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EVALUATION PLANNING FOR THE TANGAYE SOLAR ENERGY DEMONSTRATION

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SECTION ONE

CONSULTANCY SCOPE AND OBJECTIVES

A. BACKGROUND ON THE UPPER VOLTA SOLAR ENERGY DEMONSTRATION

In December 1975, the Agency for International Development approved a centrally funded effort designed to improve LDC capability for assessing and managing energy resources (Project Number 931-0234). This project, which includes a number of demonstration efforts, is being managed by AID's Office of Science and Technology (DS/OST). During 1976, DS/OST finalized an agreement with NASA's Lewis Research Center, USAID/Upper Volta and the Government of Upper Volta that was to result in a demonstration of a solar powered water pump and grain mill in Tangaye, Upper Volta.

Subsequently, USAID/Upper Volta decided to supplement the funding for the Tangaye experiment (under AIP, Project Number Number 686-0273). The Mission's interest in the project extends beyond the demonstration itself to an understanding of the impact of the mill and pump on village life, and specifically on the use of productive time in the village.

B. THE PCI CONSULTANCY

As part of a three-year engagement with AID's Office of Rural Development and Development Administration (DS/RAD), PCI is undertaking consultancies to assist USAIDs, LDCs and AID/W 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 receiving particular attention under the contract.

During the spring of 1978, Ms. Alice Morton of DS/RD visited Upper Volta and discussed with the Mission its evaluation planning activities for several projects. As a result of that visit, a cable was forwarded from the Mission requesting PCI assistance under the DS/RAD project. In the field consultancy, PCI was to provide assistance to the Mission on evaluation planning for the solar energy demonstration and one other project.* Specifically the cable requested that PCI:

> assist in developing an evaluation plan for the DSB-funded solar energy project for Tangaye for which the Mission has authority to obligate additional AIP funding. In connection with this effort PCI is to consult DS/OST and Ms. Grace Hemmings, anthropologist, whose first draft of a social soundness analysis for the project is available in Upper Volta.**

In late June 1978, PCI consultants Dr. George Burrill and Dr. Roger Popper undertook a three-week visit to Upper Volta to address the scope of work identified in the Mission's cable. Prior to their departure, the team consulted with Mr. William Roseborough and Mr. Jerome Bosken of AID/W. While on site they consulted with the Mission personnel, particularly Mr. Tom Luche and Ms. Julie Stagliano. They also met with Ms. Hemmings and, in Tangaye, with Ms. Hemmings' assistant, the village chief and various residents of Tangaye. A draft of the consultancy report on evaluation planning for the solar energy demonstration was left with the Mission prior to team departure.

Unfortunately, Ms. Hemmings' draft report, referenced in the cable, was not available at the Mission during the team visit. Thus a detailed review of her methodology and results of her work was not possible at the time the draft report was prepared. PCI delayed preparation of the final reports on both USAID/UV consultancies, beyond the normal four-week period, based on an expectation that Ms.Hemmings' draft would soon be available. The draft has not yet been forwarded to PCI. This final

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*/ Rural Water Supply Project (686-0228).

**/ Paraphrase of cable OUAGADOUGOU 2249, May 1978.

report for the Mission, DS/OST and DS/RAD attempts to compensate for the absence of Ms. Hemmings' material by pointing out types of data that need to be collected. Hopefully the report will assist AID by identifying what, ideally, will be covered by the data gathering and analysis plans prepared by Ms. Hemmings and by NASA's Lewis Research Center.

C. MAJOR CONCLUSIONS AND RECOMMENDATIONS

The Solar Energy Demonstration in Tangaye is an inter-agency project. It presently lacks design clarity, and communication among the parties to the project is less than optimal. In order for the project to be successful, the co-participants need to reach a better consensus concerning the reasons for undertaking the project, and then work together to achieve their shared objectives. An appropriate evaluation plan for the effort can only be finalized after these initial steps are taken.

Based on this consultancy effort, which attempted to clarify the project design and define an appropriate evaluative approach, PCI recommends that:

1. A meeting to clarify the project design be held that involves all parties to the project.
2. In conjunction with the joint design clarification effort, the data gathering plans of NASA LeRC and Ms. Grace Hemmings, contract anthropologist, be reviewed to determine:
   - what data will be collected?
   - what additional required data will not be collected if the plans are used without alteration?
   - whether and how the additional data that are needed can be secured by either NASA or Ms. Hemmings (given a change in the terms of reference and budget for either or both of these data collection efforts).
3. AID, NASA, and the GUV, along with Ms. Hemmings, address the question: when is data needed for decisionmaking? From this set of answers a schedule for the collection and analysis of data, i.e., an evaluation schedule, should be finalized by the project co-participants.

Information that should facilitate AID efforts to carry out these recommendations is provided throughout this consultancy report.

SECTION TWO

DESIGN CLARIFICATION

As project documentation and interviews in AID/W had suggested, the PCI team found that three organizational units had participated in the design and funding of the Solar Energy Demonstration project for Tangaye. Further, PCI's review of the design documents generated by DS/OST, USAID/UV and NASA LeRC, suggested that while all three organizations agreed on a basic definition of the project's components and intended outcomes, each organization emphasized somewhat different aspects of the effort. The three views of the project identified by the PCI team are summarized in Figure 2.1.

In Upper Volta, PCI was apprised of the fact that concern had already been expressed over the need to clarify the relationship of these various project perspectives. The quality of the project, and the feasibility of project evaluation, depends on the development of a tighter, better agreed-upon statement of intent.

When multiple units are involved in the design and implementation of a project, it is not uncommon to find that each unit views that project in a slightly different way. This phenomenon does not necessarily present a problem. However, when the various groups involved in a project are unaware of the interests of each participating group, and/or assume that there are no major differences in the perception of the project, management difficulties can arise. In this particular project there is both a research and service focus. To some degree the evaluation requirements posed by these different perspectives also differ. On the one hand, an evaluation plan must be concerned with the difference the project makes in Tangaye. However, from a research perspective, the transferability of the project's approach for providing village energy is the main evaluative concern.

DS/OST FOCUS

NARRATIVE SUMMARY

GOAL: Volume of efficient, cost-effective energy in rural areas increased (all LDCs)

PURPOSE: LDC plans and USAID/LDC rural energy projects reflect knowledge of energy options: their appropriateness in specific situations, their costs, their impact on rural food systems and other benefits

OUTPUTS:
1. Efficient and cost-effective applications of energy to the food systems of rural LDC areas demonstrated
2. Findings of energy and the food system studies/experiments disseminated

INPUTS:
1.1 Energy needs studies (4)
1.2 Field tests of energy interventions (3-4)
2.1 Reports

USAID/UPPER VOLTA FOCUS

NARRATIVE SUMMARY

GOAL: Quality of life (diet, income, housing, etc.) improved for rural residents of Tangaye, Upper Volta

PURPOSE: Tangaye women make productive use of time (released from pre-demonstration tasks)

OUTPUTS:
1. Volume of efficient, cost-effective energy in rural Upper Volta increased, i.e., solar powered grain mill and water pump operate effectively and efficiently
2. Evaluative report on the Upper Volta solar pump/mill intervention

INPUTS:
1.1 Photovoltaic cells, pump and other equipment
1.2 T.A. in installation, operation and maintenance
2.1 Data collection on effects and costs of demonstration

"A roughly parallel view of the project"

NASA FOCUS

NARRATIVE SUMMARY

GOAL: Quality of life improved in rural areas of LDCs

PURPOSE: Appropriateness, costs and benefits of photovoltaic cells as a source of rural energy in West Africa determined.

OUTPUTS:
1. Solar powered grain mill and water pump operate effectively and efficiently
2. Evaluative report on the Upper Volta solar pump intervention

INPUTS:
1.1 Photovoltaic cells, pump and other equipment
1.2 T.A. in installation, operation and maintenance
2.1 Data collection on effects and costs of demonstration

FIGURE 2.1: THREE PROJECT FOCUSES

As recommended in AID's Project Evaluation Guidelines, PCI normally tries to hold a formal design clarificiation session with all parties to a project prior to formulating an evaluation plan. This process serves to define a common frame of reference that facilitates not only evaluation, but the planning and implementation of a project as well.

During the Upper Volta consultancy visit the only key party on-site was USAID/Upper Volta. Thus it was not possible to conduct a formal (joint) design clarification effort with all of the parties involved. Comments made in Washington and Upper Volta by individuals involved in the project suggest that there are a number of outstanding issues that need to be addressed:

- The project does not appear to address a real problem. Tangaye villagers currently have water and milling services. The project will not change that situation substantially. It will:
    - Provide, at a higher cost, services that already exist nearby.
    - Probably raise some expectations--an important point to consider when one recognizes that after a year the project effort stops.
- The project may:
    - Provide an opportunity for villagers to acquire management skills--but this is not an explicit objective.
    - Motivate villagers to raise the funds to replace the demonstration with a pump/mill they can afford, e.g., one that uses gas.
    - Affect the traditional village power structure in ways they have not anticipated/examined.
    - Attract livestock herders together with their herds to the village.

- Be a 'white elephant' structure in the area once the demonstration period is over.
- Make a publicity impression concerning United States solar capabilities.

Some of these concerns, which are essentially questions about why the project is being undertaken, are strongly felt.

The project design, as defined by the time of this consultancy, suggests that two parties will be involved in the project management: NASA and USAID/UV. Success cannot be realized unless each of these groups performs its project management tasks well. Thus, it would seem that attention must be paid to communication and to a good interactive decision-making process involving NASA, USAID/UV, and AID/DS/OST as well.

The design clarification process raises several important related issues. First, if the USAID and AID/W purposes are not adequately achieved, it will put NASA's objectives in jeopardy as well. For the USAID project goal to be reached, both the USAID purpose and output level results must be positive. If the USAID purpose is not achieved then achievement of purpose in the larger DS/OST project is also affected. DS/OST's project success relies on the purpose level achievement in all of the country sub-projects.

It is also important to note that, if the budgets supporting the project are matched to the NASA and USAID/UV LogFrames, the vast majority of the funds are going to support the NASA focus--the Purpose statement in the NASA LogFrame. USAID/UV's focus may well be underfunded.*

*/ Ms. Grace Hemmings reported to PCI that her experience with the village baseline study for USAID/UV suggested that more people may be needed if adequate data are to be gathered in the village during the project. These additional people have not been budgeted for at this time. Final data analysis may also be more expensive than now envisioned. Ms. Hemmings' own statements on this issue are not inconsistent with NASA's trip report comments concerning potential gaps in the socio-economic data base (NASA LeRC Project Plan, March 27, 1978, Attachment F, page 9).

The DS/OST project focus, at the Purpose level, is research. As such, it will be successful if the research questions are answered. Thus, even if the answers are negative as to the potential of solar energy for rural development projects, the project should be seen as a success. The possibility that the results could be negative (on the potential for photovoltaics or the socio/economic impact of introducing labor saving devices) must be allowed or the validity of the results could be seriously questioned.

As Exhibit B indicates, NASA's LogFrame breaks down at the Goal level. In a Logical Framework process it is necessary to achieve success at each level in order to go from lower to higher levels in the Narrative Summary column. In the NASA LogFrame it is not necessary for the project to achieve success at the Purpose level in order to reach the Goal. Whenever this occurs in the logic it usually means that the stated goal is incorrect and that the real goal has not been identified. This may well be the case here.

A more logical goal statement might be: Potential markets will have been identified for United States-produced photovoltaic systems. A statement by Mr. Robert Nooter, on October 28, 1977, before the U.S. House Committee on International Relations, indicates that such a goal is, in fact, an AID concern: "By proving the technologies in field demonstrations in developing countries we hope to demonstrate their market demands". This objective may, however, raise some issues relating to the Agency's mandate, i.e., it might be seen as an appropriate private industry objective.

The need for review of the project's objectives, by the key participants, perhaps using Figure 2.1 as a basis for that review, remains. Since it was not possible to hold a formal design clarification session in Upper Volta with all of the co-participants, PCI's team focused on

identifying the type of evaluation information that might be needed to assess performance against each of the design perspectives identified in Figure 2.1.* While less than fully satisfactory, this approach did result in the definition of a number of evaluation questions and measurement approaches that appear to be central to the project.

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*/ Exhibits A, B and C of this section provide indicators and assumptions associated with each of these perspectives. Exhibit A is reprinted from DS/OST's Project Paper. It provides both the Logical Framework, and a narrative description of the performance measures for this project on Studies of Energy Needs in the Food System (Project Number 931-0234). Exhibit B presents a Logical Framework for the project from the NASA perspective. PCI's team created this Logical Framework based on a review of a 3/28/78 document produced by the Lewis Research Center entitled "Solar Cell Power System Demonstration for Upper Volta". Exhibit C presents a draft Logical Framework prepared by PCI to characterize the USAID/Upper Volta perspective. This third version of the project was developed based on conversations and on the AID Project Paper prepared by USAID/UV which specifies objectives, but does not provide a Logical Framework.

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EXHIBIT A

PROJECT DESIGN SUMMARY - DS/OST PERSPECTIVE

LOGICAL FRAMEWORK

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes: To determine ways which will reduce energy constraints in the economic growth or ILC's. Specifically, to determine ways to minimize the energy constraints to increased food production in the LDC's.	Measures of Goal Achievement: 1. Increased number of countries formulating energy plans with greater focus on rural energy needs. 2. Increased availabilith of energy in rural areas. 3. Wider use of small-scale renewable sources of energy.	1. Review of reports on national energy planning. 2. Review of literature concerning alternative energy use and programs. 3. Monitoring of USAID interest in alternative energy sources and projects incorporating such sources.	Assumptions for achieving goal targets: 1. Possibility of more efficient energy use in food system. 2. Increased food production will require more energy in food system 3. LDC's desire to increase food production. 4. Acceptable alternative energy sources exist and will be used.
Project Purpose: 1. To identify steps to more efficient energy production and use in the food system. 2. To indicate the most promising approaches to providing suitable energy increments to the rural areas.	Conditions that will indicate purpose has been achieved: End of project status. 1. Increased awareness of LDC and AID personnel of ways to increase food production through more efficient use of energy. 2. Increased awareness of ways to increase energy supplies for food system and rural areas.	1. AID provision of technical assistance on rural energy matters. 2. Requests for information on alternative energy systems for rural use. 3. Distribution of final reports to USAID mission's and development organizations.	Assumptions for achieving purpose: 1. Data analysis will uncover energy use by various income groups and benefits of use. 2. Planners will apply the information on alternative energy systems to their specific problems.
Outputs: 1. Description of the key energy usage in food system. 2. Determination of energy sources, costs and value of use. 3. Analysis of energy use and value for various technologies and processes in food system. 4. Identification of organizational factors that affect energy use. 5. Identification of promising application of renewable energy.	Magnitude of Outputs: 1. Studies of the energy needs in the food systems of four countries. 2. Three or more field studies of the effects of specific energy interventions. 3. Summary report.	1. Final reports. 2. Progress reports. 3. Continual monitoring of the conduct of the individual sutdy efforts.	Assumptions for achieving outputs: 1. Know socioeconomic factors of countries in order to identify their impact on energy use. 2. Know physical factors (water, wind, sun) so that can evaluate alternative energy scheme. 3. Operating and cost data available for range of energy-rising technologies in the food system.
Inputs: 1. Analysis of national energy data. 2. Collection of field data on energy use in food system. 3. Appraisal of alternative energy possibilities. 4. Construction and utilization of selected alternative energy system.	Implementation Target (Type and Quantity) 1. 4 country studies $800,000. 2. 3 specific field studies $200,000. 3. Summary report $100,000. (4. Assistance of Peace Corps -) AID Total $1100,000.	1. Project records 2. Peace Corps status reports.	Assumptions for providing inputs: 1. Cooperation of host countries in providing access to data and their assistance in data collection 2. Participation of Peace Corps in field study in Nepal 3. Existence of proven alternative energy sources and technologies.

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EXHIBIT B

PROJECT DESIGN SUMMARY - NASA PERSPECTIVE

LOGICAL FRAMEWORK

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
A-1 Goal To improve the quality of life and productivity for small farmers in rural areas of Upper Volta	A-2 Object Verifiable Indicators 1. Improved diet 2. Better housing 3. More leisure time for education, child care or economic activity 4. Increased food production 5. Increased cottage industry	A-3 Means of Verification 1. Government of Upper Volta health statistics. 2. Monitoring of HCG programs and donor country development reports. 3. Upper Volta food production statistics	A-4
B-1 Purpose Some questions answered about operation and appropriateness of photovoltaic cells as an energy source for rural poor at the village level in Upper Volta	B-2 Conditions that Indicate Purpose 1. Complete physical data on solar power input/ electrical output of system. 2. Complete physical and cost data on perfomance of cells,batteries, pump, mill, etc., as to reliability, breakdown, repair, in a village setting. 3. Appropriateness of this system resulting from cost analysis and operation experience. 4. Optimal design modifications for improving cost and social impact for next possible solar power photovoltaic system demonstration.		C-4 Assumptions for achieving output to purpose link. 1. That answers to all key questions at purpose level in the AID focus of project are found to be positive for improving quality of life and productivity. 2. More labor saving and energy efficient technology is made available to the rural poor at affordable prices or with subsidy.
C-1 Outputs 1. System designed, procured, checked-out, and develiverd to site. 2. Site preparation technically supervised. 3. System installed and checked-out physical performance and repaired or adjusted when needed. 5. Data compilation completed. 6. Status reports completed 7. Final report completed.	C-2 Objectively Verifiable Indicators Clearly stated in NASA's project plan dated March 27, 1978 under 2.2, pages 6-11, except for the specifics of the final report.	C-3 AID/UV monitoring	C-4 Assumptions for achieving output to purpose link 1. AID/W provides project monitoring, and socio-economic impact study data. 2. ORD and ISRD provide support services as planned. 3. Village does not request removal of the system before end of project period.
D-1 Inputs 1. 1.2kw (peak) solar cell power system with grain mill, water pump, and motors, designed and supplied to site. 2. Technical supervision of system installations and system maintenance 3. Instruction of AID/UV and ISRD on how to use the system and do simple maintenance. 4. Analyze data and final report.	D-2 Objectively Verifiable Indicators (Should be taken from management and budget information now in preparation).	D-3 Means of Verfication 1. Project records 2. Status reports and final report 3. AID/UV monitoring reports	D-4 Assumptions for achieving input to output link.

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EXHIBIT C

PROJECT DESIGN SUMMARY - USAID/UV PERSPECTIVE

LOGICAL FRAMEWORK

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
A-1 Goal To improve the qualtiy of life and productivity for small farmers in rural areas of Upper Volta.	A-2 Object Verifiable Indicators 1. Improved diet. 2. Better housing 3. More leisure time or time for education, child care or economic activity. 4. Increased food production. 5. Increased cottage industry	A-3 Means of Verification 1. Government of Upper Volta health statistics 2. Monitoring of HCG programs and donor country development reports. 3. Upper Volta food production statistics	
B-1 Purpose Some questions answered rigorously on the social and economic impact of introducing labor savings devices in a small rural village of Upper Volta.	B-2 Conditions that Indicate ... 1. Quantifiable changes in behavior around food preparations and water procurement are known. 2. Quantifiable changes in resource use around food preparation and water procurement, including consumption patterns are known. 3. Quantifiable changes in time usage relating to food preparation and water procurement, and what new uses of time are known. 4. Economic characteristics of complete system operation are known. 5. Managerial capability of village in operating village managed labor saving devices is known. 6. Distribution of benefits resulting from operation of system is known.	B-3 1. Final report on social and economic impact. 2. Evaluation to be carried out from TA/OST as part of larger energy needs in the food system project.	B-4 1. More labor saving and energy efficient technology is made available to the rural poor at affordable prices or with subsidy. 2. At purpose level all key questions were found to have positibe answers for improving quality of life and of productivity.
C-1 Outputs 1. Baseline study of Tangaye village completed 2. Site prepared 3. Village people understand use of the system, its upkeep and the management plan. 4. Data collected and analyzed for socio economic study.	C-2 Object Verifiable Indicators 1. Baseline study with data describing village of Tangaye: economy, geography, ethnic composition, demography, behavior around food preparation and water procurement, milling facilities and with management recommendations for solar powered system and labor saving devices. 2. Building and enclosure constructed for system. Well sanitized and capped. 3. No down time on system due to management problems. Village feels comfortable with management organization. 4. Standards for ricor should meet those set in Grace Hemmings baseline study. Recommendations in last sections of that study should be followed as to data collection.	C-3 1. AID/UV monitoring reports and project records. 2. NSA monthly and final reports. 3. TA OST evaluation.	C-4 Assumptions for Achieving Otuput to Purpose Link. 1. Energy supply system and pump and mill must work during whole study period of one year at least 95% of the time. 2. Village does notbehavior-ally reject or request removal of the system. 3. NASA's performance is of adequate quality that project results can be generalized to answer development questions related to photovoltaics.
D-1 Inputs 1. Project monitoring by AID/UV project manager. 2. Two village residents of Tangaye do data collection. 3. Energy, milling, pumping. 4. ORD and ISRD support services. 5. Anthropologist carries out baseline study and final socio/economic study.	D-2 (Should be taken from management and budget information now in preparation)	D-3 1. Project records 2. Monitoring reports.	D-4

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SECTION THREE

MEASURING THE EFFECTS OF THE SOLAR ENERGY DEMONSTRATION

At the time of the PCI consultancy, little had been developed by way of an evaluation plan for the project. Two references to evaluative assessments of the demonstration were located:

1. DS/OST's Project Paper identified three scheduled evaluations. One, involving Upper Volta, was to take place after the country studies were underway, i.e., after the hardware was installed. This review was to be primarily a status report. The second evaluation was to occur half-way through the project when one or more final country reports were completed. The final evaluation identified in this document was scheduled to follow completion of the last country report.

2. The NASA Lewis Research Center's (LeRC's) Project Plan committed that organization to a "final report covering performance and cost analyses and evaluation." The project plan did not, however, specify the questions this report would address or the specific data that NASA LeRC would collect. (At several points the NASA plan makes reference to the data that is being collected by anthropologist, Ms. Grace Hemmings, and her assistant in Tangaye.)

During the consultancy visit, steps were undertaken to define potential evaluation questions from the USAID/UV perspective, and to reconcile the implied data collection and analysis requirements with the DS/OST and NASA perspectives on the project.

A. THE NEEDS FOR EVALUATIVE INFORMATION

Evaluation is not an end in itself. We evaluate to support the decisionmaking process. In the Upper Volta Solar Energy Demonstration project

there are a number of decisions with which the various parties to the project are concerned. USAID/UV, DS/OST, NASA LeRc and the GUV all share a concern for the basic operation of the demonstration system, and the validity of key assumptions concerning the project. On a daily and weekly basis these parties need to know that the system is operating as intended. Decisions concerning basic operations are short-term decisions: repairs to be made, additional training to be provided, etc. Information for the day-to-day decisionmaking process must be supplied periodically. This type of information falls within the range of general project monitoring requirements.

All of the parties to the project, including the Tangaye villagers, also need other types of information to support their decisions. Thus, for example:

- Villagers need to know (share information about) what new uses they make of the time that has been freed as a result of the pump and mill in order to:

    a) define the best uses of their time, and

    b) stimulate further use of the mill.

- USAID/UV and the GUV need to know whether the demonstration leads to behavioral change in Tangaye that increases either productivity or quality of life (health, etc.), or both, in order to:

    a) make decisions concerning further use of the demonstration system, e.g., extending the period of time, replication in other areas, etc.

    b) determine the appropriateness/effectiveness of this and other types of energy projects in rural Upper Volta

- NASA LeRC needs to know whether the system works, and to determine the external validity of the experiment--can it be replicated elsewhere? NASA's decisions concern future involvement in this type of effort, rather than specific decisions related to AID project planning and implementation.

- DS/OST needs to have the evaluative information on all of the above questions in order to determine whether:

- AID should make investments in providing advice to LDC decisionmakers, mounting other solar energy experiments, advising USAIDs concerning energy project development, etc.

In examining the various perspectives on the project in Figure 2.1, one notes that these decision needs correspond to the Output and Purpose level results identified by USAID, NASA and DS/OST. At the Output level, information on the operation of the system can be viewed as including:

- Data on the efficiency of the demonstration system.
- Data on unanticipated (positive and negative) consequences directly associated with operation of the system.

At the Purpose level, taking the concerns and decisionmaking needs of all parties into account, information on the project is required that clarifies:

- System Effectiveness:
  - Who uses the pump and/or mill?
  - How frequently, and how much (per day/week/etc.)?
  - What do they give up by using the system?
  - What do they do with freed time?
  - Etc.
- System Transferability:
  - Are there reasons to believe that the efficiency and effectiveness of the system are tied to the Tangaye situation, to situations that "look like" Tangaye in one or multiple ways, or that the system is fully generalizable to all areas with adequate sun?
- Unanticipated consequences associated with utilization of the system: spread effects and/or negative social/environmental costs?

- System Value:
  - Considering all costs and benefits, is further experimentation/application of the system appropriate in Upper Volta, in West Africa, elsewhere?

B. COLLECTING DATA TO ADDRESS THE EVALUATION QUESTION

In this section of the report the data collection requirements for each of the substantive results listed above are addressed. The degree to which specific data elements become part of the USAID, DS/OST, and NASA LeRC evaluations, or are incorporated into the work of Ms. Hemmings, cannot be decided by the PCI team. Those decisions will need to be made by AID and its co-participants. Unless there is a coordinated effort, there is a clear potential for redundant data collection, as well as a potential for overlooking certain items by assuming that they are being collected by someone else.

1. Measuring Efficiency and Quality at the Output Level

To simplify the discussion, it is helpful to think of efficiency and quality as measures of whether the system is working as expected from technical and cost perspectives. In the following paragraphs measurement in both of these areas is discussed.

a. System Efficiency

The NASA LeRC project plan specified two conditions which should allow AID to determine whether the system is working as expected. Those two conditions are:

- Milling: Daily capacity of 5 1/2 hours, or 125 kg. (fine ground), and
- Hauling: 5,000 liters per day at capacity.

These two explicit system operation criteria are supplemented by a number of implicit criteria which are also necessary. The implicit criteria in this area would include:

- System operates "X" days per week.
- System down time does not exceed "Y" hours per week, i.e., normal maintenance and repair does not interfere with pump/mill operations. (Note in Attachment F of the NASA plan that a mill close to Tangaye had been out of operation for three months for repairs.)
- Adequately trained personnel in Tangaye--very little turn-over in pump and mill operators, if any.
- Adequate water--system does not fail due to depletion of water supply. (Note that the ODC report to the Africa Bureau on Village Energy for Africa has indicated that wells of from 75 to 800 meters deep may deplete the subterranean water supplies as well as leading to over-grazing.*)

Review of these indicators and assumptions suggests that data on the majority of them can be collected at the facility, most probably by the facility personnel. Further discussions with NASA LeRC should be held to determine which of these data elements they plan to collect, and which they are not or cannot collect. The feasibility of developing simple data collection sheets that can be filled out at the end of each day by facility personnel, and the requirements associated with training these personnel to use the forms, should be verified. Some of the issues to be addressed by the individuals who prepare these data collection forms include:

- Defining a way of recording whether the pump and the mill are capable of operating at capacity, even if user demand does not require that capacity on a given day.
- Gathering data on assumptions, e.g., that the well will not run dry, that livestock grazing will not become a problem, etc.

*/ Energy for the Villages of Africa; Recommendations for African Governments and Outside Donors, James W. Howe, et al, Overseas Development Council

In addition to considering technical efficiency, an examination of the project's Output level achievement must consider the cost of operating the system. At this level, the cost data should focus on the accuracy of the estimates made by AID and NASA. The costs involved are those associated with building the system, training the system personnel, and with the recurrent costs of daily operation, i.e., all of the expenditures required to achieve the technical efficiency standards that have been set. To some degree these costs will be recorded on order forms, and in the fees associated with various goods and services procurements related to the demonstration. However, unless AID or NASA makes an effort to ensure that all of this type of cost data is kept together, it may be difficult to reconstruct total cost at the time of an evaluation.

b. Unanticipated Consequences at the Output Level

While one cannot fully estimate the range of such outcomes, project management may well need to pay attention to the broader situation to ensure that:

- Other mills do not close or cut back operations in the face of potential competition.
- A newness, or "glamour effect," does not strain the system's capacity during the critical operating period.
- Etc.

2. Measuring System Effectiveness and Transferability

Under system effectiveness, we are considering such evaluative issues as utilization of the pump and mill (and the prices paid for these services), as well as the impact of the project: on food preparation, on health and cleanliness, and on how time is used in the village. The issue of transferability includes the foregoing, but also asks whether the results are unique to the demonstration situation.

a. System Effectiveness

User acceptance and utilization of the mill/pump are the central issues in an examination of effectiveness. All other impact questions are related to utilization:

- If the quality and efficiency of the system and its products are low, it will not be used.
- If flour from the mill is not good, or the price is too high, the mill will not be used.

As the example above suggests, data collection approaches that are used during the demonstration must:

- Be designed in a way that will ensure data on all probable forms of impact can be captured.
- Be monitored to ensure that when one type of use, or secondary outcome is not occurring, data collection can be shifted to focus on the reasons for lack of use, or lack of effect.

Some of the techniques discussed in the PCI consultancy report on USAID/UV's Rural Water Supply Project (686-0228) and used by Ms. Hemmings, are extendable for monitoring the utilization of the mill. Data collectors stationed at the facility, perhaps on an every eighth day schedule if the mill operates daily, could collect information on how many individuals use the mill, whether they are men or women, how much grain they have ground, how fine a grind they choose, where they come from (distance from the mill), and how they say they will use the milled grain. AID should review Ms. Hemmings' data collection plans to ensure coverage of such items as:

- Did the person previously use another mill?
- If no, where is the money for the milling coming from, i.e., what other good or service is being foregone?
- Has grain consumption increased in the family, and who is consuming more grain, e.g., are children snacking more, or is the family using up its grain supply faster than usual?

The third aspect of project impact--changes in the way in which villagers use time--is the most difficult to assess. The probability that inaccurate reporting, either because the ideas are not understood by villagers, or because data on time is generally considered subject to problems of estimation and recall, is quite high.

The approach used by the project to collect time-use information must focus on a wide variety of data, and on activities that take place away from the facility, e.g.:

- Is more time spent on cropping?
- Are more hectares being cultivated?
- Is livestock receiving better care?
- Is more time put into storing grain, and reducing rotting?
- Is time being put into handicraft ventures?
- Is more time being spent going further to secure firewood?
- Are new leisure activities springing up?
- Etc.

Case studies of families are one way to get these data, but it is a high-cost option. Counting, and other forms of observing what is happening have two drawbacks: they require a good deal of manpower, and may be subject to observer bias concerning what is/is not a direct result of the reduction of time spent hauling water and pounding grain. Direct measures of agricultural or craft production have some of the same bias problems. In addition, it could take a good deal of effort to establish a valid baseline for these production measures.

Interview-based studies of changes in the use of productive time have been reported in the World Bank's volume on Village Water Supply. While the methodologies, and perhaps even the interview forms for these

African-based studies might be secured, they, too, are problematic. All of the studies were futuristic, i.e., the questions asked of village women were "what if" questions.*

What is needed then is a methodology that can be used to:

- Detect changes (actual rather than ideal) in the use of time
- Associate those changes with the demonstration
- Identify positive (productive) outcomes, as well as other uses of time
- Gather data in a feasible, low-cost way, that has the minimum potential for bias and reactive effect.

One method, suggested by recent work in the U.S. and by the fact that an individual with social science training is already involved in the field data collection effort, is the use of "oral histories".** An oral history is, in effect, a retrospective semi-structured interview. While there is no pretense of detecting changes at a micro-level, e.g., minutes or hours reallocated, it does tend to produce fairly high quality macro data.

Oral history taking requires a framework and a good listener.*** In the Solar Energy Demonstration project this method of gathering data might be applied after six or eight month of system operation. The interview should probably be conducted with as random a sample of villagers as

*/ Saunders, Robert and Jeremy Warford, Village Water Supply, Baltimore: Johns Hopkins University Press, 1976, pp. 71-73.

**/ Working, and other studies by Studs Terkel have made this approach well known.

***/ Tape recorders are normally used, but may not be appropriate here.

possible.* Adult users and non-users of the pump and mill should be included. Each sample individual would be asked to describe the changes he or she noted in the village since the project began. For some respondents this question alone would generate data on changes in behavior patterns and time use. Other respondents might have to be encouraged to describe change by the use of a list of follow-up questions which focused on various normal uses of time, and how these had changed.

If this method were used, the largest cost would be in transcribing the oral histories and analyzing them for patterns of changes reported in village behavior, in the perceived cost/value of the system, etc. By trying to use a random sample of villagers, one would expect to gather data on all types of village activity, and to develop a total picture that was not unduly biased by system user views. The oral histories could be taken by Ms. Hemmings, or by individuals from ORD or ISRD, if some training were provided.

b. Data on Transferability and Unintended Outcomes

To assess transferability, AID and NASA will need to determine that there is nothing unique about Tangaye. In part, this assurance can be developed by examining how Tangaye looks like other villages.

The uniqueness of Tangaye can be examined by Ms. Hemmings and others by identifying any baseline or evaluation data that seems to deviate from what their experience tells them is typical in other Upper Volta villages, or even other West African villages. To reiterate, the data collection/analysis needed to determine transferability must focus on whether and how Tangaye differs from other locations where the system might be

*/ Random sampling is difficult where complete lists do not exist. Ms. Hemmings developed an estimate of village population about which she was reasonably confident. This list is probably as good a basis for the sample as could be developed; it should probably be used if the method is used.

installed. That is, we don't really need to know much in detail about Tangaye--we only need a method that will allow us to spot ways in which it might be called exceptional.

Unintended consequences at the Purpose and Goal levels, as was noted at the Output level, cannot be fully identified a priori. We can guess what some might be, and then monitor their development. Within our general approach to evaluation we can attempt to capture those data that would identify for us the unanticipated factors that are causing change (e.g., the presence of researchers) or resulting from the demonstration (e.g., other villages begin to request new pumps and mills for their areas). Some of these types of data may be collected by the project monitoring system and/or by the data collection effort begun by Ms. Hemmings. Oral histories, if they are used, would also be a valuable resource for detecting unplanned causes and effects, e.g., while it is not likely that a monitoring approach or the utilization counters would pick up information about how millers in other villages are faring, it is quite likely that the oral histories would include this type of data.

3. Village Level Sharing of Information

In Section Four of PCI's companion consultancy report on USAID/UV's Rural Water Supply Project evaluation, the argument was made that the utilization of new systems can be encouraged by the sharing of information among users. This discussion is equally valid for the solar pump/mill demonstration, particularly with reference to the way in which freed time is used. Two ideas that would encourage the sharing of information among users suggest themselves:

- Group interviews by the data collectors at the facility

  Instead of questioning one user at a time, the data collectors might effectively increase information sharing by questioning groups of three to five users who appear at the facility at the same time. Each respondent would hear the answers of the others, and the basis for both reflection and further discussion would have been laid.

- Group oral histories and/or the sharing of oral histories

  Group oral history taking is a possibility. However, it would dilute the data base by merging impressions. On the other hand, the sharing of oral histories after they have been taken, could be a high leverage way of disseminating information on change and its effects. It may be worth investigating whether it would be appropriate to read the oral histories out loud on some local occasion. The participatory nature of the activity is itself a stimulant where it has been tried, e.g., in community action/involvement programs in rural America, etc.

SECTION FOUR

EVALUATION RESPONSIBILITIES AND AN OVERALL PLAN

In Section One and Two of this report, the Solar Energy Demonstration project design was examined organizationally. In Section Three, the discussion focused on types of data and how they might be collected. Juxtaposing the two discussions, it is clear that AID, NASA, and the Government of Upper Volta have a basic choice:

- On the one hand the parties can decide to undertake independent evaluation efforts that focus on the issues of concern to them, or
- All parties can participate in an effort to refine the design focus and the evaluation questions so that the responsibilities for data collection can be divided functionally, for example:

TYPE OF DATA	COLLECTION & ANALYSIS RESPONSIBILITY
• System monitoring data, e.g., efficiency and quality.	NASA
• Basic system utilization data, including user counts, etc.	USAID/UV (with Ms. Hemmings carrying out/managing the effort)
• Supplementary utilization data, e.g., health impacts, time utilization, etc.	USAID/UV, as above
• Transferability data	USAID/UV, DS/OST and the GOV
• Cost/price data	NASA

At the time of the PCI consultancy, it appeared as if a "middle ground" between these two strategies was being contemplated, with NASA accepting responsibility for data collection on some of the technical and cost issues, and Ms. Hemmings planning to cover basic questions on system utilization. The coverage implied by these two data collection efforts appeared to be less than complete* in terms of the needs of various project parties for decisionmaking information. The key data elements that appear to be neglected include:

- Information on time-use, if this cannot be secured by counters who stay around the facility.
- Data on indirect costs, e.g., the other things villagers could do with the money they pay for facility services, and 'negative costs' that might be incurred, e.g., loss of income to other mills, depletion of water supplies, loss of grain, etc.
- Transferability data--information on how Tangaye differs from other potential sites.
- Information on health and other quality of life indicators that might change as a result of the project.

It is not clear that all of the information that may be needed is being collected. On the other hand, it seems plausible that the current general plan for data collection--which splits the effort between NASA and Ms. Hemmings--could be converted to a more comprehensive plan. What would be required is (a) a thorough review of the full data collection plans prepared by each, and (b) supplementation of the two plans (and appropriate changes in the terms of reference/level of effort for each), such that all of the data needed

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*/ Since it was not possible to review the written plans of either NASA or Ms. Hemmings, PCI's team found itself forced to 'guesstimate' the coverage of these plans, and the accuracy of those 'guesstimates' will need to be verified by AID when it reviews written versions of the two data collection plans. (Note that NASA's project plan raised questions about the adequacy of cost/price data collected from the villagers.)

for decisionmaking is included between the two plans. In the process of reconciling the two data collection plans, and between them comprehensively gathering the data that is needed, it would seem that AID, NASA, Ms. Hemmings, and the GUV could begin to define:

- What data is important for day-to-day decisionmaking and should therefore be incorporated by the monitoring system?
- What data is needed, periodically, but with less than day-to-day frequency, and should therefore be included in monthly, bi-monthly, or mid-project data collection, e.g., in reports generated by Ms. Hemmings' on-site assistant?
- What data is not important for decisions about this project, but only for decisions about future projects--and when must this data be collected, e.g., at one point in time, two points, or with the same frequency as is required for daily or monthly/bi-monthly decisions?

In its draft report on the consultancy, PCI suggested that monitoring, one mid-project evaluation, and a final evaluation might constitute a minimum level of evaluative review of this project. Appendix A presents these earlier notes on mid-term and final evaluation.

Upon further review of the degree to which the parties involved in this project have different views of its intended results, we have determined that the most appropriate recommendation we can make to USAID, DS/OST, NASA and the GUV is that:

- an overall review of the project: first its design, and then its evaluation requirements, is needed.

Only in the context of such a reexamination of the project itself will specific plans for collecting data begin to make sense, and warrant further investment (of time and money) by the various parties concerned.

APPENDIX A: TENTATIVE PLANS FOR MID-TERM AND FINAL PROJECT EVALUATION

APPENDIX A

MID-PROJECT AND FINAL EVALUATION OF THE SOLAR ENERGY DEMONSTRATION

A. MID-PROJECT EVALUATION

Should funds be available--which was not the case at the time of PCI's consultancy--a mid-project evaluation would allow AID to critically review progress at the Output and Purpose levels. A mid-project evaluation should be a creative process, and viewed by everyone as an opportunity to make the project better. Given the nature of the questions and issues that could be addressed mid-way through the project, the institutional context of the project, and the lack of funds in the project budget for evaluation, an evaluative effort might be carried out by individuals working on the project, with perhaps one outside evaluator acting as team leader. This internal evaluation would inject few strangers into the village (an issue that is already of concern), and would give all parties a chance to review the project together. Use of a basically internal team should also help ensure that the evaluation recommendations will have a strong chance of being implemented.

The following is a suggested list of team members:

1. An outside (though conceivably AID) evaluator as team leader. This person should bring an objective and outside perspective, should have a background in evaluation and be knowledgeable about alternative energy and food system issues (i.e., perhaps involved with the larger project "Energy Needs in the Food System").

2. Grace Hemmings, as the anthropologist and principal investigator for the final impact study.

3. AID/UV project manager.

4. NASA project manager.

5. A representative of the ORD who is involved with, or knowledgeable about, the project.

6. A representative of ISRD who is involved with, or knowledgeable about, the project.

The most advantageous time to carry out this evaluation would be when NASA personnel were going to be in Upper Volta. The present schedule calls for that to occur in June of 1979, or about five months after the system has begun working. A minimum time for the team review would be three days per person, except for the team leader who would need a minimum total of six to eight days in order to prepare an evaluation report. The optimum level of effort for this internal evaluation review should be determined as a result of a joint design/evaluation clarification session held well before June, perhaps in Washington.

Listed below are a series of questions which the mid-term evaluation, or an earlier design clarification session, should address:

- Is the data for both NASA and USAID focuses being collected properly, and with acceptable validity?

  Procedures being used by NASA and by the people collecting village level data should be checked against original plans. Of particular importance should be a check to see if adequate economic data is being collected on costs of sytem operation and on economic activity surrounding time use freed up by the mill. This latter area did not seem to be adequately covered by the draft data gathering outline seen by the PCI team.

  Quantitative data for answering this question should be in the monthly reports and on the data collection sheets. Data categories being collected should be matched against those planned for in the baseline study and listed under EOPS in the Log-Frame's Purpose level.

- Is NASA's outline for the final report adequate for achieving End-Of-Project-Status?

  One inter-agency communication problem is that NASA has not produced an outline of the final report, nor specified in any detailed way what questions and issues the report will address. This is particularly critical because NASA may not be collecting all the data necessary to answer the general research questions they have indicated need to be answered. NASA is expecting this data to come from AID's data collection process. Clearly NASA should be requested to immediately generate a report outline, and the mid-project evaluation should go over it in terms of EOPS criteria.

- Are solar energy system, mill, and pump repairs and maintenance being carried out adequately by the village, ORD, ISRD, and NASA?

  A reasonable target of not more than 5% down time is suggested by the PCI team; NASA or AID may want to adjust that figure. In any case, actual performance should be verified by the evaluation team from monthly reports and double checked with the village. A casual analysis as to institutional responsibility should be carried out on any system down time, on the corrective actions taken, by whom, etc.

- Is the system creating any physical danger to people (i.e., electrical shocks) and what has been the experience to date?

  Information will have to be gathered through interviews by the team during the village visit.

- Is the project causing any political or social disagreement between parts of the village of Tangaye or between Tangaye and other villages?

  Information will need to be obtained from interviews. Most of these interviews (on all questions) can probably be with the chief, the mill management group, the people collecting data, and the mill management trainers working with ORD. This is the suggested strategy of Ms. Grace Hemmings. Ms. Hemmings stated that others in the village might be hesitant to provide information. However, an interview strategy should be discussed by the whole team prior to visiting the village and there should be a generally agreed upon approach.

- Are the mills in other villages losing business due to the Tangaye mill, etc.?

  The evaluation team should check data on where people live who are using the mill. This data should be on data sheets for socio-economic study. Also, a team member should interview the millers and check responses against information, on the level of business, etc., that is in the baseline study.

- Has a plan been established for disposal of the system at the end of the project and has it been explained to the village?

  Information to answer this could be taken from the project paper and baseline study management plan, monthly reports, and inteviews.

- Has the management of the mill kept the mill operating with no down time as a result of management problems? Have any problems occurred with the management plan? Has the plan been adequately explained to the village, and if not, then why not?

  Information can be taken from the project management plan, the baseline study, monthly monitoring reports, the ORD, and interviews.

- Is there equitable access to the pump and the mill?

  Information from management plan, data sheets, and interviews.

- Is there an equitable distribution of benefits resulting from the village development projects being funded with profits from the mill and the pump?

  Information from project monitoring, management records, and interviews.

- Statistically, how much is the animal population increasing around the well during the dry season?

  The villagers collecting data are to be recording numbers of animals around the well and, based on their previous knowledge of the well, should be able to estimate a percentage of increase. In addition, the evaluation team should use the interviews and personal observation (the visit would hopefully occur during the last part of the dry season) to assess impact in the following areas:

  a. Village ecology and vegetation
  b. Level of water in well
  c. Possible decreased accessibility of people to water
  d. Human and animal health
  e. Increase of social and/or political conflict.

- Are people bothered by increased numbers of visitors from other villages who want to see the system or use it? By government visitors? By foreigners? Do visitors take an unacceptable amount of time (how much per week) or make them uncomfortable?

- Are there negative or positive impacts caused by the project that these questions have not covered?

Also, the evaluation team should at this time suggest additional questions and clarifications for the final evaluation. As a follow-up to the mid-project evaluation, the final project evaluation should address the status of each of these questions at the time of project completion.

B. FINAL EVALUATION

As stated in the early part of this Appendix, it is important that the results of the Solar Energy Demonstration be integrated into the larger project "Energy Needs in the Food System". There is already an End-Of-Demonstration evaluation scheduled as part of that project design; it is outlined briefly in the project paper. It would seem cost effective, as well as appropriate, if the final evaluation of the Upper Volta project was part of a larger evaluation, i.e., by the same team doing one or all of the demonstration evaluations for the larger project. A detailed scope for this evaluation should be developed following the design clarification effort, perhaps after a mid-point internal assessment.

Ideally, most of the data and information needed for carrying out the final evaluation should be in: the project files at USAID, monthly reports of all institutions involved, the final reports from NASA and the anthropologist. These should be supplemented by visits to Tangaye for field observations, etc.

At the time of this consultancy the issues to be addressed in a final evaluation seemed to be as follows:

- EOPS indicators should be examined as to degree of qualitative success or lack of success.

  If the research questions which are posed by the project are not answered with any good degree of rigor and clarity, then the usefulness of the project should be questioned and analyzed in the final evaluation. For example, if the NASA report does not break out all costs of system setup, operation,

and details on possible modifications, along with costs, then it will be difficult for USAID and DS/OST to use the conclusions and information contained in the final reports. The final evaluation should examine whether in fact it is possible for USAID and DS/OST to generalize from the results of this project as to the appropriateness of photovoltaic systems. This means that the final evaluation should make qualitative judgments on the research quality of the two reports. For example, does the data and anaysis tell USAID how to use photovoltaics and labor-saving devices, and to what kinds of situation such technologies can be appropriately and profitably employed in development activities?

- In terms of 'Energy Needs in the Food System', the evaluation should address what lessons might be learned from this project as to the importance of electricity as an energy source in the food system. For many areas of the developed world, electricity is a small fraction of energy use in the food system. Growth of food production may or may not be tied very strongly to increased electricity availability or use. Also, it may be that there are other village level energy sources that could accomplish or do the same work in a cheaper and more efficient manner. Such comparisons could be made using the project data in conjuction with the larger project's data, if the final reports are adequate on the analysis of this question. Also, the evaluation should address whether there might be other potential energy sources for the food system which could have a greater and more rapid impact on development than, say, photovoltaics.

- The data being collected can probably be put to more uses, and answer more questions, than the project will be able to utilize. The evaluation team should identify further uses to which the data might be put. For example, the data on time in agricultural tasks might help show where increased energy at a certain point could greatly increase production or improve the quality of life. Or, it may be that the data will show changes in crop production practices that indicate a potential for greater efficiency in human labor if the more efficient practices were more widely adopted. The data needs to be looked at for further and wider applicability, and this can and should be a purpose of the evaluation in relation to the larger project. In addition, a set of questions that bear on AID's future project planning should be addressed; including:

  -- What implementation lessons can USAID learn from this experience with this type of research and demonstration project?

-- What policy issues will need to be addressed in order to move ahead with development of alternative village level energy supply and what can this project tell us about these issues?

-- Are there further research and/or demonstration projects that this project indicates should or should not be undertaken in the developing world?