PD WAC 59D

REAT

MIDTERM EVALUATION

USAID/GOE RENEWABLE ENERGY FIELD TESTING PROJECT

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TABLE OF CONTENTS

Executive Summary

Section 1: Summary Conclusions and Options for the Project

Introduction. 1-1
A Perspective on the Project. 1-1
The Current Situation 1-2
Summary of Conclusions and Recommendations. 1-2
The Options 1-3
Evaluation Team Recommendation. 1-3
Option 1. PACD Extension for Field Tests Under Procurement. . . . 1-4
Option 2. PACD Extension with Project Redesign. 1-5
Option 3. Project Termination by Current PACD (August 1988) and No PACD Extension. 1-6

Section 2: Issues, Findings and Recommendations

Introduction. 2-1

A. General Issues

A.1 The Evidence of Political Commitment 2-1
A.2 The Emergence of Other Players 2-2
A.3 The Generic Delay Problem. 2-2

B. Management and Institutional Development

B.1 Management Issues. 2-3
Technical Assistance: Prime Contractor - LBII
Government of Egypt Issues
USAID Project Management Issues
B.2 Control Issues 2-6
B.3 The Original Project Paper Implementation Approach and the Lack of Subsequent Revisions Without a PASA Agreement. 2-7
B.4 Delivery of Technical Assistance by the Contractor . . . 2-8
B.5 GOE Counterpart Organizational Structure 2-10
B.6 The PP, RFP and Proposal Schedules 2-13

C. Technology Transfer

C.1 The Failure to Produce Joint U.S.-Egypt Analyses 2-14
C.2 Training Accomplishments 2-14
C.3 Other Training Issues. 2-17
C.4 Project Design Weaknesses. 2-17
C.5 Need to Consider Information and Local Production Benefits in Testing Decisions 2-20

D. Information Dissemination

D.1 Lack of Focus on the Information Dissemination Component. . 2-23
D.2 Impact on Host Institutions 2-25

Section 3: Thoughts on Redesign

Introduction. 3-1
A Management System Design. 3-1
Procurement 3-2
Rethinking the Technological Focus. 3-2
Other Activities and Procedures 3-3
Possible Roles for the Egyptian Private Sector. 3-4
Looking at What Done Elsewhere. 3-4

Bibliography

Annexes

Annex 1. People Interviewed
Annex 2. Other Renewables Activities in Egypt
Annex 3. Comments on the Project Technological Focus
Annex 4. Evaluation Terms of Reference
Annex 5. Mapping of Statement of Work and Evaluation Report
Annex 6. A Management System Design
Annex 7. Summary of GOE Counterpart History

ABBREVIATIONS

EEA	Egyptian Electric Authority
GOE	Government of Egypt
GOFI	General Organization for Industrialization
GPC	General Petroleum Corporation
IPH	Industrial Process Heat
IQC	Indefinite Quantities Contract
LBII	Louis Berger International, Incorporated
LPM	Liaison Project Manager
NASA	National Aeronautics & Space Administration
NGO	Non-Governmental Organization
NREA	New & Renewable Energy Authority
PACD	Project Activity Completion Date
PP	Project Paper
PSC	Personnel Services Contract
REFT	Renewable Energy Field Tests
REIS	Renewable Energy Information System
RFP	Request For Proposal
RPM	Resident Project Manager
TA	Technical Assistance
USAID	United States Agency for International Development
8A	Minority & Women Firms

EXECUTIVE SUMMARY

This report is the result of a mid-term evaluation of the USAID/GOE Renewable Energy Field Testing Project (REFT). Section 1 presents the conclusions in a summary form and, more importantly, the recommended options for future work on this project. Section 2 presents the evaluation's detailed findings and recommendations. Section 3 presents the Evaluation Team's major ideas for the recommended project redesign.

Summary of Conclusions and Recommendations

1. This evaluation should have taken place as early as a year ago, when it could have provided more timely insights about changes that were needed.

2. Renewable energy has increasing political support in Egypt, and the GOE expects renewable energy to play an important role in its overall development strategy.

3. After much delay, there is a staffed and functioning GOE institution capable of implementing the type of activities supported by the project; much of this capability stems from the work of this project.

4. Many of the technologies appear to be viable in today's economic conditions for particular end-uses. Furthermore, some, such as wind, may have significant economy-wide potential as a source for the electricity grid. Testing and related activities deserve continued support.

5. A redesign is required before any project activities, beyond the three field tests under procurement, are approved. The project design has weaknesses which have hurt the project and been a source of delay. A major problem was that the implementing schedule and strategy were not revised or modified as was needed at several points in the project.

6. The project is far behind schedule. While partially due to delays in institutional development, this is mostly due to management shortcomings by all parties: USAID, the technical assistance contractor, and GOE/NREA. Management must be strengthened in accordance with steps detailed in this report. Better project management is critical to future project success.

7. Delivery of technical assistance has been inefficient. The objectives of joint work and technology transfer have not been fully achieved. Furthermore, there have been numerous reported instances of problems with personnel and document quality. Alternative mechanisms for delivering additional technical assistance should be arranged. The details of this should be part of the redesign focus.

5

Future Options

The project's current PACD is August 31, 1988. Three distinct options (detailed in Section 1) which integrate the findings and recommendations of the evaluation team and provide a focus for USAID and GOE decision-making are:

Option 1. PACD Extension for Limited Activities: Extend the project for sufficient time to bring the three field tests under procurement to a useful degree of completion and to establish the element of the REIS that supports field test data collection, by the new PACD.

Option 2. PACD Extension With Project Redesign: Option 1 plus a project redesign effort that develops more field tests, new initiatives, extensive information systems, and other elements.

Option 3. No PACD Extension: Cancellation of all current activities which cannot be brought to a useful degree of completion by the current PACD.

Evaluation Team Recommendation

Option 2 is strongly recommended, but only if certain conditions (specified below) are met. One of these conditions involves a major redesign effort which considers new activities and revisions to original activities; important issues for the redesign are outlined below. The project should not be extended with only an improvement in management. This option is recommended because the area of renewable energy is important in Egypt, it has growing political support, and the U.S. is a logical source of the technology and assistance.

Option 1 is not recommended unless the conditions presented below for Option 2 cannot be met. Option 1 should at minimum be pursued because although the prior faults of the project can be traced to all parties, there is now an institution to benefit from the testing. The conditions for Option 1, which include a new management structure and schedule, are achievable and increase significantly the possibility of overcoming some of the past problems and of fulfilling a revised schedule that covers a more limited agenda. There have been some successes in the projects, the field tests are worthwhile, and many of the delays and problems are endemic to many projects in Egypt. With more effective management and a more modest agenda, these problems should be overcome. The project could proceed under Option 1 while the redesign necessary for Option 2 is undertaken.

Option 3 is only recommended as the last recourse if the pursuit of Options 1 and 2 is totally unsuccessful.

Recommended Option: PACD Extension with Project Redesign

Under the recommended Option 2, other previously approved project activities (i.e. the information system, additional field tests, and new initiatives) could continue, and new project activities (i.e. tests not yet defined, specialized training, private sector involvement programs) could be

6

included. Option 2 can be considered as an envelope containing a continuing project of varying size and complexity depending on:

1. the length of the new PACD and the amount of funds provided;
2. the mix of project elements included; and,
3. the management and implementation approach adopted.

Any version of Option 2 requires a redesign effort. Extensive changes may require a PP Amendment, although it is possible to identify a version of Option 2 that will require only limited redesign. This version would only include continuation of some existing project activities which could be completed by the new PACD defined for Option 1. For example, this might include only work on the information systems (a priority) and/or some limited new initiatives and/or training without any new field tests or other activities. Inclusion of more of the field tests and/or other activities will require a longer extension of the PACD and a greater redesign effort. USAID and GOE judgement on an acceptable new PACD and overall level of project funding would, in effect, dictate the scope of the project redesign, provided the conditions listed below are accepted.

Option 2 can be considered and its details can be designed while the project goes forward under Option 1. Meanwhile, there would be no further technical assistance via the LBII contract. The type, level and mechanism of further technical assistance would be defined in the redesign. (Some initial thoughts on this redesign are presented in Section 3.)

Conditions for Option 2

1. A project redesign (of scope and effort), possibly leading to a revised PP. The project redesign should use the findings and recommendations of this evaluation report as a starting point (see Sections 2 & 3). The redesign would consider the following aspects of the project:

   i. project management and implementation;
   ii. technical (technology/system) focus;
   iii. institutional and other support activities;
   iv. activities to include the private sector; and,
   v. procurement procedures for both technical assistance and hardware/software.

Plus the following conditions paralleling those for Option 1 (see Section 1):

2. A new project management structure which would include (i) an NREA project manager with nearly full-time attention to this project, (ii) a new project management committee, and (iii) better management controls.

3. An extended PACD and a realistic revised schedule based on the redesign, mutually agreed upon by USAID S&T and USAID contracts office and GOE/NREA.

4. A new position of Technical Assistance Project Coordinator would be staffed to coordinate the firms participating in the field test procurements. This position would replace the Resident Project Manager.

7

8

SECTION 1

SUMMARY CONCLUSIONS AND OPTIONS FOR THE PROJECT

Introduction

This report is the result of a mid-term evaluation of the USAID/GOE Renewable Energy Field Testing Project (REFT). The scope of work (Annex 4) for the evaluation team was broad, requiring both a retrospective focus to identify past problems and successes, and a perspective focus to provide assistance in decisions concerning:

1. whether to continue current project activities;
2. whether to expand project activities;
3. whether to fully obligate the project; and,
4. how to modify the project to improve its effectiveness.

The detailed findings and recommendations are reported in Section 2. Because the findings and recommendations are numerous, and in order to address the above issues, the evaluation team has integrated its recommendations into a limited set of operational options regarding the project's future. This section presents these options and the team's recommendations regarding which of these options should be selected, why, and under what conditions.

A Perspective on the Project

The project was originally designed reflecting a background that is much different than what exists today. At that time, international oil prices were high and increasing, Egypt's public and private sector capacity to design and implement renewable energy based projects was limited, and there was a USAID view that gave less emphasis to the private sector and more emphasis to public sector institution building. Changes in these conditions influenced project implementation by changing the type of the supporting technical assistance contract and the sites and technologies for the field testing. As detailed in Section 2, in both aspects the shifts in project implementation were not as well thought out as they might have been.

The increase in local institutional capability was influenced by the project as well as by efforts by other donors. After numerous delays and shifts which stymied project implementation, there is now a legislatively mandated independent organization with a staff and technical activities. Many of these activities are supported by the USAID project which has developed the staff's capabilities. Institutional capability is reaching what the project design assumed would have occurred much sooner.

The evaluation team has focused on the present state of affairs when deciding upon its recommendations about what to do in the future, and how. Many of the past problems have been addressed while others still need attention. The evaluation studied the history in order to understand what happened and why and to learn lessons. Lessons about the past will contribute to replicating the successes and avoiding the problems and failures.

The Current Situation

Many of the major problems with the project have been addressed. Actions have been taken to improve overall project management, implementation and the effectiveness of TA delivery. During 1985 and 1986, the USAID project officer repeatedly informed the contractor, Louis Berger International, Inc. (LBII), of deficiencies in the quality and timeliness of project outputs and of inadequacies in contract administration and financial accountability. Positive response has been slow in coming, but based on these complaints (some of which were also voiced by Egyptian counterparts), LBII's vice president came to Egypt to resolve some of the problems. In September 1986, the Liaison Project Manger (LPM) was replaced. Then in early 1987, the Resident Project Manager was replaced, and the training coordinator removed from the project.

At USAID's prompting, the contractor and the Egyptian counterparts convened in Ismailia in 1986 to streamline field test development procedures and reduce the number of reports generated. Results of the new procedures are mixed, but at least some field test documents were finalized in Egypt, instead of in the U.S.

Although technology transfer was not as effectively carried out as it could have been, host country counterpart planning and analytical capabilities have noticeably improved as a result of this project. NREA now has a core staff of engineers and economists that should be capable of continuing work under this project. Although specialized training will probably be necessary for the field tests and local counterparts will need to allocate more time to the project, the evaluation team believes that a competent counterpart implementation team is in place.

Summary of Conclusions and Recommendations

1. This evaluation should have taken place as early as a year ago, when it could have provided more timely insights about changes that were needed.

2. Renewable energy has increasing political support in Egypt, and the GOE expects renewable energy to play an important role in its overall development strategy.

3. After much delay, there is a staffed and functioning GOE institution capable of implementing the type of activities supported by the project; much of this capability stems from the work of this project.

4. Many of the technologies appear to be viable in today's economic conditions for particular end-uses. Furthermore, some, such as wind, may have significant economy-wide potential as a source for the electricity grid. Testing and related activities deserve continued support.

5. A redesign is required before any project activities, beyond the three field tests under procurement, are approved. The project design has weaknesses which have hurt the project and been a source of delay. A major problem was that the implementing schedule and strategy were not revised or modified as was needed at several points in the project.

10

6. The project is far behind schedule. While partially due to delays in institutional development, this is mostly due to management shortcomings by all parties: USAID, the technical assistance contractor, and GOE/NREA. Management must be strengthened in accordance with steps detailed in this report. Better project management is critical to future project success.

7. Delivery of technical assistance has been inefficient. The objectives of joint work and technology transfer have not been fully achieved. Furthermore, there have been numerous reported instances of problems with personnel and document quality. Alternative mechanisms for delivering additional technical assistance should be arranged. The details of this should be part of the redesign focus.

Future Options

The project's current PACD is August 31, 1988. Three distinct options which integrate the findings and recommendations of the evaluation team and provide a focus for USAID and GOE decision-making are presented in more detail at the end of this section. These options are:

Option 1. PACD Extension for Limited Activities: Extend the project for sufficient time to bring the three field tests under procurement to a useful degree of completion and to establish the element of the REIS that supports field test data collection, by the new PACD.

Option 2. PACD Extension with Project Redesign: Option 1 plus a project redesign effort that develops more field tests, new initiatives, extensive information systems, and other elements based on a redesign of the project.

Option 3. No PACD Extension: Cancellation of all current activities which cannot be brought to a useful degree of completion by the current PACD.

Evaluation Team Recommendation

Option 2 is strongly recommended, but only if certain conditions (specified below) are met. One of these conditions involves a major redesign effort which considers new activities and revisions to original activities; important issues for the redesign are outlined below. The project should not be extended with only an improvement in management. This option is recommended because the area of renewable energy is important in Egypt, it has growing political support, and the U.S. is a logical source of the technology and assistance.

Option 1 is not recommended unless the conditions presented below for Option 2 cannot be met. Option 1 should at minimum be pursued because although the prior faults of the project can be traced to all parties, there is now an institution to benefit from the testing. The conditions for Option 1, described below, are achievable and increase significantly the possibility of overcoming some of the past problems and of fulfilling a revised schedule that covers a more limited agenda. There have been some successes in the projects, the field tests are worthwhile, and many of the delays and problems are endemic to many projects in Egypt. With more effective management and a more modest agenda, these problems should be overcome. The project could proceed under Option 1 while the redesign necessary for Option 2 is undertaken.

11

Option 3 is only recommended as the last recourse if the pursuit of Options 1 and 2 is totally unsuccessful.

Option 1. PACD Extension for Field Tests Under Procurement

This option involves extending the project until the three field tests for which hardware and support services procurements have been initiated to a useful degree of completion. No new activities would be initiated under this option, and all further preparatory work for other field tests would be terminated. The completion, including a monitoring period, of the three field tests which are in varying stages of procurement, will require that the PACD be extended for a considerable period. The new PACD would be based on a new and realistic schedule which incorporates a redefined monitoring period for all the field tests. In addition, the REIS would be developed to the extent needed to support the collection and analysis of the data from the field tests.

A new and more effective project management structure would be needed, with tighter control by both USAID and NREA in order to insure that there is no slippage in the new schedule. This new schedule should include a contingency period and a review point. This option would include a clear understanding that if the schedule of the field tests slips by the review point, those field tests would be terminated. Technical assistance would continue, but through a new mode.

Conditions for Option 1

1. A new project management structure which should include:

   i. An NREA Project Manager who can devote at least 80 percent of his/her time to the project and can cover both management and technical functional responsibilities. This arrangement should preclude management responsibilities for any other NREA/donor projects.

   ii. A project management committee to meet biweekly without fail to insure compliance with schedule, level of effort, and other project commitments. This group would consist of the USAID project officer, the USAID technical assistance project coordinator (see condition 3, immediately below), project managers for the field test contractors (when they are in Egypt), the USAID Contracts Officer with direct responsibility for the procurements, the NREA Project Manager, and Task Leaders for the three field test activities. Periodic participation (i.e. every third meeting - six weeks) by the Director of USAID S&T and the Managing Director of NREA is recommended. When decisions regarding schedule revisions are made, the Chairman of NREA should also participate.

   iii. Better management controls exercised. Schedules and levels of effort estimates (by subtask and time period) must be mutually agreed upon and a management system used to monitor them. Deviations from these estimates must be justified. Responsible staff and organizations must be held accountable, and repeated failure to meet mutually agreed upon commitments would result in termination of the participant and/or the project activity.

2. A realistic revised schedule of the field test procurement finalization, installation, and monitoring mutually should be mutually agreed upon by USAID S&T, USAID Contracts Office and GOE/NREA.

3. A new position of Technical Assistance Project Coordinator would be staffed. The primary role of this position would be to coordinate the different (three) firms/consortium who are selected for the field test procurements.

If the present Resident Project Manager (RPM) continues to prove effective, he could assume the role of the technical assistance project coordinator. In this case, USAID might consider extending LBII's role only to provide the RPM's services. The services of the Technical Assistance Project Coordinator could be met via other mechanisms as could other needed technical assistance (beyond being a part of the field test procurement packages). Flexible contract alternatives would be: mission contracts, PSCs, 8A and IQC contracts.

Any additional technical assistance would be limited primarily to that related to the three field tests. Under this option, there would be no further technical assistance via the LBII contract. This contract would not receive additional funding and would be phased out.

Option 2. PACD Extension with Project Redesign

Under Option 2, other previously approved project activities (i.e. the information system, additional field tests, and new initiatives) could continue, and new project activities (i.e. tests not yet defined, specialized training, private sector involvement programs) could be included. Option 2 can be considered as an envelope containing a continuing project of varying size and complexity depending on:

1. the length of the new PACD and the amount of funds provided;
2. the mix of project elements included; and,
3. the management and implementation approach adopted.

Any version of Option 2 requires a redesign effort. Extensive changes may require a PP Amendment, although it is possible to identify a version of Option 2 that will require only limited redesign. This version would only include continuation of some existing project activities which could be completed by the new PACD defined for Option 1. For example, this might include only work on the information systems (a priority) and/or some limited new initiatives and/or training without any new field tests or other activities. Inclusion of more of the field tests and/or other activities will require a longer extension of the PACD and a greater redesign effort. USAID and GOE judgement on an acceptable new PACD and overall level of project funding would, in effect, dictate the scope of the project redesign, provided the conditions listed below are accepted.

Option 2 can be considered and its details can be designed while the project goes forward under Option 1. Meanwhile, there would be no further technical assistance via the LBII contract. The type, level and mechanism of further technical assistance would be defined in the redesign. (Some initial thoughts on this redesign are presented in Section 3.)

Conditions for Option 2

1. A project redesign (of scope and effort), possibly leading to a revised PP. The project redesign should use the findings and recommendations of this

evaluation report as a starting point (see Sections 2 & 3). The redesign would consider the following aspects of the project:

i. project management and implementation;
ii. technical (technology/system) focus;
iii. institutional and other support activities;
iv. activities to include the private sector; and,
v. procurement procedures for both technical assistance and hardware/software.

Plus the following conditions paralleling those for Option 1:

2. A new project management structure which would include (i) a NREA project manager with nearly full-time attention to this project, (ii) a new project management committee, and (iii) better management controls; initially to be as outlined above for Option 1, but subject to further revision depending on the redesign.

3. An extended PACD and a realistic revised schedule based on the redesign, mutually agreed upon by USAID S&T and USAID contracts office and GOE/NREA.

4. A new position of Technical Assistance Project Coordinator would be staffed as in Option 1.

Option 3. Project Termination by Current PACD (August 1988) and No PACD Extension

This option would be a controlled management (by USAID) procedure to let the project terminate in accordance with the original PACD. It would prevent continuation of any activity currently in progress which could not be be brought to a useful degree of completion by the PACD. The possibility for such completion must be assessed against a realistic revised schedule. Regarding the field test elements, a useful degree of completion would require a minimum period of post-construction monitoring for all projects. For example, if this minimum monitoring period were defined as six months, then based on current available information, this would mean cancelling of all field tests except the hybrid PV/diesel ice-making project.

Conditions for Option 3

1. Better management control by USAID to insure that only activities that can be completed by the PACD continue (see condition 1 items under Option 1).

2. A realistic revised schedule mutually agreed upon by USAID S&T and contracts offices and GOE/NREA.

3. The LBII contract would be terminated. Technical assistance would be limited to that related to the field tests which would be included in the revised schedule (likely only the PV/diesel ice plant). Any other assistance would be via mechanisms other than the LBII contract. Flexible contract alternatives would include: mission contracts, PSCs, 8A, and IQC contracts. A technical assistance coordinator (as outlined under Option 1) should be considered but may not be necessary if activity is very limited.

SECTION 2

ISSUES, FINDINGS AND RECOMMENDATIONS

Introduction

This section of the report details the important findings and recommendations of the evaluation team. The discussion is organized by the following categories:

A. general issues;
B. management and institutional development issues;
C. technology transfer issues; and,
D. information dissemination issues.

The last three categories are the three major project issues identified in the Terms of Reference. In each category, the format of the discussion is the same: a statement of the issue, followed by a presentation of the detailed findings, and then recommendations where relevant. The discussion is organized around the issues which were found to be the most important rather than the specific questions listed in the Terms of Reference. However, these questions are, with few exceptions, answered in the course of the discussion of the issues. Annex 5 is a table listing the detailed questions in the Terms of Reference and where the relevant discussion in this section can be found.

A. GENERAL ISSUES

A.1. The Evidence of Political Commitment

The Egyptian Government is seriously committed to developing the country's renewable energy potential, particularly for use in desert and remote areas, and for conventional energy conservation. This commitment is reflected in increased budgetary allocations for renewable energy development in two five-year development plans (1982-87 & 1987-92), and the annual plans. A new organization, the New and Renewable Energy Authority (NREA) has been established for the development, testing and application of renewable energy technologies. NREA's broad mandate also includes training, outreach and extension services. USAID's Renewable Energy Field Testing Project constitutes 40% of NREA's technical budget. Furthermore, there is a high degree of political and scientific interest in USAID's project, reflected by President Mobarak's interest in its status. The success of this project will obviously impact Egypt's renewable energy development.

From USAID's perspective, it would be very difficult to abandon such a politically important project. Land reclamation and renewable energy are two key objectives for the Egyptian Government, and USAID is not providing assistance in the first area. The U.S. economic assistance program to Egypt will be negatively perceived if the assistance in renewable energy is unable to test and demonstrate simple renewable energy technologies. This project must deliver something concrete (besides studies) to maintain its credibility.

USAID has already obligated $17.3 million to this project; $24 million are authorized. Over $4 million has been used in TA that seems not to have been efficiently and effectively delivered. Although the grant agreement was signed in 1982, after five years, three (the field tests, the information system, and

16

new initiatives) of the four major outputs have yet to be implemented. To terminate the project in August 1988 without these outputs (except perhaps one field test) will undoubtedly result in Egyptian dissatisfaction.

A.2. The Emergence of Other Players in Renewable Energy

Given the political importance of renewable energy, especially in the development of desert and remote areas, a significant number of institutions other than NREA are working in this area. The projects include electric power generation, water pumping and saline water desalination. Institutions active in these technologies include the General Petroleum Corporation (GPC), the Desert Development Center of the American University of Cairo, Cairo University, the National Research and Agriculture Research Centers, the military, and a number of public and private sector manufacturing firms. See Annex 2 for more details.

A.3. The Generic Delay Problem

The project is far behind schedule due to a number of factors. One important factor is that the technical assistance component is more complex than other similar projects reviewed by the evaluation team. This complexity is due to the many (7) project stages before field test implementation and the extensive mechanisms required to coordinate two bureaucracies (USAID and NREA), one prime contractor, and five subcontractors. Another factor is that a large amount of work was done in the U.S.A., which delayed almost every draft and final report.

GOE counterpart organizational issues and the pace of staffing also caused delays in design, review, and negotiations. There were different GOE implementing organizations, no permanent project counterpart staff before mid-1985, and no full-time project leader or coordinator. Because the GOE is centralized and many decisions are reached by consensus, bottlenecks were often present.

The evaluation team found that other analogous activities in other projects were implemented in about six months to two years after start up. The team has also found that the average time for moving from signing a contract to implementing a field test was one year for equipment-drop projects with somewhat more simplified beginning stages, one contractor, and a simpler counterpart situation.

In our view, only one of the three field tests already in procurement has some chance of completing the process by August 1988. Construction and operation of other tests would extend well beyond any acceptable project management limit. Significant progress is not likely to happen by the original time limit.

Most of the delays experienced in the Renewable Energy Project also occur in many or most other USAID projects. However, while delays must be expected in this type of new project and in this environment, we feel strongly that they are too extensive in this case, and that the bulk of the responsibility for the delays must be attributed to overall mismanagement or an unrealistic original project schedule.

B. MANAGEMENT AND INSTITUTIONAL DEVELOPMENT

B.1. Management Issues

The complexity of the Renewables Project with its emphasis on collaborative work throughout all phases puts extraordinary pressure on the management skills of all participants. This section outlines the background and present position of the prime contractor, NREA, and USAID management functions.

Technical Assistance: Prime Contractor - LBII

The Evaluation Team's investigation indicates that the TA input has consistently been of low quality (see Section B.4). This effects other project components since technical assistance is key to both the technology transfer and the training. To provide adequate TA, the project requires a very strong Resident Project Technical Assistance Manager (RPM) and excellent U.S.-based coordination and backstopping. The evaluation team found a lack of the necessary management leadership, and the project has suffered.

The Resident Project Manager is required to master two bureaucratic systems, coordinate several GOE agencies including NREA, GPC, and GOFI, manage the work of five subcontractors, coordinate with USAID, and work in two different countries. This results in a critical and very demanding technical assistance function, and is not typical of many similar technical assistance component positions. The RPM must drive project elements through the various systems requiring sign-off (see Section B.4) and effect organizational change. To accomplish this, major behavior changes from past performance must be fostered: building local grantsmanship skills, informal training, and inter-agency cooperation. In addition, more traditional project management and administrative skills, such as subcontractor management, multi-project control, and generation of printed and oral reports must be strong.

The prime contractor did not do a consistently adequate job on any of these major functions. Numerous complaints regarding the RPM began early in the contract period and have continued. Inadequate coordination of subcontractors and quality control of the work has been a shortcoming (see Section B.4); many reports were of poor quality and were usually late. The scheduling issues became worse over time because the RPM did not make the necessary schedule adjustments to reflect evolving project realities.

The evaluation team was told from very start that some problems have resulted from LBII's personnel and its personnel policy. The LBII technical proposal offered a project management structure which had a Liaison Project Manager (LPM) based in the U.S. as the overall head of the consultant team and a Resident Project Manager (RPM) based in Cairo. Prior to contract signing, LBII was asked and agreed to substitute the designated LPM for the RPM, but when the project began, this substitution was not possible. Furthermore, the actual RPM that was placed in-country was not the original RPM candidate in the proposal. So the project commenced with neither the RPM originally offered in the proposal nor the requested and agreed upon RPM who was the basis for the contract agreement. These initial problems may have flavored some of subsequent interactions among the parties. This situation was worsened by the

18

fact that the LPM left LBII in 1985, and the GOE and USAID were not immediately informed. Subsequently, the services of LBII were suspended for three months until a new LPM was put in place.

Assessment of the Present Conditions As a result of the problems outlined above and documented by both USAID and NREA staff, a new RPM has recently started work, and all comments regarding this new RPM have been positive. The requisite set of strong management and technical skills are now present in-country.

Recommendation It is our recommendation that the present TA contractor be phased out as the project moves to field tests and monitoring. Eventually the position of RPM should be replaced by an in-country field test coordinator. There may be a role for the new RPM under some new arrangements.

Government of Egypt Issues

The NREA has technically qualified Task Leaders in place, but it is the Evaluation team's opinion that the agency proceeded slowly. Throughout our investigation NREA management has been uniformly cooperative, but few have admitted responsibility for any of the serious problems or project delays. While NREA has expressed concern regarding delays and performance on the part of the technical assistance contractor, written statements detailing the problems and requesting action have been infrequent and usually not sufficiently explicit to result in change.

The USAID project is unique (theoretically) in its institutional capacity-building focus. The local project management team was to have been a full participant in all of the project tasks, with NREA having prime responsibility for two tasks - (i) institutional arrangements for the field tests and the post-field test O&M and (ii) data collection. However, as some of the NREA interviewees pointed out, renewable energy testing and application is relatively new to Egypt, and staff skills required for a participatory project management and implementation procedure were not present. In addition, in the past the production of planning and design papers was also a new activity. The management situation may improve as the project moves into the field test procurement, construction, and implementation as these areas will probably be more familiar. Nevertheless, one project team leader lauded the REFT project as valuable training ground for the NREA staff (see Section C.2).

Throughout the project the GOE counterparts have been changing their organizations. NREA has been part of three reorganizations during the life of the project; see Annex 7 for a summary of this history. The shifting of GOE project management and implementation responsibilities through three organizations undoubtedly contributed to project implementation delays.

NREA is not yet a totally autonomous organization in that it is currently financially dependent on EEA. This situation is supposed to change at the beginning of the next fiscal year. This dependence has slowed the internal NREA appproval process.

To this date no full time NREA Project Manager has been designated, although this project represents approximately 40% of the agency's total budget. There is a marked difference of opinion as to when the project was

fully staffed. There are also differences of opinion as to efficiency of training trips, response to report drafts, and how other administrative work was performed. Although it is not the task of the evaluation team to sort through all the claims, these differences of opinion alone have affected the project's progress.

Assessment of the Present NREA now has a cadre of field test managers and staff who have appropriate training and technical experience. Most have benefited from their experience in this seven stage process, and many have been on site visits to the U.S.A, attended conferences or have otherwise been informally educated about the latest applications. The Evaluation Team is concerned about staff time commitment and work load issues, and is particularly concerned about an apparent lack of acceptance of responsibility for project problems, delays, and progress (see Section B.5).

Recommendations We recommend that a senior GOE project manager position be created to supervise the project and to deal more effectively with the communications, control, and coordination issues outlined above. This project, manager must be able to devote about 80 percent of his/her time to this project, precluding all other project management roles. Senior NREA management (e.g. the Managing Director) should periodically attend the project management meetings, and on certain occasions (when schedules are agreed upon) the Chairman should join the meetings.

The link between EEA and NREA should be cut. NREA should be allowed to function as a fully autonomous organization as of July 1987.

USAID Project Management Issues

The USAID Project Manager must also be very active and skillful. Project complexity creates a similar level of demands on the USAID Manager as it does on the RPM. He must be proactive in order to ensure the best efforts from all parties, and above all, be in charge. This position requires attention to details, communication and negotiating skills, and the ability to foster cross-cultural multi-agency collegial relationships.

As problems with the contractor mounted, our evaluation indicates that project management did not measure up to these increasing challenges. The problems have not been dominated by technical or alternative energy engineering issues. The project manager has repeatedly indicated dissatisfaction with the performance to the Technical Assistance (TA) Contractor. There appears to have been insufficient follow-through to result in better performance in a timely fashion. The USAID system does not appear adequately supportive to allow better oversight and control of level of effort contracts (e.g. by withholding payment). If the project is to approach its original potential, the USAID Manager must develop and enforce very high performance standards for the TA contractors and GOE agencies, pay particular attention to local needs at the earliest stages of hardware installation, hold all other agencies to their commitments, and insist on timely reports and submission of control documents.

In the face of all of this, this evaluation should have taken place about one year ago.

20

Assessment of the Present After years of working on the issues outlined above, there are now several of the most important conditions for progress: technical assistance personnel have been replaced, a long record establishing quality in report standards are in place, NREA task leaders are hired, and the implementing organization itself is formed and has a mandate.

Recommendations New performance criteria should be established depending on which of the options discussed in Section 1 is adopted, because there is no more room for error or slippage. USAID management must ensure schedule achievement. To this end, the Contract Office must become a regular participant in project management, and the director of the S&T Office should participate in project management meetings more often.

Even in a scaled back project more attention must be paid to documentation, dissemination of data, and recording proceedings and lessons learned in the remaining stages of the project. Technology transfer will continue to the extent that collegial relationships are established via collaborative work, professional contacts, and joint work projects. These activities must be reinforced.

B.2. Control Issues

Control issues are always difficult in large level-of-effort projects; and as the schedule deteriorated in this project, control problems were exacerbated and have become very serious. At the time of this evaluation, these types of contracts are management intensive, especially from USAID's point of view if the TA contractor is on an USAID direct contract. Our evaluation has found that very little concrete evidence of cost effective quality professional work has been generated by the technical contractors. The Egyptian counterparts were slow in getting organized and staffed, and USAID project management has not been able to manage the process on schedule in the face of these problems.

On several occasions draft reports and even final versions were found by the review committees to be unacceptable, yet funds were still disbursed. The field test task leaders and their agencies have documents supporting their complaints over the years. Some actions have been taken, but the report writing phase is nearly complete.

The level-of-effort contract is a sensitive issue with several Egyptian managers interviewed by the Evaluation Team. It is our view that this type of contract is not well understood or appreciated by the GOE. They seem to sincerely believe that it is to the contractor's advantage to prolong work as much as possible. Further, they believe there is no recourse, since it is a USAID direct contract. They also believe that status reports became relatively meaningless because they were too late to be used as a management tool and had insufficient detail. Our interviews have found disputes over minutes of meetings and financial reports, and over records that have been adjusted after being approved by the project committee.

The views of the Egyptians have some basis, in our opinion. It was the responsibility of the prime contractor to demonstrate why its estimate of the project cost/time was becoming insufficient to accomplish the required tasks. As time went on and delays mounted, it was their further responsibility to

detail the reasons for the delays beyond those flowing from long lag time for reviews by NREA and USAID, and to provide recommendations for addressing the problems. They have done little of this self-monitoring.

The financial reporting system of the Technical Assistance contractor is not sufficiently disaggregated to be a useful management tool. Items are broken down by subcontractor and test project and by funds and level of effort. There is no way to monitor the activity on any test in any detail (e.g. the wind farm). Expenditure information is not provided by sub-task. As a result, NREA/USAID do not have concise costs for the individual reports submitted by the TA contractor. While not required in the contract, thes costs were later requested by the S&T office and would have been useful information in performance tracking.

It is this team's understanding that this issue has been addressed with the TA contractor and the response was two-fold. First, the prime contractor agreed with the recommendations for more financial controls of the sub-tasks. Later, the contractor indicated that it was either impossible or too difficult to disaggregate further. Such controls should have been demanded from them or payment should have been withheld. It is unclear whether the USAID contracts office would support such actions.

This situation is indicative of another problem with the level-of-effort contract due to the lack of controls and follow-through by the Contract Officer. Overall, the lack of adequate controls accentuated by the contract form did not foster the best level of effort on the part of the prime contractor.

Assessment of the Present

The history of the control component of the Renewables Project has been very frustrating for USAID management. Quality improvements have been demanded, promised by the contractor, but not delivered. As in the previous section, it appears that the most severe control issues are being resolved. Early performance of the new Resident Manager is very encouraging. The elements may be in place to implement management controls as the project moves into limited field testing.

Recommendations

The team recommends that a management/control system be put in place to insure better performance (see Section 3). For example, minutes from committee meetings, recommendations on remaining draft reports and other proceedings should be closely administered. The Contract Officer or his representative should become active participants in any project redesign which takes place. It is likely that contractual arrangements are going to become increasingly diverse and early input from these functional experts will help facilitate project management and control.

B.3. The Original Project Paper Implementation Approach and the Lack of Subsequent Revisions Without a PASA Agreement

The Project Paper (PP) explicitly stated that the project implementation would utilize a PASA agreement, whereby NASA Lewis would provide the technical assistance and be responsibe for the design and subsequent field test

procurement. There would not be two parties involved, one for design/procurement document preparation and another to execute procurement, as is now the case. Implicit in this design was the flexibility for NASA to utilize whatever procurement mechanism was most appropriate (e.g. turn key, time and materials works, competition for systems/component hardware) depending on the conditions and particulars of the individual field test.

Later (post PP), the implementation approach was changed and a private consultant was selected through a competitive process to provide the technical assistance, which included preparation of procurement documents. It was also decided that USAID would do the field test procurement and that the procurement would be done from USAID/Cairo. Thus, there are now two parties to do the procurements and no party is in the States where the sourcing is being done. While this procurement structure is not solely responsible for the project delays, it is clearly part of the problem. These procurements are complex for their dollar size, and many of the potential sources are not very experienced with exportation or with USAID and Egypt. When the shift from a PASA-type arrangement was made, too little attention was paid to the needed redesign of the procurement process in terms of who should be responsible and what mechanism should be utilized.

Recommendation

If additional field tests and other hardware procurement are to remain part of the project, changes in both the procurement contract mechanism and the responsibility for procurement management should be considered. Particular consideration should be given to mechanisms which would allow separating the procurement of hardware from that of services. A mixture of cost reimbursable for services and fixed price for components/systems is conceivable. Under such an approach, a hardware contractor would not have to include contingency funds to cover his uncertainties regarding delivering services, including construction, in an unfamiliar environment. Only the hardware would have to be delivered under fixed price terms. Such an approach should lower equipment costs, but will require greater diligence in contract monitoring. Other options to be considered are the use of performance specifications rather than technical equipment specifications. In any case, the merits and drawbacks of alternative procurement mechanisms should be examined prior to any further field test procurement. This should be part of the overall project redesign needed before additional field test or other activities are undertaken.

B.4. Delivery of Technical Assistance by the Contractor: LBII et al.

The original technical assistance budget has effectively been exhausted; however, the objectives of such assistance are far from being attained. The expenditures and much of the delay can be attributed to inefficient delivery of technical assistance. LBII as the prime contractor failed to adequately schedule/reschedule the activities of the technical assistance.

The naivete of the PP schedule (see Section B.6 below) should have been recognized within a short time of contractor mobilization, if not earlier. There was inadequate rescheduling to reflect and accommodate the realities of GOE staff availability and the status of the institutional development. This

was particularly necessary during the earlier phases of the work, during the transition from the Quattar Authority to EEA and while the EEA staff was growing.

The contractor appears to have lost sight of the repeated and explicit requirement for joint work by the contractor and the GOE staff on many of the project activities as required by the RFP. The contractor did not manage the project (including rescheduling and delaying the expenditure of expensive foreign technical assistance, as called for by the situation) to maximize technology transfer by such joint work (see Section C.1 below). Instead the contractor effectively minimized the technology transfer by assigning most of the elements that were to be joint work largely to its own staff and by working mostly in the U.S., without GOE participation. Consequently, the GOE staff generally had only a reactive review role rather than a more active participatory one, with one exception of data collection.

Work in Egypt by the U.S. experts was not organized for the joint/sequential accomplishment of activities in order to allow formal and informal training and technology activities to overlap with site visits, annual plan development or other work. There should have been more overlapping of the different multistep field test preparation activities and a greater percentage of the work implemented in Egypt. This would require longer missions by the U.S. experts.

According to comments by both GOE and USAID staff, there have also been continuing problems with the professional expertise, experience and responsiveness of some contractor team personnel. In some cases, they were unwilling to cooperate adequately in efforts such as seminars and workshops. On the other hand, it should be pointed out that there have also been positive comments regarding the competence of many of the consultant team members.

Other specific contractor management and implementation shortcomings pointed out to the team are:

1. LBII failed to insure uniform approaches and formats by subcontractors (Meridian, Lockwood Green, E3I, Battelle, EMECO) when appropriate;

2. Deliverable reports and responses to comments were not on schedule.

3. The evaluation team heard numerous comments regarding deficiencies in many of the contractor's deliverables. At various points, the contractor acknowledged such problems and promised to provide internal review for quality control. Such review has not been systematically implemented to our knowledge. Some reports continue to be criticized by USAID and/or GOE (e.g. the Training Report).

4. The quality of contractor documents has contributed to delays in several ways. The first is due to the need for revisions. A second way is that, in the judgment of USAID project and contract staff, the shortcomings in the tender documents and the failure of the contractor to incorporate corrections indicated by the review has had very serious negative impacts on the procurement process. This was the case for at least the wind farm.

5. The contractor team failed to identify some of the deficiencies in the substantive focus of the project (see Section C.4) and in the approach utilized in evaluation of field test alternatives (see Section C.5).

Recommendations

In the evaluation team's view, the inadequate performance by the technical contractor reinforced by the personnel problems (see Section B.1) argue for the termination of the LBII contract. Other mechanisms, such as a PSC coordinator, should be considered to coordinate and arrange the necessary technical assistance. Continuing expenditure on technical assistance should be limited until there is a review, since all of the technical assistance required for the field tests already under procurement is already included with the hardware procurement. In light of the underlying management flaws (see Section B.1), design shortcomings (see Section C.4) and general implementation problems, other technical assistance inputs should await a project redesign effort.

B.5. GOE Counterpart Organizational Structure

As this project has been through three GOE implementing organizations, the development of a core counterpart implementing staff with requisite skills and clearly delineated responsibilities has suffered. The Renewable Energy Field Test (REFT) project manager was also the Acting Director of EREDO (later named NREA), plus the manager of other donor-financed projects. The separate task leaders had other project and functional responsibilities as well. This increased workload for the senior project counterparts, the directors, seems to have been a negative factor in following schedules and providing timely communication with the TA contractor, especially since the directors initially had no junior support staff.

In addition, NREA counterparts informed the evaluation team that, in general, they did not feel that they "owned" the project because of their lack of control over the TA contractor (who was on an USAID direct contract). In their view, prior to the arrival of LBII's current RPM, the contractor dealt directly with the USAID Mission and did not adequately address their needs and concerns. The problem was further exacerbated by (i) the general Egyptian lack of experience and dissatisfaction with a level of effort mode of TA delivery and (ii) the impracticality of conducting most of the field test design and review work in the United States, as called for in the project design. All of the above problems combined to place GOE counterparts into a reactive review role as opposed to active collaboration and joint effort as was originally planned (see Section C.1).

Counterpart Staff Allocation and Availability

A distinction is made between the allocation of counterpart staff and its availability. Availability, in this context, concerns the degree of active participation in this project and the level of having other on-going responsibilities (see Sections B.1 and B.2). Staff allocation was an issue during the project's transition from one GOE institution to another, but now it appears to have been resolved by the specific allocation of NREA personnel to the project.

Although the project did have counterpart staffing problems in the beginning, NREA states that it currently has over fifty people working on the project (not all of them are full-time staff). The evaluation team believes that the REFT project now has a qualified and capable counterpart team in place (see Section C.2). The REFT team constitutes the core professional and technical staff at NREA, which is still divided along compartmentalized project lines (i.e. the EEC project, the American project). A further subdivision of responsibilities occurs within the USAID project by major tasks. NREA presently is being expanded to run more along functional lines then by project. As this change proceeds, internal management control and coordination and integration of activities should improve.

Presently, the allocation of counterpart staff is not a problem, particularly for junior staff who appear to be working on the project full-time. However, NREA needs to directly commit to the project more time and effort of the project's directors for more effective control and implementation. Given the continuing multiple responsibilities of the project's senior management and the current government salary structure, project activities may have to be realistically paced to the availability (in terms of time and effort) of these counterparts. A revised schedule of project activities will have to be built upon the full-time availability of key staff in order to make the most efficient use of expatriate technical assistance and of a more active and participatory local project management structure.

NREA's Budgetary Resources and Sustainability

According to the EEA Chairman, NREA's budget for the next five years (1987-1991) is L.E. 53 million. For fiscal year 1986-1987 NREA did not have a separate budget, but received funds from EEA. According to NREA team leaders, their GOE budget for fiscal 1987 is L.E. 14 million, of which 10 million is earmarked for projects.

The REFT project constitutes 40% of NREA's current budget. As a nascent institution, NREA relies quite heavily on external assistance for budgetary support. In the interests of long-term endurance, the institution could consider ways of revenue generation in order to become more self-reliant.

NREA's mandate calls for the provision of consultant and extension services. As the institution's capability is strengthened, NREA could consider generating income to supplement its budgetary resources by charging for services. Currently, NREA staff provide advisory services to other ministries and organizations by participating in committees and work groups, but there is no formal fee-for-service structure. Another possible source of income might be the renewable energy information system and other information dissemination activities.

The provision of renewable energy information has some characteristics of a public good/service (like weather reports or the U.S. National Bureau of Standards testing), and the pricing/cost recovery of these services is an issue that requires considerable analysis. The provision of consulting services should not be done in a manner to discourage the provision of such services by the private sector (therefore, it should be priced similarly to what a private firm would charge). On the other hand, in the absence of private sector consulting services, there is a role for the public sector to provide such services and demonstrate a viability of this market.

Incentives

The lack of incentive payments appears to be an issue with some of the project team members interviewed by the evaluation team. One task leader emphasized the fact that NREA project staff provided intensive review work that was not rewarded by incentives; meanwhile the U.S. TA contractor was getting highly paid in return for poor performance. Clearly, there was a general feeling of frustration and resentment at the sight of a highly paid level of effort TA contractor, who, in some of the counterparts' perception, was not responsive to their needs. The present RPM told the evaluation team that some of the NREA counterparts appeared to be excessively concerned with the overall contractor salary budget, and, in particular, with his local staff's salary rates.

While incentive payments appear to be a problem in this project, the problem is generic with other USAID projects in Egypt. The team has mixed views about suggesting that incentives be instituted in this project, but it is an issue that USAID project management should consider. However, as NREA's organizational structure assumes functional characteristics, there will be less need for a project-specific incentive system. In general, expatriate technical assistance should be delivered and used as efficiently as possible so as not to further aggravate the sensitivity of government-salaried counterparts. Also, as NREA's budgetary resources stablilize, serious thought ought to be given to offering higher salaries in order to attract and retain qualified staff. Examples of other autonomous governmental agencies in Egypt are the Suez Canal Authority and the General Petroleum Corporation.

Institutional and Political Pressures

As a newly established institution, NREA is concerned with justifying its existence and maintaining continued political support. It is in NREA's immediate interests to make this project work. The REFT project is NREA's biggest and most visible project, yet there is nothing (e.g. field tests) to show. This pressure was communicated to us by the NREA Chairman, whose first and foremost priority is to get any field test up and running. Even though he is strongly dissatisfied with the TA contractor's performance (see Section B.4), he is reluctantly willing to continue with LBII (as opposed to terminating their contract at this point) in order to minimize future delays in implementing the three field tests under procurement.

Recommendations

Key project implementation functions such as annual operating plans, annual and progress reports, and program raview meetings should be transferred to NREA counterparts as soon as possible. Thus, rather than its past review/collaboration role, NREA would have the principal responsibility for this work. Future project activities should be paced according to counterpart organizational and implementation capabilities, including availability and expertise of staff.

NREA should commit project counterpart staff for a more active and collaborative role in the REFT project implementation. REFT project staff should have clearly delineated and delegated task responsibilities with appropriate accountability.

If this project is to retain its institutional development emphasis, some project activities should be implemented through host country contracts. Possibly, separate field test activities and perhaps components of the information system hardware could all be host country contracted.

In the long-term, NREA should consider charging fees for consulting and extension services in order to achieve sustainability, and should consider offering higher salary rates to attract and retain qualified staff.

B.6. The PP, RFP and Proposal Schedules

The project paper indicated that the first field test installations were to be completed in the first quarter of the second year; all installations were to be completed by early in the fourth year. An overall project schedule of five years was planned. The five-year plan was probably chosen to reflect USAID limits on project life. However, given the status of GOE institutional structure at the time of project design and for some time thereafter (see Section B.5) and the general implementation problems (see Section A.3), this schedule was unrealistic at best, even with the assumption of NASA PASA as the implementing mechanism. The revision of schedule for the RFP led to an even more optimistic schedule by calling for the first field test installation by the first quarter of the second year and all tests installed by the end of the third year. This revision was done despite the institutional development problems that should have been obvious to USAID staff at that time and despite the change from a PASA type implementation approach (see Section B.3). Realistically, to accomplish all of the project at that time, a PACD extension would be needed.

Unfortunately, the USAID systems does not easily accept such realism, particularly before implementation has really started and given that the original schedule was likely set knowing it was a bit unrealistic because of the five year constraint. It can be assumed that the contractor thought that it must be responsive to the RFP request and promised to implement such a tight schedule. In the summer of 1984, with a contractor in place, a one year extension was made in the PACD. Some more reality should have set in, certainly by the time of the preparation of the first operating plan or soon thereafter. There has been a slowness to accept the reality, to overcome the many delaying factors, or to set more realistic schedules. The discipline of realistic schedules and of accountability for failure in meeting them appears to have been woefully missing. Some of this may stem from initial naivete, but the USAID/GOE project grant agreement is now five years old, LBII has been under contract for 3 years, and the first field test is yet to be installed. At some point, realism regarding project planning and scheduling should have taken hold. The fault lies with all parties - the contractor, USAID and GOE.

Recommendation

A new and realistic schedule must be developed and agreed upon by all parties before any further work, including field tests, proceed. The schedule should be a tool for holding parties accountable and for making key decisions, such as those concerning cancellation of activities (see Sections B.1, B.2 and Section 3).

C. TECHNOLOGY TRANSFER

C.1. The Failure to Produce Joint U.S.-Egyptian Analyses

Some technology transfer elements are in place in this project. Although the cost was very high, engineers and technicians have been trained or have been upgraded. Our analysis found a generally positive attitude, a willingness to cooperate with others and work for a common goal. While there are some successes in the technology transfer process, one of the major weaknesses of the efforts to date is the failure to produce many joint U.S.-Egyptian products. Furthermore, while several field test projects have been planned in great detail and some key people have gained valuable technical and project management experiance through this system, the process remains very inefficient.

One of the most critical factors for technology transfer is a supportive infrastructure. However, professional staff from the technical contractor and sub-contractors do not work jointly often enough in the same office over a period of time to produce a jointly authored document. During the recent meeting in Ismaila, it was agreed to reduce the number of documents and prepare more of them jointly in Egypt; results since that meeting are somewhat better.

Effective technology transfer is a highly personal process that includes acculturation of values and points of view to an even greater extent than it does technical information/data. To be effective, the engineers on this alternative energy subtask must share the complete process together. Therefore, this project should place representatives of the various agencies in the same "room" until a product is produced. In this way, all parties will have a greater sense of participation in the resulting project than if it has been mailed back and forth between the separate groups.

Recommendations

We recommend that a great deal more of the work be accomplished jointly in Egypt (see Section B.4). There has been movement in this direction recently. Day to day communications between decision-makers is very important and will become even more so as decision-making includes the additional parties who are participants in the field tests. A representative of each decision-making institution must be located in-country.

We recommend that all work be joint efforts and be written and signed jointly. This can be done with the expatriate consultant heading a joint team to do the application review, conceptual design, etc. and with the NREA staff working as associate engineers on the team producing the report/design reports of substance. Initially the GOE staff would largely follow methodology in which they have been instructed by the consultant. After gaining some experience they can undertake work largely independently, with the consultant taking the role of senior supervising engineer.

C.2. Training Accomplishments

All of the GOE counterparts interviewed by the evaluation team unanimously concurred that their involvement in the Renewable Energy Field Testing (REFT) project was a valuable learning experience; the project was an "educational

tool" in the words of one field test team leader. In fact, the same team leader suggested that the TA contractor's poor performance on some of the project activities turned into a positive experience for the counterpart staff, who were forced into doing independant work and substantively revising some of the documents submitted. However, most of the same interviewees stated that their exposure to project implementation had been an expensive process due to the inefficient delivery of technical assistance.

In this project, the major objectives of training are to increase the ability of the counterpart project management team to replicate field tests, conduct supporting analyses and promote the use of renewable energy technologies. In addition to formal academic training, other training activities emphasized practical experience and were designed to permeate all aspects of the project.

Though formal training activities have not yet started, some degree of technology transfer has been achieved through short-term on-the-job (OJT) and special training activities conducted for EEA/NREA staff and host agency counterparts. OJT includes site assessments and data collection, participation in application reviews and conceptual designs, and preparation of specifications. Special training covers technical workshops and seminars.

Counterpart project team leaders at NREA were positive about their staff's immediate exposure to the process of selecting, evaluating and designing field tests. In fact, some task leaders were confident that their staff is now capable of producing some of the documents and reports required for identifying and designing field tests, as well as preparing specifications and issuing tenders.

The evaluation team was informed that at least fifteen NREA engineers have improved their technical and economic analysis skills through their intensive exposure to the project. According to the Industrial Process Heat (IPH) team leader, one of the project's direct benefits was the ability of NREA staff to design systems, perform economic evaluations and prepare tenders for the Mehalla textiles plant/IPH application.

In addition, more than twenty technical workshops and seminars were held. Attendees included EEA/NREA and host agency representatives, local private sector firms (especially solar energy equipment manufacturers), university professors, and solar energy experts from European and Arab countries. Observational site tours to the U.S. and participation in technical conferences abroad were also considered beneficial to project staff.

However, the team believes that technology transfer in the training activities already carried out has been substantially diluted because of the TA contractor's largely unilateral project implementation and the GOE counterpart's largely reactive or review role. The field tests were to have been an integral part of the capacity building objectives of this project through joint work on their development, implementation and evaluation in seven discrete steps or phases. The seven steps are: (1) application review, (2) technological review, (3) conceptual design, (4) preparation of RFP packages, proposal, review and selection of installation contractors, (6) field test implementation, coordination and oversight, and (7) field test evaluation.

Of these seven phases, only the first three have been implemented for all eleven field tests; so far, three SOW's and two RFP's have been prepared. With a few exceptions, such as some of the REIS reports and the Training Needs Assessment document, the multi-step implementation approach was not jointly executed. GOE and host agency counterparts were minimally involved. The technology transferred was largely through a process of osmosis or exposure of counterpart staff to the process, as opposed to one of active collaboration.

The reasons for this are many (see Sections B.3, B.4 and C.1), but the two major ones are that the delivery mode of TA was both impractically designed and inadequately implemented. The preparation and final completion of application reviews, technological reviews, conceptual designs and statements of work in the U.S. severely limited the required interaction and collaboration envisaged in this project. In addition, a basic flaw in the project design was not concentrating on the completion of one or a few field tests as opposed to concurrently working on all eleven tests. The former procedure might have allowed for more collaboration and would have highlighted any problems in the process before proceeding with the next field test.

Host Agency Counterparts

It does not appear that field testing host agencies have fully benefited from the technology transfer element of this project because they did not fully collaborate in the design of the field tests. Though these agencies participated in the preliminary data collection and site preparations (GPC, General Poultry Co. and the Fishing Development Authority) as well as in the finalization of application reviews and conceptual designs in the U.S., they have been excluded from the field test development process.

The value of technology transfer might have been enhanced with a more integrated system of communication and consultation between the TA contractor, NREA and the host agencies (as discussed in Sections B.4 and B.8, communication was not the only TA problem). Upgrading host agency capability is particularly important as the complete operation and maintenance of field tests are turned over to the host agencies within a two to five year period. More direct and practical technology transfer in field test implementation, monitoring and maintenance will probably occur when field tests are installed.

Recommendations

If additional field tests are to be developed other than the three under procurement using the same or similar collaborative approach in identification, design and implementation, all preparatory documents required should be written and completed in-country with the active participation of NREA staff. This mode of operation was agreed upon under recent management changes.

Future development of additional field tests should include active participation by host agencies. This process will further enable host agencies to operate and maintain this project's field tests in addition to replicating similar field tests and applications through contracting with local private sector firms (with NREA assistance if necessary).

C.3. Other Training Issues

Lack of Training Plan

The most important problem with the project's training activities is that to date, there is no clearly defined training plan. Only two documents have been produced: the Training and Information Dissemination Needs Assessment, and the Training and Information Dissemination Statement of Work, but they do not contain a comprehensive or long range coherent training strategy for the project's implementing staff. LBII suggested that the role of a training contractor be eliminated and that LBII take on the training implementation and monitoring activities directly.

Performance of Sub-Contractors

The NREA training team leader (who is also team leader for the PV application field tests) complained to the evaluation team that the sub-contractors' site visits to assist in the collection of data were too short, and that they did not define the additional data requirements to their counterparts prior to departure. In addition, site data collection activities were hampered in one case because the sub-contractor delivered non-functional equipment.

Coordination and Integration with Other Local Training Institutions

To date, there has been limited integration between NREA and host agency training activities financed under this project and existing local institutions and firms with expertise in renewable energy systems and applications. The 1985 Training Needs Assessment has already identified local academic and technical institutions (i.e. ASRT, Cairo University's DRTPC, and AUC's Desert Development Division) capable of offering relevant instruction.

Recommendations

A comprehensive training plan must be produced following the redesign of this project.

Future short-term and long-term training programs should make maximum use of existing Egyptian capabilities.

C.4. Project Design Weaknesses

Technology transfer has been less than optimal because of failings in the original project design and the relative lack of adjustments either prior to or during implementation. This lack of adjustment is a large failure since the original design and the RFP allowed for such adjustments. Project adjustments could have been incorporated through decisions agreed upon and incorporated in the annual operating plans, as well as through the choice and implementation of new initiatives.

Other failures/weaknesses fall into three interrelated categories:

1. limited institutional focus and implementation strategy;
2. limited technological focus; and
3. lack of dynamic and future looking perspectives.

Limited Institutional Focus and Implementation Strategy

Although the PP repeatedly refers to technology transfer to the private sector, the current and planned implementation strategy does not include integral roles for the private sector. With the exception of participation in some seminars and workshops, some limited attempts at coordination, and their inclusion in the team's bidding the procurements, neither the private for-profit sector players, nor military, academic and NGO players have been involved in project activities. This has been a mistake for at least four reasons:

1. the PP called for such participation, and subsequent developments reinforce the importance of such participation (reasons 2 and 3 immediately below);

2. most of the renewable energy activity in Egypt is being done by players outside of NREA (see Annex 2); and if renewables in Egypt are to penetrate the market, these other players also must be the recipient of technology transfer;

3. there exists in Egypt the technical and industrial capability to manufacture much if not all of the value added of many of the relevant technologies; and

4. significant involvement of other players could provide comparative models of project implementation efficiency.

The implementation strategy always focused on the local public sector as the end user and on NREA/LBII/Hardware Contractor as the implementor. Apparently little or no consideration was given to the private sector (broadly defined) as a participant, although the private sector has been successfully involved in donor-assisted projects elsewhere and could be so in this project.

The implementation strategy involved performing the preliminary work on most or all the candidate tests simultaneously. No consideration appears to have been given to a more sequential implementation process. There should have been a focus with some accelerated schedule for one of the project components, that would be relatively easier to complete. An example could have been one of the PV systems, particularly a simple system such as a well-defined pumping system. The importance of this approach would have been two-fold:

1. to get through all of the steps as quickly as possible, including procurement so as to understand the possible problems and delays, and then to adjust the procedures accordingly; and

2. to either succeed in moving from the implementation to the monitoring stage before the project midpoint (last year), or at least to have failed and thereby gained an understanding of implementation delays.

Failure to adopt such a schedule for at least one test is a sign of poor and experienced management on the part of all parties.

Limited Technological Focus

The project's technological focus was to be broadened through the new initiatives activity, but heretofore this element has had no impact except for one study. Furthermore, this study ignored the most critical technological focus missing from the project: local manufacturing and production. A contributing factor to the limited technological focus is the approach to the economic evaluation used an inadequate selection criteria of test candidates (see Section C.5). The project technological focus is limited at least in the following aspects:

1. little consideration of local renewable energy technology manufacturing and related capabilities;

2. little focus on village/rural/household end uses (other than desalination);

3. narrow candidate considerations in some areas; and,

4. insufficient attention to speciel niche technologies.

No Consideration to Manufacturing and Related Capabilities Field tests aimed at better defining, improving and transferring production/manufacturing technologies for one or more renewable energy technologies have not been considered, although they should have been. The issues of licensing of technologies and transfer of production/manufacturing "know how", creation of joint ventures, and setting of standards and testing of local products are important (see Section C.5).

No Focus on Village/Rural/Household End Uses Much of Egypt's population lives in rural areas. For many of these people, supplies of conventional fuels are either unavailable, unreliable or too expensive. Rural areas continue to rely on renewable energy-based traditional fuels (dung and cotton stalks) to meet both some household needs (cooking) and some village/small commerce and industry needs (e.g. backeries). Both the traditional fuels and the traditional technologies are commercial. The commercial nature of these end uses should have allowed their consideration under this project. Moreover the GOE's focus on renewable energy places particular emphasis on meeting energy needs in rural and remote areas. After many failures, improved stove and related programs in many countries are now beginning to succeed as teams have finally learned to focus on market mechanisms as well as technology. The failure to consider these important end uses may be related to their perceived "low tech", to a lack of understanding of the commercial nature of these systems, or to a lack of dynamic thinking as discussed below.

Narrow Candidate Considerations in Some Areas The view of candidate technologies appears too narrow even in the chosen areas of focus in that there is not sufficient appreciation of the diversity of end user settings. For example, in the industrial process heat, too little focus has been given to recognizing the importance of differences in system configurations that use the same basic collector technology, i.e. the large differences between a system that is integrated into a waste heat recovery system versus one that is not.

Insufficient Attention to Special Niche Technologies There are a number of technologies which would be attractive in special niches. An example would be the potential for biogas under specific settings that are common.

Lack of Dynamic and Future Looking Perspectives The project has failed to be dynamic in its view of technologies partially due to the fact that thus far the new initiatives study has not led to any substantive change. This is manifested in various ways. There has been no reflection of the evolution of success and failure elsewhere of renewable technologies (including "low tech" technologies such as wind pumpers). There has not been any integration in the selection process of how costs might evolve in light of local manufacturing or changes in the technology, including changes in the commercial technologies that have emerged in the US and elsewhere just during the period the project has been in place.

Recommendation

Undertake a project redesign before further implementation of any project components other than those for which procurement has proceeded (three of the field tests). This redesign should examine not only the issues raised in this section, but also other issues, particularly the project management ones.

C.5. Need to Consider Information and Local Production Benefits in Testing Decisions

Information: A Testing Benefit

A major element in the project, as defined in the project paper, is the field testing of renewable energy technologies in Egypt which are already proven in the U.S. The objective of these tests is to evaluate the appropriateness of these technologies "from a technical, cultural and economic .... point of view" (PP Project Overview). The multi-step procedure of preparing for the specific field tests and subsequent field monitoring and evaluation were designed to be vehicles for technology transfer, training and skill development by the Egyptian staff. Having this broad goal, the decision of whether or not to test technologies is not the same as the decision of a potential private sector or public sector user to invest in the technology.

Discounted cash flow investment evaluation procedures are appropriate for end users decisions, with financial calculations for the private user and economic calculations for government decisions.* The reliance solely or primarily on discounted cash flow investment type analysis without due consideration of the value of the primary benefit of technology testing - information, can result in a poor allocation of testing resources. The information benefits from the testing program have been either ignored or not given significant attention in the decisions regarding:

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* A government corporation may need to act more according to financial criteria if it must generate the investment from its own cash flow rather than from Government investment budgets.

1. what is the list of candidate tests;
2. what tests should go forward;
3. what should be the priority, which tests to do first; and
4. what should be the protocols for the test monitoring.

Both the project design and the implementation have inadequately addressed these issues. There has been no attention paid to what are the more important information benefits. The project design assumed that all the candidate technologies identified and shown to be economic based on the current world prices would be tested, and hence a priority was not needed. Moreover, the project design implicitly assumed that there would be subsequent focus on the technical, cultural and economic information needs and the appropriate monitoring protocols. However, because only some of the field test could be performed and because oil prices have changed significantly, a broader field test selection criteria was needed, but was never developed. Such criteria should have included the value of information.

There is a wide range of important information issues. Consider some of the following questions that might be examples of uncertainties that exist or issues for which the tests could provide information:

1. What will be the differences between design specifications and actual performance in the field? Are they due to differences in the assumed versus the actual resource availability (wind speed, solar radiation), or due to incorrect system design factors?

2. What is the frequency and duration of system failures of different types? What is the time to repair and how do these compare with the assumptions used in the design studies?

3. Is the regular maintenance and repair personnel and other support needs in line with those assumed in the design studies?

4. Did the regular use and/or maintenance require any significant change in the user's behavior? For example, does the user of PV pumping system have to change his hours of work? How does this effect his acceptance of the technology?

The importance of these and other questions can be analyzed both qualitatively and quantitatively as part of the decision process. There are procedures that can be utilized to weigh both the magnitude of the uncertainty and the value of the information that could decrease this uncertainty.

Local Production

Technology transfer should include local production where feasible. The project design did stress that implementation was to encompass both the private and public sector. If renewable energy technologies are to penetrate the Egyptian market, it is likely to be necessary that they be manufactured locally in part or in whole so that their prices will be as low as possible. The viability of such local production, and most importantly local production on a

cost competitive basis, is a function of a number of factors including: the local manufacturing capability, the size of the market, and the possibility for licensing, joint ventures or other technology transfer arrangements to overstep the technology development expenses and difficulties.

Given the existence of local manufacturing capability in many light and heavy industries and the already existent presence of manufacturers in segments of the industry, it is reasonable to assume that local manufacturing is possible to some degree. As a consequence, the analysis done in considering the testing alternatives should have considered at least the following options:

1. the import option;

2. a partial or total local production scenario based on current industrial capabilities and a limited or "ad hoc" technology transfer and assistance arrangement; and

3. a local production scenario based on a targeted technology transfer and assistance program geared to the specific technology and maximum efficient local value added.

The implications for these alternative scenarios on the cost of the technology would be the focus of this analysis. If necessary, the estimates for scenarios 2 and 3 could be made with limited analysis. Estimates could be made using analogies from other technology transfers, assumptions regarding production techniques (job shop versus limited production line, degree of automation), materials, labor, and other input factor costs and assumptions regarding labor productivity.

What is critical is to differentiate the options and examine their implications on the potential for the technology in the Egyptian market. In general, the Pre-RFP Market/Economic studies do not consider these scenarios. The study for IPH application at Helwan Textile (Field Test No. 4) gives some consideration to system cost figures much lower than the import figures, but it is unclear whether these lower cost figures bear any relationship to the local production scenarios outlined above.

Recommendation

Consideration should be given to the information benefits and local production issues as part of the decision making procedure regarding any subsequent field tests. Local production issues should also influence the definition of field tests, with consideration given to field tests that focus on local production capabilities. These considerations should play a paramount role in the necessary project redesign referred to in the various recommendations in this report.

D. INFORMATION DISSEMINATION

D.1. Lack of Focus on the Information Dissemination Component

The goal of the information dissemination element is to strengthen and promote NREA's role in the development of renewable energy resources in Egypt by developing and disseminating appropriate information to target audiences both inside and outside Egypt. The team's understanding of this project element, according to project documents, is that information dissemination is divided largely into two categories: (1) an educational program seeking to inform the public and other interested parties and to identify renewable energy constituencies; and (2) a renewable energy technologies user database for both the public and private sectors.

The two major documents prepared by the TA contractor for this project component (the Needs Identification and Recommended Training/Information Dissemination report and the Statement of Work for Training /Information Dissemination report) overemphasized the "PR" aspect of information dissemination. NREA does not have to solicit political support and commitment. In addition, the Ministry of Energy and Electricity has a public affairs office that can easily handle NREA general promotional and informational activities without the need to establish a separate unit within NREA as was proposed.

The documents did not include well defined plans for a traditional library activity as a component of the information system that would be an essential repository for the data collected and analyzed through the life of the project. The major failing in these documents is that they did not adequately emphasize the development and operationalization of REIS (renewable energy information system) as a central vehicle for disseminating information.

To date, there have been no training activities with regards to information dissemination. In addition, general awareness brochures and publications were supposed to have been developed in 1985 according to the Annual Operating Plan. Pre-drafts of these publications were submitted to NREA in 1986.

The Renewable Energy Information System (REIS)

At this stage in the project, the REIS has not been developed. There are many reasons for this situation: The project's design and initial implementation did not clearly define nor realistically plan the REIS activity. The RFP and LBII's Technical Proposal did not define the scope and function of the REIS. Nevertheless, the information system was supposed to be in place within four months of project start-up, which is unrealistic given that the system was to be initiated by the project in a sector new to Egypt. The TA contractor's July 1986 project status report projected that the REIS would be turned over in January 1987. Currently, political pressure on the GOE to "demonstrate" this project's impact is so strong as to place first priority in procuring hardware for implementing the field tests.

According to the task leader, there was a high degree of Egyptian counterpart involvement in the development of the REIS. The only local sub-contractor in this project, EMCO, worked on the REIS component. Four major reports have been prepared for the REIS. The first outlined a general organizational structure and was prepared jointly by the U.S. sub-contractor

(Meridian Corp.), EEA, and EMCO. The second report, which identifies user requirements, was prepared in-country by EEA and EMCO. Most of the work for the third document, a general design strategy, was conducted in the U.S. NREA's current REIS task leader further refined user needs, budgetary requirements and operational strategies in the fourth report.

Contractor/Sub-Contractor Performance The task leader informed the evaluation team that NREA received little guidence from the sub-contractor in making the REIS relevant to local users. Contrary to their contractual obligations, there was no input from Meridian during the preparation of the user requirements report. The task leader did not seem to think that the splitting up of work assignments between the U.S. and Egypt was effective. Fast and reliable communication was a particular problem. The sub-contractor made only two visits to Egypt, one in September 1984 and one in May 1986. It also appears that LBII did not facilitate the sub-contractor's parformance. LBII issued a stop order on the REIS in July 1986 due to budgetary constraints.

Lack of Flexibility to Redesign the REIS A major part of the information dissemination element of this project relied on data collected after the installation and implemantation of the field tests. Although there is no field test-specific information to disseminate, the REFT project has so far generated a substantial amount of technical and economic data (of particular importance is Batelle's wind resource assessment) which could be made accessible. Moreover, NREA's other donor-assisted activities and other renewable energy activities implemented by various groups and institutions (see Section A.2) can provide valuable data for operationalizing the REIS.

Technical information dissemination plans should have been revised mid-way through the project as the implementation of field tests was delayed. Even the PR activities were too dependent on the implementation of field tests (i.e. films, newsletter, brochures and site visits). Plans and schedules should have been revised to make use of existing and currently generated information on other aspects of the REFT as well as other renewable energy activities. The functioning of some form of information system is crucial to NREA's institutional building, as well as to the widespread application and commercialization of tested energy systems.

Procurement Issues According to the REIS task leader's assessment, some form of expatriate TA will continue to be needed to develop application software and to procure the appropriate hardware end software. However, it was not clear in the activity plans how procurements would be processed and who the purchasing agent would be. Under the TA contract modification, LBII will be responsible.

Recommendations

Development, operationalization and outreach (especially to private sector users and producers of renewable energy systems) of the REIS, even in the form of an organized and central library, should have proceeded independently of progress on specific field tests.

The development and operationalization of the REIS should be seriously considered under Option 1 to the extent needed to support analysis of the data collection from field tests. Under Option 2, the REIS should be a major priority once additional thinking has been undertaken about the design of its potential components.

Prior to procurements, physical facilities for hardware installation should be made available at NREA. Specific and appropriate training should be provided to NREA staff.

D.2. Impact on Host Institutions

This project has had a positive impact on "spreading the word" on the viability of renewable energy systems identified and preliminarily evaluated under the project. Local private sector manufacturers of solar water heaters have requested NREA to test their equipment in NREA's solar energy lab.

GOFI's (the General Organization for Industrialization) general concern with energy conservation and waste heat recovery in their many industrial projects has made them very interested in the results of the industrial process heating field tests to be performed under this project. Other GOFI companies not originally included in the project's scope have indicated interest in participating in field tests. Likewise, GPC is considering the use of wind generated electricity on their off-shore platforms after assessing the viability and replicability of their planned field test on the Red Sea.

A third host agency, the Fisheries Development Authority, is considering replication of PV-powered ice-making applications, if their field test at Wady El Rayan proves successful. In addition, other scientific institutions who are aware of the REFT project can make use of the new initiatives component or the information system to design and test other technological applications not included in initial project plans. Cairo University's research work on solar ponds (see Annex 3) is an example of this.

4D

SECTION 3

THOUGHTS ON REDESIGN

Introduction

In Section 1, the Evaluation Team recommended that USAID and GOE redesign the project. Section 3 outlines some of the Evaluation Team's ideas regarding a redesign. The areas addressed below concern procurement, the technological focus, the Egyptian private sector, and other possible project activities. Furthermore, due to the critical nature of the project management, this section and an accompanying annex also present a possible management system. Although this section goes beyond the scope of this particular evaluation work, it is included to reinforce the overall recommendations of the team.

A Management System Design

As the previous sections of this report indicate, the Evaluation Team feels that management/control has been a major project weakness. The Evaluation Team views the redesign of the project management system as the starting point for the entire redesign process. The next phase of the Renewable Energy Project can take any one of several forms. If Option 2 as described in Section 1 is selected, the project will possibly include some new initiatives to go along with the field tests, REIS and training. The demands on the project management function will likely become more diverse and will include multi-project management, widely separated locations, different time schedules, a broadening of technical areas, and a growing need for data collection and communication skills. Therefore, project management will become even more crucial.

It is our strong impression that among the features required by USAID and NREA for a management system are that it is quick (it should only take a few minutes for a manager to review), easy to generate in the field, and can be written into a statement of work for a variety of contractors. Since it is hoped that the private sector will become involved, one of the features of the project management system should be that it can work with inexperienced subcontractors and with contractors lacking extensive USAID and/or NREA experience. The redesign is urged to not be bound by "conventional wisdom". USAID and NREA need help to improve the management of this project.

Annex 6 presents an example of a management system that the team feels will address the project's needs and that has been successful elsewhere. The redesign effort could suggest an alternative management system, but the Evaluation Team suggests consideration of the model presented in this annex. While we are recommending this project management system, an important objective of this recommendation is to generate creative input from all of the professional staff. Because the elements of effective project management are interrelated with the organizational structure and the overall environment, we recognize that the final design detail is, quite properly, subject to the approval of agency decision makers.

Procurement

The discussion in Section 2 (see Sections B.3 and B.4) indicated that procurement procedures have been and will continue to be an important issue in the project. Hence, an important element of the redesign effort should be to examine different procurement and contracting procedures and should address the following:

1. Whether to include some host country contract/procurements so as to build NREA contracting and procurement skills along with its technical skills, to perhaps allow some activities to go forward more quickly, or to at least provide a reference point regarding the host country contract alternative.*

2. What contract and procurement mechanisms should be utilized by considering:

   i. Whether to separate in some cases the hardware from the services and software components of the field test, for example, combine fixed price for the hardware and cost reimbursable for the services and software, in order to overcome some procurement difficulties.

   ii . Whether there are (and if so, when to use) mechanisms that would allow the prequalification of field test contractors under either Egyptien or USAID requirements.

   iii. Whether to do the procurements (if USAID) from Cairo or the U.S. If the latter, who should assist: a procurement contractor, USAID/Washington, etc.?

   iv. How to structure such a conditioned procurement, if it is decided to make some procurements conditional on a supplier's willingness to license and transfer the technology or possibly a joint venture.

   v. What alternative contract mechanisms or combination of mechanisms should be used for the technical assistance, e.g. new technical assistance contractor, PSC, mission support contracts, 8As, IQCs.

Rethinking the Technological Focus

Discussion elsewhere in the report (see Section C.4 and Annex 3) indicates the shortcomings in the current technological focus of the project as defined by the PP, the RFP, and the annual operating plans. Originally, the project's technological focus was to be broadened through the new initiatives activity, but thus far the new initiatives have not been part of the project implementation except for a study which ignores some of the important missing foci. The redesign analysis must consider what areas of technological focus should be included in the future activities that might compose the project under Option 2. Thus consideration must be given to activities geared to the following:

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*A set of parallel procurements of similar nature, one by host country and one by AID procedures, might better inform both parties regarding the difficulties and delays that are part of their respective systems and lead to less "blaming the other system".

1. local renewable energy technology manufacturing and related capabilities;

2. village/rural/household cooking and other thermal end uses (other than desalination);

3. alternative subsystem situations within same technology class such as industrial process heat for hot water vs. hot air; and

4. possible special niche technologies (e.g. industrial and other larger scale biogas).

Other Activities and Procedures

Option 2 can go forward at alternative levels of budgetary approval and time extension, thereby affecting what and how many field tests can be done. However, in addition to the testing activities, Option 2 may include other activities. As indicated earlier in this report, there are activities in the original design which deserve greater attention. Therefore, the redesign should consider both existing (non-testing activities) as well as new non-testing complementary activities and develop procedures for undertaking these activities. The redesign should consider at least the following issues:

1. Test Preparation Procedures The current multi-step report procedure seems too cumbersome and somewhat redundant, moreover the failure of these efforts to be truly joint products (see Section C.4) must not be continued.

2. Test/Demonstration Selection Criteria It is important to incorporate into the selection criteria the information benefits from testing. Furthermore, the technologies should be analyzed in a dynamic framework that considers future market characteristics, local manufacturing possibilities, and other issues.

3. The Renewable Energy Information System REIS is, in principle, one of the most valuable components of the project and should be a major priority, but it has not received sufficient attention or resources. The REIS structure and scope needs some rethinking particularly with regard to its likely users and to the inclusion of traditional information resources such a greater reference library.

4. Training Significant resources should be provided to develop and undertake a training plan under any option of continued work.

5. Special Studies and Supporting Analysis There remains a role for such project activities but efforts in this area must be well defined and not simply provide additional TA resources to other components. For example, if local manufacturing is to be a testing focus, it may be necessary to undertake some analysis of the local equipment capability relative to what is needed for a particular technology. An example of a special study would be further study if wind results continue to be so encouraging. In this case, studies of grid interconnector should be undertaken, perhaps through a joint effort of NREA, EEA and if needed, project TA consultants. In the redesign, an initial list of possible special studies and supporting analysis requirement should be identified so that project resources can be allocated for this effort.

Possible Roles for the Egyptian Private Sector

To meet the original project objectives of technology transfer to both the public and private sectors in Egypt, much more needs to be done. The redesign effort should consider alternatives approaches. Which of these approaches would be most appropriate will be somewhat dependent on (i) the revised technological focus of the project, and (ii) the capabilities and interests of various segments of the private sector, i.e. the local consulting community, industrial firms/groups, academics and non-governmental organizations.

USAID and NREA could begin now to examine the private sectors capabilities and interests. Whether initiated now or as part of a formal redesign process, this examination should consider at least the following possible roles for the private sector:

1. An increased level of workshops and seminars aimed at the private sector, and an effort to insure that the information system developed serves the more important needs of the private sector.

2. Participation in (a) special studies, (b) the design, design reviews, construction, and monitoring of future field tests, and (c) other newly defined and approved activities.

3. Prime contractors for field tests in which the guarantee requirements or procurement procedures are modified (e.g. only for the hardware).

4. End users for field tests with possible consideration of cost sharing.

5. Participation in or targets of activities aimed at improving or initiating local manufacturing of various technologies. This could range from assistance in arranging technology licensing and joint venture agreements to assistance in improving manufacturing capabilities on the level of either a specific producer or an industry.

6. Private electricity generators if wind proves to be widely attractive since this has been very successful in parts of the U.S.

Looking at What is Done Elsewhere

Since the project paper design, a number of renewable energy efforts have gone forward in both the industrialized and developing countries. The record of these other efforts is mixed, but there is much to be learned regarding the technologies themselves and more importantly regarding implementation strategies and procedures. A few relevant examples that should be considered include:

- In a remote area of Argentina, the collaboration between an academic engineering group and local small industry has developed the capability for design, construction and subsequent maintenance for various wind and hydro machines based on both foreign and local designs.

- In Sudan, the USAID/GOS renewables energy project has employed a competitive small grants program to sponsor/finance tests and demonstrations. The program is open to the public and private sectors and is administered by the National Renewable Energy Agency. Similar competitive grant programs have been part of U.S. state (e.g. California) and federal programs.*

- In Jamaica and elsewhere in the Caribbean, solar collector manufacturing technology has been improved through technical assistance and collaborative arrangements between US and local firms.

The redesign process should draw upon experiences elsewhere. In addition, the redesign should include a mechanism for NREA staff and others in Egypt to become more familiar with both successes and failures elsewhere.

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* The grants program in the USAID/GOE University Linkages Project is similar, except only academic groups are recipients.

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Annex 1
People Interviewed

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Annex 2
Other Renewables Activities in Egypt

by
Prof. Amin Mobarak

Introduction

Regarding the facts that 5% of the Egypt's land is cultivated, the solar energy potential is very high all over Egypt, and the wind energy potential is also good in some regions, an important force in the future of Egypt could involve desert development using renewable energy.

The infrastructure for desert development includes the important three items: roads, energy and water. Therefore, different institutions and organizations have started applied and field projects for electric power generation, water pumping and salt water disalination using renewable energy. In the following, a summary is given for the major renewable energy activities undertaken in Egypt outside of NREA.

Institutions and Organizations

Working in the field of Renewable Energy:

1. The General Petroleum Company

This company is working on a Project for desert development east of Owianat, which is located in the south west of Egypt between latitudes 22o00-24o15N and longitudes 27o00-30o00E. It covers a total area of about 39,000 square kilometers, which is about 9,400,000 feddan. In this area, ground water has been found while digging for petroleum. The result of the ground water evaluation was that the aquifer saturated thickness ranges from 100 to 700 meters in the intensive study area. The aim of the project is to use renewable energy for pumping water and supplying the new community there, with the necessary electric power. The details of the project are as follows:

a. Project for irrigation of 10 feddans. This project comprises:

-21.5 KW Photovoltaic (PV) system supplied by Solarex Corporation;
-1 deep well pump 35m3/hr;
-1 boaster pump; and
-3 KW pv system (Lucas) originally supplied to the Military Technical College.

b. Project for irrigation of 200 feddans. This project is sponsored under the Egyptian-Italian Renewable Energy Settlement (EIRES) and comprises photovoltaic, wind and biogas power generation, as a total annual

load of 5000 000 KWhr, to irrigate an area of 200 feddans. The system is now under erection and shall be put into operation in early 1988. The project includes the following:

- water storage tank 40,000 m3;
- 200 KW, photovoltaic panels;
- 380 KW, wind energy conversion system (5 units);
- 25 KW, I.C. engine driven by biogas from cattle manure;
- storage batteries;
- a control room for the different power sources;
- drop irrigation system for 176 feddans; and
- passive solar aspects for heating and cooling the buildings of this new community.

It is worthy to note that the project is an integrated system with direct and clear impacts on the social and economic levels.

2. <u>The Armed Forces</u>

a. Hybrid wind-diesel 2 MW system (Sidi-Barani). This project is aiming to generate the necessary electric power for an army unit in Sidi-Barani on the north coast near Libya. It includes:

- 5 x 200 KW wind turbines (1 MW total);
- 5 x 200 KW diesel generating units (1MW total);
- a control room (computerized); and
- a metrological station.

b. Sea water desalination project (Mersa-Matrouh)

i. 5 m3/day Solar thermal still, which comprises two U-shaped channels, each 200m long, covered with glass.

ii. Reverse osmosis disalination unit powered by a hybrid windlassed system (20 KW single-bladed wind mill MBB West Germany).

c. 5 kW Thermal Solar Power Plant using flat plate collectors and Rankine cycle. "King Tut" project, Military Technical College, Cairo.

3. <u>Desert Development Center American University</u>

The aim of this center is to investigate and develop technologies suitable for desert agriculture and desert development, including modern techniques for irrigation and renewable energy for pumping water and electric power production.

The center activities are located in Sadat City and South Tahrir. The following are the main activities of the center in the field of renewable energy:

1. 10 KW photovoltaic system with inverter to supply the main building in Sadat City with A.C. electric power;

2. 3 KW PV system for a deep well (45m head) and a boaster pump;

3. 0.7 KW PV system to supply power for a D.C. pump for the Nutnient Film Technique (NFT);

4. 7 KW PV - 3 KW wind energy hybrid system for pumping water; wind turbine rated 2.7 KW at a speed of 7 m/s (type Bergy BWC Excel - R/48 48 DC); the PV system is ARCO Solar (133 modules, model M55); still under construction;

5. a project to produce biogas form agricultural waste and cow manure (22 cows) is now under testing and evaluation in South Tahrir; and

6. attention is paid to introduce bioclimatic design for the main building and the dwelling houses for desert communities, which includes passive solar heating, cooling and ventilation; design creates almost stable temperatures inside the building, regardless of the ambient temperature variations.

4. Cairo University

Cairo University has established a Center for Renewable Energy in Kom Osheem Fayum. Originally this was an FRCU Project for an integrated Biogas-Wind Energy Hybrid System to minimize or eliminate storage.

This system has the following components:

- 3 bio-gas digesters for anaerobic digestion each 15 m3 capacity and gas total production rate 22 m2/day;
- 2 gas holder for storage, each 10 m3 capacity;
- 2 KW Honda engines and 1 KW Briggs & Stratton gasoline engine which are converted to run on bio-gas; and
- 2 KW wind machine, type APS-78-2.

5. The National Research Center (NRC)

NRC has a lot experience, past and ongoing, in the field of development and demonstration of relevant anaerobic digestion systems, including end uses of biogas for thermal, mechanical and electrical applications, together with the use of the digested effluent as organic fertilizer. Demonstration of biogas technology was carried in 3 villages, Manawat village Giza, Omar Makram village El Tahrir Province and Shubra Kass village Gharbia. Large and mechanized digesters of 320 cubic meters volume are designed for Misr Aluminum Company.

6. The Agricultural Research Center (ARC)

This center also has a lot of experience in the field of development and demonstration of anaerobic digestion systems, having more than 80 small units in different villages. It has also helped in the design and testing of a large system for an army unit.

7. The Private and Public Sectors

The private and public sectors are mainly working on manufacture, erection and maintenance of flat plate solar collectors. At least 3 public sector companies (Refco, a military factory and the Arab Organization for Industrialization) and 4 small private companies are working in this field.

References:

A. Mobarak and H. El Agamawi, (Editors): International Symposium on Applications of Solar and Renewable Energy. March 1986, Volume I and II of the ASRE 86 Proceedings, Cairo, Egypt.

A. Mobarak (Conference Chairman): Proceeding of the conference "Future of Renewable Energy and its Role in the development". Cairo March 1987 (In Arabic), Published by Friedrich Ebert Striftung, Cairo, Egypt

Annex 3
Comments on the Project Technological Focus

A. Field Tests
B. Review of Renewable Energy Options

by
Prof. Amin Mobarak

A. Field Tests

Subproject document 263-0123.2 of the USAID/GOE Renewable Energy Field Testing Project identifies and proposes the following field tests.

I. Solar Process Heat Applications

1. Solar Water Heating for milk products plant with a cost estimate $910,000 from which $440,000 for equipment.

2. Solar assisted fruit dehydration with a total cost estimate $515,000 ($220,000 for equipment).

3. Solar energy and heat recovery for poultry processing with a total cost estimate $940,000 ($455,000 for equipment).

4. Solar energy and heat recovery for textile dyeing with a total cost estimate $890,000 ($424,000 for equipment).

5. Solar water heating for metal processing with a total cost estimate $2,035,000 (1,245,000).

These 5 projects all involve the same technology: low temperature solar thermal heating using flat plate collectors in the temperature range 40-80oC. The equipment represents 40-60% of the total cost estimate of the project depending on its size.

A great saving in money, time and effort could have been reached by writing down accurate specification for each project and issuing a tender document for local and American manufacturing firms of flat plate collectors. The manufacturers of such a simple technology could also do the engineering work of the project and provide means for testing and evaluating the performance of the system in collaboration with the Ministry of Electricity and Energy. Such firms are capable of doing the necessary maintenance of the equipment.

Also, it may be useful and advantageous if some medium (100-300oC) applications are considered instead of one or two projects of such low temperature applications.

II. Photovoltaic Power Application

6. Photovoltaic - Powered Fishermen shelter systems, with a total cost estimate of $275,000 (100,000 for equipment).

55

7. Photovoltaic - Powered irrigation systems with a total cost estimate of $132,000 ($52 for equipment).

8. Photovoltaic - Powered Reverse osmosis desalination system with a total cost estimate of $1,970,000 ($675,000 for equipment).

The chosen PV applications are important and useful for developing remote and desert areas in Egypt. However, the estimated ratio of equipment to total cost is rather low (less than 40%).

It is worth mentioning that low head pumping is not important or Egypt, except in the Nile Delta, where generally diesel or electric pumps are economically and efficiently used. Therefore, it may be much more beneficial, if deep well pumping is considered for desert development.

III. Wind Power Application

9. Village wind power system, with a total cost estimate of $407,000 ($120,000 for equipment).

10. Wind - Powered Reverse Osmosis (R.O.) desalination system, with a total cost estimate of $2,130,000 ($775,000 for equipment).

These two different wind energy conversion systems (WECS) are important and useful for the development of remote areas. However, it is much more beneficial if hybrid systems are considered to increase energy availability and minimize the storage system. Also, a grid connected WECS project can be very useful for gaining the experience of grid connected WECS for large projects in the future.

IV. Solar Thermal Power Application

11. Solar Rankine Cycle cold store system with a total cost estimate of $2,265,000 ($735,000 for equipment).

It is not clear whether such a system is technically and economically competitive with other systems, such as PV array, to supply electric power for a conventional cold store. Also a hybrid system to minimize storage may be considered here.

Overall Conclusions

While the Renewable Energy Field Testing subproject document is a good techo-economic study, it is lacking focus on the replicablility and local production of R.E. equipment. Our opinion is, that GOE should be mainly interested in R.E. technologies which can be mass produced in Egypt.

B. Review of Renewable Energy Technology/Application Options Identification (Volumes 1&2) and Comments

B.1. Evaluation Criteria

In task 2.2.1 Final Report prepared by Meridian Corporation (Fall Church, VA, Sept. 1985) for USAID/GOE renewable energy project, the following evaluation criteria have been suggested.

Rank	Evaluation Criteria	Assigned weight
1	Replicability in Egypt	25
2	Technology Status	18
3	Resource Availability	15
4	Government Priorities	12
5	Economic Feasibility	10
6	Current Status in Egypt	10
7	Institutional Requirements	5
8	Social/Environmental Impacts	5
	Existing Total	100

Proposed New Criterion:

percentage of possible component manufacturing form R.E. technology in Egypt	20
New Total	120

I agree with the above mentioned criteria with the addition of the new criterion, which may be ranked in the second place. This criterion is related to large scale R.E. projects in Egypt. For example, if 1000 MW wind farm is to be installed in Suez Gulf area, then this project may comprise 10,000 WECS. Each of these wind turbines will be a 100 KW machine comprising, the motor, the gear box, the generator, the controls and the tower. So, unless Egypt is capable of the local manufacturing of the tower, most of the air turbine components, the gear box and the generator, we cannot begin such a project would have lower priority. Local manufacturing could absorb a huge number of workers, for manufacturing, erecting and maintaining large wind farms. The same can also be said for large solar thermal, electric power plants (parabolic cylinders or power tower).

B.2. Renewable Energy Technology Characterization and Author Comments Regarding Its Possible Potential for Egypt

The following eight renewable energy (R.E.) technologies have been identified in the final report document, as possible candidates for application in Egypt.

1. Wind and Wind Energy Conversion System (WECS)

The wind energy potential in Egypt is rather high in the following regions:

i. the Suez Gulf with average wind velocities 7-9 m/s;
ii. the Red Sea Coast from Hurgada to Ras Gahreb with average wind velocity 5-7 m/s;
iii. the North West Coast of the Mediterranean See from Alexandria to Sidi-Barani with average wind velocities 4.5-6 m/s;
iv the East of Oweinat region with average wind velocities 5-7 m/s;

Such regions are suitable for wind-electric power production on a small or large scale (WECS rated Power 10-200 KW). This wind power may be used for pumping water, R.O. desalination plants, and electric development. Also, small wind - mechanical pumping units (0.4-4 KW) may be used for the development of urban areas and the North Coast of Egypt.

* 80-90% of WECS can be manufactured locally in Egypt. We believe, that today WECS can compete economically with conventional power in remote areas, such as the above mentioned regions.

* The military factories, the Arab Organization for Industrialization, and the steel construction firms may work together in joint effort to produce WECS.

2. Photovoltaic PV Systems

PV systems can be used all over Egypt, a wide variety of applications, such as water pumping, R.O. desalination, refrigeration, cathodic protection, remote communication posts, and power source for desert communities.

However, PV Systems are still rather expensive, if compared with conventional or other R.E. technologies. Experience has shown, that PV panels are very reliable. Many small plants are running for several years almost trouble free in Egypt. However, the subsystems are still unreliable with frequent maintenance needs (e.g. pumping systems and its controls).

3. Solar Thermal

Solar Thermal energy may be used for the following applications:

1. Water heating (40-80oC) for houses and buildings.
2. Process heat (40-600oC) for different industries.
3. Crop drying (40-80oC) heated air.
4. Thermal desalination (80-120oC).
5. Electric power production (50-30,000 KW Modules).
6. Refrigeration (absorption systems).

Normally, the solar collector field constitute 40-60% of the total plant cost, so if effort is done to improve the manufacturing techniques and reducing the cost of flat plate collectors, then this will enhance the use of flat plate collectors in household water heating and low temperature industrial process heat applications.

Also, attention should be given for parabolic through manufacturing in Egypt, as such a collector can be the nucleus of medium temperature process heat systems (100-300oC) and for electric power production using parabolic concentrating collectors on large scale (30 MW each module).

The companies working in manufacturing flat plate collectors are:

Public Sector

1. REFCO which is a joint venture of El Maco (a company of the ministry of electricity and energy) and a French group.
2. Engine Factory, the Arab Organization for Industrialization, Helwan, Egypt.
3. Military Factory 36, Helwan, Egypt

Private Sector

1. The Egyptian German Company for Solar Energy, 10 Fouad Bedawani St., Block 73, 8th district, Nasr City, Cairo, Tel. 611304
2. The Solar Energy Investment Company, 16 Adly St., Cairo.
3. Misr-America Solar Energy Company, Heliopolis, Cairo.

4. Geothermal

Data is gathered regarding the temperature gradients of the earth subsurface in Egypt. This information has been obtained, while digging for petroleum. However, the data is not enough and detailed investigations should be done regarding the completion of a geothermal map for Egypt. The regions of good potential could be summarized as follows:

i. A belt with high heat flux and temperature gradients ranging from 1.5-4 times the normal gradients, extended in the Eastern Desert along, the Red Sea Coast for 30 Km between latitudes 24o and 27o North.

ii. Red Sea Gulf with a lot of hot spring, like Hammam Pharaon (75OC), Mousa springs and the Sokchna Hot Spring (45oC).

iii. The Oasis in the Western Desert with different hot springs.

Overall, the geothermal potential in Egypt is not very promising. Nevertheless, efforts should be done in the direction of preparing geothermal map for Egypt. It is possible that some small touristic projects utilizing the hot springs may be initiated in the near future, especially in Suez Gulf area, Dakhla, Baharia and Kharga Oasis.

5. Biomass and Biogas Technology (BGT)

Though previous estimates have set the limit by the year 2000 to 4000,000 biogas units, development of new designs tailored to relax feature constraints in Egyptian rural areas, seem to stretch the potential of biogas technology to almost double the original estimate. In the final analysis, however, the extent to which these expectations will materialize will depend crucially on the kind of organization infrastructure and implementation network utilized. The end use for biogas may be cooking, lighting and space heating for small units, while the larger units may be used for electric power production by burning the gas in a modified internal combustion engine. We conclude that:

i. BGT has good potential in the Egyptian rural settings.

ii. It is important to locally adopt and develop designs for mass production of the digester components to enhance the adoption of BGT. These designs should include the design of a small or family unit and a larger or community unit.

6. Solar Ponds

Although the solar pond technology still faces problems in running and maintaining the proper function of the pond (Salt gradient maintenance, wind brakes and surface flushing), we believe that solar ponds may be a keystone in the utilization of renewable energy in Egypt. One important possibility is the novel thermal cycle for producing electric power and fresh water simultaneously (A. Mobarak: patent project No. 268, July 1986, the Academy of Science, Egypt). The major advantage of solar ponds is that it is the only R.E. technology which inherently includes storage. So large solar ponds power plants, if connected to the grid, may be used to meet base or peak load demand.

Many places are suitable sites for solar pond technology, such as the salt lakes: Karoon, El-bardawil, Edco, Mariuut. Also, many location lagoons on the North Coast and the Red Sea are suitable. The stored heat may be used for space heating, low temperatures process heat (40-80oC), water desalination and electric power production.

7. Municipal Solid Waste

This technology is very important and useful for Egypt. However, its projects should be managed by a team from the governorates of big cities such as Cairo, Giza and Alexandria and the Ministry of Electricity and Energy.

8. Passive Solar Heating and Cooling

The use of this technology should be included in the design of buildings and houses of new settlements and communities, especially in the desert. Projects in this direction should be initiated in conjunction with the ministry of housing and new communities.

General Recommendations

1. The project should concentrate on R.E. technologies which have direct impact on desert development. These technologies include deep well pumping, salt water desalination and electric power production for remote areas using renewable energy.

2. The R.E. technologies chosen for demonstration, should lead to designs or licenses agreements for mass production of most of the system components.

3. For future large scale applications of R.E. technologies, only technologies should be considered, which most of its components can be mass produced locally. This is because, such technologies are modular with several hundred or thousands of repeated equipment. If imported, the packing, shipping disassembly and reassembly costs will be very high.

4. Candidate technologies, which can meat such requirements are:

   a. Wind Energy Conversion System (WECS).
   b. Flat Plate and Concentrating Collectors.
   c. Biogas Digesters.

5. Emphasis should be given to solar pond technologies, because this technology may lead to the development of the North Coast and the Red Sea Coast.

Annex 4
Evaluation Terms of Reference

ARTICLE I - TITLE

Mid-Term Evaluation of the Egyptian Renewable Energy Field Testing Project. (Project No. 263-0123.2)

ARTICLE II - OBJECTIVE

The objective of this mid-term evaluation is to:

assess project progress to-date, and identify major accomplishments and implementation problems;

asssess the adequacy of project design and the continuing applicability of the project purpose; and

make recommendations for changes in project design and implementation, and for tuture project directions.

The evaluation will assist USAID and the Ministry of Electricity and Energy to decide:

whether to continue current project activities;

whether to expand project activities;

whether to fully obligate the project; and

how to modify the project to improve its effectiveness.

ARTICLE III - STATEMENT OF WORK

A. The evaluation will examine three major issues that cut across individual project elements:

- management and institutional development;
- technology transfer; and
- dissemination of information.

The evaluation team will address these overall concerns as they apply to the four major project elements, i.e., field tests, supporting analysis, training, and new initiatives. The team will address the following, specific questions in each of these areas:

1. Management and Institutional Development

   Are host-country implementation structures functioning effectively? Have they provided sufficient organizational stability for the project? Should any changes be made in these arrangements?

   Is technical assistance (TA) functioning effectively? Has EEA/REDUA used technical advisory services effectively? What changes, if any should be made in the delivery of TA services?

   Has the project correctly defined key institutional constraints to developing, introducing and managing renewable energy technologies by EEA/REDUA? What progress has been made towards meeting these institutional development needs? Are current project activities in this area adequate, or are other institution-building initiatives needed to achieve project objectives?

2. Technology Transfer

   Has the field test selection process identified replicable, viable technologies and systems? What has been the role of technical assistance in identifying appropriate technological choices? Based on preliminary analysis of field tests, is the current technological emphasis appropriate, or should the project give more or less emphasis to certain technologies?

   Is the host agency mode of field test implementation an effective model for technology transfer to other agencies? Is it adequate to build a core of technical expertise capable of supporting the replication of renewable energy systems on a commercial scale? Does this model have any effect on decision-makers in these agencies who determine future technological choices?

3. Information Dissemination

   Is the type of data and information identified for collection by the REIS appropriate to meet public and private sector information needs on the viability of renewable energy technologies in Egypt? As currently structured, will the REIS be useful for audiences outside Egypt? Is the input format able to accomodate field test data from other sources?

Are planned and existing REIS outreach mechanisms adequate to ensure that organizations examining energy needs will consider renewable energy technologies? In what ways should REIS outreach be strengthened?

B. Required Tasks

1. Review project documents, including field test data, supporting analyses and REIS formats.

2. Interview appropriate USAID, MOEE, EEA/REDUA and LBII officials involved in project implementation.

3. Visit field test sites, as appropriate, to observe field tests under implementation.

4. Interview officials in field test "host" agencies, as well as other major potential renewable energy users in Egypt.

5. Prepare an evaluation report providing findings, conclusions and recommendations responsive to the questions in the Statement of Work, based on analysis of information obtained through the tasks described above.

Annex 5
Mapping of Statement of Work and Evaluation Report

This annex presents the mapping between the evaluation report and the SOW questions. In particular, the specific parts of Section 2 which presents the detailed findings of the evaluation, are indicated. Sections 1 and 3 of the report both address all of these questions.

Report Section	Statement of Work
B.1, B.5	Are host country implementation structures functioning effectively? Have they provided sufficient organizational stability for the project? Should any changes be made in these arrangements?
B.1, B.3, B.4	Is technical assistance (TA) functioning effectively? Has EEA/REDUA used technical advisory services effectively? What changes, if any should be made in the delivery of TA services?
B, C.4	Has the project correctly defined key institutional constraints to developing, introducing and managing renewable energy technologies by EEA/REDUA? What progress has been made towards meeting these institutional development needs? Are current project activities in this area adequate, or are other institution-building initiatives needed to achieve project objectives?
C.4, C.5	Has the field test selection process identified replicable, viable technologies and systems? What has been the role of technical assistance in identifying appropriate technological choices? Based on preliminary analysis of field tests, is the current technological emphasis appropriate, or should the project give more or less emphasis to certain technologies?
C.1, C.2, C.3	Is the host agency mode of field test implementation an effective model for technology transfer to other agencies? Is it adequate to build a core of technical expertise capable of supporting the replication of renewable energy systems on a commercial scale? Does this model have any effect on decision-makers in these agencies who determine future technological choices?
D	Is the type of data and information identified for collection by the REIS appropriate to meet public and private sector information needs on the viability of renewable energy technologies in Egypt? As currently structured, will the REIS be useful for audiences outside Egypt? Is the input format able to accommodate field test data from other sources?
D	Are planned and existing REIS outreach mechanisms adequate to ensure that organizations examining energy needs will consider renewable energy technologies? In what ways should REIS outreach be strengthened?

Annex 6

A Management System Design

This Annex presents an example of a management system that the team feels will address the project's needs and that has been successful elsewhere. While we are recommending this project management system, an important objective of this recommendation is to generate creative input from all of the professional staff. Because the elements of effective project management are interrelated with the organizational structure and the overall environment, we recognize that the final design detail is, quite properly, subject to the approval of agency decision makers.

Background

One of the Evaluation Team members, Dr. D. C. Braithwaite, designed a similar system for a well known international agribusiness consulting firm several years ago because they wanted a management tool that would work for them both at the home office and in a variety of locations and projects. Top management uses this system to monitor scores of projects in the developing world as well as Europe and the U.S.A. As the reader will see at the same time the system must be used in considerable detail by lower management levels.

Description of Features

There are three basic elements of almost any project which have to be managed: scheduling, performance, and expenditures. The Renewables Project (under Option 2) will have to manage these elements for several different tests simultaneously. Furthermore, three aspects of each project needs to be monitored; alternative energy technology, expenditure (funds and personnel), and data collection and information system. The objective of this system is to promote realistic project planning and to minimize

- Cost and time requirements
- Implementation bottlenecks
- Formalized management inputs while increasing flexibility.

Through personal experience it is known that an application of this system elsewhere takes a few minutes each reporting period by the field manager and fewer minutes for a project manager to review. Senior managers can review multiple projects in a very few minutes and flag items to be investigated. Perhaps the best features of this system has proved to be twofold: it takes very limited time at any level, and senior management knows where to investigate and to spend their time.

Using the Renewable Project as an example, it also encourages field test (or other task) managers to:

- Assume more formal responsibility
- Make better use of program review

66

- Set expectations at the outset of a sub-project
- Assist in formalizing task management/subcontractor evaluation
- Enable USAID and NREA project managers to substitute for each other with increased ability to make informed decisions.

Project Management

Once a field test (or other project activity) is approved and underway, a status report is submitted by the field test manager on a periodic basis (probably weekly in most cases). The Status Report is based on the work schedule or other formal planning document, and it is designed to update cost, schedule, and performance status. (The format is modeled below.) In addition to enabling senior personnel to make an assessment of all field tests quickly with a sound basis for determining which on-going project or project components require special attention. It will also serve as the building blocks for more informed planning and remedial action.

The Status Report requires each first level manager (in this project, the sub-contractors and field test or other activity managers) to make an evaluation as to whether the project (activity or task) is meeting the essential elements. The field test manager must give a "yes" or "no" answer to the essential elements and then color-code the project status based on those answers. The key for the whole multi-project system is:

- Green indicates that the element is proceeding according to plan.
- Yellow indicates a qualified answer, warns of potentially serious trouble and flags areas for special attention.
- Red highlights elements that are "out of control" and that are situations which will strongly influence contractual obligations and constraints.

Tasks or checkpoints are also reported in the Status Report. Triangles could be used to represent beginning and completion dates; circles around a triangle to indicate interaction with the client is required.

Managing Multiple Field Tests

The status of every active project, field test, or other reporting activity is posted weekly (or other reporting period) on a status board. The beginnings and completion dates of each field test are denoted by strong vertical lines. Each week, the green, yellow and red ratings for every active project are posted on a large display board. Project review meetings are noted in the form of a black bullet (o). Formal field test beginnings and completion or other endpoint milestones are noted by black triangles ( ).

At a glance top executives can gain an accurate impression of individual field tests (or other activities) and the status of their whole operation. If they are concerned enough about a field test, they may review the individual Status Report or dig deeper by going into the Statement of Work or other appropriate document, or by talking to the appropriate manager.

In summary, the status board:

- Identifies all active project components
- Shows where each started and scheduled completion
- Indicates reviews and major milestones
- Presents a chronological evaluation of field tests (and other activities according to technical performance, cost and scheduling status.

The following managerial benefits can come from this multi-field test management system.

- Management procedures are formalized, and training is facilitated.
- Field test and other activity managers can be "calibrated". That is, some will be overly optimistic, always be "in the green" while others may tend to panic too early. Such tendencies become clear on the board. (If the organization wants to be on the leading edge, low cost sub-contractor etc. they may try to operate "in the yellow" as a matter of policy).

Summary

This proposed management system has some real advantages for top management at USAID and NREA. Most importantly the Status Reports and Status Board facilitate very quick review by senior managers. Both management tools have visual impact. In addition, the Status Reports contain all important details. Review can take a few minutes, or can take place over the phone, i.e. a secretary or office manager could say, "3 of 5 projects are in the red, 1 yellow, 1 green, this week".

To be useful any multi-field test management system must be practical, fit the needs and style of the organization that it is designed to serve. For NREA and USAID, this would seem to include a system that is manageable from afar and in a hurry.

The redesign must recommend a management system, and one must be adopted. The system outlined above is a strong candidate. If this system or a variant is not adopted, some other formal and operational system must be so adopted and used. If the above system is adopted, it might well serve USAID/NREA to do so immediately without waiting for any redesign effort.

Annex 7

Summary of GOE Counterpart History

Originally, the project's GOE implementing counterpart was the Qattara Hydroelectric and Renewable Energy Authority (QHREA). Within the Authority, a Project Management Team (QPMT) was to be jointly responsible with the U.S. TA contractor for managing and implementing project activities. QHREA made staff available (8 to 10 people) for the project. Because of GOE/USAID problems with the contractual mode for expatriate technical assistance, it took almost two years from the Grant Agreement (August 1982) to get the TA contractor in place.

By the time the project was fully underway in May 1985, project implementation responsibilities were shifted to another GOE organization, the Egyptian Electricity Authority (EEA). As only one project counterpart was transferred from QHREA to EEA, EEA had to find new staff to implement the project. EEA's renewable energy development division (first called EREDO - Egyptian Renewable Energy Development Organization) was then spun off into a new organization in 1986.

The new agency, called the New and Renewable Energy Authority (NREA), was created to identify, design and implement renewable energy activities in Egypt. USAID's renewable energy field testing project and staff were transferred to NREA. However, as of the time of this evaluation, NREA is not totally autonomous from EEA in its operations. Specifically, NREA's chairman is not able to sign off on financial matters relating to the USAID project without the approval of EEA's chairman. This is supposed to change at the beginning of the new fiscal year in July 1987, when NREA's budget will be separated from EEA's.

As a new agency, NREA was initially preoccupied with staff recruitment and allocation, in addition to defining its general mandate and responsibilities. The institution also had to deal with other donor-financed activities, most if not all of which are commodity/equipment "drops" with no process or institution-building components.