THE PURPOSE OF MONITORING AND EVALUATION SYSTEMS

Information is needed at all stages of project design and implementation. Good information is essential to a good decision making process, from conceptualization of a project through to a final evaluation. Ideally, a project should have a coherent information system that generates appropriate data, at the right times, to support all key decisions at the time they need to be made. Methods for collection and analysis of data during project design phases should be as compatible as possible with methods to be used during monitoring and evaluation. The system should provide neither too much nor too little information. Before discussing information issues related to energy projects I believe a short summary of why we should bother with information systems, and why past efforts have not always worked, is necessary to establish the context of our discussion.

Project monitoring and evaluation for renewable energy projects should:

- track project activities, inputs and outputs, for level of achievement;
- identify present problems and possible future problems;
- provide mechanisms for analyzing problems and identifying possible solutions;
- measure project impacts;
- provide the correct information to the correct individuals, agencies, villages, etc., at the correct

times to support good decision making related to the above items;

- answer all key questions about technology performance and transferability.

It is difficult to achieve these information related objectives, but we must grapple with the problems if we are to have consistently successful development projects, and ones which we know are successful. In reality, the literature and field experience tell us that this ideal is rarely achieved. There are some basic reasons why it is so difficult.

SOME PROBLEMS IN UTILIZING SUCCESSFUL MONITORING AND EVALUATION SYSTEMS

In general, most people working on project design and implementation have difficulty determining what information they really need. Moreover, information and data that are generated by a systematic process are often viewed as suspect and either non-essential or negative. Funding agencies must do more than establish the data to be collected, indicate how it is to be done, and believe that successful projects will be undertaken and that the expected information will come back. Certainly any discussion of uniform data collection must be placed within the context of managerial issues and problems in the field related to monitoring and evaluation systems.

- Project managers are often threatened by information systems because: 1) they don't really want to be held accountable in situations they feel are very difficult; or, 2) they

don't want to discover problems or change anything.

- Project managers don't understand or believe in information systems because: 1) they believe it takes too much money and time away from the "real" part of the project; 2) they believe the cost is not worth what you get out of the system; or 3) they don't understand how they can use the information for their needs.

- Often, the only experience project managers have had is with systems designed for someone else's needs and goals rather than their own. Such information systems have, either through design or bad management, provided inappropriate or inadequate data at the wrong time for people in the field and have been designed for the national government (or an outside donor). The project is awarded the cost and job of executing what is for the project staff an unwarranted job.

In order to have a good monitoring and evaluation system it is highly important that:

1) the system be designed for each specific project, and fulfill the decision making requirements of the various groups and individuals associated with the project;

2) the project managers and field staff understand the importance and potential of the information system, and that the system is built into the project to coincide as much as possible with other ongoing project activities.

These two points are especially important for renewable energy projects. Most renewable energy technologies are in

early stages of development or are new to the particular region where they are to be used. As has been pointed out so often, renewable energy technologies are usually extremely site specific in both design and cost/benefit calculation. In general, data should be collected and analyzed that will allow for technology improvement, identification and development of good strategies for implementing projects in the field, determination of technology and project cost/benefits, and transferability.

This brings us to a key point of this paper and a major reason for my previous general discussion about project managers and information systems. There is a real potential clash between the needs of national ministries and donor agencies (outsiders) and the needs of project field staff and villagers. The "outsiders" want and need comparable data and a set of common information criteria for larger geographic and technology analysis and discussion as well as issues of transferability. The project field staff and villagers need a successful project that results in positive on-site impact from that technology and project. This means that project implementation, if it is responsive to a dynamic situation, may have a tendency to drift from pre-set data concerns that do not relate directly to project staff needs for site specific success. The result can be a lack of comparable data as intended in project design.

Research and demonstration projects are doubly prone to this problem. Research mandates holding everything in as

controlled and well defined a manner as possible, while demonstration often means changing things as the project develops. In such a situation there is, in addition to conflicting managerial forces, conflicting project purposes.

The point of this discussion is to indicate that the interaction of some human problems in operating successful information systems with the unique information needs of renewable energy projects, results in a particularly difficult information system situation. Due to the site specific nature of many renewable energy projects, and their newness, there is no way to completely eliminate potential conflicts. Assuming good project design, it can be minimized if project managers understand the importance, meaning, and use of a good information system and are rewarded for using it properly. If changes in data methods need to be made to achieve success in the field, this can be done while still gathering appropriate information for other concerns which include issues of comparability. I believe the key rule is that in establishing and designing common criteria, and putting them into information system designs, we do not forget to determine the feasibility of people in the field carrying out the work as designed.

THE DEVELOPMENT OF COMMON DATA ELEMENTS

Any scheme that lays out a set of common criteria has implications for all the normal information elements of a monitoring and evaluation system. For our purposes here I think we can identify three general focal areas in which

people will want to establish comparable formats for renewable energy projects. They are listed in ascending order of difficulty for comparative or uniform data collection and analysis.

1--Data on system design, and on adaptions in system design.

There are common design elements that are present in every design of a particular technology (e.g., a windmill or a photovoltaic system), as well as common characteristics of the manner in which that technology can satisfy a particular end use (e.g., pumping water). Because most renewable energy projects are so site specific, the quality of technical reporting and design information and drawings is very important. That is, for each type of technology and end use of that technology, the standard design elements common to the technology should be explained in detail so that someone else could easily replicate the application. All adaptions or unique elements should also be detailed in the same manner. This is simply a matter of all project managers, donor agencies, and national ministries, requiring that good design information be developed and kept. One option which would make the process more formal and standardized would be to develop a set of case studies on each technology and its major applications that identified the common design elements, showed how drawings should be done, what quantitative data should be specified, etc. These case (model) studies could then be circulated among agencies involved in renewable energy work.

2--Data or measurements which are mostly physical data; that is, measurements of energy availability in sun, water, biomass: of energy inputs and outputs for a system; operating data and data on work actually accomplished by a system measured in other than direct energy output.

These kinds of data are covered by the comparable or common physical criteria identified on most energy surveys, and by common units of measurement for systems under operating conditions. That is, measurements in watts, BTU's, temperature, horsepower, time, etc., and measurements of work accomplished, such as litres of water pumped, kilograms of an item dried or produced, etc. Some of these are covered in the characterization criteria matrix in the paper entitled "A Process for Matching Village Energy Requirements and Small Scale Renewable Energy Sources" by John Ashworth and Jean Neuendorffer. Of course, project specific measurement criteria are dependent upon the chosen technology and/or the specific end use.

3--Impact and effectiveness data on both the technology and the project implementation strategies in terms of economic, social, and environmental criteria.

For most projects, it is in this area that the causes of success or failure are to be found. Yet, this is the most difficult area to establish common criteria that are specific enough to be meaningful. It is also the area that poses the most expense and difficulty for data collection.

I believe it is important that a comprehensive cost/benefit analysis be undertaken as part of any project. These cost/benefit reports should not simply give the formula used, highly aggregated data (with no explanation of assumptions), and the

final results. They should be detailed and written so that the basic data used is presented in as disaggregated a format as possible. One way to assure being able to use data from various projects, related to impact and effectiveness, is if rigorous and systematic C/B studies are carried out.

Appendix One* is an outline of general common evaluation criteria covering all three of the local areas identified above. I believe they can be used as a guide for most renewable energy projects. Making them more specific requires application to a particular technology and project site. One final point. Energy use is a means to an end. Energy projects are a means to other development aims, and as such there are implicit assumptions in any energy project that a successful project will result in achievement of some type of development aim. These assumptions need to be constantly tested, as they provide the larger framework and rationale for our development efforts. Appendix Two places renewable energy projects in this context.

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*Appendices One and Two are adapted from a paper by George Burrill entitled, "The Role of Evaluation for Renewable Energy Projects in Africa," prepared for the Overseas Development Council and AID. The paper also outlines a model for project evaluation design for renewable energy projects. This model provides a basic and common format.

Appendix One

Finely detailed or specific data categories can only be developed with a particular project in mind. For example, the socio/cultural factors relevant to use of a solar cooker will be different than those of a village wood lot. Below is a discussion of a set of data categories and their sub-elements that are non-specific in terms of particular renewable technologies but which can be adapted to the specific technology and local setting of the project.

A. Data Categories

Technical

--Adequate physical data (amount of biomass, wind, solar, etc.) should be gathered to verify the original assumptions or estimates made during project design.

--Complete records of component acquisition in person hours, costs, and skill requirements.

--Complete records of technology installations in person hours, costs, and skill requirements.

--Complete records of system output.

--Complete records of system performance, down time, maintenance activities and costs.

--Records on environmental impacts.

--Changes that could be made, for example, in:

- overall system design
- component acquisition
- local manufacture of technology

- system maintenance

Information can then be assembled on the potential technical effects of such changes on the system.

Social/Cultural

--Relationship of the energy project and technology to the users or to village daily and seasonal life patterns. Also, data on behavior changes required by the technology and on villagers' traditional habits or ways of doing things which are affected by the project, although not necessarily required to change by the technology (i.e., behavioral side effects).

--People's attitudes towards the technology and the project.

--Behavior of organizations in the project.

--Other cultural constraints discovered during the project that were not identified by the project planners.

--Data on performance of the project's ownership strategy and maintenance strategy from a social/cultural standpoint.

--Equity results of the project as implemented:

- impact on male and female roles
- impact on local income level groups
- impact on ethnic sub-groups and castes
- related to individual vs. family vs. community

Economic and Financial

David French has suggested the following elements:*

*French, David, "The Economics of Renewable Energy Systems for Developing Countries", US/AID, Washington, D.C., January 1979.

--Value of a system's output (if measurable in market prices).

--Alternative employment opportunities (to measure benefits if the system chiefly releases labor from former tasks).

--Costs of site preparation and installation of the system.

--Direct operating costs.

--Degree of local unemployment (to find shadow wages).

--Existing uses of raw materials (to find their shadow price).

--Extension costs of introducing the system.

--Market interest rates for local borrowing (to estimate investors' discount rates).

--Characteristic local investments (to suggest willingness to take financial risks).

I would add two more elements. The investor's point of view is extremely important for the long-term success of any project, whether it be government, community, individual, or a combination of these. The extent to which the project is testing economic or financial acceptability to potential investors should depend upon the extent of proven technology development. Less developed technologies will generally have higher subsidies, and project results are therefore less of an indicator of future investor behavior than unsubsidized technologies. Moreover, investors very often do not act in a financially or economically

rational manner. Economic and financial positive or negative analysis results may not correlate with investor decisions experienced in the project. Therefore, a reasonable estimate as to what can be determined about potential investor behavior based on project data should be clarified before any conclusions are reached. To do this, data should be gathered during the project on the additional elements of:

--investor perception of financial or economic cost/benefit, and

--investor opinion as to competing investment choices. (I am not referring to cost effectiveness analysis here, but to the fact that monies may be invested in items for completely different purposes.)

Appendix Two

There are three levels of hypotheses, linked together, which form a causal objective tree for any energy intervention or strategy. A graphic illustration of this is on the following page. This objective tree indicates that the logic of a project moves from lower to higher levels in the tree. In other words, if the energy technology performs adequately (level 4), the hypothesis is that the intended events or impact will occur on the next level up on the tree (level 3). Each level is linked by hypotheses which at the appropriate time should be tested by evaluative research. The higher one goes on the tree the more traditional impact evaluation one can utilize. I am suggesting that present energy projects are operating in the field almost exclusively at level 4 and somewhat at the level 4-3 hypothesis linkage.

Level 2-1, or the highest, concerns hypotheses about whether or not increased renewable energy supply will improve the quality of life. Before these kinds of hypotheses can be field tested, we will need a great deal more data at levels 2 and 3 than have yet been gathered by the development community. This situation for energy projects has been acknowledged (Howe, 1979), and I would suggest that for the moment evaluation design concentrate at evaluating links between levels 3 and 4.

Viewing evaluation as an incremental activity, wherein implementation is examined before impact, is quite accepted (Rossi, p.45). The idea that there exists eventual potential for a high level of impact is what drives the project and the evaluation design. Inferences about potential are made, but because the inferences are based on case studies, it seems more useful to focus evaluation primarily on implementation and technology development. Secondary focus can then be given to impact possibility. That is, the case study data with more general country or regional data is analyzed to make inferences.

This strategy is supported by the fact that most energy projects have small field samples (are at such a low level of intervention) that no formal or statistical valid inference of proof could be made anyway. Even in projects where large populations are affected, judging impact has been very difficult throughout various types of development efforts. Although it is certainly possible to lay the fault on evaluative design, the fact remains that little is known about quality of life impacts for large hydro-electric or road building projects in rural areas,* and these intervention strategies

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*For a discussion of this see "Evaluating AID Rural Electrification Projects," a report to AID by Robert Nathan Associates under Contract No. AID/afr-c-1380 (February, 1979).

Figure 1

Level 1	Increased income	Village self-reliance and prestige	Unemployment caused by people being replaced by devices	Altered socio-economic role of women	Higher literacy	Lowered birth rate	Improved health	Improved ecological conditions (e.g. slowed desertificati
Level 2	Increased acreage under cultivation	Increased agricultural production	More intense cropping	Increased off-farm production	Increased small industry	More energy efficient and/ or intensive farming	Increased educational/ recreational activities	
Level 3	More efficient threshing, winnowing, irrigation, cultivation	Better cooking systems	Reduced time spent hauling and chopping	Better lighting (possibility of working, playing and studying at night)	Relief from onerous tasks	Better heating/ cooling systems	Clean drinking water	Washing and bathing in hot water	Stop stripping of vegetation for fuel
Level 4	Performance of energy sources: the energy source or technology provides adequate quality, quantity, and convenience.							

(The source or technology must be compared to traditional ways of accomplishing the work, if they exist, and to other feasible ways including imported or central sources if they are feasible. Criteria include:

--cultural and sociological;
--technical performance including maintenance and repair;
--costs, capital and recurring;
--extension and other social infrastructure requirements;
--political factors and managerial factors are also important in determining what may be needed for wide scale application.)

have years of development history.

The same problem is true of testing hypotheses linking levels 2 and 3, except that it is not nearly as difficult. One important point is that at these levels other energy projects can be used at testing proxies. That is, if energy devices result in improved and more efficient irrigation (level 3), and this does in fact result in increased production, then theoretically increased production is likely to occur from any efficient and appropriate energy source (as judged by level 4).

Level 3-4 hypotheses have been overlooked in evaluation of energy projects, although they have been given a great deal of thought by project planners and managers. These hypotheses are concerned about the successful design of both the technology and the energy project intervention implementation. That is, the institutional, incentive, and interpersonal dynamics that are used to operationalize the intervention. For example, can a particular solar fish dryer design perform at adequate physical and economic levels of efficiency that increased work will be done? Can it do so within larger environmental and social guidelines or policy? This is the level that most of the evaluation discussion to date has centered around.

Development projects usually have strategies for putting the project into place that are quite clearly discussed and often monitored. Sadly, the hypotheses and assumptions that these strategies rest on are rarely tested systematically or empirically validated so that there is some clear logic for their choice. This is now the case with energy projects, and this issue should be addressed. Projects often fail or don't reach their objectives because project hypotheses were invalid.

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*See, for example, Systematic Monitoring and Evaluation of Integrated Development Programmes: A Source-Book, United Nations, New York 1978; Evaluation: A Systematic Approach, Peter Rossi et al, Sage Publications, Beverly Hills, California 1979; Evaluation Research and Development Activities, Francis W. Hoole, Sage Publications, Beverly Hills, California 1978.

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