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PROJECT COMPLETION REPORT

Botswana Renewable Energy Technology Project (633-0209)

FUNDING: AID	\$ 3,304,000 (Grant)
PEACE CORPS	225,000
GOB	1,178,300
TOTAL	<u>\$ 4,707,300</u>

SUMMARY

Botswana is a semi-arid country with few indigenous conventional energy resources. In the late 1970s it was one of several countries evaluated in terms of the potential for renewable energy. Given the availability of sunlight in Botswana and the dependence of the population on fuelwood, it was considered to be an ideal possibility for the successful implementation of a pilot renewable energy technology project. The Botswana Renewable Energy Technology Project (BRET) was approved in September, 1980, and the contractor, Associates for Rural Development (ARD), arrived in November, 1981. AID funding, including the technical assistance component, was completed on September 26, 1985. The Project had a budget of \$3.3 million of which \$2.5 million was included in the contract won by ARD. While considerable success was achieved over the life of the project, insufficient progress had been made to ensure the continuation of the project components at the Project Assistance Completion Date (PACD), with the exception of the comparative pumping component. The project's methodology for technology dissemination was intellectually rigorous but insufficient in terms of marketing and dissemination strategies. Given the size of the project, the results of BRET were disappointing, with the significant exception of the ongoing work on comparative pump testing. While the Project was able to evaluate the potential for many renewable energy technologies in Botswana, it did not possess the mechanisms or the commitment to ensure the successful replication of any of the more suitable technologies.

DESCRIPTION:

A. BACKGROUND

Botswana is a sparsely populated semi-arid/arid country, with few indigenous conventional energy resources other than coal. It also has limited wood resources which are being rapidly depleted. However, the country has an abundance of solar energy, and in certain sections of the country an adequate wind regime.

During the 1970's, the Africa Bureau sponsored the design of renewable energy projects in several countries in Africa; projects similar to BRET were implemented in Lesotho, Sudan, and Kenya. These projects shared some common attributes, including an initial emphasis on rural technology centers, and the training and deployment of rural technicians.

B. THE BOTSWANA RENEWABLE ENERGY TECHNOLOGY PROJECT:

BRET followed the general structure of the renewable energy projects being implemented by AID in the late 1970's, with an initial emphasis on base line surveys and needs assessments in two pilot villages. The project also collected national solar and wind data. The project emphasized what were defined as institutional RET's (passive solar housing, photovoltaic power, and pumping systems) and rural household RET's (cookstoves, desalination, and other technologies for the rural poor).

C. TECHNICAL ASSISTANCE:

The contracting firm of Associates in Rural Development (ARD) was selected in 1980, and after delays due to contracting and other difficulties was able to begin activities in August, 1981.

STATUS:

A. TECHNICAL ASSISTANCE

After initial problems with the project's organizational structure, and a change of Chief of Party on the part of the contractor, the project progressed relatively smoothly between the midterm evaluation and the final evaluation. The quality of long term technical assistance during this period was satisfactory, and the quality of short term technical assistance was excellent.

In particular, the Project successfully trained the identified local staff, and had developed a strong team by the end of the project. The inclusion of Peace Corps personnel greatly improved the quality of technical field support.

B. PROJECT OUTPUTS:

The contractor developed several methodologies for reviewing the potential of individual technologies, and implemented them over the course of the project. In most instances, this approach allowed for the elimination of proposed technologies during the lifetime of the project.

After the midterm evaluation in December, 1983, the project was revised, to emphasize the process of technology design, testing, and replication, rather than the numbers of devices manufactured during the life of the project. In addition, the types of activities were regrouped and narrowed. The revised Logframe identified the following outputs:

1. Energy needs data collection and analysis;
2. National energy assessment studies;
3. Research, development and field testing of water pumping systems;

4. Research and development of small-scale photovoltaic electrification;
5. Research and development of solar heaters for urban households and rural institutional use;
6. Urban and rural passive solar buildings designed, constructed, monitored, and evaluated;
7. Design, monitoring, analysis and promotion of passive solar houses and office buildings;
8. Institutional assessment of two pilot villages and districts;
9. Design, testing, and pilot diffusion of domestic rural technologies;
10. Village awareness and outreach campaigns;
11. Training.

The results achieved for each of the components listed in the revised LogFrame is described in depth in the Final Evaluation Report, prepared in June, 1985, as well as the contractor's final report, dated December 20, 1985.

A summary of accomplishments for each of these defined outputs is presented below, grouped in the categories used in the Final Evaluation and the Contractor's Final Report:

1. Energy needs assessments.

The village needs assessment undertaken of the two pilot villages, Ditshegwane and Shoshong, provided sufficient material to adequately design activities of relevance to the pilot villages. Unfortunately, insufficient emphasis was placed on willingness or ability to pay for those technologies clearly identified by villagers as felt needs. In addition, no national rural survey was undertaken, (since the ODA was undertaking a national rural energy survey), which proved to limit the ability of the project to place the two pilot villages in perspective, or to identify potential for national replication.

The project did undertake an urban survey, which proved to be exceedingly useful, and assisted in the redesign and implementation of the project's portable stove program and the passive solar activities.

2. National surveys.

National surveys were undertaken, or data collection initiated for wind and solar resources, while the woodfuel survey was eliminated in favor of the survey undertaken by ODA. As noted above, the national surveys did not include a review of socio-economic variables which would have improved the project's ability to identify replicable, commercially viable technologies.

3. Comparative pumping assessment.

The project's component on wind, handpump, animal-driven, and solar pumps was expanded based upon the midterm evaluation to include a review of electric grid and diesel systems. This component of BRET was integrated into the Ministry of Mineral Resources and Water Affairs, and continued for 15 months through the centrally-funded WASH Project.

4. Photovoltaic (PV) electrification.

Several pilot installations in schools and clinics were undertaken during the project. These installations illustrated the potential for PV lighting, and there apparently is increased interest in the technology on the part of the GOB. The full economically-viable potential for PV lighting in Botswana is still unclear.

5. Commercial Solar Water heating

Smaller systems for rural use were eliminated from the project due to the fragility of the technology and the unwillingness of villagers to pay for the systems. BRET also had hoped to work with commercial fabricators, but their experience with one such entrepreneur was not entirely satisfactory. Progress was achieved, however, in convincing GOB personnel of promoting solar hot water, and in improving housing standards if necessary.

6. Passive Solar Design, Construction and Promotion

The first part of the project emphasized the design of model low cost housing, as well as housing and offices to be used by BRET staff. While the design, construction and monitoring of these units encountered some difficulties, the project had a significant impact on the outlook of GOB personnel involved in urban planning and architecture.

This is one of the components not continued after the project's PACD which deserves further support from the donor community.

7. Rural Development Renewable Energy Technologies

The project identified several technologies for further design, development, field testing, and possible replication. By the midterm evaluation, the project had narrowed the technologies to be included in the project to the following: earthen stoves; portable sheet metal stoves; retained heat cookers; improved buildings; and simple solar water heaters.

The project followed the methodology developed by the contractor for reviewing the potential for each of the priority technologies. By the PACD, it was concluded that retained heat cookers and earthen stoves had potential, but may prove to be difficult to replicate. Improved buildings for rural areas were more problematic, except for use in

rural institutions such as schools and government buildings. Small solar water heaters were considered not to be a viable technology for rural areas, due to technical as well as socio-economic reasons.

Metal stoves were considered to be potentially viable, and considerable work was done to develop stove models which could be easily fabricated locally, and replication strategies which relied on the private sector. There was insufficient time to complete work on the improved metal stove, but the GOB has incorporated this component into the Ministry, and has asked donors for follow-on support.

The Energy Initiatives for Africa Regional Stoves Subproject will be including Botswana as one of its cooperating countries.

8. Institutional Assessment.

The midterm evaluation urged that the project identify the institutions involved in the two villages, and to identify if possible the mechanisms needed to be able to work with these institutions in meeting project objectives. An emphasis on institutions helped to bring the project closer to problems of implementation; unfortunately, the institutional assessment, as well as more economic analysis, should have been included at the beginning of the project.

9. Awareness and Outreach.

Considerable work was done in building awareness of the importance of renewable energy, both in the two pilot villages, and at the district level. In general, while these efforts were competently done, the activities were probably most useful in those instances where technical options were well-advanced. Except for metal stoves at the end of the project, the awareness programs did not have the level of specific impacts which had been expected in the Project Paper.

10. Training.

The training programs included training for staff, as well as extensive training of village workers, artisans, water crews, and others. The training of staff was extremely well done, both in terms of the U.S. training activities as well as special management skills training in Botswana. While some of this training was lost when staff were not retained by the GOB after the PACD, the staff training program should serve as a model for other small projects in Botswana.

Participant training was somewhat less successful, due to the reasons noted above concerning awareness campaigns. The transfer of skills for a technology which is not yet commercially viable may represent premature training.

C. FINANCIAL SUMMARY:

<u>Authorized LOP</u>	<u>Obligated</u>	<u>Accrued Expenditures</u>
\$3.3 million	\$3.3 million	\$3.3 million

CONCLUSION:

BRET was able to identify those technologies which appeared to have applicability, and put them through a structured methodology of research, development, field tests, and replication which effectively forced out marginal technologies.

The contractor provided satisfactory long term staff, and excellent short term personnel. Institution-building was effective; the level of experience and training of the BRET staff was excellent. Unfortunately, only one of the staff is still involved in work directly related to BRET activities.

Unfortunately, the project's rural bias, relatively poor focus on economic considerations until the end of the project, and inability to alter a poorly designed Project Paper until the midterm evaluation made it impossible to adequately meet all of the original project objectives and outputs by the end of the project.

The project's midterm evaluation recommended significant changes in the project's outputs and purposes, thus improving the potential for successful completion on the part of the contractor, by emphasizing the process of technology testing and replication. Since the project was a pilot activity and since the Mission's portfolio did not permit a second project; the project's ambitious objectives could not be satisfactorily completed prior to the PACD.

The original emphasis on two pilot villages limited the project's ability to consider regional or national replicability, and limited the project's flexibility to adequately react to the changes recommended in the Midterm Evaluation. While excellent nation-wide data collection was initiated on wind and solar resources, the lack of national comparability of relevant socio-economic data severely affected the project.

The project was designed with an ambiguous management structure, sharing responsibilities between the BRET staff and the Botswana Technology Center (BTC). This relationship written into the Project Paper seriously hurt the ability of the contractor to implement the project; once this impediment had been removed after the midterm evaluation, the contractor was able to be far more effective.

Insufficient effort had been taken either by the contractor or by the Government to consider possible approaches for ensuring incorporation of project activities and staff into ongoing GOB institutions, even though this had been outlined in the Midterm Evaluation.

LESSONS LEARNED:

1. Renewable energy projects per se should not be financed by AID; projects which examine specific activities or end uses, and which are not limited to renewable energy could be considered if adequate attention has been given to economic and institutional barriers.
2. Missions should be prepared to support projects involved in needs assessments, technology development and testing and field replication for at least five years; follow-up projects, or assistance to ensure adequate support by donors should be included in Mission CDSS.
3. More emphasis should be given to economic and market analyses; base line surveys should provide data which will permit the analysis of the potential for commercially viable diffusion.
4. Clear delineation of responsibilities should be made by the Mission and the Government as to the relative role of project partners. If possible, cross-cutting responsibilities should be avoided.
5. Project outputs should emphasize the potential for replicability, and the existence of mechanisms and strategies to influence expansion of sales or the use of technologies, rather than numbers of objects.
6. Project should ensure that the Chiefs of Party identified by the contractor have adequate experience with management and administration on similar projects in the developing world. Technical skills should not be placed before management skills, if possible.
7. End-of-Project report writing should begin early enough. The amount of data accumulated by renewable energy projects is often underestimated and can easily overwhelm the contractor's team if advanced planning is not carefully done. A schedule of when various drafts are to be submitted and reviewed should be agreed upon by USAID, the Government, and the contractor's team a year before the PACD. The format and content of the reports should be clarified. The submission of the reports should be staggered with the first report used as a test case to determine if the format and content requirements have been satisfied.