if they had enough water. (Small peach and grape orchards are watered by hand.) They also keep some cattle, pasturing them in the valleys below the plateau.

Water is one of the main preoccupations of the residents of Redencion. There are shallow wells (4 to 5 meters) with a limited water supply. They have tried deeper wells and say that they find some water at about 20 meters deep but none below that. They have had trouble with pumping from greater depths. Their ongoing search for a productive well is both for drinking and for irrigation water. But so far, no irrigation is practiced. The nearest river, Rio Grande, is about 40 km from Redencion and at a lower elevation than the plateau on which Redencion sits.

There are six grain mills in town, run by eight to sixteen horsepower diesel and gasoline generators. There are also seven small carpentry shops also without power. The colegio has a shop with power wood-working tools, run on a small diesel generator. Two windmills are visible in Redencion, but apparently neither does anything just now (one at least is supposed to pump water). The people say that the wind is steady most of the year.

There is a cooperative--of campesino members--in town. It runs a general store and owns two tractors, which members can utilize (and which it may also rent out). The coop members want to expand their operation: They want to have a large grain mill of their own and a noodle factory (i.e., they want to use part of the members' wheat production to make flour and noodles). The noodle factory idea apparently stems from problems having marketing unprocessed wheat through middlemen in Sucre.

Cooking is done with kerosene and gas stove and with wood (at least 50% of cooking is with wood--probably much more). Ovens, for baking bread,

are all wood-fired. Bottled gas costs $b19 in Sucre and $b33 in Redencion. A 10 kilo tank lasts about 20 days in normal domestic use. Kerosene costs $b5 a bottle (app. .75 of a liter). Kerosene is also used for lighting, and a family uses about two liters a week. Firewood costs $b200 for a Toyota truckload (i.e., a small pick-up truckload), or $b15 a carga (exact size of a carga was not established, but it seems to be the amount that a burro carries). Cooking requires five to nine cargas of firewood a month for a household. Firing an oven for bread baking, we were told, takes one carga (that sounds high to Foreman); most households bake bread about twice a week. (We were not able to learn what percentage of people buy firewood rather than collecting it in the valleys.)

The farmers of Redencion use some chemical fertilizers and herbicides. One told us that he uses two quintales (quintal = 45 kilos) of fertilizer per hectare; it costs him $b700 a quintal. Folks said that in a good year wheat production is about 50 quintales a hectare. The sale price of wheat is fixed by the national government and is currently $b160 a quintal.

The people of Redencion are very eager to have grid electricity (which is due to reach them soon). They were insistent on this topic. But they also are concerned because the grid they will connect with is "monophase" electrical power, and they are aware that to run larger equipment (e.g., mills) they need "triphase" power.

In the group meeting that was called for our benefit, it was possible to note some differences in wealth/status. Two men were present who seemed to us to be either urban types, or more likely ex-hacendados. They tried to take a dominant role during the meeting, and afterward one mentioned owning a mill. Perhaps half of the 60 or so people present seemed to be monolingual in Quechua, and to judge from dress, many of them were poor.

The leadership in this community seems strong and articulate. Additionally, the community has a recent history of collective work: Building the school and hospital and working on a large road improvement project.

The two most apparent needs felt by people in terms of energy use were:

- o Water for irrigation, and
- o Cooking fuel.

Water is in short supply and poses a real problem, perhaps not unsolvable but a study would have to be made of the situation. There is wind and sun to power pumps if adequate water can be delivered.

Cooking fuel poses several possible strategies which would have to be studied and discussed with villagers: (1) The planting of trees and a village wood lot, (2) improved wood stoves, and (3) biogas during the dry season.

Case Two: Mojocoya (about 170 km from Sucre)

Mojocoya is about ten km from Redencion. It is an old community with a very different feel from Redencion. The population is about 600, and apparently everyone engages in some agriculture. There is a school, a church (no resident priest), and a clinic (nurse, with weekly visit from doctor). Older people speak Quechua, but we were informed that the younger generation rarely does. Children from this community go to high school, and even university, in Sucre

As in Redencion, the major crop in Mojocoya is wheat. Each person cultivates we were told, five to ten hectares of land. In contrast to Redencion, folks here said they harvest from 15 to 20 quintales per hectare. They also produce maize, potatoes, and some fruits. They said that the land they possess is sufficient, but that they need irrigation water. One of the farmers interviewed said that a Dr. Alfred (Hydrologist) had spent a month in the area. Dr. Alfred had told the farmers water was probably in good supply at 150 meter but that the best way to get water for irrigation was to bring it from the Rio Grande River.

There is a spring for drinking water and a pipe network to many of the houses in the community. But the flow from the spring is limited. (While we were in town, three different spigots we tried failed to produce any water.) They pay $b12.50 a month for water service to the town.

The women do most of their daily cooking in the mornings, taking three to four hours to prepare most of the day's food. They cook with firewood (and apparently sometimes with charcoal), some of which is gathered locally and some of which is purchased. They also bake bread in wood-fired ovens, about twice a week. The stoves are simply open fires, built on a brick platform about two to three feet off the floor. Pots rest directly on the burning wood or on bricks. Apparently, a few people have kerosene or gas stoves.

The residents of Mojocoya take the wheat for subsistence use to Redencion for milling. (It is 1½ hours to Redencion by foot, with loaded burros or horses.) They would like to have their own mill, but currently lack a power source. The one diesel generator in the village does not work at this time.

Mojocoya has a noticeable home industry of distilling. They buy cane juice (miel de cana) from farmers in the valleys and distill it into aguardiente. (They also distill a small amount of a liquor made from grapes, called singani.) They sell their product to dealers from Sucre.

There are five distilleries in Mojocoya and seven in the nearby countryside. Each is a part of a household, built next to a house. At least one produces about 200 bottles a day of aguardiente. The cooking pots of the stills are fired with wood; one owner said he buys two truckloads (big trucks) of wood a month, at the rate of $b2,000 for a truckload. In addition to costs for firewood, miel de cana, and apparently in some cases, hired labor, the distilleries pay the state a tax quoted to us as $b7,000 a month. One man said his net gain per month from his distillery is about $b2,000

Folks say that there is not much wind (the village is in a bit of a canyon). There is one truck owned in town. Apparently, most people use little, if any, mechanized devices in their farming. There is at least one exception--a large-scale, modernized farmer who has two tractors.

Like the people in Redencion, the people we talked to in Mojocoya are insistent about wanting grid electricity.

They ave a history of collective work efforts: Building the school and working on road improvement (three or siz days each in the last year). Leadership seems firm. It was not possible to get any real idea of wealth or other differentiation.

The energy interventions possible to determine from our brief stay were the same as in Redencion. However, in-depth analysis might well shed light on quite a few more possibilities.

Case Three: Achiras (about 150 km from Santa Cruz)

Achiras is along one of the major roads out of Santa Cruz. The area is almost tropical, with steep hillsides and narrow valleys. Achiras has a population of 70 to 80 households (maybe 400 people). Almost all of the residents work in agriculture, with some concentrating on cattle raising.

Our informants said that village farmers have up to about six hectares per household. The major crops are maize, potatoes, and yucca; they also produce fruit (oranges, mandarines, grapes) and some small garden crops.

There is a small school and one tienda in the village. No industry was in evidence; some people process a small amount of cheese for sale and home use.

Maize for domestic use (human and animal feed) is ground on a stone matate and in a wooden mortar and pestle. There used to be a small maize mill in the village, but when the owner died, it was removed.

Women cook with gas and firewood. One woman said that most households have a gas stove. A ten kilo tank of gas costs $b22 and lasts 15 to 20 days. Firewood is preferred for cooking when people are preparing certain dishes and when they are cooking in large quantities to feed temporary farm workers. Firewood is gathered from nearby; apparently, not much is purchased.

There is a small river about 100 meters from most of the houses in the village. This is the source for drinking water, which is carried to the houses in buckets every morning, and for some limited irrigation, tubed in, for some households near the river. Apparently only fruit trees and house gardens are irrigated. One person pointed out that if they could irrigate potatoes, they could grow them continuously during the year. The river does not seem to have enough drop or flow volume for a hydroelectric unit.

The residents report that they have some wind February through April.

These people want to have grid electricity (primarily for lighting). They once tried to collect $b30,000 to pay for their share of expending the grid to the village, but were unable to collect the entire amount.

There seems to be little wealth differentiation in this village. There is formal political organization (a corregidor, etc.), but apparently no other organizations. No mention was made of collective activity, except the effort to collect money mentioned above. There are no cooperatives.

Some labor is hired during peak agricultural activities. Apparently, labor is in short supply. The rate is $b40 to $b50 a day, plus meals.

No large or significant energy related problem was identified which had an obvious potential for local resources solving it. In-depth analysis, however, might have reached more problems and options.

Others

In addition to the three communities described above, we visited three others, which will be very briefly described here.

Santa Fe de Yapacani is about 120 km from Santa Cruz. It is next to a large river (large at least during the rainy season), and some residents engage in fishing, though apparently most are agriculturalists. The

climate is nearly tropical, and crops are grown all year around. The farmer we interviewed produces rice, soy, maize, and peanuts, in rotation. The rice is not irrigated, but must be planted during the rainy season. He must shell and dry the soy and peanuts before marketing them.

The central part of Yapacani has grid electricity, but households that are more than 100 meters or so from the center do not (unless the householder wishes to personally buy a transformer for about $b15,000). The farmer we interviewed was very annoyed about not having electricity when his neighbors do.

The community is a "colony," and members come from all over the country. Our informant has lived here for about nine years. He says there are no organizations in the community and that people cooperate with each other very little. He attributes this to their coming from different places. There are no authorities.

Cooking is done both with gas and with firewood.

Rice, peanuts, etc. are marketed through middlemen from Santa Cruz. No fertilizers are used in farming, but stubble is burned.

The data gathered here did not uncover an immediate needs/resource match.

Tahari is a village of Aymara-speaking small farmers on the Altiplano near Achacachi. The people we encountered were hesitant to talk to us and provided limited answers (perhaps partly because of limited understanding of Spanish). They did say there are about 300 households in the community (though it didn't look that big). They were particularly reluctant to talk about the amount of land they have, but it sounded like a situation of land scarcity. They plant potatoes, habas, and ocas (and probably quinoa). Manure is used only on the potatoes. Cooking is done with cow dung. After it is burned, the ash is used on the fields. The village has a school, but no real political organization (no corregidor). They made it very clear that their major need is water for irrigation. They say that wells could be dug on the hillsides. (Also, part of the lake is nearby.) Their drinking water sources are wells, and the ones we saw are in the house yards and near where animals are kept (probably serious contamination, given a shallow water table).

Compi is another Altiplano community right on the lake. The farmers produce habas, peas, onions, and other vegetables that sell in La Paz. There is a school and a colegio, and the village is politically organized. There was strong wind when we visited, and they say there is most of the time. Water for irrigation is in short supply and is needed for the truck gardening. They are trying to get together a potable water project.

Outside of solar and wind for pumping water, no matching of potential energy technologies with end-uses was attempted. The data obtained on the Altiplano during our brief visit was simply too incomplete.

APPENDIX FIVE: ENERGY SURVEY INSTRUMENT

ENERGY SURVEY INSTRUMENT: SPANISH VERSION

Entrevistador_____

Fecha_____

Lugar_____

N° de entrevista_____

ENCUESTA DE ENERGIA EN EL SECTOR RURAL DE BOLIVIA

CUESTIONARIO

PRIMERA ETAPA

Primera Etapa de la Encuesta: Entrevista con una de las autoridades del pueblo. Explíquele a él el propósito y el plan general de trabajo de la encuesta. Explique también que las primeras preguntas que Ud. va a hacerle tienen el propósito de poder decidir el número de entrevistas que se van a realizar. Entonces siga a las preguntas:

1-1. ¿Cómo se llama Ud.? _____

1-2. ¿Cuál es su cargo en la comunidad? _____

_____

1-3. ¿Cuál es la autoridad máxima de la comunidad? _____

_____

1-4. ¿Qué otras autoridades existen en la comunidad? _____

_____

_____

(corregidor, presidente del sindicato campesino, notario, párroco, jefe de policía, etc.)

1-5. ¿Qué tipo de organizaciones existen en la comunidad? _____

_____

_____

(cooperativas, clubes, asociaciones de padres, asociación de evangélicos, sindicato agrario, sistema de riego, etc.)

1-6. ¿Cuántas familias viven en esta comunidad? _____

_____

(El entrevistador debe observar si algunos miembros de la comunidad se identifican por algún otro aspecto, tal como pertenencia a una cooperativa, o vecindad al pueblo, o si residen en el pueblo sólo una parte del año)

1-7. ¿Existen familias que pertenecen a la comunidad pero viven en las cercanías del pueblo o residen en el pueblo sólo parte del año? _____

_____

_____

(Si dice sí, haga 1-7a.)

1-7a. ¿Cuántas son? _____

1-8. Del total de las familias, ¿qué proporción pertenece a otra religión que no sea la católica? _____

_____

1-9. ¿De todas las familias, ¿qué proporción de los jefes de familia no hablan castellano como idioma principal? _____

_____

1-10. ¿Hay una escuela en el pueblo? _____

1-11. ¿Cuántos maestros hay en la escuela? _____

1-12. ¿Cuántos cursos tiene la escuela? _____

Informe a la autoridad que Ud. quisiera hablar más con él y las demás autoridades y líderes y haga una cita para encontrarse con ellos más tarde ese día o el día siguiente.

Usando los datos de las preguntas 1-1 a 1-12, seleccione el tipo de muestra que se necesita. También, haga notas sobre sus primeras impresiones de la comunidad y de la autoridad.

:evistador_____

ıa_____

ır_____

le entrevista_____

SEGUNDA ETAPA

Segunda Etapa de la Encuesta: Entreviste otra vez a las autoridades y líderes del pueblo. Explíqueles otra vez el propósito de la encuesta. Explíqueles el plan de trabajo, incluyendo el tamaño de la muestra y las características más importantes de la muestra y tipos de preguntas. pídales que ellos le hagan conocer algunas casas y oficinas de organizaciones (según las características de la muestra) donde Ud. puede empezar el trabajo. También pídales que ellos informen a la gente de la encuesta y animen a la gente a colaborar. (En algunos lugares, tal vez Ud. va a tener que pedir a una autoridad le acompañe a las entrevistas). Entonces, siga a las preguntas:

(A cada uno de los líderes presentes, pregunt 2-1)

2-1. ¿Cómo se llama y cuál es su cargo en la comunidad? _____

_____

_____

_____

_____

_____

_____

_____

Familias

2-2. ¿Cuántas familias viven en esta comunidad? _____

2-3. ¿Existen familias que pertenecen a la comunidad pero viven en las cercanías del pueblo o residen en el pueblo sólo parte del año? _____

_____

_____

(Si dice sí, haga 2-3a.)

2-3a. ¿Cuántos son? _____

2-4. Si incluimos al total de las familias, ¿cuántas personas (adultos y niños) pertenecen a la población de la comunidad? _____

_____

_____

2-5. De todas estas familias, ¿qué proporción pertenece a otra religión que no sea la católica? _____

_____

_____

2-6 De todas las familias, ¿qué proporción de los jefes de familia no hablan castellano como su idioma principal? _____

_____

_____

2-7. ¿Qué idioma hablan estos jefes de familia? _____

_____

2-8. ¿Qué proporción de los miembros de la comunidad trabaja ocasionalmente fuera de la comunidad? _____

Escuelas

2-9. ¿Hay escuela en la comunidad? _____

(Si hay más de una escuela, repita 2-10 a 2-12 para cada una)

2-10. ¿Cuántos maestros hay en la escuela? _____

2-11. ¿Cuántos cursos tiene la escuela? _____

2-12. ¿Cuántos niños de la comunidad asisten a la escuela? _____

_____

2-13. ¿Qué proporción de los adultos de la comunidad (mayores de 15 años) saben leer y escribir? _____

_____

Viento

2-14. ¿Cuáles son los meses de más viento? _____

_____

2-15. ¿Es muy fuerte el viento en esos meses? _____

2-16. ¿Varía mucho el viento durante el día? _____

_____

Ríos

2-17. ¿Hay ríos próximos al pueblo? _____

_____

(Si dicen sí, anote las respuestas a preguntas 2-18 a 2-23 en el Cuadro 2-A)

2-18. ¿Qué ríos son? (Anote en el Cuadro 2-A. Pregunte 2-19 a 2-23 para cada río listado, siguiendo río por río)

CUADRO 2-A: RIOS

Nombre del río	Tiene agua todo el año	Meses secos	Ancho en		Corriente		Distancia del pueblo
			Meses secos	Meses de lluvias	Meses secos	Meses de lluvias	

2-19. ¿Tiene agua todo el año el río? (Anote en el Cuadro 2-A)

2-20. ¿En qué meses no tiene agua? (Anote en el Cuadro 2-A)

2-21. ¿Qué ancho tiene la corriente en los meses secos y en los meses de lluvias? (Anote en el Cuadro 2-A)

2-22. ¿Corre mucho el agua en meses secos? ¿En meses de lluvias? (Anote en el Cuadro 2-A)

2-23. ¿A qué distancia queda del pueblo? (Anote en el Cuadro 2-A)

Pozos

2-24. ¿Hay pozos de agua en el pueblo? _____

2-25. ¿A qué profundidad está el agua en la época de lluvias? _____

2-26. ¿A qué profundidad está el agua en la época seca? _____

Viajes

2-27. ¿Cuál es el pueblo importante más próximo? _____

2-28. ¿En qué se va a ese pueblo? _____

2-29. ¿En cuánto tiempo se llega en la época de lluvias? _____

2-30. ¿En cuánto tiempo se llega en la época seca? _____

Organizaciones

2-31 ¿Qué tipo de organizaciones existe en la comunidad? (Anote en el Cuadro 2-B. Pregunte individualmente 2-32 a 2-35 a cada una de las organizaciones, siguiendo una por una)

CUADRO 2-B: ORGANIZACIONES

Nombre de la organización	Número de los miembros	Cuántos miembros de la Directiva	¿Es activa?	Equipos y bienes que posee

2-32. ¿Cuántas familias o personas pertenecen a esta organización? (Anote en el Cuadro 2-B)

2-33. ¿Cuántos de los miembros o socios participan de la directiva? (Anote en el Cuadro 2-B)

2-34. ¿Es una organización activa? (Anote en el Cuadro 2-B)

2-35. ¿Qué equipos o bienes posee esta organización? (Tractores, máquinas, camiones, bienes para vender en una tienda. Anote en el Cuadro 2-B)

2-36. De estas organizaciones, ¿cuál es la más importante? _____

_____

Comunidad

2-37. ¿Tiene la comunidad tierras de propiedad comunal? _____

_____

2-38. ¿En qué se utilizan estas tierras? (pastoreo, monte, bosque, etc.)

_____

_____

_____

2-39. ¿Se reúnen las personas de la comunidad para realizar algún trabajo comunitario? (apertura de caminos, construcción de escuelas, etc.)

_____

_____

2-40. ¿Cuál ha sido el caso más reciente? _____

_____

_____

_____

2-41. ¿Hace cuánto tiempo fue este caso? _____

Trabajos

2-42. ¿En qué trabajan los miembros de la comunidad fuera de su granja? (Anótelas en el Cuadro 2-C, de la siguiente página. Pregunte 2-43 a 2-44 para cada tipo de trabajo anotado)

2-43. ¿Qué salario se paga (o qué ganancia se recibe) en este trabajo? (Anote en el Cuadro 2-C, de la siguiente página)

2-44. ¿Cuántas personas de la comunidad trabajan en esta clase de trabajo? (Anote en el Cuadro 2-C, de la siguiente página)

CUADRO 2-C: TRABAJOS

Tipo de Trabajo	Salario o Ganancia por Tiempo	Número de Personas que Trabajan

Productos Agrícolas

2-45. ¿Qué productos agrícolas y de animales se produce en la comunidad? (Anote en el Cuadro 2-D. Pregunte 2-46 y 2-47 para cada producto, uno por uno)

2-46. ¿Dónde venden estos productos? (en la granja, en la comunidad, etc. Anote en el cuadro 2-D)

2-47. ¿A qué precio lo venden? (Anote en el Cuadro 2-D)

CUADRO 2-D: PRODUCTOS AGRICOLAS

Tipo de Producto	Lugar de Venta	Precio por Unidad

Industrias, Negocios e Instituciones

2-48. ¿Qué tipo de talleres, molinos, industrias, mecánicas y artesanías hay en la comunidad? ¿Cuántos hay de cada tipo? (Liste)

Tipo	Número

2-49. ¿Qué tipo de tiendas, restaurantes, pensiones y hoteles hay en la comunidad? ¿Cuántos hay de cada tipo? (Liste)

Tipo	Número

2-50. ¿Qué tipo de oficinas del gobierno o de instituciones (incluyendo iglesias, cooperativas, policía, posta sanitaria, etc.) hay en la misma comunidad? ¿Cuántos hay de cada tipo? (Liste)

Tipo	Número

2-51. ¿Hay una oficina de telégrafos o teléfono o radiocomunicaciones en la comunidad? (Si dice sí, sigue con 2-52 a 2-54)

_____

2-52. ¿De dónde saca la electricidad para el telégrafo, etc.?

_____

_____

2-53. ¿Cuánto se gasta en la electricidad para el telégrafo, etc.?

_____

_____

2-54. ¿Funciona todo el año? _____

_____

Vehículos

2-55. ¿Qué tipo de vehículos pertenecen a personas u organizaciones de la comunidad? ¿Cuántos hay de cada tipo? (Liste)

Tipo	Número

Electricidad

2-56. ¿Hay electricidad en la comunidad? _____

2-57. ¿Cuántos generadores de motor diesel hay? _____

2-57a. ¿Quiénes son los dueños? (Liste)

_____

_____

_____

_____

_____

2-58. ¿Cuántos generadores de motor de gasolina hay? _____

2-58a. ¿Quiénes son los dueños? (Liste)

_____

_____

_____

_____

_____

2-59. ¿Cuántos molinos (bombas) de viento hay? _____

2-59a. ¿Quiénes son los dueños? (Liste)

_____

_____

_____

_____

_____

2-60. ¿Cuántos generadores hidroeléctricos hay? _____

2-60a. ¿Quiénes son los dueños? (Liste)

_____

_____

_____

_____

_____

Refrigeradores

2-61. ¿Cuántos refrigeradores hay en la comunidad? _____

_____

2-62. ¿Cuántos de éstos son de instituciones y cuáles?

_____

_____

_____

_____

_____

_____

2-63. ¿Cuántos son particulares y a quién pertenecen?

_____

_____

_____

_____

_____

_____

_____

Ya se ha completado la segunda etapa. Pida que alguna autoridad le haga conocer un poco de la comunidad (por ejemplo, los límites, dónde quedan las oficinas, escuelas, tiendas, etc.), y/o le presente a algunas familias que va a entrevistar. Avíseles a las autoridades que quiere reunirse con ellos otra vez después de hacer las demás entrevistas. Si parece necesario, según los datos de la segunda etapa, ajuste la muestra.

trevistador_____ 5.I-15

cha_____

gar_____ _____

de entrevista_____

TERCERA ETAPA

Tercera Etapa de la Encuesta - Parte 3-a: Debe obtener usted datos de familia y de uso doméstico de energía. Los datos sobre el uso doméstico de energía se deben conseguir de la señora o ama de casa. Los datos de familia se deben conseguir del jefe de familia, con la señora presente (si ella no es el jefe de familia). Se puede hacer la entrevista de la parte 3-b (agricultura) antes o después de esta parte.

Cuando se empieza la entrevista en la casa (sea 3-a ó 3-b), se debe explicar el propósito de la encuesta, los tipos de preguntas que se van a hacer y a quién quiere hacer los diferentes tipos de preguntas.

En ningún caso haga primero las preguntas sobre la familia (es decir, 3-a-130 a 3-a-137); deje estas preguntas hasta el final de la entrevista.

3-a-1. ¿Cómo se llama el jefe de familia?

_____

Cocina - General

3-a-2. ¿Cómo cocinan Uds.? _____ _____

_____ _____

3-a-3. A veces ¿cocinan Uds. en otra manera?

¿Cuál es? _____

3-a-4. ¿Dónde está ubicada la cocina? _____

(El entrevistador debe pedir ver la cocina. Si se le permite verla él puede contestar 3-a-6 por simple observación). Si la cocina no es de kerosene o gas, pregunte 3-a-5 y 3-a-6, u observe).

3-a-5. ¿De qué esta hecha su cocina? _____

3-a-6. ¿A qué altura del piso está la comida cuando está cocinando?

_____

3-a-7. ¿Quién cocina todos los días? _____

3-a-8. ¿Cuántas veces al día cocina? _____

3-a-9. ¿Cuántas horas está cocinando cada comida? _____

_____

3-a-10. Las ollas que usa para cocinar, ¿son de barro o de fierro? (Describa los tipos de ollas que menciona o que se pueden ver) _____

_____

3-a-11. ¿Varía Ud. el modo de cocinar según el tipo de comida o la época del año?

_____

(Si dice sí, pregunte 3-a-11a.)

3-a-11a. ¿Cómo varía? (Describa) _____

_____

_____

_____

3-a-12. ¿Hace hervir el agua para beber o calienta el agua para bañarse, o hierve el agua para otro uso (uso fuera de la comida)? _____

_____

3-a-13. ¿Tiene Ud. un horno? _____

3-a-14. ¿Qué tipo de horno? _____

_____

(Pida ver el horno y descríbalo)

Cocina - Gas

(Para los que cocinan a gas, haga las preguntas 3-a-15 a 3-a-18)

3-a-15. Para su cocina a gas, ¿cuánto tiempo le dura una garrafa de gas? (Obtenga la respuesta en días)

_____

3-a-16. ¿Dónde compra el gas? _____

3-a-17. ¿Cuánto cuesta la garrafa? _____

3-a-18. ¿Es fácil de obtener? _____

Cocina - Kerosene

(Para los que cocinan con kerosene, haga las preguntas 3-a-19 a 3-a-22)

3-a-19. Para su cocina de kerosene, ¿cuántos litros o botellas usa cada semana?

_____

3-a-20. ¿Dónde compra el kerosene? _____

3-a-21. ¿Cuánto cuesta (por litro o botella u otra unidad) _____

3-a-22. ¿Es fácil de obtener? _____

Cocina - Leña o Residuos Agrícolas (paja, mazorca, bagazo)

(Para los que cocinan con leña, primero pregunte 3-a-23 y 3-a-24; después continúe con 3-a-25 a 3-a-27 y/ó 3-a-28 a 3-a-33, dependiendo de la respuesta a 3-a-23)

3-a-23. ¿Compra o recoge la leña/residuos que usa para cocinar ú hornear?

_____

3-a-24. ¿Cuánta leña/residuos emplea Ud. por semana? (Especificar la unidad)

_____

3-a-25. ¿De quién compra la leña/residuos? _____

3-a-26. ¿Cuánto cuesta cada (unidad) la leña? _____

(Si es necesario, pedir una descripción de la unidad)

3-a-27. ¿Es fácil de obtener? _____

3-a-28. ¿Quién recoge la leña/residuos? _____

3-a-29. ¿Cuánto tiempo emplea recogiendo leña/residuos cada día o semana?

_____

3-a-30. ¿Cuánto de leña/residuos recoge por día o semana?

_____

3-a-31. ¿Qué tipo de leña/residuos es? (Arboles, ramas, ramitas, hojas, paja, mazorca, bagazo)

_____

_____

3-a-32. ¿Se puede recoger leña todo el año? _____

(Si la respuesta es no,¿cuándo no se puede?) _____

3-a-33. ¿Se consigue suficiente leña/residuos por todo el año?

Cocina - Guano

(Para los que cocinan con taquía o guano, haga las preguntas 3-a-34 a 3-a-42)

3-a-34. ¿De qué clase de animales es el guano? _____

3-a-35. ¿De cuántos animales es el guano? _____

3-a-36. ¿Le alcanza también el guano de estos animales para usarlo como abono?

_____

3-a-37. ¿Qué proporción emplea como fertilizante? _____

3-a-38. ¿Quién recoge y amontona el guano? _____

3-a-39. ¿Cuánto tiempo emplea esta persona por día o por semana recogiendo est

_____

3-a-40. ¿Compra o vende guano para cocinar? _____

3-a-41. ¿A qué precio? _____

3-a-42. ¿Qué cantidad de guano se necesita para cocinar una comida? (Describa la unidad)

_____

Cocina - Carbón

(Para los que cocinan con carbón, haga las preguntas 3-a-43 a 3-a-46)

3-a-43. ¿Cuánto carbón usa por día o por semana? (Especificar unidad)

_____

3-a-44. ¿Dónde compra el carbón? _____

3-a-45. ¿Cuánto cuesta una (unidad) de carbón? _____

3-a-46. ¿Se consigue el carbón fácilmente? _____

Luz

3-a-47. ¿Con qué se alumbra por la noche? _____

3-a-48. ¿Por cuántas horas? _____

(Si usan lámpara o mechero a kerosene, haga las preguntas 3-a-49 a 3-a-

3-a-49. ¿Cuánto kerosene usa por semana? (Especificar unidad)

_____

3-a-50. ¿De dónde consigue el kerosene? _____

3-a-51. ¿Cuánto cuesta? (Por unidad) _____

3-a-52. ¿Se consigue el kerosene fácilmente? _____

(Si usan lámpara de gas, haga las preguntas 3-a-53 a 3-a-56)

3-a-53. ¿Cuántos días dura una garrafa de gas? _____

3-a-54. ¿Dónde compra el gas? _____

3-a-55. (Cuánto cuesta por garrafa? _____

3-a-56. ¿Se consigue fácilmente? _____

(Si usa velas, haga las preguntas 3-a-57 a 3-a-61)

3-a-57. ¿Usa velas de esperma o de sebo? _____

3-a-58. ¿Cuántas velas usa por semana? _____

3-a-59. ¿Dónde compra las velas? _____

3-a-60. ¿Cuánto cuestan (por unidad)? _____

3-a-61. ¿Son fáciles de conseguir? _____

(Si ellos usan electricidad, haga las preguntas 3-a-62 a 3-a-66)

3-a-62. ¿Cuántas horas al día tiene corriente eléctrica? _____

3-a-63. ¿Cuántos focos de luz tiene? _____

3-a-64. ¿Tiene medidor? _____

3-a-65. ¿Cuánto paga por mes? _____

3-a-66. ¿Cuántos días al mes no tiene corriente eléctrica? _____

Calefacción

3-a-67. ¿Usan Uds. algo para calentar la casa o un cuarto de ella?

_____

3-a-68. ¿En qué época del año usa la calefacción? _____

3-a-69. ¿Qué combustible usa? _____

3-a-70. ¿Cuánto combustible para calefacción usa por semana? _____

3-a-71. ¿De dónde consigue este combustible? _____

3-a-72. ¿Cuánto cuesta (por unidad)? _____

Agua

3-a-73. ¿De dónde consigue el agua para uso en la casa (incluyendo para cocinar, bañarse, lavar ropa, animales, etc.)? (Anote en el Cuadro 3-a-A. Pregunte 3-a-74 a 3-a-83, una por una, para cada fuente del agua).

3-a-74. ¿Tiene agua todo el año? (Anote en el Cuadro 3-a-A)

3-a-75. ¿En qué meses no tiene agua de esta fuente? (Anote en el Cuadro 3-a-A)

3-a-76. ¿A qué distancia de la casa está? (Anote en el Cuadro 3-a-A)

3-a-77. ¿Cómo transporta el agua? (Anote en el Cuadro 3-a-A)

3-a-78. ¿Quién recoge el agua (quién de la familia)? (Anote en el Cuadro 3-a-A)

3-a-79. ¿Cuántos viajes al día hace (si está lejos) para recoger agua? (Anote en el Cuadro 3-a-A)

3-a-80 ¿Con qué proposito usa usted esta agua? (Anote en el Cuadro 3-a-A)

3-a-81. ¿Qué cantidad de agua de esta fuente usa cada día? (Anote en el Cuadro 3-a-A)

(El entrevistador debe describir la unidad de agua usada)

3-a-82. ¿Esta fuente es de propiedad privada? (Anote en el Cuadro 3-a-A)

(Si dice sí, continúe)

3-a-83. ¿Cuánto paga usted (por unidad o período de tiempo)? (Anote en el Cuadro 3

3-a-84. ¿Se encuentra con los vecinos para conversar cuando va a recoger el agua o a lavar ropa?

Molienda

3-a-85. ¿Qué alimentos ralla o muele para su familia o para sus animales? (Anote en el Cuadro 3-a-B. Pregunte 3-a-86 a 3-a-91, uno por uno, para cada uno)

3-a-86. ¿Cómo lo muele? (Anote en el Cuadro 3-a-B)

(Si la molienda se hace fuera de la casa, pregunte)

3-a-87. ¿A qué distancia de la casa? (Anote en el Cuadro 3-a-B)

3-a-88. ¿Quién es el propietario del molino? (Anote en el Cuadro 3-a-B)

3-a-89. ¿Cuánto le cobra el propietario del molino (por unidad)? (Anote en el Cuadro 3-a-B)

3-a-90. ¿Cuántas horas por día o semana emplea usted en moler o transportar el grano al molino? (Anote en el Cuadro 3-a-B)

3-a-91. ¿Quién está encargado de moler el grano (quién de los familiares)? (Anote el Cuadro 3-a-B)

CUADRO 3-a-A: AGUA DE USO DOMESTICO

Fuente de Agua	Meses sin Agua	Distancia de la casa	Modo de transporte	Quién la recoge	Cuántos viajes al día	Uso del agua	Cantidad al día	Es la fuente privada?	Cuánto cuesta

CUADRO 3-a-B: MOLIENDA DE ALIMENTOS

Tipo de alimento	Uso del alimento molido	Cómo muele	A qué distancia está el molino	De quién es el molino	Costo de moler por unidad	Horas moliendo o llevando el molino	Quién se encarga de moler

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Secando Alimentos

3-a-92. ¿Qué alimentos tiene que secar? _____

_____

_____

_____

_____

(Si hay más de uno, repita 3-a-93 a 3-a-97 para cada uno)

3-a-93. ¿Cómo los seca? _____

_____

_____

_____

_____

3-a-94. ¿En qué meses los seca? _____

_____

_____

_____

_____

3-a-95. ¿Tiene pérdidas de estos alimentos(o este cultivo)cuando llueve? _____

3-a-96. ¿Cuánto pierde? _____

_____

3-a-97. ¿Cuántos días tarda en secar? _____

(Si secan los alimentos por algún otro medio fuera del sol, pregunte:)

3-a-98. ¿Qué tipo de combustible usa para secar? _____

_____

3-a-99. ¿Cuánto usa de combustible ? (Unidad por tiempo) _____

3-a-100. ¿Cuánto le cuesta el combustible (por unidad)? _____

_____

Procesamiento

3-a-101. ¿Hace algún trabajo de procesamiento de alimentos o bebidas (ej: chicha, queso, azúcar, miel de caña, chancaca. pisco, manteca, etc.)? (Anote en el Cuadro 3-a-C. Continúe listando las respuestas a 3-a-102 en el Cuadro 3-a-C. Después pregunte 3-a-103 a 3-a-109 y 3-a-110 a 3-a-114 por cada tipo de alimento. uno por uno, incluyendo la respuesta en 3-a-C. Si la respuesta a 3-a-107 es "no", , ponga una X bajo "precio". Si la respuesta a 3-a-110 es "no", ponga una X bajo "qué animal". Escriba la respuesta a 3-a-115 junto con la pregunta).

3-a-102. ¿Qué productos procesa? Anote en el Cuadro 3-a-C)

3-a-103. ¿Cómo los procesa? (Anote en el Cuadro 3-a-C)

3-a-104. ¿Quién es el encargado de este trabajo? (Anote en el Cuadro 3-a-C)

3-a-105. ¿Cuánto tiempo emplea en esto por día, o por semana, o por mes? (Anote en el Cuadro 3-a-C)

3-a-106. ¿Qué cantidad produce por día, semana, o por mes? (Anote en el Cuadro 3-a-C).

3-a-107. ¿Vende usted éste? ¿Cuál es el nombre del producto? (Anote en el Cuadro 3

3-a-108. ¿A qué precio (por unidad) lo vende usted? (Anote en el Cuadro 3-a-C)

3-a-109 ¿Cuánto vende cada vez? (Anote en el Cuadro 3-a-C)

3-a-110. ¿Emplea animales o combustible en este trabajo? (Anote en el Cuadro 3-a-C)

3-a-111. ¿Qué animales o combustible emplea? (Anote en el Cuadro 3-a-C)

3-a-112. ¿Cuánto combustible o tiempo de trabajo por animal usted emplea? (Anote en el Cuadro 3-a-C)

3-a-113. ¿Cuánto cuesta el combustible o el alquiler de los animales? (Anote en el Cuadro 3-a-C)

3-a-114. ¿Dónde compra el combustible? (Anote en el Cuadro 3-a-C)

3-a-115. ¿Es fácil de obtener el combustible o animales de alquiler? _____

Refrigeración

3-a-116. ¿Tiene usted un refrigerador? _____

(Si dice sí, continúe)

CUADRO 3-a-C: PROCESAMIENTO DE ALIMENTOS

Tipo de Producto	Cómo lo procesa	Quién se encarga	Tiempo empleado	Cuánto produce	Precio de venta	Cuánto vende	Animales o combustible empleados			Dónde lo consigue
							De qué animal o combustible se trata	Cuánto tiempo se necesita	Cuánto cuesta por tiempo (unidad)	

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3-a-117. ¿Para qué lo usa? _____

_____

3-a-118. ¿Lo usa todo el año? _____

3-a-119. ¿Lo usa todo el día y la noche? _____

3-a-120. ¿Qué combustible usa la refrigeradora? _____

(Si la respuesta es gas o kerosene, continúe con:)

3-a-121. ¿Cuánto combustible usa (unidad por tiempo)? _____

3-a-122 ¿Cuánto cuesta el combustible (por unidad)? _____

3-a-123. ¿De dónde consigue el combustible? _____

3-a-124. ¿Se consigue fácilmente? _____

3-a-125. ¿Compra Ud. barras de hielo? _____

(Si dice sí, continúe con:)

3-a-126. ¿Para qué las usa? _____

_____

3-a-127. ¿Qué cantidad usa (unidad hielo por unidad tiempo)? _____

_____

3-a-128. ¿De dónde consigue el hielo? _____

3-a-129. ¿Cuánto cuesta (por unidad)? _____

Datos Familiares

3-a-130. ¿Cuántas personas viven en la casa? _____

(Si le parece que las personas son abiertas y amistosas, siga con las preguntas de la Forma 2, pero si le parece resistentes, siga con la Forma 1)

FORMA 1

3-a-131. ¿Cuántos años de educación formal ha completado el jefe de familia?

_____

3-a-132. ¿Cuántas de las personas que viven en la casa trabajan fuera de la comunidad ocasionalmente?

_____

3-a-133. ¿Cuál es el trabajo principal del jefe de familia?

_____

_____

(Si dice "agricultura", siga a 3-a-134; si dice otra ocupación, siga a 3-a-135)

3-a-134. ¿Qué otra ocupación tiene cuando los cultivos son pocos?

_____

3-a-135. ¿Realiza también tareas agrícolas? _____

3-a-136. ¿Cuáles son las ocupaciones de los otros miembros adultos de la familia?

_____

_____

_____

_____

_____

FORMA 2

Anote las respuestas a 3-a-137 en el Cuadro 3-a-D de la página siguiente, una por una.

Tiene usted que repetir preguntas principales acerca de edad, sexo, ocupación, etc., por cada persona. Se puede empezar preguntando: (a) ¿Quién es la persona mayor? ¿Cuántos años tiene? ¿Sexo? etc., y después continúe con la persona de más edad o (b) pregunte a la primera persona con quien usted habló"¿Cuántos años tiene Ud.? ¿Sexo? ¿Años de escolaridad?, etc." y luego puede continuar con el/la esposo/esposa, hijos, etc. Se quiere realizar una lista completa de los miembros de la casa.

TABLA 3-a-D: CENSO DE LA CASA

Edad	Sexo	Años de escolaridad	Ocupación principal	Ocupación secundaria	¿Trabaja fuera de la comunidad? (Especifique en qué)

TERCERA ETAPA

Parte 3-b

Tercera Etapa de la Encuesta - Parte 3-b, Datos sobre Agricultura a nivel de la familia: Se puede hacer esta parte antes de 3-a (Datos familiares) si es necesario. Se deben dirigir estas preguntas a la persona principal responsable del trabajo agrícola..

(Liste las respuestas a 3-b-1 en el Cuadro 3-b-A, de la página siguiente)

3-b-1. ¿Qué cultivos produce Ud.? (Anote en el Cuadro 3-b-A)

3-a-2. ¿Hace rotación de cultivos en sus parcelas? ¿Cómo lo hace (describa la rotación)?

_____

_____

_____

(Si el entrevistado le parece resistente, continúe con las preguntas de la Forma 1; pero si es cooperativo, continúe con las preguntas de la Forma 2)

Terrenos

FORMA 1

3-b-3. ¿Tiene todas sus parcelas juntas? _____

(Si dice "no", continúe con 3-b-4)

3-b-4. ¿Qué distancia hay entre las parcelas? _____

_____

FORMA 2

3-b-5. ¿Cuántas parcelas tiene? _____

_____

3-b-6. ¿Cuál es la extensión cultivada de cada parcela? (Lístelas)

_____

_____

_____

_____

CUADRO 3-b-A: CALENDARIO AGRICOLA

Tipo de cultivo	Meses y Equipo de Siembra	Meses y Equipo de Cultivo	Meses y Equipo de Cosecha	Meses y Equipo se Secar, etc.	Meses y Equipo de Arar	Tipo de fertili-zante usado	Riego

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3-b-7. ¿A qué distancia están las parcelas? _____

_____

_____

_____

_____

_____

_____

(Ahora continúe a llenar el Cuadro 3-b-A. Por cada cultivo, haga las mismas preguntas de 3-b-8 a 3-b-14 y escriba las respuestas en 3-b-A)

Calendario de Trabajo

3-b-8. ¿En qué meses efectúa la siembra y con qué herramientas o máquinas? (Anote en el Cuadro 3-b-A)

3-b-9. ¿En qué meses y con qué herramientas usted cultiva (desyerbar, surcar, fumigar, etc.)? (Anote en el Cuadro 3-b-A)

3-b-10. ¿En qué meses y con qué herramientas o máquinas es recogida la cosecha? (Anote en el Cuadro 3-b-A)

3-b-11. ¿En qué meses y con qué herramientas efectúa las labores posteriores a la cosecha (trillar, secar, aventar, prensar caña, etc.)? (Anote en el Cuadro 3-b-A)

3-b-12. ¿En qué meses y con qué herramientas o máquinas efectúa la preparación (arado) de la tierra? (Anote en el Cuadro 3-b-A)

3-b-13. ¿Emplea fertilizantes o abono en este cultivo? ¿Cuáles? (Anote en el Cuadro 3-b-A)

3-b-14. ¿Aplica riego a este cultivo? (Anote en el Cuadro 3-b-A)

Máquinas

(Para las siguientes preguntas, el entrevistador debe sacar la información del Cuadro 3-b-A y repetir las preguntas como sea necesario. Continúe hasta la pregunta 3-b-22, anotando cada respuesta en el Cuadro 3-b-B).

("Usted dijo que emplea _____". (Tractor, equipo de fumigar, etc.). (Repita una por una todas las máquinas que le mencionó anteriormente).

3-b-15. Hablando de _____ (una de las anteriores máquinas), ¿es propio o alquilado? (Anote en el Cuadro 3-b-B).

(Si propio, pregunte:)

3-b-16. ¿Qué combustible emplea? (Anote en el Cuadro 3-b-B)

3-b-17. ¿Cuánto gasta en combustible durante el año? (Anote en el Cuadro 3-b-B)

3-b-18. ¿Es fácil de obtener el combustible? (Anote en el Cuadro 3-b-B)

(Si es alquilado, pregunte:)

3-b-19. ¿Cuánto paga por hora, hectárea, o día? (Anote en el Cuadro 3-b-B)

3-b-20. ¿Tiene algún otro gasto asociado con esta maquinaria? (Anote en el Cuadro 3-b-B)

3-b-21. ¿Cuál es? (Anote en el Cuadro 3-b-B)

3-b-22. ¿Cuánto es? (Anote en el Cuadro 3-b-B)

Yunta

3-b-23. Hablando de la yunta, ¿es suya o alquilada)

_____

(Si dice "alquilada", continúe con:)

3-b-24. ¿Cuánto le cuesta por día? _____

3-b-25. ¿La yunta la trabaja el dueño o Ud.? _____

_____

CUADRO 3-b-B: MAQUINAS EMPLEADAS EN AGRICULTURA

Tipo de Máquina	Propia o Alquilada	Propio			Alquilado		
		Qué clase combustible	Cuánto cuesta por Año	Es fácil de obtener	Cuánto cuesta por período de tiempo	Cualquier otro gasto	Cuánto es
Tractor							
Cosechadora							
Equipo Fumigador							
(Otros)							

Obrero agrícola

3-b-26. ¿Emplea usted jornaleros en el trabajo agrícola? _____

3-b-27. ¿Para qué faenas? _____

_____

_____

3-b-28. ¿Cuántos jornaleros contrata usted? _____

_____

_____

3-b-29. ¿Cuánto les paga (por unidad de tiempo)? _____

_____

3-b-30. ¿Esto es, con o sin comida? _____

_____

3-b-31. ¿Por qué no cultiva Ud. más tierra? _____

_____

_____

_____

_____

Animales

3-b-32. ¿Qué clase de animales o aves tiene Ud.? (Anote en el Cuadro 3-b-C; luego, continúe con 3-b-33 a 3-b-38, haciendo cada pregunta por cada tipo de animal o de ave y anotando las respuestas en 3-b-C)

3-b-33. ¿Cuántos animales (o aves) tiene de este tipo? (Anote en el Cuadro 3-b-C)

3-b-34. ¿Para qué los utiliza? (Anote en el Cuadro 3-b-C)

3-b-35. ¿Quién cuida o alimenta estos animales? (Anote en el Cuadro 3-b-C)

CUADRO 3-b-C: ANIMALES Y AVES

Tipo de Animales o Aves	Cantidad de cada Tipo	Uso	Quién cuida o alimenta	A qué distancia de la casa	Cuántos viajes	Cuántas horas al día cuidando y alimentand

3-b-36. ¿Qué distancia hay que viajar para cuidar o alimentar estos animales? (Anote en el Cuadro 3-b-C)

3-b-37. ¿Con qué frecuencia hace ese viaje? (Anote en el Cuadro 3-b-C)

3-b-38. ¿Cuántas horas al día tiene que trabajar una persona para cuidar o alimentar estos animales? (Anote en el Cuadro 3-b-C)

Fertilizantes

"Ud. dijo que emplea _____ (fertilizante)"

(Continúe con lo que él ha mencionado en el Cuadro 3-b-A)

3-b-39. ¿Qué tipo de fertilizante (químico) emplea Ud.? _____

_____

3-b-40. ¿Cuánto utilizó el año pasado? _____

3-b-41. ¿Cuánto le costó, incluyendo el transporte? _____

3-b-42. ¿Dónde lo compró? _____

3-b-43. ¿Es fácil de obtener? _____

3-b-44. Hablando de abono natural, ¿qué tipo de abono utiliza? _____

_____

3-b-45. ¿Es de sus propios animales o lo compra? _____

(Si dice "comprado", siga a 3-b-46 hasta 3-b-49. Si dice "propio", continúe con 3-b-50)

3-b-46. ¿Dónde lo compra? _____

3-b-47. ¿Cuánto compra (especificar unidad)? _____

3-b-48. ¿Cuánto cuesta (por unidad)? _____

3-b-49. ¿Se consigue fácilmente? _____

3-b-50. ¿¿Obtiene Ud. suficiente abono de sus propios animales? _____

_____

Riego

"Ud. dijo que utiliza riego en sus cultivos de _____
(lo que ha mencionado en 3-b-A)

3-b-51. ¿Cuántas hectáreas tiene bajo riego? _____

_____

_____

3-b-52. ¿Tiene suficiente agua para esa área de tierra? _____

_____

3-b-53. ¿Tiene agua para riego todo el año? _____

_____

3-b-54. ¿De dónde obtiene el agua? _____

_____

3-b-55. ¿Desde qué distancia trae el agua? _____

3-b-56. ¿Tiene que bombear el agua? _____

(Si dice sí, siga con 3-b-57 hasta 3-b-64. Si dice no, continúe con 3-b-65 hasta 3-b-67)

3-b-57. ¿Qué tipo de bomba utiliza? _____

_____

3-b-58. ¿Quién es el dueño de la bomba de agua? _____

(Si no es propia, continúe con 3-b-59. Si es propia, continúe con 3-b-60 a 3-b-64)

3-b-59. ¿Cuánto paga por el agua (por tiempo o unidad? _____

3-b-60. ¿Qué clase de combustible o energía emplea la bomba? _____

3-b-61. ¿Cuánto combustible o energía emplea? _____

3-b-62. ¿Cuánto cuesta? _____

3-b-63. ¿Dónde compra el combustible? _____

3-b-64. ¿Se consigue fácilmente? _____

3-b-65. ¿Es miembro de una asociación de riego? _____

3-b-66. ¿Cuántos miembros hay? _____

3-b-67. ¿Cuántos días por año tiene que trabajar en la limpieza de acequias?

_____

(Ahora si el entrevistado o su familia tienen un taller, tienda, restaurante, taller de mecánica, vehículo o generador, etc., el entrevistador debe seguir con las preguntas pertinentes de las partes 3-d, 3-e, o 3-f. De lo contrario, debe continuar con 3-c).

TERCERA ETAPA

Parte 3-c

Tercera Parte de la Encuesta - Parte 3-c Datos sobre las Necesidades y Problemas del Manejo de Casa y desde el Punto de Vista de la Famili
Estas preguntas se deben hacer al jefe de familia y a su esposa/espos
Además, las debe hacer como una conversación, con muchas anotaciones tomadas por el entrevistador, como sea posible.

3-c-1. ¿Cuáles son las necesidades más importantes en su familia? _____

_____

_____

_____

_____

_____

_____

3-c-2. ¿Cómo piensa que se podrían solucionar estas necesidades? _____

_____

_____

_____

_____

_____

_____

3-c-3. ¿Cuáles son las necesidades o problemas más importantes en su comunidad?

_____

_____

_____

_____

_____

_____

3-c-4. ¿Cómo piensa que se podrían solucionar estas necesidades o problemas?

_____

_____

_____

_____

_____

_____

3-c-5. ¿Tienen Ud. y los miembros de su familia tiempo y/o dinero disponible para ayudar a resolver estas necesidades?

_____

_____

_____

_____

TERCERA ETAPA

Parte 3-d

Tercera Etapa de la Encuesta - Parte 3-d - Datos sobre el Uso de Energía en Industrias y Negocios: El entrevistador tiene una lista (del Cuadro 2-B y de 2-48, 2-49, 2-50, 2-55, 2-57, y 2-61) de todas las empresas, oficinas, vehículos, etc., en la comunidad. Debe entrevistar a todos (si hay muchos de una categoría, entrevistar por lo menos a dos de cada categoría) haciendo las preguntas pertinentes abajo indicadas. En algunos casos hay cuadros para las respuestas. Haga un registro de cada entrevista en la lista en Parte 2.

Talleres, Molinos, Industrias, Mecánica, y Artesanías

3-d-1. POR OBSERVACION: Describa el tipo de negocio y la tecnología empleada (máquinas y herramientas)

_____

_____

_____

_____

_____

_____

3-d-2. ¿Cuántas personas trabajan en la tienda (etc.) _____

3-d-3. Además de energía humana, ¿qué otros tipos de energía usa? (Anote en el Cuadro 3-d-A)

(Pregunte por cada tipo de energía empleada)

3-d-4. ¿Qué cantidad emplea (por período de tiempo)? (Anote en el Cuadro 3-d-A)

3-d-5. ¿Cuánto paga por este combustible (por unidad)? (Anote en el Cuadro 3-d-A)

3-d-6. ¿Dónde lo compra? (Anote en el Cuadro 3-d-A)

3-d-7. ¿Se consigue fácilmente?

3-d-8. ¿Qué clase de animales y cuántos de cada uno son usados? (Anote en el Cuadro 3-d-A)

CUADRO 3-d-A: USO INDUSTRIAL DE ENERGIA

Tipo de Industria o negocio _____ Nombre del dueño _____

Tipo de Energía	Combustible y Electricidad				Animales		Agua		
	Cantidad empleada	Costo por Unidad	Dónde se compra	Fácil de obtener	Cuántos de cada tipo	Precio alquiler	Dónde se consigue	Cantidad por día	Precio del agua
Gas natural									
Diesel									
Gasolina									
Kerosene									
Electricidad									
Carbón									
Leña									
(Otro)									
Bueyes									
Caballos									
Mulas									
Burros									
(Otro)									
Agua									

3-d-9. ¿Son alquilados? si lo son ¿cuánto paga (por tiempo)? (Anote en el Cuadro 3-d-A)

3-d-10. ¿Usa agua en este trabajo? (Anote en el Cuadro 3-d-A)

3-d-11. ¿Dónde consigue el agua? (Anote en el Cuadro 3-d-A)

3-d-12. ¿Qué cantidad de agua usa por día (o unidad de tiempo)? (Anote en el Cuadro 3-d-A)

3-d-13. ¿Tiene que pagar por esta agua? ¿Cuánto (por unidad)? (Anote en el Cuadro 3-d-A)

3-d-14. ¿Cuánto produce por día o por semana? _____

_____

3-d-15. ¿Cuál es el precio de venta (por unidad)? _____

3-d-16. (Si la cantidad no puede ser medida) ¿Cuál es su ingreso bruto mensual que le produce la tienda?

_____

Tiendas, Restaurantes, Pensiones, y Hoteles

3-d-17. ¿Qué tipo de negocio es? _____

_____

(Anote las respuestas de 3-d-18 hasta 3-d-23, como pertinente, en Cuadro 3-d-B, haciendo preguntas de 3-d-19 hasta 3-d-23 para cada tipo de energía empleada)

3-d-18. ¿Qué tipo de combustible o electricidad emplea? (Anote en el Cuadro 3-d-B?

3-d-19. ¿Para qué propósito es usada? (Anote en el Cuadro 3-d-B)

3-d-20. ¿Qué cantidad emplea por día, mes, o semana? (Anote en el Cuadro 3-d-B)

3-d-21. ¿Dónde lo compra? (Anote en el Cuadro 3-d-B)

3-d-22. ¿Cuánto cuesta (por unidad)? (Anote en el Cuadro 3-d-B)

3-d-23. ¿Se consigue fácilmente? (Anote en el Cuadro 3-d-B)

3-d-24. ¿Cuál es el valor de ventas por día, semana o mes? (Anote en el Cuadro 3-d-B)

CUADRO 3-d-B: USO DE ENERGIA EN TIENDAS ETC.

Tipo de Energía	Uso	Cantidad por tiempo	Dónde Compra	Cuánto cuesta por unidad	Fácil de obtener
Gas					
Kerosene					
Gasolina					
Diesel					
Carbón					
Electricidad					
Leña					
(Otro)					

Oficinas e Instituciones

3-d-25. ¿Qué tipo de oficina o institución es? _____

_____

(Anote respuestas a 3-d-26 a 3-d-31, como pertinente, en el Cuadro 3-d-C. Haga preguntas de 3-d-27 hasta 3-d-31 en el Cuadro 3-d-C por cada tipo de energía empleada)

3-d-26. ¿Qué tipo de combustible o electricidad emplea? (Anote en el Cuadro 3-d-C)

3-d-27. ¿Para qué lo emplea? (Anote en el Cuadro 3-d-C)

3-d-28. ¿Cuánto combustible (o electricidad) emplea por día, semana o mes? (Anote en el Cuadro 3-d-C)

3-d-29. ¿Dónde lo compra? (Anote en el Cuadro 3-d-C)

3-d-30. ¿Cuánto cuestra (por unidad)? (Anote en el Cuadro 3-d-C)

3-d-31. ¿Se consigue fácilmente? (Anote en el Cuadro 3-d-C)

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CUADRO 3-d-C: USO INSTITUCIONAL DE ENERGIA

Tipo de Energía	Uso	Cantidad por tiempo	Dónde compra	Cuánto cuesta por unidad	Fácil de conseguir?
Gas					
Kerosene					
Gasolina					
Diesel					
Carbón					
Electricidad					
Leña					
(Otro)					

TERCERA ETAPA

Parte 3-e

Tercera Etapa de la Encuesta - Parte 3-e, Datos sobre Vehículos y Transporte: El entrevistador tiene una lista, de 2-55, de todos los vehículos de la comunidad (incluyendo tractores, etc.)

Debe entrevistar a todos los dueños (organizaciones o personas) de todos los vehículos; pero, si hay muchos, al menos dos dueños de cada tipo de vehículo. Después de la entrevista, debe anotarlo en la lista 2-55)

3-e-1. ¿Quién es el dueño entrevistado? _____

_____

3-e-2. ¿Qué tipo de vehículos tiene? (Anote en el Cuadro 3-e-A)

(Haga las preguntas 3-e-3 a 3-e-11 por cada tipo de vehículo, anotando las respuestas en el Cuadro 3-e-A)

3-e-3. ¿Cuántos tiene de este tipo? (Anote en el Cuadro 3-e-A)

3-e-4. ¿Para qué los usa? (Anote en el Cuadro 3-e-A)

3-e-5. ¿Qué distancia viaja? (Anote en el Cuadro 3-e-A)

3-e-6. ¿Cuántos viajes hace por semana? (Anote en el Cuadro 3-e-A)

3-e-7. ¿Qué clase de combustible emplea? (Anote en el Cuadro 3-e-A)

3-e-8. ¿Cuánto combustible emplea por semana? (Anote en el Cuadro 3-e-A)

3-e-9. ¿Dónde lo compra? (Anote en el Cuadro 3-e-A)

3-e-10. ¿Cuánto cuesta (por unidad)? (Anote en el Cuadro 3-e-A)

3-e-11. ¿Se consigue fácilmente? (Anote en el Cuadro 3-e-A)

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CUADRO 3-a-A: VEHICULOS Y TRANSPORTE

Tipo de vehículo	Cantidad	Uso	¿A dónde o a qué distancia?	Viajes por semana	Tipo de combustible	Cuánto por semana	Dónde compra	Costo por Unidad	Fácil de obtener?
Camión									
Camioneta									
Moto									
Automóvil									
Bus o micro									
Tractor									
(Otro)									
(Otro)									
(Otro)									

Practical Concepts Incorporated

TERCERA ETAPA

Parte 3-f

Tercera Etapa de la Encuesta - Parte 3-f, Datos sobre Generación de Electricidad: El entrevistador tiene una lista, desde 2-56 a 2-60, de todos los generadores y sus dueños. Debe entrevistar a todos los dueños (si hay muchos, a por lo menos dos por cada tipo de generador)

Después de cada entrevista, debe anotarlo en las listas 2-56 hasta 2-60.

3-f-1. ¿Quién es el dueño entrevistado? _____

3-f-2. ¿Qué tipo de generadores tiene? (Anote en el Cuadro 3-f-A)

(Haga las preguntas 3-f-3 hasta 3-f-10 por cada generador, anotando las respuestas en el Cuadro 3-f-A)

3-f-3. ¿Qué capacidad tiene el generador (Anote en el Cuadro 3-f-A)

3-f-4. ¿Para qué lo usa? (Anote en el Cuadro 3-f-A)

3-f-5. ¿Funciona regularmente? (Anote en el Cuadro 3-f-A)

3-f-6. ¿Cuánto combustible usa (por período de tiempo) (Anote en el Cuadro 3-f-A)

3-f-7. ¿Dónde consigue el combustible? (Anote en el Cuadro 3-f-A)

3-f-8. ¿Cuánto cuesta (por unidad)? (Anote en el Cuadro 3-f-A)

3-f-9. ¿Se consigue fácilmente?

3-f-10. Si vende electricidad, cuál es el precio de venta? (Anote en el Cuadro 3-f-A)

CUADRO 3-f-A: GENERACION DE ELECTRICIDAD

Tipo de Generador	Capacidad	Uso	Funciona bien?	Combustible				Precio de Venta
				Cuánto usa por tiempo	Dónde lo compra	Cuánto cuesta	Fácil de conseguir	
Motor Diesel								
Motor Diesel								
Motor de Gasolina								
Motor de Gasolina								
Molino de viento								
Molino de viento								
Hidroeléctrico								
Hidroeléctrico								
(Otro)								

:revistador_____

:ha_____

;ar_____

de entrevista_____

CUARTA ETAPA

Cuarta Etapa de la Encuesta - La Ultima Entrevista con las Autoridades de la Comunidad: Además de hacer las preguntas de abajo, el entrevistador debe explicarles cómo la encuesta ha progresado y debe preguntar si hay algo más que él deba conocer.

Además, esta entrevista debe hacerla de una manera muy abierta, como una conversación, tomando la mayor cantidad de notas que fuera posible.

4.1 ¿Cuáles son las necesidades o los problemas más importantes de la comunidad?

_____

_____

_____

_____

_____

_____

_____

_____

_____

4.2 ¿Tienen ustedes algún plan o proyectos en marcha para solucionarlos? ¿Cuáles son?

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

4.3 (Si no está solucionado) ¿Cómo piensa que podría resolverse estas necesidades?

4.4 De conformidad con lo que ha dicho, ¿cómo creen Uds, que los miembros de la comunidad podrían contribuir para resolver estas necesidades?

ENERGY SURVEY INSTRUMENT: ENGLISH VERSION

interviewer_____

date_____

place_____

no. of interview_____

ENERGY SURVEY ON THE RURAL SECTOR OF BOLIVIA

QUESTIONNAIRE

FIRST STAGE

First Stage of the Survey: Interview a village leader. Explain to him the purpose and work plan of the survey. Explain also that the first questions are to help you select the number of interviews to conduct. Then proceed with the questions:

1-1. What is your name?_____

1-2. What is your position in the community?_____

_____

1-3. Who is the maximum authority in the community?_____

_____

1-4. What other authorities exist in the community?_____

_____

_____

(examples: corregidor, president of the farmworkers union, notary, parish priest, police chief, etc.)

1-5. What kinds of organizations exist in the community?_____

_____

_____

(examples: cooperatives, clubs, PTA's, evangelical associations, farmworkers union, irrigation cooperatives, etc.)

1-6. How many families (households) live in this community?_____

_____

(The interviewer should note if some members of the community identify with the community because they are coop members or live nearby or live in the village part of the year.)

1-7. Are there families who belong to the community but who live outside the village or who live in the village only part of the year?_____

_____

_____

_____

(If he says yes, go to 1-7a)

1-7a. How many are there?_____

1-8. Of the total of these families, what proportion belong to a religion other than Catholicism?_____

_____

1-9. Of all these families, what proportion of heads of family speak other than Spanish as their principal (or first) language?_____

_____

1-10. Is there a school in the village?_____

1-11. How many teachers are there in the school?_____

1-12. How many grades does the school have?_____

Inform the authority that you wish to talk more with him and other community leaders and make an appointment to meet with them later that day or the next day.

Using the data from questions 1-1 to 1-12, select the type of sample needed. Also, take notes about your first impressions of the community and of the authority you have interviewed.

terviewer_____

te_____

ace_____

of interview_____

SECOND STAGE

Second Stage of the Survey: Interview again community authorities and leaders. Explain again the purposes and work plan of the survey and explain the size and nature of the sample and the types of questions you will ask. Ask them to help you get to know some homes and some organization offices (following the sample specifications) where you can begin your work. Also ask them to tell the community members about the survey and to urge them to cooperate. (In some places, you may also have to ask that a village leader accompany you at interviews.) Now, ask the questions:

2-1. What is your name and what is your position in the community?_____

_____

_____

_____

_____

_____

_____

_____

Families

2-2. How many families live in this community?_____

2-3. Are there families which belong to the community but which reside nearby or live in the village only part of the year?_____

_____

_____

(If they say yes, do 2-3a)

2-3a. How many are there?_____

2-4. If we include the total number of families, how many people (adults and children) make up the population of the community?_____

_____

_____

2-5. Of all these families, what proportion belong to a religion other than Catholicism?_____

2-6. Of all the families, what proportion of family heads do not speak Spanish as their principal language?_____

2-7. What language do these household heads speak?_____

2-8. What proportion of the members of the community work occasionally outside the community?_____

Schools

2-9. Is there a school in the community?_____

(If there is more than one school, repeat 2-10 to 2-12 for each one.)

2-10. How many teachers are there in the school?_____

2-11. How many grades does the school have?_____

2-12. How many children from the community attend the school?_____

2-13. What proportion of the adults in the community (older than 15 years) know how to read and write?_____

Wind

2-14. Which months have the most wind?_____

2-15. Is the wind strong in those months?_____

2-16. Does the wind fluctuate much during the day?_____

Rivers

2-17. Are there rivers near the village?_____

_____

(If they say yes, note the responses to questions 2-18 to 2-33 in Table 2-A.)

2-18. What rivers are there? (Enter in Table 2-A. Ask 2-19 to 2-23 one by one for each river listed.)

TABLE 2-A: RIVERS

Name of River	Has Water All Year	Dry Months	Width In		Current/Flow		Distance From the Village
			Dry Months	Rainy Months	Dry Months	Rainy Months	

2-19. Does the river have water all year round? (Enter in Table 2-A above)

2-20. In what months does it not have water? (Enter in Table 2-A above)

2-21. How wide is the river in dry months and in rainy months? (Enter in Table 2-A above)

2-22. Is the flow (or current) strong in dry months? In rainy Months? (Enter in Table 2-A above)

2-23. How far is the river from the village? (Enter in Table 2-A above)

Wells

2-24. Are there water wells in the village?_____

2-25. At what depth is the water in the rainy season?_____

2-26. At what depth is the water in the dry season?_____

_____

Travel

2-27. Which is the closest important town?_____

2-28. How do you get to that town?_____

2-29. How long does it take to get there in the rainy season?_____

2-30. How long does it take to get there in the dry season?_____

Organizations

2-31. What types of organizations exist in the community? (Enter in Table 2-B. Ask 2-32 to 2-35 one by one for each organization entered.)

TABLE 2-B: ORGANIZATIONS

Name of Organization	Number of Members	Number of Board Members	Is It Active?	Equipment and Other Assets

2-32. How many families or individuals belong to this organization? (Enter in Table 2-B above)

2-33. How many members or partners participate in the board of directors? (Enter in Table 2-B above)

2-34. Is it an active organization? (Enter in Table 2-B above)

2-35. What equipment and other assets does the organization own? (Tractors, machinery, trucks, goods in stock. Enter in Table 2-B above.)

2-36. Which of these organizations is the most important one?_____

_____

Community

2-37. Does the community have land that is communal property?_____

_____

2-38. How is such land utilized? (pasture, scrub, forest, etc.)_____

_____

_____

_____

2-39. Do the people of the community get together to undertake any communal work? (e.g., improving roads, constructing schools, etc.)_____

_____

_____

2-40. What is the most recent case of communal work?_____

_____

_____

_____

2-41. How long ago was this case?_____

Jobs

2-42. What jobs do the members of the community do apart from working their farms? (Enter in Table 2-C, following page. Ask 2-43 and 2-44 for each type of work entered.)

2-43. What wage is paid (or what profit is made) in this job? (Enter in Table 2-C, following page)

2-44. How many people in the community work in this type of job? (Enter in Table 2-C, following page)

TABLE 2-C: JOBS

Type of Job	Wage or Profit Per Time Period	Number of People by Type of Job

Agricultural Products

2-45. What are the agricultural and animal products that are produced in the community? (Enter in Table 2-D. Ask 2-46 and 2-47 for each product entered.)

2-46. Where do you sell these products? (e.g., at your farm, in the village, at a weekly market, etc. Enter in Table 2-D below)

2-47. At what price (per unit) do you sell them? (Enter in Table 2-D below)

TABLE 2-D: AGRICULTURAL PRODUCTS

Type of Product	Where Sold	Price Per Unit

Industries, Businesses, and Institutions

2-48. What types of manufacturers, mills, industries, and mechanical shops are there in the village? (Include repair shops, carpenters, etc.) How many of each are there? (Add to the list)

Type	Number

2-49. What kinds of stores (shops), restaurants, boarding houses and hotels are there in the community? How many of each kind are there? (Add to the list)

Type	Number

2-50. What kinds of governmental or other institutional offices are there in the community (including churches, cooperatives, police, emergency wards, etc.)? How many of each kind are there? (Add to the list)

Type	Number

2-51. Is there a telegraph, telephone, or radiocommunications office in the community? _____

2-52. Where do you get the electrical power to run the telegraph, etc.?

_____

_____

2-53. How much does this electricity cost for the telegraph, etc.?

_____

2-54. Does it work all year round? _____

Vehicles

2-55. What kind of vehicles belong to individuals or community organizations? (List them) How many of each type are there? (Add to the list)

Type	Number

Electricity

2-56. Is there electricity in the community?_____

2-57. How many diesel generators are there?_____

2-57a Who are the owners? (List them)

_____

_____

_____

_____

2-58. How many gasoline generators are there?_____

2-58a Who are the owners? (List them)

_____

_____

_____

_____

2-59. How many windmills are there?_____

2-59a Who are the owners? (List them)

_____

_____

_____

_____

_____

2-60. How many hydroelectric generators are there?_____

2-60a Who are the owners? (List them)

_____

_____

_____

_____

Refrigeration

2-61. How many refrigerators are there in the community?_____

_____

2-62. How many of these belong to institutions and which institutions do they belong to?

_____

_____

_____

_____

_____

2-63. How many are privately owned and whom do they belong to?

_____

_____

_____

_____

_____

Now you have completed the second stage of the survey. Ask one of the village leaders to help you get to know a little more about the community (e.g., boundaries, schools, shops, etc.) and to introduce you to some households where you can begin the survey. Tell the authorities that you will want to meet with them once more. If necessary, adjust the sample.

interviewer_____

date_____

place_____

no. of interview_____

THIRD STAGE

Third Stage of the Survey--Part 3-a: You should obtain data on household and domestic use of fuels. The data on domestic use of fuels must be obtained from the housewife. Data on family composition should be obtained from the head of the family, with the housewife present (if she is not the head of the family). Part 3-b (agriculture) can be done before or after this part.

When you begin the household interview (be it 3-a or 3-b), explain what you are doing and what types of questions you will be asking.

Under no circumstances ask family data first (e.g., 3-a-130 to 3-a-137); leave these questions until the end of the interview.

3-a-1. What is the name of the person who is the head of the family?

_____

Cooking--General

3-a-2. How do you do your cooking?_____

_____

3-a-3. Do you sometimes do it another way?

What is it?_____

3-a-4. Where is your kitchen located?_____

(The interviewer should ask to see the kitchen. If he is permitted to do so, he can answer 3-a-6 by simple observation. If the stove is not of kerosene or gas, ask 3-a-5 and 3-a-6, or observe.)

3-a-5. What is your stove made of?_____

3-a-6. At what elevation from the floor is food when you're cooking?

_____

3-a-7. Who cooks every day?_____

3-a-8. How many times a day does he/she cook?_____

3-a-9. How many hours does it take him/her to cook each meal?_____

_____

3-a-10 Are your cooking pots made of pottery or metal? (Describe the types of cooking pots mentioned or visible.)_____

_____

3-a-11. Do you change your cooking method according to the type of food or the season of the year?

_____

(If yes, ask 3-a-11a)

3-a-11a How do you change it? (Describe)_____

_____

_____

_____

3-a-12. Do you boil water to drink or heat water for bathing, or boil water for any other use?_____

_____

3-a-13. Do you have an oven?_____

3-a-14. What kind is it?_____

_____

(Ask to see the oven and describe it)

Cooking--Gas

(For those who cook with gas, ask 3-a-15 to 3-a-18)

3-a-15. For your gas stove, how long does a tank of gas last? (get the answer in days)

_____

3-a-16. Where do you buy the gas?_____

3-a-17. How much does it cost per tank?_____

3-a-18. Is it easy to obtain?_____

Cooking--Kerosene

(For those who cook on kerosene stoves, ask 3-a-19 to 3-a-22)

3-a-19. For your kerosene stove, how many liters or bottles do you use each week?

_____

3-a-20. Where do you buy the kerosene?_____

3-a-21. How much does it cost (per bottle or per unit)?_____

3-a-22. Is it easy to obtain?_____

Cooking--Firewood and Agricultural Waste (Straw, Corncobs, and Bagasse)

(For those who cook with wood, first ask 3-a-23 and 3-a-24; then continue with 3-a-25 to 3-a-27 and/or 3-a-28 to 3-a-33, depending on the answer to 3-a-23.)

3-a-23. Do you buy or gather the firewood/waste you use to cook or bake?

_____

3-a-24. How much firewood/waste do you use each week? (Specify unit)_____

_____

3-a-25. From whom do you buy the firewood/waste?_____

3-a-26. How much does it cost per unit?_____

(If necessary, ask for a description of the unit)

3-a-27. Is it easy to obtain?_____

3-a-28. Who gathers the firewood/waste?_____

3-a-29. How much time does she/he spend gathering firewood/waste each day or week? _____

3-a-30. How much firewood/waste does she/he gather each day or week?

_____

3-a-31. What kind of firewood /waste is it? (Trees, branches, twigs, leaves, straw, corncobs, bagasse)

_____

_____

3-a-32. Can you gather firewood all year round?_____

(If not, when can't you?) _____

3-a-33. Can you get enough firewood/waste all year round?_____

Cooking--Dung

(For those who cook with dung, ask questions 3-a-34 to 3-a-42)

3-a-34. From what kind of animals is the dung?_____

3-a-35. From how many animals is the dung?_____

3-a-36. Is the dung from these animals sufficient to use it also as fertilizer?

_____

3-a-37. What proportion of it goes for fertilizer?_____

3-a-38. Who gathers and piles up this dung?_____

3-a-39. How much time per day or per week does this person spend collecting dung?

_____

3-a-40. Do you buy or sell dung for cooking?_____

3-a-41. At what price?_____

3-a-42. How much dung does it take to cook a meal? (Specify unit)_____

_____

Cooking--Charcoal

(For those who cook with charcoal, ask 3-a-43 to 3-a-46)

3-a-43. How much charcoal do you use per day or week? (Specify unit)

_____

3-a-44. Where do you buy it?_____

3-a-45. How much does a (unit) of charcoal cost?_____

3-a-46. Is it easy to obtain?_____

Lighting

3-a-47. What do you use for lighting at night?_____

3-a-48. For how many hours?_____

(If they use kerosene lamp or lantern, ask 3-a-49 to 3-a-52.)

3-a-49. How much kerosene do you use per week? (Specify unit)

_____

3-a-50. Where do you get the kerosene?_____

3-a-51. How much does it cost (per unit)?_____

3-a-52. Is it easy to obtain?_____

(If they use a lamp that burns bottled gas, ask 3-a-53 to 3-a-56.)

3-a-53. How many days does a bottle of gas last?_____

3-a-54. Where do you buy it?_____

3-a-55. How much does it cost (per bottle)?_____

3-a-56. Is it easy to get?_____

(If they use candles, ask 3-a-57 to 3-a-61)

3-a-57. Do you use wax or tallow candles?_____

3-a-58. How many candles per week do you use?_____

3-a-59. Where do you buy them?_____

3-a-60. How much do they cost (per unit)?_____

3-a-61. Are they easy to get?_____

(If they use electricity, ask questions 3-a-62 to 3-a-66.)

3-a-62. How many hours a day do you have electricity?_____

3-a-63. How many light bulbs do you use?_____

3-a-64. Do you have a meter?_____

3-a-65. How much do you pay per month?_____

3-a-66. How many days a month are you without electricity?_____

Heating

3-a-67. Do you use anything to heat your house or one room in it?

_____

3-a-68. In which season do you use heating?_____

3-a-69. What fuel do you use?_____

3-a-70. How much heating fuel do you use per week?_____

3-a-71. Where do you obtain this fuel?_____

3-a-72. How much does it cost (per unit)?_____

Water

3-a-73. From where do you get water for use in the house (for cooking, bathing, animals, etc.)? (Enter in Table 3-a-A. Ask 3-a-74 to 3-a-83 one by one for each water source entered.)

3-a-74. Do you have water all year round? (Enter in Table 3-a-A)

3-a-75. In which months do you not have water from this source? (Enter in Table 3-a-A)

3-a-76. How far from the house is it? (Enter in Table 3-a-A)

3-a-77. How do you transport this water? (Enter in Table 3-a-A)

3-a-78. Who gets the water (i.e., who in the household)? (Enter in Table 3-a-A)

3-a-79. How many trips a day do you make (if it is far away)? (Enter in Table 3-a-A)

3-a-80. For what purpose do you use this water? (Enter in Table 3-a-A)

3-a-81. How much water from this source do you use each day? (Enter in Table 3-a-A)

(The interviewer should describe the water unit used.)

3-a-82. Is this source privately owned? (Enter in Table 3-a-A)

(If yes, continue)

3-a-83. How much do you pay (per unit or time period)? (Enter in Table 3-a-A)

3-a-84. Do you meet with neighbors to talk when you go to collect water or to laundry?

Grinding

3-a-85. What kind of food do you grind or mill for the family or for your animals. (Enter in Table 3-a-B. Ask 3-a-86 to 3-a-91 one by one for each.)

3-a-86. How do you grind it? (Enter in Table 3-a-B)

(If the grinding is done outside the household, ask)

3-a-87. At what distance from the house? (Enter in Table 3-a-B)

3-a-88. Who owns the mill? (Enter in Table 3-a-B)

3-a-89. How much does the mill owner charge you (per unit)?(Enter in Table 3-a-B)

3-a-90. How many hours per day or week do you spend grinding or transporting the grain to the mill? (Enter in Table 3-a-B)

3-a-91. Who is in charge of grinding grain (who in the household)? (Enter in Table 3-a-B)

TABLE 3-a-A: DOMESTIC WATER USE

Source of Water	Months Without Water	Distance from the House	Means of Transport	Who Gets Water	How Many Trips/Day	Use of This Water	How Much Water/Day	Is the Source Private?	If So How Much Does It Cost?

TABLE 3-a-B: FOOD GRINDING

Type of Food	Ground Food Use	How is It Ground	How Far Is the Mill?	Who Owns the Mill?	Grinding Cost Per unit	Grinding Or Transport Hours/Day	Who Does Grinding or Transport?

Drying Foods

3-a-92. What foods (crops) do you dry?_____

_____

_____

_____

_____

(If there is more than one, repeat 3-a-93 to 3-a-97 for each one.)

3-a-93. How do you dry them?_____

_____

_____

_____

_____

3-a-94. In what month(s) do you dry them?_____

_____

_____

_____

_____

3-a-95. Do you have losses of this food (or this crop) when it rains?_____

3-a-96. How much do you lose?_____

_____

3-a-97. How many days does it take to dry?_____

(If they dry crops by any means other than sun, ask:)

3-a-98. What type of fuel do you use to dry them?_____

_____

3-a-99. How much fuel do you use (unit per time)?_____

_____

3-a-100 How much does this fuel cost you (by unit)?_____

_____

Food Processing

3-a-101. Do you process foods or beverages (e.g., cider, cheese, sugar cane syrup, cane sugar, pisco, lard, etc.)? (Enter in Table 3-a-C. Continue listing the answers to 3-a-102 in Table 3-a-C. Then ask 3-a-103 to 3-a-109 and 3-a-110 to 3-a-114 for each food type, one by one, including the answer in 3-a-C. If the answer to 3-a-107 is "no," put an X below "price." If the answer to 3-a-110 is "no," put an X under "what animal." Write the answer to 3-a-115 together with the question.

3-a-102. What products do you process? (Enter in Table 3-a-C)

3-a-103. How do you process them? (Enter in Table 3-a-C)

3-a-104. Who is in charge of this work? (Enter in Table 3-a-C)

3-a-105. How much time does this take him/her per day, week, or month? (Enter in Table 3-a-C)

3-a-106. How much do you produce by day, week, or month? (Enter in Table 3-a-C)

3-a-107. Do you sell this? (What is the name of the product?) (Enter in Table 3-a-C)

3-a-108. At what price (per unit) do you sell it? (Enter in Table 3-a-C)

3-a-109. How much do you sell each time? (Enter in Table 3-a-C)

3-a-110. Do you use animals or fuel in this work? (Enter in Table 3-a-C)

3-a-111. What animals or fuel do you use? (Enter in Table 3-a-C)

3-a-112. How much fuel or work time per animal do you use? (Enter in Table 3-a-C)

3-a-113. How much does the fuel or rental of animals cost you? (Enter in Table 3-a-C)

3-a-114. Where do you buy the fuel? (Enter in Table 3-a-C)

3-a-115. Is it easy to obtain the fuel or animals for rent?_____

Refrigeration

3-a-116. Do you have a refrigerator?_____

(If yes, continue:)

TABLE 3-a-C: FOOD PROCESSING

Type of Food Product	How Is It Processed	Who Does It?	Time Required	Quantity Produced	Sale Price	Quantity Sold	Animals of Fuel Used			
							What Animal Or Fuel Is It?	How Much Time Needed?	What cost/ time unit?	Where do you Get It?

3-a-117. For what purpose do you use it? _____

_____

3-a-118. Do you use it all year round? _____

3-a-119. Do you use it day and night? _____

3-a-120. What fuel does your refrigerator use? _____

(If the answer is gas or kerosene, continue with:)

3-a-121. How much fuel does it use (by time unit)? _____

3-a-122. How much does this fuel cost (per unit)? _____

3-a-123. Where do you get this fuel? _____

3-a-124. Is it easy to obtain? _____

3-a-125. Do you ever buy ice blocks? _____

(If yes, continue with:)

3-a-126. What do you sue them for? _____

_____

3-a-127. How much do you use (ice units by time unit)? _____

_____

3-a-128. Where do you get the ice? _____

3-a-129. How much does it cost (per unit)? _____

Household Data

3-a-130. How many people live in the household? _____

(If it seems to you the people are open and friendly, proceed with questions in Form 2, but if they are unfriendly proceed with Form 1.)

3-a-131. How many years of formal education has the head of the household completed?

_____

3-a-132. How many household members occasionally work outside the community?

_____

3-a-133. What is the main work activity of the head of the household?

_____

_____

(If he/she says "agriculture," go to 3-a-134; if something else, go to 3-a-135.)

3-a-134. What other occupation do you have when farming is slow?_____

_____

3-a-135. Do you also do any farm work?_____

3-a-136. What are the occupations of the other adult members in the family?

_____

_____

_____

_____

_____

FORM 2

(Write the answers for each household member in Table 3-a-D, following page, one by one.)

You have to repeat relevant questions about age, sex, occupation, etc. for each person. You can start by asking: (a) "Who is the oldest person? How old? Sex? etc." and then continue with the next oldest person. or (b) ask the first person you speak with "How old are you? Sex? Schooling? etc." and then you can continue with the spouse, children, etc. You want to have a complete list of the household members.

TABLE 3-a-D: HOUSEHOLD CENSUS

Age	Sex	Main Schooling	Main Occupation	Secondary Occupation	Does He/She Work Outside the Village? (Specify Work)

THIRD STAGE

Part 3-b

Third Stage of the Survey--Part 3-b, Data on Agriculture at Household Level: You can do this part before 3-a (Household) if necessary. You should address these questions to the main person responsible for the agricultural work.

(List the answers to 3-b-1 in Table 3-b-A, following page)

3-b-1. What crops do you produce? (Enter in Table 3-b-A)

3-a-2. Do you rotate crops in your fields? How do you do this (describe)?

_____

_____

_____

(If the interviewee seems to be resistant, continue with Form 1; but if he cooperates, continue with Form 2.)

Land

FORM 1

3-b-3. Are all your fields close together?_____

(If he says "no," continue with 3-b-4.)

3-b-4. At what distance are they from each other?_____

_____

FORM 2

3-b-5. How many fields do you have?_____

_____

3-b-6. What is the cultivated acreage in each plot you have? (List them)

_____

_____

_____

_____

_____

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TABLE 2-a-B: AGRICULTURAL CALENDAR

Type of Crop	Months & Equipment of Planting	Months & Equipment of Cultivating	Months & Equipment of Harvest	Months & Equipment of Drying, etc.	Months & Equipment of Land Prep.	Type of Fertilizer Used	Irrigation

3-b-6. What is the cultivated acreage in each plot you have? (List them)

_____

_____

_____

_____

_____

_____

3-b-7. How far apart are your lots? _____

_____

_____

_____

_____

(Now continue to fill in Table 3-b-A. For each crop, ask the same questions from 3-b-8 to 3-b-14 and write the answers in 3-b-A.)

Work Calendar

3-b-8. In what months and with what tools do you plant? (Enter in Table 3-b-A)

3-b-9. In what months and with what tools do you cultivate (weeding, fumigating, etc.)? (Enter in Table 3-b-A)

3-b-10. In which months and with what tools or machines is the harvest gathered? (Enter in Table 3-b-A)

3-b-11. In which months and with what tools is the post harvest work done (threshing, drying, winnowing, pressing cane, etc)? (Enter in Table 3-a-B)

3-b-12. In which months and with what tools or machines do you prepare (plow) the land? (Enter in Table 3-b-A)

3-b-13. Do you use fertilizer or manure on this crop? Which ones? (Enter in Table 3-b-)

3-b-14. For this crop, do you use irrigation for the cultivation? (Enter in Table 3-b-A)

TABLE 3-b-B: MACHINES USED IN AGRICULTURE

Type of Machine	Owned or Rented	What Kind of Fuel	How Much Per Year	Is it Easy to Obtain	How Much Per Time Period	Rented Any Other Expenses	How Much
Tractor							
Harvester							
Fumigating Equipment							
(Others)							

Machines

(For the following questions, the interviewer should extract the information from Table 3-b-A and repeat the questions as necessary. Continue through question 3-b-[illegible], writing each answer on Table 3-b-B.)

("You said you use a _____." (Tractor, fumigating equipment, etc.) Repeat one-by-one all the machines he mentioned.)

3-[illegible]-15. Speaking of _____ (one of the above machines), is it your own or rented? (Enter in Table 3-b-B)

(If it is owned, ask:)

3-b-16. What fuel does it use? (Enter in Table 3-b-B)

3-b-17. How much do you spend for fuel during the year? (Enter in Table 3-b-B)

3-b-18. Is the fuel easy to obtain? (Enter in Table 3-b-B)

(If it is rented, ask:)

3-b-19. How much do you pay by hour, hectare, or day? (Enter in Table 3-b-B)

3-b-20. Do you have any other expenses associated with this machinery? (Enter in Table 3-b-B)

3-b-21. What is it? (Enter in Table 3-b-B)

3-b-22. How much is it? (Enter in Table 3-b-B)

Teams

3-b-23. Speaking of your plowing team, is it yours or is it rented?

_____ _____

(If he says "rented," continue with:)

3-b-24. How much does it cost per day?_____

3-b-25. Does the owner or you work the team?_____

_____ _____

Farm Laborers

3-b-26. Do you employ day-workers in agricultural work?_____

3-b-27. For what tasks?_____

_____

_____

3-b-28. How many workers do you contract?_____

_____

_____

3-b-29. How much do you pay them (by time unit)?_____

_____

_____

3-b-30. Is this with or without meals?_____

3-b-31. Why don't you cultivate more land?_____

_____

_____

_____

_____

Animals

3-b-32. What kinds of animals and birds do you have? (Enter in Table 3-b-C; then continue with 3-b-33 to 3-b-38, asking each question for each kind of animal or bird and writing the answers in Table 3-b-C.)

3-b-33. How many animals (or birds) of this kind do you have? (Enter in Table 3-b-C)

3-b-34. For what purpose do you use them? (Enter in Table 3-b-C)

3-b-35. Who herds or feeds these animals? (Enter in Table 3-b-C)

TABLE 3-b-C: ANIMALS AND BIRDS

What Kind of Animals/Birds	How Many of Each Kind?	Use	Who Herds or Feeds?	How Far From the Household	How Many Trips	How Many Hours Herding/Feeding

3-b-36. How far does one have to travel to herd or feed these animals? (Enter in Table 3-b-C)

3-b-37. How often does one have to make the trip? (Enter in Table 3-b-C)

3-b-38. How many hours a day must a person work to herd or feed these animals (Enter in Table 3-b-C)

Fertilizers

"You said you use _____(fertilizer)."

(Continue with what he mentioned in Table 3-b-A)

3-b-39. What type of (chemical) fertilizer do you use?_____

_____

3-b-40. How much did you use last year?_____

3-b-41. How much did it cost you, including transport?_____

3-b-42. Where did you buy it?_____

3-b-43. Is it easy to obtain?_____

3-b-44. Speaking of manure, what type of manure do you use?_____

_____

3-b-45. Is it from your own animals or purchased?_____

(If he says "purchased," go to 3-b-46 to 3-b-49. If he says "own," continue with 3-b-50.)

3-b-46. Where do you buy it?_____

3-b-47. How much do you buy (specify unit)?_____

3-b-48. How much does it cost (per unit)?_____

3-b-49. Is it easy to obtain?_____

3-b-50. Do you get enough manure from your own animals?_____

_____

Irrigation

"You said you use irrigation on your crops of _____ (what he mentioned in 3-b-A)

3-b-51. How many hectares do you have under irrigation?_____

_____

_____

3-b-52. Do you have enough water for that land area?_____

_____

_____

3-b-53. Do you have irrigation water all year?_____

_____

3-b-54. Where do you obtain water?_____

_____

3-b-55. Over what distance is the water carried?_____

3-b-56. Do you have to pump the water?_____

(If he says yes, go to 3-b-57 through 3-b-64. If he says no, continue with 3-b-65 through 3-b-67.)

3-b-57. What type of pump do you use?_____

_____

3-b-58. Who owns the water pump?_____

(If it is not his own, continue with 3-b-59. If he owns it, continue with 3-b-60 to 3-b-64.)

3-b-59. How much do you pay for water (by time or unit)?_____

3-b-60. What kind of fuel or energy does the pump use?_____

3-b-61. How much fuel or energy does it use?_____

3-b-62. How much does it cost?_____

3-b-63. Is it easy to obtain?_____

3-b-64. Are you a member of an irrigation cooperative?_____

3-b-65. How many members are there?_____

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3-b-66. How many members are there?_____

_____

3-b-67. How many days a year do you have to work cleaning irrigation channels?

_____

(Now if the interviewee or his/her family has a shop, store, restaurar repair shop, vehicle or generator, etc., the interviewer should procee with the relevant questions from parts 3-d, 3-e, or 3-f. Otherwise, he should continue with 3-c.)

THIRD STAGE

Part 3-c

Third Stage of the Survey--Part 3-c, Data About Needs and Problems at the Household Level and From the Family's Point of View: These questions should be posed to the household head and his/her spouse. Moreover, the tone should be conversational with as many notes taken by the interviewer as possible.

3-c-1. What are the most important needs of your family?_____

_____

_____

_____

_____

_____

_____

3-c-2. How do you think they might be resolved?_____

_____

_____

_____

_____

_____

_____

3-c-3. What are the most important needs or problems of your community?

_____

_____

_____

_____

_____

3-c-4. How do you think they might be resolved?_____

_____

_____

_____

_____

_____

_____

3-c-5. Do you and your family members all have time and/or money available to help resolve these needs?

_____

_____

_____

_____

THIRD STAGE

Part 3-d

Third Stage of the Survey--Part 3-d, Data About Energy Use in Industries and Businesses: The interviewer has a list (from Table 2-B and from 2-48, 2-49, 2-50, 2-55, 2-57, and 2-61) of all the businesses, offices, vehicles, etc. in the community. He should interview all of these (if there are too many in one category, interview at least two of each category) asking relevant questions from the ones given below. In some cases, there are charts for the answers. Make a record of each interview in the list in Part 2.

Shops, Mills, Industries, Mechanics, and Crafts

3-d-1. BY OBSERVATION: Describe the type of business and the technology employed (machines and tools).

_____

_____

_____

_____

_____

_____

3-d-2. How many people work in the shop (etc.)?_____

3-d-3. Besides human energy, what other types of energy do you use? (Enter in Table 3-d-A)

(Ask for each type of energy employed)

3-9-4. How much do you use (per time period)? (Enter in Table 3-d-A)

3-d-5. How much do you pay for this fuel (by fuel unit)? (Enter in Table 3-d-A)

3-d-6. Where do you buy it? (Enter in Table 3-d-A)

3-d-7. Is it easy to obtain ? (Enter in Table 3-d-A)

3-d-8. What kinds of animals and how many of each are used ? (Enter in Table 3-d-A)

3-d-9. Are they rented; if so, how much do you pay per unit? (Enter in Table 3-d-A)

TABLE 3-d-A: INDUSTRIAL USE OF ENERGY

Type of Industry_____ Name of Owner_____

	Fuels and Electricity				Animals		Water		
Type of Energy	Amount Used	Cost Per Unit	Where Purchased	Easy to Get	How Many of Each Kind	Rental Fee	Where to Get It	Quantity Per Day	Water Price
Natural Gas									
Diesel									
Gasoline									
Kerosene									
Electricity									
Charcoal									
Firewood									
(Other)									
Oxen									
Horses									
Mules									
Donkeys									
(Other)									
Water									

3-d-10. Do you use water in this work? (Enter in Table 3-d-A)

3-d-11. Where do you get the water? (Enter in Table 3-d-A)

3-d-12. How much water do you use per day (or time period)?(Enter in Table 3-d-A)

3-d-13. Do you have to pay for this water? How much (per unit)? (Enter in Table 3-d-A)

3-d-14. How much do you produce per day or per week?_____

_____ _____

3-d-15. What is the sale price (per unit)?_____

3-d-16. (If the quantity cannot be measured) What is your gross income from the shop?

_____

Stores, Restaurants, Boarding Houses, and Hotels

3-d-17. What type of business is it?_____

_____

(Include the answers to 3-d-18 through 3-d-23, as relevant, in Table 3-d-B, asking questions 3-d-19 through 3-d-23 for each type of energy used.)

3-d-18. What type of fuel or electricity do you use? (Enter in Table 3-d-B)

3-d-19. For what purpose is it being used? (Enter in Table 3-d-B)

3-d-20. How much do you use per day, month, or week? (Enter in Table 3-d-B)

3-d-21. Where do you buy it? (Enter in Table 3-d-B)

3-d-22. How much does it cost (per unit)? (Enter in Table 3-d-B)

3-d-23. Is it easy to get? (Enter in Table 3-d-B)

3-d-24. What is the value of your daily, weekly, or monthly sales? (Enter in Table 3-d-B).

TABLE 3-d-B: ENERGY USED IN STORES, ETC.

Type of Energy	Use	Quantity/ Time Period	Where Purchased	Cost Per Unit	Easy to Get?
Gas					
Kerosene					
Gasoline					
Diesel					
Charcoal					
Electricity					
Firewood					
(Other)					

Offices and Institutions

3-d-25. What types of office or institutions is it?_____

_____

(Write answers to 3-d-26 to 3-d-21, as relevant, in Table 3-d-C. Ask questions 3-d-27 through 3-d-31 in Table 3-d-C for each type of energy used.)

3-d-26. What type of fuel or electricity do you use? (Enter in Table 3-d-C)

3-d-27. For what purpose is it used? (Enter in Table 3-d-C)

3-d-28. How much fuel (or electricity) do you use per day, week, or month? (Enter in Table 3-d-C)

3-d-29. Where do you buy it? (Enter in Table 3-d-C)

3-d-30. How much does it cost (per unit)? (Enter in Table 3-d-C)

3-d-31. Is it easy to obtain? (Enter in Table 3-d-C)

TABLE 3-d-C: INSTITUTIONAL ENERGY USE

Type of Energy	Use	Quantity/ Time Period	Where Purchased	Cost Per Unit	Easy to Get
Gas					
Kerosere					
Gasoline					
Diesel					
Charcoal					
Electricity					
Firewood					
(Other)					

THIRD STAGE

Part 3-e

Third Stage of the Survey--Part 3-e, Data About Vehicles and Transportation: The interviewer has a list, from 2-55, of all vehicles in the community (including tractors, etc).

He should interview the owners (organizations or persons) of all vehicles; but if there are too many, at least two owners in each category of vehicle. After the interview, he should note it on Table 2-55.

3-e-1. Who is the owner interviewed?_____

_____

3-e-2. What type of vehicles do you have? (Enter in Table 3-e-A)

(Ask 3-e-3 to 3-e-11 for each type of vehicle, noting responses on Table 3-e-A.)

3-e-3. How many of this type do you have? (Enter in Table 3-e-A)

3-e-4. For what purpose do you use them? (Enter in Table 3-e-A)

3-e-5. How far do you travel? (Enter in Table 3-e-A)

3-e-6. How many trips do you make per week? (Enter in Table 3-e-A)

3-e-7. What kind of fuel does it use? (Enter in Table 3-e-A)

3-e-8. How much fuel does it use per week? (Enter in Table 3-e-A)

3-e-9. Where do you buy it? (Enter in Table 3-e-A)

3-e-10. How much does it cost (per unit)? (Enter in Table 3-e-A)

3-e-11. Is it easy to get? (Enter in Table 3-e-A)

TABLE 3-a-A: VEHICLES AND TRANSPORT

Type of Vehicle	Quantity	Use	Where & How Far	Trips Per Week	Type of Fuel	How Much Per Week	Where Purchased	Cost Per Unit	Easy to Get?
Truck									
Small Truck									
Motorcycle									
Car									
Bus or Minibus									
Tractor									
(Other)									
(Other)									
(Other)									

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THIRD STAGE

Part 3-f

Third Stage of the Survey--Part 3-f, Data About Electrical Generators: The interviewer has a list, from 2-56 to 2-60, of all the generators and their owners. He should interview all the owners (if there are too many, at least two for each type of generator.)

After each interview, he should note it on lists 2-56 through 2-60.

3-f-1. Who is the owner interviewed?_____

3-f-2. What type of generators do you have? (Enter on Table 3-f-A).

(Ask questions 3-f-3 through 3-f-10 for each generator, writing the answers on Table 3-f-A.)

3-f-3. What is the generator capacity? (Enter in Table 3-f-A)

3-f-4. For what purpose do you use it? (Enter in Table 3-f-A)

3-f-5. Does it run regularly? (Enter in Table 3-f-A)

3-f-6. How much fuel does it use (per time period)? (Enter in Table 3-f-A)

3-f-7. Where do you buy the fuel? (Enter in Table 3-f-A)

3-f-8. How much does it cost (per unit)? (Enter in Table 3-f-A)

3-f-9. Is it easy to get? (Enter in Table 3-f-A)

3-f-10. If you sell electricity, what is the sale price? (Enter in Table 3-f-A)

TABLE 3-f-A: ELECTRICITY GENERATION

Type of Generator	Capacity	Use	Runs Well?	Quantity/ Time Period	Where Purchased	Cost	Easy to Get	Sale Price
Diesel Motor								
Diesel Motor								
Gasoline Motor								
Gasoline Motor								
Windmill								
Windmill								
Hydro-electric								
Hydro-electric								
(Other)								

interviewer_____

date_____ 5.II-48

place_____

no. of interview_____

FOURTH STAGE

Fourth Stage of the Survey--The Final Interview With Community Leaders: Besides asking the questions below, the interviewer should explain how the survey progressed and ask if there is anything else he should know.

Moreover, he should conduct this interview in a very open manner, like a conversation, taking as many notes as possible.

4.1 What are the most urgent needs or problems of the community?

_____

_____

_____

_____

_____

_____

_____

_____

_____

4.2 Do you have any plans or projects under way to address these needs? What are they?

_____

_____

_____

_____

_____

_____

_____

_____

_____

4-3. (If there are no current projects) How do you think one might resolve these needs?

4-4. According to what you have said, how do you believe the members of the community might contribute toward resolving these needs?

SECTION FIVE

THE ANALYSIS AND USE OF ENERGY NEEDS ASSESSMENT DATA

As PCI's diagram of the process for matching village level needs and appropriate energy sources and technologies in Figure I-2 suggested, planners will need to undertake several analytic tasks before reaching conclusions concerning the optimal approach for providing energy resources to rural Bolivian villages. The first analytic tasks require on the needs data identified in Table II-1. (The remaining analyses will normally be undertaken following the completion of an initial screening and matching process that produces a short list of candidate sources and technologies. Additional data may be required from the villages along with data about the state of development of specific technologies, to complete these later analyses.)

In this section of the consultancy report, PCI describes the analytic procedures that planners should undertake once village level energy needs data and other pertinent data have been collected.

A. GENERAL COMMENTS ON THE ANALYSIS OF NEEDS ASSESSMENT DATA

Once the village surveys are completed, planners should review the survey data and other information called for in the analytic framework for accuracy and completeness. The PCI team expects that these data will not normally be aggregated or summarized for each village or for a group of villages. Rather, planners will work with the survey data and other data for each village in the basic form in which the field interviewer has provided it. Planners and analysts will use raw data to prepare the descriptions, profiles, etc. called for in the analytic framework.

Ideally, this will suggest to planners the relative priority of various energy needs. Once rough priorities are established, analytic personnel with specific

expertise can begin to assist the planners as they move through the decision-making and feasibility analyses described below.

B. DETAILED ANALYSES DESIGNED TO IDENTIFY OPTIMAL ENERGY SOURCES & TECHNOLOGIES

In this subsection PCI describes four analyses that USAID/Bolivia and the Government of Bolivia need to undertake in connection with the development of village level energy projects. These are:

- A Technical Feasibility Analysis
- An Economic Analysis
- A Socio-cultural (or Social Soundness) Analysis
- An Environmental Analysis.

While each of these analyses is discussed separately, it is worth remembering that an energy source or technology which proves to be unacceptable in terms of any one of these analysis should automatically be considered inappropriate.

If a number of specialists are to assist in preparing these analyses, planners might consider some overlap in their timing. Because the feasibility analyses are time-sequenced for effective decision-making, the use of other experts should largely follow the same sequence.

Finally, after each step of the data analysis is completed by the planners or other experts, concise written reports detailing the contents of data inputs, descriptive profiles, analysis and outputs of the decision step should be prepared.

C. TECHNICAL FEASIBILITY ANALYSIS

Once village needs and an energy demand profile have been determined, an initial feasibility analysis can be carried out. A technical analysis at this point

can eliminate those clearly inappropriate technologies or strategies for a village. This may leave planners with no possibilities, or one, or several. The technological analysis will also clarify where certain site specific information is inadequate and what additional information is needed before a specific technology can be selected. For example, if the depth to the water table in the area has large variations, then more specific technological information might be required to learn general sizing needs for specific technologies and whether various wind or solar technologies could supply the energy for pumping.

The matrix on the following page, Table V-1, indicates the range of end-uses likely to be found in rural areas of Bolivia and matches these with possible technologies for meeting those energy needs. While the matrix can be used as an initial first guide, a series of "end-use characterization" criteria should also be applied to any technology taken from the matrix.

To carry this additional analytic process, planners should have a general technical understanding of the technologies involved and the capability and background to secure the additional technical profile information required to match a technology with the technical demands of energy end-use characterization criteria explained in Table V-2. Planners can make a tentative list of all the possibilities by using the matrix in Table V-3. They will then need to match each of the possible technologies against the seven end-use characterization criteria.

After matching the possible technologies to the end-use characterization criteria, planners will have identified those technologies and variations which technically have a high degree of potential in the villages under consideration. Planners will also have a good idea of sizing requirements for various options.

TABLE V-1

LOCAL RENEWABLE ENERGY TECHNOLOGY MATRIX

RENEWABLE ENERGY TECHNOLOGIES	ENERGY END-USES															
	Water Pumping	Lighting	Cooling	Communications	Spinning	Sawing	Grinding	Desalination	Drying	Transport	Fertilizer	Cooking	Space Heating	Hot Water Heating	Cultivation	Threshing
Solar Cells	+	0	0	+	0	-	0	-	-	-	-	-	-	-	-	-
Flat Plate Collectors	0	-	0	-	-	-	-	+	+	-	-	0	+	+	-	-
Concentrating Collectors	+	+	+	-	-	-	-	+	-	-	-	·	-	-	-	-
Box Collectors	-	-	-	-	-	-	-	-	+	-	-	-	+	+	-	-
Tent Collectors	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-
Stirling Engines	+	+	+	0	0	0	0	-	-	-	-	-	-	-	-	-
Rankling Engines	+	+	+	-	+	+	+	-	-	-	-	-	-	-	-	-
Geothermal	0	+	+	+	+	-	+	-	-	-	-	-	-	-	-	-
Wind Mechanical	+	-	-	-	+	0	+	-	-	-	-	-	-	-	-	0
Wind Electrical	+	+	+	+	+	0	+	-	-	-	-	-	-	-	-	-
Hydro Electrical	+	+	+	+	+	+	+	-	-	-	-	0	-	-	-	-
Hydro Kinectic	-	-	-	-	+	+	+	-	-	-	-	-	-	-	-	0
Hydraulic Ram	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biogas, Methanol, Ethanol } Bio Conversion	0	+	0	0	0	0	0	-	0	+	+	+	-	-	+	+
Draft Animals	+	-	-	-	-	-	+	-	-	+	+	+	-	-	+	+

Key to the Symbols:

+ = applicable

0 = potentially applicable

- = not applicable

TABLE V-2

ENERGY END-USE CHARACTERIZATION CRITERIA

Criteria	Explanation
1	Form of Energy. The form of energy (electricity, heat, shaft power, etc.) that can satisfy the end-use being considered is very important. The fewer conversions in energy form, the greater the energy efficiency, and generally as close a match as possible should be attempted. Depending on the technology chosen, some end-uses can employ several energy forms. Table V-3 lists likely technologies and the form of energy output for each.
2	Level of Demand. There are two aspects of level of demand. First, what is the absolute level of kinetic or thermal energy required by the end-use? For example, the degrees centigrade required for heating hot water for bathing is much lower than the level required to fire a kiln. Second, what quantity is required of this absolute level? To answer this second aspect, it may be necessary to apply criteria 4, 5, 6 and then come back to arrive at the total level of demand.
3	Spatial Distribution. Energy must be delivered to the site where it is to be used, but the conversion technology may or may not be needed or required at the site. For example, irrigation to farmers' fields might be supplied by individual stand alone systems or by a large centralized pumping irrigation system. The site specific nature of the end-use as described by data from the energy survey will allow for an analysis of various technology options.
4	Seasonal Variations. End-uses often have seasonal fluctuations and demand more energy at one time than at other times of the year, even when they may not be ongoing. Seasonal end-use variations must be matched with the potential seasonal variations in energy output characterizing the technology under consideration. For example, wind in adequate amounts must be available at the site during the time of year when water is needed for irrigation if wind pumping is to be feasible.
5	Daily Variations. Energy must be supplied at the time of day it is needed to perform the work. If the time of day when an adequate amount of energy is being produced is different, then the technology will not be feasible without some type of energy storage system.
6	Duration. If the end-use task must be performed a certain number of hours per day, then the technology must be capable of providing that number at a certain minimum level of output, with or without storage capability. This duration period and minimum level relate back to the total level of demand outlined above.
7	Sensitivity to Interruption/Fluctuation. The length of time that an end-use task can be either reduced or halted must be matched with the variability and reliability of the technology's output. Again, storage systems can help correct a match that is not exact.

TABLE V-3

POTENTIAL LOCAL ENERGY TECHNOLOGIES & STRATEGIES & FORM OF ENERGY OUTPUT

TECHNOLOGY	
1. Energy Conservation Strategies	
a. Energy Storage	Thermal (mechanical, electrical)
b. Stoves (earth & metal) Cookers (pressure)	Thermal
c. Passive solar building design (houses, greenhouses)	Thermal
2. Indirect Renewable Energy Production Strategies	These are indirect in that they must be further converted, except in the case of direct biomass combustion
a. Improved forest management	
b. Tree planting	
c. Non-wood crop planting and harvesting	
3. Direct Renewable Energy Production or or Conversion Technologies	
a. Solar cells	electrical
b. Flat plate solar collectors	heat (water or air)
c. Concentrating solar collectors	heat (liquids or steam)
d. Box and tent collectors	heat (water or air)
e. Solar stirling engines	mechanical, electrical
f. Solar rankling engines	mechanical, electrical
g. Geothermal	heat (steam)
i. Wind-mechanical	mechanical
j. Wind-electrical	electrical
k. Hydro-electrical	electrical
l. Hydro-kinetic	kinetic
m. Hydraulic ram	kinetic
n. Biogas (methane)	Bio Conversions: combustible gas and
o. Methanol	Bio Conversions: liquid fuels
p. Ethanel	Bio Conversions: kinetic, biomass
q. Draft animals	Bio Conversions: kinetic, biomass

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A technology profile which will be needed in the rest of the feasibility decision-making steps should also result from this analysis. Planners will have identified particularly weak data elements on which more data gathering or analysis will be required before a final decision can be made about an energy system's technical feasibility. For example, in cases where wind speed, rates of water flow, or other physical data have never been measured in a village, measurements of this sort may have to be made before a final conclusion can be reached about the site specific feasibility of a particular technology.

1. Economic Feasibility Analysis

At this point, planners may have identified one or more technologies that seem to be technically feasible. Once it is shown that certain technology applications are technically feasible, the next step is to determine their economic feasibility or performance. The following questions need to be answered:

- Will the benefits be superior to the efforts involved in the application of this technology for the person or group of persons who will use the new technology?
- Will the costs and benefits be reasonable from the perspective of private investors, as well as for the society or national economy whose interests are represented by the institutions that will attempt to introduce the new technology?

To properly carry out these analyses, the analyst team must include at least one well trained economist capable of capturing the peculiarities that a particular village might have in relation to the parameters to use in an economic and financial analysis.

To evaluate the desirability of an investment, the expected benefits should be compared to the expected costs. This small task contains a number of difficulties that may appear only as the procedure is implemented; e.g.,

comparison of the investment costs incurred in the first years with the expected benefits in later years. Clearly, the value of money invested today is higher than the same amount of money delivered in the future, even in the absence of price inflation. In other words, future benefits or costs must be discounted if they are to be compared with current benefits and costs. Therefore, to compare a time series of expected benefits with a string of future expected costs, it is necessary to calculate their present value.

There are two methods of calculating the net worth of a project: Net present value and internal rate of return. They both apply to financial and economic analyses. Net present value is simply the present value of the benefits minus the present value of the costs. If the value of the benefits exceeds the value of the costs, then the investment may be worthwhile. Internal rate of return is the discount rate that gives a net present value of zero for the investment by equating the present value of the benefits to the present value of the costs. In the following paragraphs PCI discusses the application of these approaches to the analysis of energy technology options.

In undertaking an economic analysis, it will also be important for analysts to understand and remember that village values may differ from the values the analysts hold; e.g., poorer villagers may make decisions based on risk avoidance in situations where the analysts themselves might make decisions based on potential gains.

a. Comparing and Ranking Investments

An internal rate of return is the proper tool if a group of investments is to be ranked. If budget constraints force a choice between two investments of different size, then the net present value method should be used in a comparason. When two investments produce identical benefits, the procedure is simpler. It is sufficient to select the one with the lower discounted costs.

b. Financial Analysis

In this type of analysis, all of the inputs or labor required are valued at market prices or wage rates prevalent in the area. This also applies to the outputs that result from the investment, even if they are consumed by the private investor rather than being sold in the market. If the project results in a net increment of labor input from the buyer or members of his family, or if alternatively, it provides them with additional free time by releasing them from tasks previously performed, then this labor must be valued at a wage rate reflecting the value that the buyers attach to their labor. As a first approximation, something between 50 to 100 percent of the prevailing wage rate for work should be used.*

When these prices are extrapolated to the future, allowances must be made for expected changes due to price inflation. Usually no changes in relative prices are assumed, but if there are clear indications of such a tendency, it should also be considered in projecting future prices.

It is extremely difficult to decide which discount rate to use in this type of analysis. The internal rate of return method has an important advantage here because it does not require a discount rate. However, a point of reference is still needed for comparison and that is the discount rate of the investor.

A good starting point is the interest rate charged for credit in the area. In rural areas this should be the rate charged for unsubsidized credit. In

* It has been argued that even in conditions of total unemployment, there is a loss of leisure time involved in working and, therefore, a certain opportunity cost. In addition, people might be more willing to perform certain tasks over other tasks, even if they receive the same amount of money. In other words, people might attach different values to their labor according to the task to be performed. The analyst will probably find it difficult to collect quantitative information on this matter, but it is something that should not be overlooked.

practice, this rate is likely to vary widely, even within a given area. World Bank data show that in most countries, the annual real rates charged for commercial agricultural loans are between 20 and 66 percent, the average being at about 32 percent.* Because a financial analysis includes price inflation effects, these real rates should be adjusted upwards. For example, if a 30 percent real discount rate is estimated for the private investor, and a 20 percent annual inflation is expected, the adjusted discounted rate will be 56 percent.**

If credit will be available to the private investor, disbursements should be introduced as benefits and the loan payments as costs. If the rate of interest charged is considerably lower than the discount rate or the internal rate of return, then the availability of credit will enhance the financial feasibility of the investment.

In many cases it will not be possible to obtain reasonably accurate estimates on physical parameters because technologies not previously tried in the area are to be introduced and there is a lack of good quality data or data on economic parameters such as future prices, discount rates, and devaluation of the currency. In these cases, sensitivity analysis will assist in providing a range of answers that incorporate possible outcomes on important variables.

A financial analysis should examine whether the private investor can provide the flow of resources and cash outlays required by the project. If the analysis indicates that this will not be the case, a credit program should be incorporated into a project's implementation package.

---

* Agricultural Credit: Sector Policy Paper, IBRD, Washington, D.C.

** To adjust for inflation use the equation:

$$1 + n = (1 + r)(1 + i)$$

where:

n = nominal or adjusted rate
r = real estate
i = inflation

c. Economic Analysis

This analysis measures expected benefits and costs from the society's perspective. In the presence of barriers to perfect competition (such as taxes, subsidies, price controls, and monopolies) market prices and wage rates do not measure the value of energy resources to society as a whole. Therefore, it is often appropriate to apply "shadow prices" that attempt to measure the returns and costs of a project from the national perspective. The issues covered by shadow pricing usually include traded and untraded goods, exchange rate, labor costs, and discount rates. Traded goods are valued at the price the country would be paid when exporting these goods or what it would pay when importing it. No export or import taxes or subsidies should be included here. Untraded goods should be valued at their market price. If their prices are controlled, an attempt should be made to estimate how they would change if controls were eliminated. Such changes should be considered in a sensitivity analysis.

It is not uncommon for developing countries to arbitrarily fix their exchange rates at levels that overstate the purchasing power of their currencies. In the case of Bolivia, however, this factor should probably be ignored. The current practice in the economic evaluation of projects is to attribute a unit shadow price to foreign exchange or, at most, consider it only in the sensitivity analysis.*

The shadow wage rates measure the cost to an economy of diverting its labor resources away from their current occupation to the new investment. If laborers were totally unemployed, the social cost should be zero. In the rural areas of Bolivia this cost should be set somewhere between zero and the market wage rate, depending on the type of skill, sex and age of the laborers, season, and geographical area. In general, the higher the rate of unemployment, the lower the shadow wage should be. In extrapolating the future economic value of benefit

* As was done in the feasibility study for the Misicuni and San Jacinto multipurpose project.

and costs in an economic analysis for a project, (unlike a financial analysis) the future impact of price inflation should be ignored. Only expected changes in relative prices should be entered in the analysis.

In theory, the economic discount rates should approximate the interest charged for commercial loans in the country, after a downward adjustment using the expected rate of inflation. To reflect the perspective of society as a whole, which uses a larger time horizon than do individuals, and in valuing future benefits at a lower discount rate, the shadow rate should be adjusted downward again. In practice, it is difficult to calculate this rate following the procedure outlined above. The current practice in Bolivia for World Bank or IDB loans is to use 11 percent as the economic discount rate.

In undertaking an economic analysis, it will also be important for analysts to understand and remember that village values may differ from the values the analysts hold, e.g., poorer villages may make decisions based on risk avoidance in situations where the analysts themselves might make decisions based on potential gains.

d. Social Costs and Benefits

A final point to be considered in an economic analysis is social benefits or costs directly related to the project. In the case of energy systems, social costs (such as the provision of extension services or use of communal or public resources) might arise. Social benefits, such as environmental improvements, may also result from a project.

If the introduction of the project requires the provision of extension services or technical assistance, the cost of these activities should be considered as a project cost. Similarly, if common resources, not privately owned, are used, an effort should be made to estimate their economic value to society.

If the project has an environmental impact, such as a reduction in firewood collection that ultimately results in the control of land erosion, its economic benefits should be estimated and included in the analysis.

e. Secondary Effects

A project can impact on other activities not directly related to it. For example, an irrigation scheme for increasing agricultural production in an area can also increase activities that transport goods to and from the area. In practice, the measurement of such secondary effects is a complex task. In comparing alternative investments, these effects are usually ignored on the assumption that the different alternatives generate equivalent amounts of economic benefits and that their inclusion in the analysis would not alter the relative ranking of investments.

f. Sensitivity Analysis

Estimating certain parameters in the economic and financial analysis may involve uncertainty and a lack of accuracy. Rather than seeking a single figure that assesses a project, it will be appropriate to accept the existing constraints in our knowledge and provide a range of values for the economic or financial worth of the project when convenient. The only way to deal directly with uncertainties encountered in project analysis are: Discount rate, price and wages, and length of implementation period. Thus sensitivity analysis can be an important tool for financial as well as economic analysis.

g. Conclusion

Cost-benefits analysis is a valuable mathematical tool for evaluating project interventions comparing alternative investments. It can also be used to determine alternative ways to increase the financial or economic impacts of the

project. Nevertheless, the usefulness of the results will depend heavily on the accuracy of estimates of future project benefits and costs. Analysts should be extremely careful to avoid introducing personal biases in favor of or against the project when evaluating its benefits and costs.

2. Socio-cultural Feasibility Analysis

A socio-cultural feasibility analysis for an energy project in a village or rural area is the fourth step in the screening/matching procedure. The two general questions posed at this step are:

- Does the socio-cultural system of the community manifest features that would be more likely to facilitate a successful project than features that would mitigate against success?
- Would the overall impact of an energy project contribute, on balance, a positive rather than in a negative way to the social and cultural conditions of life in the community?

In the screening phase of the socio-cultural analysis, both of these questions must be answered "yes" or "no". If the answers are no, project planning should be halted or drastically modified. If the answers are yes, then in the matching component of the socio-cultural analysis procedure should be used to address identifying means of coping with mitigating features of a community social system and for identifying methods of minimizing the foreseeable negati impacts of a project.

The survey results and other data (from other surveys, enthographic studies and project reports) will provide bases for evaluating a community's position with regard to the critical parameters discussed below. In undertaking a socio-cultural feasibility assessment, analysts and planners should first utilize the survey and other data to describe the community situation in terms of the parameters outlined. Next, they will need to weigh the factors involve against each other, i.e., examine supportive against obstructive socio-cultura

features and positive against negative impacts. This type of complex weighing process should be undertaken once the findings of a needs assessment are known and when the technical and economic analyses are underway. Analysts can answer the two general questions in the socio-cultural feasibility assessment only by consideration of the socio-cultural aspects of a community.

a. Assumptions

Planners should recognize the number of assumptions underlying the formulation of PCI's analytic approach to socio-cultural analysis. All of the assumptions derive from a view that "feasibility" must be assessed in a holistic way, i.e., context cannot be ignored in attempting to evaluate feasibility and impacts.

The first set of assumptions involves the socio-cultural factors involved in managing a proposed project: PCI's approach assumed that all aspects of the project, at the local level, will be carried out in the appropriate language(s). To obtain accurate survey data and reasonable responses to project actions participants must be able to respond in their native language. It is further assumed that project field personnel will possess the personal characteristics (e.g., respectful behavior with the villagers) and training (e.g., in fieldwork techniques, communication, etc.) to carry out their roles in an effective and socially non-disruptive fashion. It is further assumed that all project personnel--from planners to field operators--are committed to working with the local people. No matter what the nature of the local socio-cultural system, the feasibility of a successful project will be significantly lower if these assumptions about the socio-cultural interaction of interviewers and local population are not met.

The second set of assumptions concerns the policy foundations of the project. In line with the current general policy positions of USAID and other development agencies, it is assumed that projects should (a) address basic human needs, (b) help the poorer segments of populations and lead toward greater, rather than lesser, social and economic equity, and (c) work toward decreasing

rather than increasing social and economic dependences at all societal levels. This set of assumptions has significant implications for the impact component of the feasibility analysis.

The nature of rural and peasant societies (especially those in Latin America) constitutes the third set of assumptions. These assumptions are based on anthropological and sociological research. It is assumed that the socio-cultural system present at any one moment in a rural community represents the current phase of an active and on-going process of adaptation, by that community and its members, to environmental, social and economic conditions. Negative views of peasant society (e.g., that it is backward, traditionalist, apathetic, comprised of historical leftovers, etc.) inhibit an understanding how changes can occur in rural, developing areas. The adaptative model subsumed in our assumption above provides a means for understanding the processes of change in peasant communities: Change comes about through systemic interactions between a group of people and the conditions (ecological and societal surrounding their existence. Clearly energy sources constitute one of those kinds of conditions.

One derivative of our first assumption about the nature of society is that while patterns of socio-cultural adaptation can be identified as each communi interacts with and adapts to specific local ecological, social and historical conditions, each community can also be viewed as uniquely linking such factor This assumption has two implications for energy projects in Bolivia: (1) a socio-cultural feasibility analysis must be based on site-specific informatic as is provided for in the survey methodology, and (2) different communities, even in the same region, may vary significantly in terms of their pertinent socio-cultural features and, hence, in their potential to accept, integrate a benefit from a project.

b. The Screening Model

The last point above suggests a "threshold" model for analysts and planners to use in considering the economic and socio-cultural feasibility of intervening in a specific locale with a specific sort of project. This model envisions a continuum of community types. Where a community falls along this continuum at any moment in time is a function of the particular mix of socio-cultural characteristics it exhibits, in terms of the parameters to be discussed below. Examination of this continuum of community types in light of a particular kind of project--technology level and type, organizational requirements, economics, etc.--enables planners and analysts to divide the continuum into three sections, e.g., "pre-threshold", "threshold", and "post-threshold".

The pre-threshold communities would be those whose socio-cultural and economic characteristics do not match critical project variables and/or have inadequate resources to initiate or sustain required project costs or activities. Threshold communities are those whose socio-cultural and economic characteristics match, within some range of tolerance, project variables and requirements. Post-threshold communities are those which might find the project acceptable and which could initiate and sustain project costs and activities. However, one might expect that post-threshold communities are already functioning with a set of adaptations that are in some sense beyond the level optimally addressed by the potential project. For example, in a fully grid-electrified community it might be less than appropriate to consider installing a small-scale hydroelectric generator.

During the screening/matching procedure, analysts and planners should apply the threshold model as one step in their feasibility judgment after describing the characteristics of a community.

c. Critical Socio-cultural Parameters

The parameters listed below are not the only socio-cultural parameters to be considered in a feasibility analysis, but are the most important ones for assessing the feasibility of energy projects in rural Bolivia.

- Degree and type of organizational capacity. This facet of the socio-cultural system of a community can be examined in several ways. Many rural Bolivian communities have one or more existing organizations--clubs, cooperatives, school associations. Such organizations can provide information on the general capacity for structured, coordinated activity in the village. Moreover, one or more of them may offer a pre-existing channel for project introduction.

  In addition to special interest organizations, Bolivian rural communities have at least a nominal political organization for the entire community. The level of integration and operation of the formal political organization should be examined in terms of its capacity to organize the population for collective activity and in terms of the internal and external communication ability of its leadership.

  The survey includes many questions on organizations and their effectiveness. The responses to these should receive careful analysis since organizational capacity may be the single most important socio-cultural variable for assessing the feasibility of energy projects in the rural Bolivian context.

- Level of education and of intellectual openness. This parameter is less significant than organizational capacity for screening communities, but it is crucial in terms of matching project inputs with the profile of a community. It is also likely to be highly correlated with the next parameter, motivation.

- Level of motivation to fulfill perceived needs. Assessing and describing the level of motivation that characterizes a community is very difficult. To some extent motivational level can be extrapolated from responses to questions about needs and plans, and from a history of change efforts. The field interviewer can also assess motivation from the manner in which people interact with him, the questions they ask, and the general tone of their response to the survey. But even with such information at hand, additional efforts to assess motivation should be included in the project preparation stage.

- Type and effect of social diversity. Four types of social diversity are distinguishable in the rural Bolivian context. They are based on: (1) Differences in religion (Protestant versus Catholic); (2) ethnic differences; (3) differences in wealth (and social status and power) which may be recent and rather strictly economically determined or which may be based on past socio-economic relations such as those of hacendado and peons; and, (4) differences in regional background associated with lack of kinship and similar social bonds in newly colonized communities. Obviously, it is possible to find many communities in which two or more of these types of social diversity exist and cross-cut each other.

  Social diversity needs to be a factor which mitigates against the feasibility of a successful project, although sometimes it will be. However, it will always be an important factor to consider in matching project components with community characteristics.

  In small, rural communities, the existence of differentiated groups often means the existence of rather closed sub-populations whose members manifest distinctive levels of education, motivation and organizational capacity. Communication between groups and the ability to organize projects on a community-wide scale may be limited. Under the worst of circumstances, diversity may be a cause of active conflict in a community. In these cases, the introduction of projects may exacerbate conflict and make success doubtful. On the other hand, diversity sometimes offers the opportunity to work with a sub-population in a way that leads to wider benefits and future possibilities for other groups.

- In carrying out a socio-cultural feasibility assessment, analysts should pay attention to the sources of diversity in a community, the relative proportions of the population in different sub-groups, and the level of communication or conflict among groups. Information from the survey will indicate whether important social diversity exists. If a notably diverse community is being considered for a project, additional study of the effects of diversity may be called for.

- Cultural preferences and taboos. Cultural preferences and taboos that may facilitate or obstruct a project can take myriad forms. For example, food cooked in a solar cooker may not meet taste and texture preferences, or culturally defined views of hygiene may not permit the handling of fecal matter necessary for a biogas generator. It is essentially impossible to identify such cultural factors by survey means, When possible, planners might turn to ethnographic literature for help on this parameter. Otherwise, secondary phases of project preparation should include careful investigation, with the local population, of their reactions to specific features of a proposed technology or end-use. PCI realizes that cultural taboos are not likely

to constitute a significant problem in rural Bolivia. However, preferences may cause serious difficulties.

- Daily, seasonal and annual work and activity patterns. The survey will provide extensive information on activity schedules and work calendars. Analysts need to consider the degree of fit between these and the activity patterns required by the project technology. This analysis should also assess the degree of behavioral change required in a community by specific technologies. The greater the changes required, the more difficult it may be to integrate a technology into a community.

- Sexual and age division of labor, and task/prestige hierarchies. Again, the survey will provide data on division of labor by age and sex, and the analysts should consider the match between existing patterns and the requirements of the project, particularly with respect to the tasks of women and the implications of new technologies on the patterns of their lives. The prestige associated with different kinds of work will not be clearly revealed in the survey and should be explored at a later stage. In particular, the planner should be aware of attitudes among some members of a community that physical/manual labor is beneath their station in life.

- Marketing habits, existing constraints to marketing and market demand. In projects aimed at increasing production of marketable commodities, the survey data on existing marketing practices should be examined for fit with proposed changes. Prior market knowledge may be restricted to local fairs or weekly markets and may not be appropriate for larger scale operations. Similarly, constraints to marketing, such as poor roads, may be an intervening variable in some communities.

d. Critical Impact Factors

Not all impacts that may result from changes in energy-use patterns and energy technologies can be foreseen. However, planners should endeavor to consider some of the more significant potential socio-cultural impacts in answering the second screening question and in the course of matching technologies to local conditions.

Procedurally, this effort is probably most effectively carried out with a cross-impact matrix. In the impact matrix, Table V-4, the critical areas

TABLE V-4: CROSS-IMPACT MATRIX FOR SOCIO-CULTURAL IMPACTS OF ENERGY PROJECTS

Variables of Energy Project	1. Employment Level	2. Division of Labor	3. In & Out Migration	4. Wealth Differentiation	5. Female Dependency	6. Regional Dependency	7. Health	8. Nutrition	9. Social Conflict	10. Other
End-Use Changes 1.										
2.										
3.										
4.										
etc.										
Technology Requirements 1.										
2.										
etc.										
Information & Training 1.										
2.										
etc.										
Activity Patterns 1.										
2.										
etc.										

Key: Reading across form each energy variable, indicate for each socio-cultural variable a positive (+), neutral (0), or negative (-) quality of impact.

of impact are noted across the top. For a specific proposed project, analysts or planners would fill in the technology variables and end-uses down the side and then complete the matrix by assessing the positive, neutral or negative impacts for each cell. After completing the matrix, a planner should form an overall judgment about impact and identify the key positive and negative effects that need to be addressed in the matching process.

e. Notes on Impact Matrix

To determine the nature of an impact (positive, neutral or negative). reference should be made to the assumptions discussed above regarding regional and national policy goals and to the overall socio-cultural and economic profile of the community. While some general guidelines can be formulated for examining the quality of impacts, specific situations may have characteristics that call for modifications in these guidelines, i.e., different judgments concerning the quality and nature of a specific impact.

Listed below are a series of rough guidelines that may assist planners in reaching impact judgments using the matrix:

Item 1. Increased employment would be positive and vice versa.

Item 2. Impact on the division of labor is most important if it means an increase in the share of work done by a particular segment of the population (e.g., women and children) or if it changes the status aspects of tasks so as to affect differentiation.

Item 3. In or out migration might be positive or negative depending on a range of internal and external variables.

Item 4. Increases in wealth differentiation would be negative.

Item 5. Greater dependency of women on men for livelihood and security would be negative.

Item 6. Increased dependency on outside sources or wider market, especially for food or fuel would be negative.

Item 7. Indirect and direct impacts on health should be examined.

Item 8. Same as 7.

Item 10. This is left open for other factors specific to a site.

3. Environmental Feasibility Analysis

When new energy resources are utilized or a new way of delivering energy is brought to a village, there will almost always be some new interactions with the environment. Changes in a community's patterns of using local energy resources will change their impacts; new technologies may also affect human and animal behavior. These effects may be positive, neutral, negative or mixed. In all cases, some real attempt should be made to determine how the energy intervention will affect the environmental situation in the village or region.

Environmental impacts can be divided into two special types:

- Those impacts that may occur at the physical site of the technology installation; and
- Those impacts that may occur in the general region of the village or area.

Energy interventions should be checked against both types of environmental impact. The only way to determine what potential impact the intervention will have is to identify and examine the implications of any changes that may occur due to an energy project intervention. The following matrix (Figure V-1) provides a conceptual way of organizing the appropriate questions and ensuring that no major area is omitted. If planners use this matrix, a comprehensive review of the interaction between (1) change brought about by the technology and (2) connections between potential areas of environmental impact will emerge. The quality of accurateness of the review and the validity of the implications drawn will depend heavily on the knowledge and background of the analyst.

Across the top of the matrix are the physical environmental categories in which impact is likely to occur. Down the side of the matrix, planners should list all the identifiable changes in physical surroundings and in human and animal behavior that a technology is likely to bring about. The implications of various interactions can then be drawn.

Technology Caused Change Element	Impact Areas					
	Animal, Aquatic Life	Water Quality	Water Availability	Vegetation	Air Quality	Soil Quantity
1.						
2.						
3.						
etc.						

FIGURE V-1: ENVIRONMENTAL IMPACT MATRIX

For example, if the energy project under consideration is a wind water pumping system that is to be installed on a central village water supply (where previously people had carried domestic water a distance of 4 km), the change elements might be:

1. A 125 meter well drilled at a central spot in the village;
2. A windmill installed over the well;

3. A cement storage holding tank next to the well;

4. 100 people coming daily to the well to meet the needs of 550 people;

5. An average of 250 domestic animals per day coming to the well for water; and

6. 100 people no longer going 4 km every other day with donkeys to get water.

Given expert knowledge, the site specific information available on the village from the survey, and a technical profile of the whole system, it will be possible to draw some conclusions about the potential environmental impact of each of these changes on the immediate and on the broader physical area.

Once these implications are identified, it should be possible to compare the probable environmental impact of an energy project with the traditional way of carrying out a specific task or type of work, and with any other technological or energy intervention strategies that are being considered.

If this type of analysis suggests that serious negative environmental impacts will occur, analysts should return to earlier stages in the overall feasibility analysis to recalculate the costs, benefits and impacts of alternative energy project interventions.