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AN EVALUATION OF THE UNIVERSITY OF FLORIDA  
TRAINING PROGRAM IN ALTERNATIVE ENERGY TECHNOLOGY  
(Training in Alternative Energy Technology,  
Project No. 936-5716)

Report to

THE UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT  
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## EXECUTIVE SUMMARY AND RECOMMENDATIONS

### A. INTRODUCTION

The purpose of this report is to present our evaluation of the Training in Alternative Energy Technologies (TAET) Program at the University of Florida. While the evaluation concerns a wide range of questions, it focuses on two basic areas:

- To what extent has the program been successful in delivering training that is responsive to the needs of the LDC participants?
- To what extent has the University of Florida been in compliance with the cooperative agreement with USAID?

The findings in this report are based on intensive interviews with TAET participants, faculty and administrators, a review of course materials, and examination of the course outline. In addition, our findings reflect the review team's experience and background in the areas of economic development, alternative energy technology, and education.

Your contract specified that our report should include an analysis of the following:

- The attitudes and perceptions of past and current participants.
- A program review that considered objectives, curriculum, faculty, administration, participant life and University oversight.
- Costs associated with the TAET Program.
- University of Florida compliance with the cooperative agreement.
- Review of the 1980 AID Management Review Team's report.
- The relevance of the TAET Program to the needs and interests of the LDC participants.

Compliance with these specific contract requirements produced a series of reports that all focus on essentially the same issues and come to similar conclusions. In order to avoid possible redundancy in the body of this report, we have therefore put the detailed analyses required by the contract into a series of appendices.

### B. GENERAL FINDINGS

#### 1. Overall Evaluation

While we believe that substantial changes in many aspects of the TAET Program at the University of Florida are warranted, we find that the program makes a useful contribution to the understanding and utilization of a number (but not all) alternative energy technologies of importance in the range of developing countries from which the participants come. The

program operates in compliance with contract requirements and within cost parameters that are consistent with USAID guidelines and is taught for the most part with skill and enthusiasm. Participants generally express satisfaction and many of them are attempting to apply their technological training to projects in their own countries. While this report does not spare the program from criticism and makes a number of suggestions for improvement, we recommend that it be continued at the University of Florida.

With respect to the requirement of our contract that we "recommend whether introducing contract competition for the continuation of this program will result in an improvement of the type and quality of training", we are of the opinion that it will be more cost-effective at this time to make such improvements through moving toward adopting the recommendations of this report and that seeking competitive offers should be held in abeyance until sufficient time has gone by to provide a basis for observing the response of the University and TAET management. This recommendation obviates the need for meeting the related requirement of our contract that we "indicate other academic institutions that might offer all or part of this training under AID financing"; although we are in a position to do so on request.

## 2. Participant Opinions

In general the participants whom we interviewed at the University during the final week of Program III expressed satisfaction with the course and stated that it is a worthwhile undertaking. Special importance was attributed by the participants to the dedication and enthusiasm of the TAET teaching and support staffs.

On the other hand participants were critical of various aspects of the program. The most significant of these criticisms, in our opinion, are:

- That excessive attention is given to small-scale solar thermal technologies leading to relatively limited emphasis on wind, biomass, and small-scale hydro technologies which are of particular interest in many LDCs;
- That insufficient emphasis is given to overall applications analysis, including socio-economic evaluations of systems relevant to LDC needs;
- That there is a lack of emphasis on reviewing the overall status of the technology including commercial availability in the U.S. and elsewhere of systems, components, and special materials;
- That there is inadequate preparation of guest speakers and a general lack of experience in the LDCs and with LDC energy problems on the part of TAET staff other than the Program Director;
- That there is need for more laboratory equipment, covering a broader range of technologies;
- That the selection of site visits could be improved, especially by including a wider exposure to successfully operating systems of relevance to LDCs.

We also interviewed ten former participants through telephone conversations. These former participants had opinions which were very similar to those of participants in Program III.

### 3. Program Review

- Goals and Objectives

There appears to be a lack of full consensus between USAID and the University of Florida about the goals and objectives of the TAET Program. This lack of fully agreed upon goals and objectives complicates the tasks of conducting and of evaluating the success of the course.

- Curriculum

Solar thermal technology plays a predominant role in the TAET Program. Exposure to a number of non-solar thermal technologies is incomplete, spasmodic, and often provided by outside lecturers with little awareness of participant interests or needs. There is bias towards small-scale rural applications to the point where discussions related to technologies that could more significantly affect a country's energy balance are not covered adequately.

The strong focus on technology tends to limit discussions of important socio-economic factors associated with the implementation of alternative energy technologies. Of particular concern is the fact that most discussions of socio-economic issues are presented by guest lecturers and are not integrated into the technology discussions.

Laboratory work could be improved by greater emphasis on evaluating a broader range of commercially ready systems in alternative configurations or those using competing equipment or technologies.

The field trips are considered an important program activity by the participants and several sites displaying operational equipment to advantage are visited as part of the program. A number of the demonstration systems visited, however, were non-operational or, in some cases, not particularly relevant to the needs of the developing countries. The field trip schedule should be reviewed and modified to expose participants to a larger number of successful systems employing a broader range of commercially available technologies of specific interest in the developing countries.

- Faculty

Our overall impression of the faculty is that it lacks the background to cover material outside the area of solar-thermal technology. The primary experience of all of the tenured and non-tenured TAET faculty is technological with the result that socio-economic areas receive limited attention.

The new faculty proposed to date do not appear to be in a position to deal effectively with the above issues.

Guest speakers are a concern because of the uneven focus and structure of their presentations and because of their very significant role in the TAET Program. In particular, it appears that many guest lecturers are not prepared to address subject areas relevant to participant needs.

Teaching loads for the TAET faculty seem low by comparison with those in other academic institutions and with those in traditional teaching environments. The TAET administration defends the relatively light formal teaching loads because faculty are expected to spend a large number of non-classroom hours with the participants. Because of the time frame in which we performed our evaluation, we were unable to fully evaluate this issue.

- Teaching Materials

Our general impression is that there is room for improvement in the quality and assortment of teaching material provided to the participants. Handout materials are not well organized and do not include the wealth of material that is available and is directly relevant to LDC problems in this field.

- Administrative Staff

Two areas of the administrative structure are of some concern. There do not appear to be clearly defined lines of responsibility within the administrative staff, a condition which can lead to inefficient use of resources. Partly as a consequence, there is an apparent excess of administrative personnel.

- Participant Selection and Life

The TAET Program has some difficulties in dealing with the heterogeneity of its participants. This is a problem, common to similar programs, which probably can be mitigated by careful planning of the curriculum.

Many participants reported that they felt isolated from the University and the people of Gainesville, a condition that would be difficult to ameliorate because of limitations imposed by the physical location of available facilities. It can be argued that there are compensating advantages.

- University Advisory Committee

All but one member of the University Advisory Committee have primarily technological backgrounds. As a result, the Committee as now constituted may not be well positioned to advise the TAET management on the range of non-technical issues which may be important factors in evolving a broader-based course responsive to LDC needs. It is also not clear that the Advisory Committee has to date played an active role in critical evaluation of the program.

#### 4. Compliance With the Cooperative Agreement

The University of Florida is in compliance with the terms of the cooperative agreement and a program of the type being offered is clearly within its scope. The few minor departures from literal requirements appear to flow primarily from ambiguity or differences in interpretation.

#### 5. Program Costs

Per participant, monthly costs appear to be within USAID cost guidelines. There are, however, a number of areas where cost control measures could be considered with possible savings up to \$100,000 a year.

#### 6. Review of 1980 AID Management Review Report

Many of the issues raised in the 1980 AID Management Review Report ("Site Assessment") of the TAET Program remain as issues of concern to the Arthur D. Little evaluation team. Specifically these "carryover" issues are:

- The extent of emphasis on solar thermal technology,
- Inadequate attention to non-technology areas; e.g., economics,
- Organization and content of course reading materials,
- Background and LDC experience of the faculty,
- Uneven quality of guest speakers, and
- Size of administrative staff.

#### 7. Relevance of the TAET Program to Developing Country Needs

There are questions meriting consideration about the TAET Program's relevance to developing country needs as represented by participants:

- Does the course contribute to the capability of technically oriented decision-makers to identify which technologies merit R&D to adapt them for use and manufacture in-country?
- Does the course provide planners with an approach for determining which Renewable Energy Resources (RER) systems merit consideration for widespread use?
- Does the course sufficiently expose the participants to equipment status and development on a worldwide basis so as to discourage excessive duplication of effort.
- Is the relative emphasis among technology options appropriate?

## C. RECOMMENDATIONS

### 1. Program Objectives

One of the difficulties encountered in evaluating the TAET course is that, despite the general language about goals and objectives which appears in the cooperative agreement (see Appendix IV), it is not entirely clear what the objectives of the course in fact are and how these objectives address major issues of interest to USAID and the LDCs.

Future efforts to improve and modify the TAET course should therefore be carried out against a background of renegotiated and explicit overall goals and objectives which have been mutually agreed upon by TAET management and USAID. If this is done, course activities can be measured in terms of how they contribute to meeting such objectives and goals. Corrective action can then be taken as appropriate. We give, below, examples of what such a statement might cover.

#### a. Issues To Be Addressed

The TAET course should address specific issues which are common to many LDCs and be aligned with the overall policy directions of USAID's energy development programs.

Major issues include the following:

#### • Technical Capability

In many LDCs there is a lack of analytical and experimental capability relative to RER systems. This deficiency manifests itself in poorly conceived R&D projects which are often not well implemented. Such poorly executed projects often take up most of the scarce R&D resources available to these countries, with obvious negative implications. It is this aspect of LDC needs which has been emphasized by Dr. Farber in describing the benefits of the TAET Program.

#### • Technical Awareness

It is very difficult for technical and management staff in LDCs to maintain adequate cognizance of developments in the industrialized nations, including the United States. As a result, many decisions to undertake R&D projects, develop energy policies, etc., are made without knowing all the technology options available. This results in extensive duplication of effort, large amounts of time being lost in project formulation, and many potentially useful activities not being initiated at all.

#### • Application Opportunities and Economics

In many LDCs there is only very limited understanding of the issues affecting the use of systems (capacity factors, operation and maintenance requirements, etc.) and the resultant system economics. Experience in LDCs indicates that even highly-skilled technical people

will undertake programs in high technology systems (for example, solar thermal power) with only a vague notion of how much they are likely to cost or their potential use.

As a result, much of the research, development, and demonstration activity in LDCs is inappropriate since even technical success does not lead to useful output.

- National Impact

It is possible for systems to be technically successful and have acceptable cost while still being of minimal utility to a country due to a limited number of applications.

Conversely, the benefits of implementing RER systems can include increased employment opportunities, decreased foreign exchange drains, and rural development. These benefits would not normally be quantified in the evaluation of individual systems, but could be critical in determining the overall merits of the technology on a national basis.

Most participants in RER development in LDCs are not inclined by training to consider the full range of national impacts when considering different technology research and development programs. Again, this tends to result in poor evaluations of technology options and subsequent poor use of resources.

- b. Course Objectives

The overall objective of an RER course funded by USAID should be to provide training to participants in RER development which will help them make better decisions in allocating scarce manpower and financial resources for R&D, implementation, and commercialization activities. *LDC motivate and*

An effort to achieve this overall objective should address the specific issues referred to previously. As such, it is suggested that the course have the following mutually supporting objectives:

- Objective 1

To instruct technically-oriented LDC participants on the analysis and operation of applicable technology options.

- Objective 2

To provide participants with up-to-date information on technology status in the U.S. (and elsewhere) and to identify potential sources of goods and services which individual LDCs might contact to assist in their R&D and implementation activities.

- Objective 3

To instruct participants in how to evaluate the technical and economic performance of systems when serving both small and larger scale applications identified as being of importance in LDCs.

- Objective 4

To outline the methodologies by which the overall national impacts of RER systems can be assessed and, thereby, provide the required information for allocating manpower and financial resources.

Only the first of these objectives is now addressed in any detail within the course and then primarily for solar thermal technologies. Limited attention is also given to Objectives 2 and 3 although not on any consistent basis between technologies.

At present very little attention is given to Objective 4 which may well be the single most important objective of a program aimed at furthering USAID's policy of assisting LDCs to become more energy self-sufficient.

## 2. Academic Changes

The evaluation team believes that the effectiveness of the TAET course could be improved if significant modifications were made in subject matter emphasis. The recommendations made reflect the opinions of the evaluation team that meeting the course objectives stated above requires a broader overview of the technical/economic implications of RER development than is now the case. Specific recommendations relative to academic changes are divided into two areas:

- Changes in course content and emphasis to better meet overall objectives, and
- Changes in composition of teaching staff (including guest lecturers) required to effectively implement the recommended course modifications.

### a. Course Content

One of the most serious concerns of the evaluation team is the lack of consistent presentation of technology alternatives and an over-emphasis on engineering detail at the expense of applications analysis (including the full range of socio-economic factors involved in such an analysis). Although progress has been made in this area, additional efforts should be made to give the course better balance. Appendix X presents a preliminary outline of how a revised course might be structured to meet these criteria. Specific recommendations consistent with the suggested course outline include:

- Give more attention to wind, small-scale hydro, and biomass systems with particular emphasis on their application in LDCs. These technologies were consistently referred to by participants as being of

particular relevance in their countries and as having been treated ineffectually in the course.

- Provide participants with an overview of relevant activities in the United States (and elsewhere), including the commercial status and availability of equipment. This would tend to stimulate future contacts between LDC interests and U.S. manufacturers, thereby serving a number of general foreign policy objectives. It might help LDCs reduce costly duplication of effort in system development and better ensure that their efforts are preferentially directed to areas where they can efficiently add to the value of systems.
- Review the cost structure of different equipment options now available and study approaches to estimating the costs of equipment and systems. Particular emphasis should be given to how the cost of systems divides among purchased materials, special processing, manufacturing, distribution, installation, and operation. This will help participants better evaluate system options and identify those systems which can most economically be manufactured and used in their countries.
- Show how the economic performance characteristics of all systems should be evaluated, based on both present and projected cost structures. Approaches for comparing the economics of systems with both conventional and non-conventional options should be outlined. This evaluation process should be integrated within the discussion of each technology and should not be relegated as a special (almost irrelevant) subject to be addressed by a guest lecturer as is now the case.
- Present and involve participants in the analysis of case studies of how such systems have been and could be used within LDCs. These studies should include the technical analysis, design constraints, installation issues, operating experience review, and economic evaluations. Such case studies would provide participants with a better perspective on all the issues associated with the RER option under consideration.
- Discuss the numerous socio-economic issues relevant to LDCs which are associated with each technology option. These issues include the requirements for local manufacture, utility interface problems (for electric power systems), impacts on foreign exchange due to reduced oil imports, and installation and organization and management infrastructure requirements.

In response to the comments of the first review team, which made suggestions similar to those just presented, TAET course management made certain course modifications. These included the use of University of Florida guest lecturers to address biomass and wind power technologies and short seminars on methods of economic evaluation. In our view, these measures are not sufficient. Specifically we believe strongly that the socio-economic issues should be an integral part of the discussion of each technology option and that these important issues cannot be effectively treated by short-term guest lecturers.

Also, the design of course content in each technology must be done by TAET personnel if this content is to address adequately the rather special needs of the LDC participants. This does not preclude the use of guest lecturers. It would ensure that such lecturers, when properly prepared, are addressing issues pertinent to and integral with overall course objectives.

#### b. Teaching Staff Requirements

Presently the staff is intellectually dominated by Dr. Farber, who has many years of experience in solar thermal technologies and is a well-known expert in this field. The other TAET staff members also have a solar thermal technology orientation. Two new staff slated to teach in Program IV have very limited experience in RER and are also from primarily technological backgrounds. In short, it does not appear to us that the present staff mix can effectively undertake the recommended course content modifications.

We therefore recommend that the TAET course teaching staff be modified so that it includes:

- One or more staff members with an in-depth knowledge of important non-thermal RER technologies such as biomass (with particular emphasis in LDC applications) and wind energy utilization.
- Individuals with an overall technology-evaluation orientation including economic analysis and national socio-economic assessments.

A further recommendation is that staff with these backgrounds should also have experience in the LDCs. Most of the participants noted that the staff has not had LDC experience and that this was evident from their course presentations.

It appears, therefore, that in order to give the appropriate re-direction a new senior staff person is required, a person who has a broad view of technologies and their application in the LDCs. This should be accompanied by a review of the backgrounds of present and new staff members to determine whether other changes are needed.

### 3. Administrative Changes

The recommendations in this subsection on administration are aimed at the following goals:

- Reducing the administrative costs associated with the TAET Program
- Increasing the breadth of academic input into the program
- Clarifying lines of responsibility and increasing the amount of delegation of authority and responsibility

We believe that the TAET Program could run efficiently and effectively with an administrative staff performing the following broadly outlined duties:

Program Director	This individual would be totally responsible for the TAET Program. It would be a full-time position in which the person managed both the academic and administrative affairs of the TAET Program. The person in this position should be a fully-qualified academic with wide experience in the full range of topics to be covered in the program.
Program Administrator	This is a full-time position in which the individual would be responsible for the academic and fiscal administration of the TAET Program. Duties would include program scheduling, cost planning and control, interfacing with faculty, ordering books and coordinating handouts of teaching material.
Participant Affairs Coordinator	This is a full-time position with the individual having responsibility for those activities which have direct interface with participants; i.e., housing, transportation, admissions, insurance, social activities.
Budget Clerk	This is a full-time position with the individual having responsibility for maintaining the TAET Program financial records.
Secretary	Full-time, general secretarial functions.
Word Processor Operator	Full-time, general secretary and word processor operator.

Figure 1 shows this streamlined organization in the form of a traditional organization chart. To complete the picture we have added Faculty and Advisory Committee to the chart.

This new organization is designed to give greater authority and responsibility to the University Advisory Committee. We believe that this group should have a more significant role in the overall running of the TAET Program.

The Committee should include a wider diversity of individuals. There should be representation from individuals who can contribute expertise on economic analysis and on the sociological issues. There should be greater representation from individuals with LDC experience.

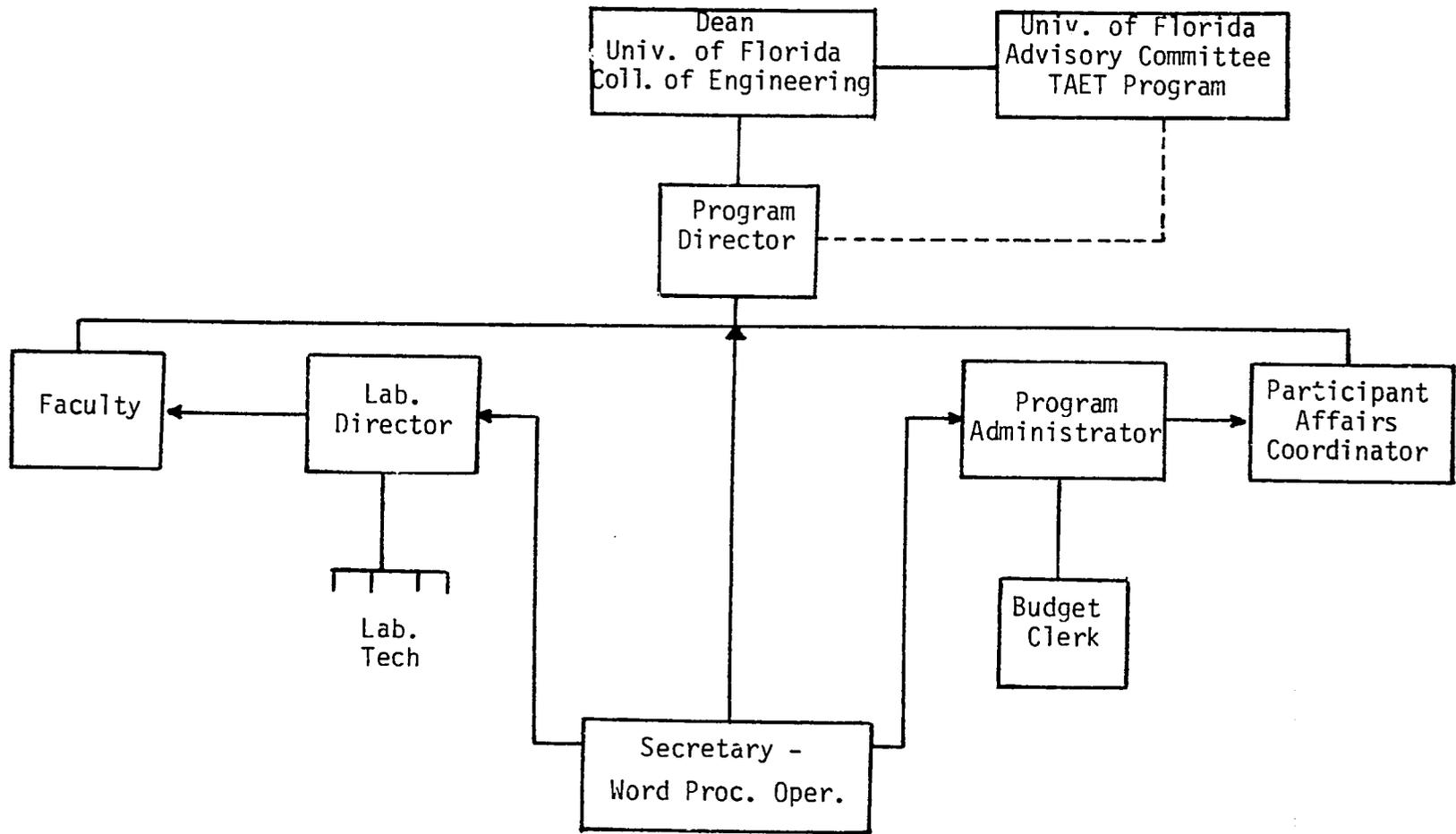


FIGURE 1: RECOMMENDED TAET ADMINISTRATIVE STRUCTURE

We believe that success in making the improvements that these recommendations suggest will require active participation by USAID DS/EY with TAET program management, especially in bringing course goals and objectives fully into line with evolving USAID objectives and AID Mission needs as well as assuring that there is full consensus on the translation of these into program structure, staffing and management.

## APPENDIX I

### BACKGROUND

Arthur D. Little, acting under contract to USAID, has performed an evaluation of the Training in Alternative Energy Technologies (TAET) Program offered at the University of Florida. Although we have covered a broad range of questions, our evaluation has focused on two basic areas: the degree to which the University of Florida has been successful in delivering a training program that is responsive to the needs of the LDC participants, and the degree to which the University has been in compliance with the cooperative agreement with USAID.

Our findings and the recommendations to which they lead were derived from analysis in each of the following areas, as called for in the contract:

- The attitudes and perceptions of past and current (Program III) participants.
- A program review that considered objectives, curriculum, faculty, administration, participant life and University oversight.
- Costs associated with the TAET Program.
- University of Florida compliance with the cooperative agreement.
- Review of the 1980 AID Management Review team's report.
- The relevance of the TAET Program to the needs and interests of the LDC participants.

In considering how broadly we should venture in our findings and recommendations, we decided to err on the side of breadth rather than risk taking too narrow a view. We have provided specific, action-oriented recommendations dealing with program objectives, academic content and administration.

This review team has been most fortunate in obtaining full cooperation from all parties involved in our investigation. The administration, faculty and participants in the TAET Program went out of their way to insure that we received all relevant and necessary information.

Throughout our review we have been careful to allow all sides of the relevant issues to emerge. The study proceeded as follows:

- Step 1 Interviews in Washington with Ray Roan and Shirley Toth of the USAID Office of Energy to clarify scope of study and work procedures.
- Step 2 Visits to the University of Florida by Arnold Weinstein and W. Peter Teagan of the Arthur D. Little evaluation team.  
Discussions with

1. Dr. Erich A. Farber, Director of the TAET Program
  2. Dr. Wayne H. Chen, Dean, University of Florida School of Engineering
  3. University of Florida TAET Advisory Committee
  4. Dr. Roberto Pagano
  5. Dr. Anil Rajvanshi
  6. Dr. Herbert Ingley
  7. Leonard Laketek
  8. All Participants
  9. Dianne Wright, Staff Assistant
  10. George Shipp, Program Administrator
  11. Alan Jacobs, Director, Office of Energy, Development Support Bureau, USAID
- Step 3 Interviews through international telephone calls to a sample of past participants.
- Step 4 Visit by William A. W. Krebs of the Arthur D. Little evaluation team with Dr. Farber and other individuals at the University of Florida.
- Step 5 Detailed discussions of findings among members of the evaluation team.
- Step 6 Draft report.
- Step 7 Review of draft report in meeting with Allan Jacobs, William Eilers, Ray Roan, Shirley Toth (AID); Dean Chen and Dr. Farber (University of Florida); and William Krebs and Arnold Weinstein (Arthur D. Little).
- Step 8 Review of written comments from Dr. Farber and Mr. Jacobs.
- Step 9 Preparation of final report.

## APPENDIX II

### PARTICIPANT INTERVIEWS

As part of the review process all the participants in the third session (ending in May 1981) were interviewed to solicit their views on the course. In addition, 10 participants from Programs I and II were contacted by telephone to determine how they perceived the course after they returned home. General observations resulting from this interview process are reviewed in this section. Also, comments of the participants in the different sessions are compared to determine to what extent suggestions for improvement from the participant perspective have been acted upon.

#### A. PROGRAM III INTERVIEWS

During the visit of the review team to the University of Florida all of the TAET course participants in Program III were interviewed. The purposes of the interviews included:

- Determining what the participants perceived to be the strong and weak points of the course.
- Defining what modifications in the course would result in its better meeting the needs of a higher percentage of the participants.
- Determining the present responsibilities of the participants in their countries and how the course will help them be more effective in their positions.

Based on questions asked in general accordance with the questionnaire (Appendix III), the following observations are warranted.

#### 1. General Impression

In general the participants expressed satisfaction with the course and felt it would help them in their activities in their home countries. In no case did a participant indicate that the course was a waste of time or make generally negative remarks. There were, however, comments and suggestions made by the participants which indicated many areas for improvement in the course. It is these areas which are stressed in the following observations.

#### 2. Technology Options Orientation

The participants were nearly unanimous in commenting on the heavy focus on small-scale solar thermal systems in the course. In this regard it was pointed out that all the permanent staff were solar thermal oriented and that all "seminars" on wind, photovoltaics, biomass, and hydropower utilization were done by guest speakers in a somewhat uncoordinated fashion.

This focus was considered by some participants to be a major issue since they perceived substantial opportunities in their countries for the other technologies. For example, a staff person from the Ministry of Electricity would be much more interested in small-scale hydro than solar crop dryers.

One of the most common comments was on a lack of relevant discussions on biomass systems. This might reflect the fact that many of the biomass options (digesters, small-scale pyrolysis) are not being actively pursued in the U.S. and that a speaker in this field would need a broad overview of relevant worldwide developments. Also, wood is now and will continue to be a major fuel form in many LDCs. Almost no attention is given to better ways to use this energy form.

### 3. Technology Emphasis

About half the participants interviewed commented that the course was heavily engineering-oriented and that little attention was given to general applications analysis, system costs, economics, and national impacts. This heavy engineering orientation resulted in many non-engineering participants being at a distinct disadvantage ("not knowing what was going on for days at a time"). The engineering participants, also, were not terribly impressed since they knew most of the basic heat transfer technologies involved anyway.

The participants that did not comment independently on the lack of applications analysis were often those from government or university R&D centers. When asked if they thought that more emphasis on system costs, economics and implementation issues would be worthwhile, they generally answered affirmatively. This suggests that the course may tend to reinforce a general weakness in these countries - namely a reluctance to consider a broad range of issues associated with technology developments.

### 4. Technology Development Status

The participants indicated that they did not receive a great deal of information on the present technical and commercial status of equipment in the United States. Several participants overcame this deficiency by contacting manufacturers on their own to obtain information on materials, components, test equipment, etc., which might contribute to their home country activities. Most of the participants indicated that they would find it highly beneficial to be made aware in some formal way of the availability of equipment in order to facilitate setting up R&D activities in their countries, reduce duplication of effort, and facilitate future commercial contacts.

### 5. Quality of Speakers

The participants were in general favorably impressed by the commitment and knowledge of the TAET course staff and the way they handled themselves in the lectures.

However, there was almost unanimous concern that the guest speakers were not well prepared and often did not address relevant issues. For example, the speaker on "small-scale" hydropower only discussed systems of 30MW and higher. Thirty megawatts is, of course, relatively large-scale power generation in many of the countries of interest.

## 6. Laboratory Work

Most of the participants were favorably disposed toward the laboratory activities which accompanied the course. Those with a technology orientation felt it increased their familiarity with testing equipment while those with a planning or evaluation orientation felt the exposure to hardware gave them additional insights into system realities.

Complaints about the laboratory work centered about the need for additional equipment so that all the participants could work with the hardware in the time allotted.

## 7. Field Trips

All the participants like the idea of field trips in general. However, most of them questioned the particular selection of sites and indicated that in many, if not most, cases the equipment was not working. One rationale given for selecting such sites by TAET personnel was that it acquainted participants with the various failure modes which is important at this early stage of technology development.

Particular reference was given to the Sandia Laboratory visit since this entailed a long trip to a well-known U.S. R&D center. Several participants found the lack of operating hardware at this site particularly disconcerting since it is given a great deal of favorable publicity in the literature.

It is clear that a better selection of site visits would help improve the image of the U.S. solar activity and give participants more confidence that RER systems can be made to function effectively once the normal R&D related problems are resolved.

## 8. Support Staff

The support staff received very favorable comments from the participants. Almost all of them stated that the support staff extended themselves to be friendly and helpful and to facilitate the adjustment of the participants to the new environment.

## B. TELEPHONE INTERVIEWS WITH PAST PARTICIPANTS

It was considered to be highly useful to contact a number of past participants in order to determine:

- How their views on the course compared with those in the third session,
- If they have found the course to be useful in undertaking their present work assignments (and, if so, how),
- To what extent participation in the course has affected their professional activities, and
- Specific suggestions which they might have now that they have had more time to reflect on their experiences in the course.

Contacts were made by telephone with 10 participants from Programs I and II in the following countries:

- Dominican Republic
- Egypt
- Bolivia
- Kenya
- Philippines

Observations resulting from these conversations are summarized below.

### 1. General Impressions

All the participants contacted indicated that the course was very useful and should be continued. They all commented on the high level of commitment by the teaching staff and the enthusiasm with which the support staff addressed their widely varying needs. They were all aware that the course was undergoing growing pains and indicated that they understood that the faults which existed in these early sessions were being addressed.

Most of the participants indicated that they were using information from the course in their present work assignments. This was particularly true of the technically oriented participants who were doing R&D projects in small-scale technologies (about six of those contacted). The participants who had planning responsibilities indicated that the course helped provide a technology overview but did not directly provide guidance in their work assignments.

It was clear, also, that attending the TAET course was influential in improving the professional positions of over half the participants contacted. Of course, in many cases the course participants are selected initially on the assumption that they have been identified for promotion within their organizations.

As with the participants of Program III, all earlier participants had observations and suggestions which they felt would make the course more relevant to their needs. These are discussed below.

### 2. Technology Orientation

All the previous participants indicated that more emphasis should be given to non-solar thermal technologies and specifically biomass (with emphasis on wood and wastes), wind, and small-scale hydro. They emphasized the need for the course to be able to address these technologies as they would apply to LDC needs.

### 3. Technology Emphasis

The participants varied somewhat on their feeling on how much more emphasis should be given to socio-economic issues in the course. Those who worked at technical institutes (about half the participants contacted) felt that

these issues probably needed a bit more emphasis but were not vociferous in their comments on this issue.

Participants who had more energy systems planning and policy responsibilities were quite strong in their comments that the course needed major strengthening in this area.

#### 4. Quality of Staff and Guest Speakers

All the participants had a very high regard for the teaching ability and background of Dr. Farber. They also commented on the enthusiasm and commitment of the other staff members. However, most of them indicated that the backgrounds or experience of the other staff did not appear particularly strong in the subject areas of interest.

Similarly, the performance of the guest lecturers appears to have been highly varied. The general consensus appears to be, however, that several of the guest lecturers were not well prepared to address issues relevant to LDC needs.

#### 5. Support Staff

The support staff received high praise for their performance. All the participants went out of their way to indicate how understanding and helpful the support staff had been - particularly in view of the "difficult circumstances" of starting a new course.

#### 6. Field Trips

The feelings on the field trips were highly varied. Several indicated that some of the trips were not worth the amount of time spent on them and, in particular, that the sites visited were often not relevant to their needs. Even those who were generally satisfied with the field trips indicated that a better selection would be helpful and that more time should be spent on-site to really see how the system works; i.e., just visiting a site and "looking at" the equipment is not too informative.

#### 7. Suggestions

The previous participants had obviously given considerable thought to their experiences in the TAET course and had some well-thought-out suggestions on how the course might be improved. The majority of these suggestions ran along the following lines:

- Establishing a more structured course which gives appropriate emphasis to the full range of RER technologies.
- Providing more and better laboratory equipment so that the participants can better utilize the significant amount of time spent in this activity area.
- Restructuring the course so that there is a general course review of subject areas common to all the participants complemented by 2 to 3 weeks of specialized studies which address specific needs and interests of individual participants.

- Additions of staff members with in-depth experience in non-solar thermal technologies and their application in LDCs.
- Providing some formal mechanism by which participants in each geographical area can get together periodically to discuss common problems and experiences.

### C. COMPARISON BETWEEN SESSIONS

There is a strong similarity in the comments made by the participants in the different sessions. From AID's perspective it is important to note that all the participants feel the course is very worthwhile and helps them better address RER issues at home.

On the other hand, certain deficiencies in the course seem to be consistent between sessions with little indication that they are being effectively rectified. Specific examples include the following:

#### 1. Technology Focus

The participants in the first two sessions were particularly uniform in stressing the over-emphasis on solar thermal technologies. Given the very strong feelings of the participants on this issue, it is unfortunate that this situation is perceived to be only slightly improved in the third session.

#### 2. Laboratory Activity

The earlier participants felt that the laboratory set-up was not as effective as it might be and that a greater variety of practical equipment should be made available - particularly in light of the short period of time available. This comment did not seem as strong with the third session participants which indicates progress is being made on this issue.

#### 3. Field Trips

The selection of field trips does not seem to be improving so that participants in all sessions had unfavorable comments relative to the utility of many of the visits.

In summary, therefore, the course does not seem to be adjusting as rapidly as might be desirable to better meet participant needs and expectations as they have expressed them to the review teams and to the TAET management.

APPENDIX III

PARTICIPANT INTERVIEW FORMAT

Introduce Self - Explain purpose of interview - help US AID decide if funding should continue. If University of Florida should be site - identify areas for improvement. Identify areas where praise should be given.

NAME \_\_\_\_\_ NATIONALITY \_\_\_\_\_

AGE \_\_\_\_\_ SEX \_\_\_\_\_

1. Please tell me a little bit about how you became involved with this program.

2. I need some educational background data:

Have you attended college?      yes \_\_\_\_\_ no \_\_\_\_\_  
Have you graduated from college?      yes \_\_\_\_\_ no \_\_\_\_\_  
What was your area of concentration or major? \_\_\_\_\_

3. Would you tell me a little bit about the type of work you were doing at home?

4. What were your reasons for wanting to attend this program? Did you have some specific goals in mind? If yes, what were they?

5. Have you had any friends or colleagues who attended this program?

yes \_\_\_\_\_ no \_\_\_\_\_

If yes, what did they think of the program?

6. If we can, let's talk about your experience in this program. If I asked you to rate the quality of your experience so far on a scale of 1-10 (1 being awful, 10 being great), how would you rate your experience?

Rate \_\_\_\_\_

Why:

7. If we can, let's talk a little bit about some specific issues.

a. Relevance of the courses (1-10)

Specifically good \_\_\_\_\_

Specifically bad \_\_\_\_\_

b. Logic and structure of the program (1-10)

Good points \_\_\_\_\_

Bad points \_\_\_\_\_

c. Overall quality of the instruction (1-10)

Specifically good \_\_\_\_\_

Specifically bad \_\_\_\_\_

d. Overall quality of the support services. (1-10)  
Specifics

e. Quality of the Library Facility (1-10)

8. Specific features of the program that could be improved.
9. What specific things do you feel you might be able to do with the knowledge you have gained when you get home?
10. Is there anything I should know about that we have not already covered?

11. As a last question I wonder if you might describe one of the technologies that you have learned about here that you feel might be useful in your home country. And if you would, tell us why you feel it would be a wise decision to make use of that technology.

## APPENDIX IV

### PROGRAM REVIEW

In this Appendix we review the following elements of the TAET Program: general program structure, goals and objectives, curriculum, faculty, administrative staff and services, participant selection and participant life, and the University Review Committee. We briefly describe the situation as we found it and then provide our reactions. It should be kept in mind that we did not have an opportunity, due to the scheduling of this evaluation effort, to actually audit classes in session; our data sources were therefore review of written material, interviews with participants, and interviews with faculty and staff.

#### A. GENERAL PROGRAM STRUCTURE

The academic structure of the program being offered is divided into three distinct parts:

1. General lectures
2. Seminars
3. Laboratory work

General lectures were typically conducted by TAET full-time academic staff or University of Florida full-time faculty. These were most often three-hour seminars conducted in the mornings.

Seminars were most often conducted by guest lecturers. They were held in the afternoon and were typically three hours in length. Seminars were designed to offer the participants the opportunity to discuss the subject under consideration.

Laboratory work was conducted on those days when seminars were not scheduled in the afternoon. Early in the program the laboratory work was devoted to general issues. During the second phase of the program the laboratory time was devoted to working on the participants' projects.

In addition to these three basic elements the TAET Program includes a number of one-day field trips and a one-week field trip. There are also periods of time devoted to presentations made by the participants.

A detailed daily schedule is provided as Appendix V. The remainder of this discussion analyzes the elements of the program.

#### B. GOALS AND OBJECTIVES

The Program Description included in the cooperative agreement between the University of Florida and USAID describes the purpose of the arrangement in the following terms:

"The purpose of this agreement is to make effective use of the broad experience and demonstrated competence of the University of Florida (UF) Solar Energy and Energy Conversion Laboratory in the field of

alternative energy technology, specifically, small-scale solar technology. It is to enable the UF to enhance its ability to train LDC participants in the theory of alternative energy technologies, the machine shop and construction aspects of building low-cost mechanisms based on small-scale solar energy technologies to provide energy for such purposes as crop drying, fish drying, hot water, refrigeration and water purification...The recipient will, to the extent possible, tailor its training to the special needs of the individual LDC participant and will provide training in the social, financial and cultural implications of the transfer of small-scale alternative energy technologies to the rural and urban poor."

The "specific objectives" are then presented as follows:

- "(1) The development of LDC human and thus institutional technical skills in small-scale alternative energy technologies, specifically solar [underlining added]. This involves the conduct of an intensive training program for LDC participants by the recipient. The recipient would provide two training sessions of 15 weeks each year. These sessions would be open to 40 students per session of whom 30 would be LDC students supported under this program. The session would involve classroom and laboratory activities designed to provide participants with the skills and knowledge necessary to build, test and install small-scale solar technologies-mechanisms which are inexpensive, safe and replicable and provide energy to meet basic needs of the rural and urban poor. The trainees would provide their LDCs with a nuclei of technically skilled persons capable of providing technical leadership and support in the development of a program of small-scale solar technologies.
- "(2) The application of these trained human and institutional skills to site and problem specific situations in the LDCs to provide energy to meet basic needs of the rural and urban poor [underlining added]. This involves consultation between recipient and the LDC government, the USAID Missions and the LDC participants on an on-going basis. This requires the establishment of continuing contact and support to these LDC participants and their LDC institutions to carry out in-country training by LDC participants and to construct, test, adopt and replicate the small-scale solar technologies as rapidly and as widely as possible."

In the recommendations of the report we outline and describe what we believe would be a different and more meaningful set of overall goals and specific objectives for the TAET Program which, if accepted, would require changes in both the contract and the program.

Over the two years the TAET Program has been in existence there has continued to be a lack of consensus about basic program goals and objectives. Dr. Farber and his staff seem to have one set of goals in mind while USAID appears to have another set - and these not necessarily themselves consistent with the contract language. This is most apparent when one reviews the report of USAID's first review team. The University of Florida has, perhaps quite properly, taken a very literal interpretation of

its contract as a goal statement. We believe that the first review team (and possibly USAID management) wanted these goals and objectives modified although no formal action has been taken to do so. Moreover our interviews lead us to believe that Dr. Farber, his faculty and staff also maintain concepts about program goals that display a fair amount of variance among themselves and that are not necessarily consistent with the goal concepts of the contract, or those of USAID as expressed in the first review team report.

This lack of consensus about goals has contributed to some participant disappointment and to the feeling of some participants that they have received what they felt to be inappropriate training.

An additional difficulty arises from this situation; the goals and objectives of the TAET Program are not defined clearly enough to be used as a measure of success.

### C. CURRICULUM

Our review of the TAET curriculum is divided into the following sections: Technology, Socio-Economic Focus, Balance Within and Between Technology Presentations, Laboratory Work and Projects, Field Trips and Industrial Exposure.

#### 1. Technology

We found that there were attempts to cover all of the relevant alternative energy technologies at some point in the program. Our interviews indicated that there was a significant amount of learning taking place. Participants were able to converse on a fairly sophisticated level about the technological aspects of the various alternative energy technologies that were discussed during the program. Those individuals who came to the program without formal training in alternative energy engineering were exposed to and learned an impressive amount of engineering detail on this subject.

The amount of technological learning that was achieved by those with an energy engineering background seemed to be satisfactory. Several of the PhDs in the program said they picked up a good deal of useful technological detail.

The role of solar-thermal technology plays a dominating and perhaps overriding place in the TAET Program. This is evidenced by the very limited amount of time devoted to biomass, wind, hydro and other non-solar thermal technology. See Table 1 for the allocation of classroom time by subject matter as shown in the formal schedule. More importantly, the full-time academic staff associated with this program are specialists in solar thermal technology. The training in the other alternative energy sources is provided by other University of Florida faculty or non-University of Florida guest speakers. These individuals, who have only limited contact with the TAET Program, do not have the opportunity and perhaps the inclination to have a major impact upon the program.

Exposure to a number of the non-solar thermal technologies was incomplete and spasmodic. For example, there was very little, if any, information provided on small-scale hydro.

TABLE 1

APPROXIMATE DISTRIBUTION OF CLASSROOM TIME\*  
AS SHOWN IN ACADEMIC SCHEDULE

	<u>Percent</u>	<u>Hours</u>
Overview Material	10.0	21
Theory of Solar Radiation and Heat Transfer, etc.	22.5	48
**Solar Thermal Applications	29.5	63
Hydro	3.0	6
Wind	5.5	12
Geothermal	1.5	3
Photovoltaic	3.5	12
Biomass	7.0	15
Ethanol	4.0	9
Economics/Sociology	11.4	24

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\* Does not account for field trips and student presentations.

\*\* See comment by Dr. Farber in Appendix XII.

The TAET Program is planning to bring in two new instructors for the coming year. One of these individuals has a limited and narrowly focused background in solar technology; the other is an individual with a more general background and has some interest in non-solar thermal applications. Neither of these two individuals will be strong enough nor do they have the background necessary to change the balance of the TAET Program.

Dr. Farber reported that one of the individuals he hopes to hire may not join the faculty. If this happens and it is felt necessary to hire another full-time faculty member, then this individual should have a non-solar technology specialty or the individual might be looked on to bring a strong economics or social science influence.

The TAET Program focuses much of its attention on alternative energy for small-scale rural utilization. The focus seems to be on the individual family or very small unit. There is a very conscious focus on the utilization of local materials in locally manufactured products. This focus does not deal with those items that can have significant impact on a country's energy balance.

Many participants are from newly industrialized LDCs such as India and Brazil. There is no reason why renewable energy resources should not be considered a potential major resource in such countries for process heating, grid-connected wind, etc. Countries such as Brazil already have several companies manufacturing such equipment. Argentina makes more wind pumps than the United States. The narrower view which dominates TAET instruction helps perpetuate an unfortunate bias in some LDCs that renewable energy resources are unimportant in a national energy supply context and therefore do not merit serious consideration in national planning activities.

There is also an implicit assumption that imported goods are always more expensive than locally manufactured goods. This assumption is consistent with the overall lack of sophisticated economic analysis in the program. Participants do not learn how to approach the make or buy decision from a purely financial basis or from a social cost/benefit analysis. The assumption seems to be that the shadow price of local research and development is zero. This is obviously not true.

The TAET's focus on small-scale rural applications with a special emphasis on showing how these devices can be fabricated from locally available materials is not without merit (and it certainly is consistent with the statement of goals and objectives in the cooperative agreement). Many LDCs are not in a position to take advantage of more sophisticated technologies and therefore the issues of small-scale rural application have a place in the curriculum. It is only the emphasis that we question.

## 2. Socio-Economic Focus

The TAET Program has as its primary focus the technological considerations associated with small-scale alternative energy resources for rural areas in the LDCs. We take issue with the heavy emphasis on technological

considerations. This technological bias leads to a diminished and unsatisfactory treatment of many other dimensions of the alternative energy problem in an LDC. Our interviews indicated that participants did not view alternative energy programs as systems with economic, social and very real implementation problems.

Participants developed fairly good skills in understanding the engineering of an alternative energy device, but they could not then analyze that device for its impact on the society where it was to be installed. We believe that concepts of social cost/benefit analysis are not covered adequately although they apparently are referred to. Few participants appeared to us to be in a position to assess the impact of a suggested technology on a country's energy balance.

As far as we could tell, the subjects of economic and social analysis were separated from the treatment of each technology. There were a limited number of separate classes on economic analysis and/or social analysis. We feel this type of treatment relegates economic and social issues to a lower level of importance.

It would appear that the participants were primarily involved in learning how to solve engineering problems rather than in identifying the appropriate questions to ask when evaluating the potential for a technology in a particular situation or country.

### 3. Balance Within and Between Technology Presentations

One of the most serious concerns we have about the TAET course is the lack of a consistent presentation between the various technology alternatives and an over-emphasis on engineering detail at the expense of applications analysis. In Appendix X we present an outline for a wind power course to illustrate an alternative approach which could better ensure a balanced and complete discussion within each technology area.

The present course approach focuses on information relative to resource characteristics (i.e., wind availability) and performance characteristics. However, relatively little emphasis is given to overall system design issues, cost structure of equipment and systems, how to evaluate system economics, availability of equipment in the U.S. and elsewhere, how the equipment can be applied in LDC applications, and socio-economic issues associated with widespread use.

In the course approach suggested in Appendix X the socio-economic issues are considered as an integral part of the technology option discussion. Both review teams agree that this is preferable to having these issues treated separately by guest lecturers.

The outline presented is specifically for wind power. It is considered that each technology area could be treated according to a common format similar to that indicated, so that participants can learn how to compare alternatives and thereby improve their decision-making capabilities when they return home.

Having all the technologies presented in a similar format will help ensure that a reasonable balance is provided between the technologies.

Also, such an integrated curriculum will help guide the presentations made by guest lecturers by explicitly providing them with the context within which their presentations will be made, adding to the breadth and scope of the course.

An additional advantage of a standardized format is that it will assist TAET staff in preparing a coherent set of handouts for the participants - a lack noted during the participant interviews and by several of the AID Missions.

#### 4. Laboratory Work and Projects

In line with the cooperative agreement between USAID and the University of Florida, the TAET Program provides extensive hands-on experience in building alternative energy devices. Each participant is given the opportunity to participate in one or more projects. These projects are devoted to building items such as solar crop dryers, wood gasifiers and solar hot water heaters. This experience exposes many participants for the first time to the realities of hardware assembly and proper experimental procedures. This will help the technical people better plan their own experimental programs and provide planners with additional insights into system construction and operations.

We fully agree that some experience of this nature is desirable. The question we raise relates, rather, to the balance between "hands on" experience and learning about the operation and evaluation of commercially available hardware. It appears to the review team that more emphasis should be given to operating and evaluating commercially ready equipment (waste heaters of various designs, distillation systems, photovoltaic coolers, etc.) so that participants are exposed to a wide variety of system options<sup>1</sup>.

The laboratory equipment was adequate for current purposes but fell short of being able to respond to more than the relatively unsophisticated needs of the current laboratory philosophy. The laboratories could not provide the participant with a chance to evaluate usable systems in alternative configurations or those utilizing competing equipment or technologies.

At times, we understand, there were shortages of laboratory personnel, but this problem may be susceptible to a solution through improved scheduling.

Not every participant chose a special project that required building a piece of hardware. Participants could choose to do an economics-oriented project. This flexibility was a useful feature in the TAET Program.

#### 5. Field Trips and Industrial Exposure

Participants go on several local field trips and one extended one-week field trip that includes, among others, visits to Sandia Laboratories, Schuchuli Village, and the Gila Bend Irrigation System. The composition of the field trip conducted in week 14 of the program raised some questions in the minds of the evaluation team. There appears to be an emphasis on showing the participants some large-scale sophisticated U.S.

<sup>1</sup>Dr. Farber's comment on this subject appears in Appendix XII.

failures in the area of alternative energy. The focus on failures is to drive home the need for appropriate technology. We find no serious fault with the concept of ensuring that participants do not repeat U.S. mistakes. We do, however, believe that the emphasis on failures may be a bit overdone. Greater exposure to well-planned, working systems would appear also to be a valuable learning experience. Such systems exist in the U.S. and could be visited within the framework of the one-week field trip<sup>1</sup>.

In general, there was very little attempt to expose participants to U.S. industrial practice. One trip to a flat plate collector manufacturer is made during the course of the program. It would seem that many U.S. manufacturers would be happy to have participants visit their facilities. This would provide the participants with a much better feel for what would be involved if their countries were to become serious about local manufacture. It would also provide greater exposure to the range of already available commercial devices. It might even provide a sales lead for a U.S. company.

#### D. FACULTY

In this section we look at each of the following issues: Faculty Background and Functions, Teaching Loads, Teaching Materials, and Guest Speakers.

##### 1. Faculty Background and Functions

The faculty for the TAET Program is comprised of three groups: members of the University of Florida full-time tenure-track faculty, full-time faculty hired for the TAET Program and not within the University tenure systems, and guest speakers not associated with the University of Florida.

##### • Full-Time Tenured Faculty

The two faculty members in this category are Dr. Erich A. Farber and Dr. Herbert Ingley. Dr. Farber is a highly qualified, world-recognized expert in the area of solar thermal technology. He is also highly qualified as a teacher and director of the TAET Program. His developing world experience makes his contribution to the program invaluable.

Dr. Farber is the intellectual father of this program. It was his conception, and his input continues to dominate all areas of the academic program. He also has major administrative responsibility for the TAET Program. It was apparent that Dr. Farber also controls the administrative decision-making structure of the TAET Program.

Dr. Ingley is a member of the Mechanical Engineering Department of the University of Florida. He is assigned to teach on the TAET Program and the program picks up 20 percent of his salary costs. He received his Ph.D. from the University of Florida in 1971. His specializations are air pollution technology, solar heating and cooling, low-temperature solar air-conditioning and a number of other related areas. Within the TAET Program Dr. Ingley is responsible for the solar cooling and air-conditioning material. The

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<sup>1</sup> See comment on this point by Dr. Farber in Appendix XII.

review team sees him as a qualified engineer with technical expertise in the area of his responsibility. We noted, however, Dr. Ingley's lack of developing country experience and the highly technical focus he brought to his teaching.

- Non-Tenure-Track Faculty

The most senior non-tenure-track faculty member associated with the TAET Program is Dr. Roberto Pagano. Dr. Pagano acts as the academic administrator for the program and has responsibilities for teaching in the area of solar radiation. He has a relatively limited academic and research background in the renewable energy field other than with solar radiation. His specialization prior to coming to the TAET Program was nuclear reactors and their associated problems. He also has extensive experience in assessing the environmental impact of energy developments.

The review team found Dr. Pagano to be a hard-working, enthusiastic individual. We were, however, somewhat concerned with his lack of experience outside the solar radiation field which militates against his being in a position to provide broad academic leadership throughout the TAET Program.

Dr. Anil Rajvanshi has just left the TAET Program. His area of interest was in the solar thermal area. He studied for his Ph.D. under Dr. Farber. During our interviews it became obvious that Dr. Rajvanshi was a well-liked member of the faculty. Being a junior member, however, made it very difficult for him to have a substantive impact on the direction of the TAET Program.

Leonard Laketek is in charge of the laboratory work for the TAET Program. He seems well qualified for this work. The participants felt he was very supportive of their efforts. Mr. Laketek also completed his studies at the University of Florida.

Dr. Farber has made offers to two individuals to join the teaching faculty this coming September. One of the individuals, Dr. Agarwal, is a physicist with what appears to be a fine theoretical background. The review team notes, however, that Dr. Agarwal does not bring significant experience in the application of renewable energy resources in the developing world. He does not fulfill the need for a faculty member who has a background in areas other than solar thermal technology.

The other individual Dr. Farber hopes to hire is Dr. Martin Bush. Dr. Bush is a well-trained chemical engineer. Again, we note this individual's lack of experience in renewable energy.

Our general observation about non-tenure-track faculty associated with the TAET Program has to be that there is a noticeable lack of depth and breadth. While Dr. Farber is an acknowledged expert in his field, the other faculty (tenure-track, both current and anticipated) lack the practical experience to bring relevance to their teaching in this particular curriculum. They also lack the skills

required to complement those of Dr. Farber. There do not seem to be faculty who can bring relevant non-solar thermal expertise to bear nor do they provide expertise in the non-technology issues.

- Guest Speakers

A wide variety of guest speakers is used throughout the TAET Program. Technical experts from the University of Florida and from government and industry are brought in for periods of one-half to two days. The use of guest speakers has some very real potential benefits.

We see several problems in the way the TAET program utilizes guest speakers. The most significant problem is associated with the appropriateness of the technology being discussed. A second problem relates to the adequacy of the briefing given to guests and the thoroughness of preparation by guest speakers themselves.

In more than a few instances guest speakers, typically non-University of Florida faculty, were only prepared to talk about U.S. technology and very large sophisticated systems. This was unfortunately true in the non-solar thermal area where strong presentations of relevance to the LDCs would be most important.

It was apparent to participants that many of the guest speakers had been inadequately briefed on their talks. They had very little knowledge of the TAET Program, its students or the goals of the program. This was true both of non-University of Florida guest speakers and University of Florida faculty.

Participants commented that several of the guest speakers had not adequately prepared for their sessions. This could be a function of the amount of preparation time being paid for, or it could be a function of faculty interest and dedication. Guest lecturers were provided somewhere between two and three days of consulting fees to prepare and present a three-hour seminar. This is very limited compensation for what could be a major task. Guest speakers cannot look to the TAET Program for a consulting fee that fully compensates for the work being done but the program should be sure that the amount is not so small as to discourage adequate preparation.

A serious problem with guest speakers is associated with the fact that there is no consistent format for treating the technology options. Each speaker was free to choose his own format and area of coverage. This led to widely varying approaches that made it very difficult for the participants to compare the technologies covered by the various guest speakers.

Perhaps the most serious problem with guest speakers was that in certain areas they provided all or the vast majority of the subject treatment for a particular energy alternative. This left the participants with little opportunity to follow up on subjects covered by a guest speaker. This was particularly true in the areas of

wind, hydro, geothermal and economics. If we consider non-full-time TAET faculty as guests, then we would have to add the biomass and thermal areas to this list.

As one analyzes the teaching load for regular classes, excluding laboratory sessions, it would appear that about one-third of the sessions are covered by full-time TAET faculty, one-third by other University of Florida faculty and one-third by outside guest speakers. There are the equivalent of 20 sessions covered by each group of instructors.

The problems associated with coordinating close to 20 outside lecturers in the time available make it unrealistic to assume there will be any consistency in approach or quality of presentation.

## 2. Teaching Loads

A review of the daily schedule for Program III shows that there is very limited classroom utilization of Drs. Pagano and Rajvanshi. Both of these individuals are full-time employees of TAET and had four classroom contacts of three hours each. This 12 hours total teaching in a 15-week period seems less than full utilization of resources.

Dr. Pagano has other responsibilities, being the Technical Director of the program, but that would not seem to require 95 percent of the work time available.

Dr. Rajvanshi worked closely with the students on their projects, and this undoubtedly used up a significant amount of his time. One wonders, however, if 12 hours of formal teaching and project supervision over the entire 15-week period is appropriate utilization of this resource.

Dr. Ingley, who has 20 percent of his time charged to the TAET Program, also carried a teaching load of 12 hours during a 15-week program.

In the forthcoming year, the TAET Program has hired two full-time instructors while only Dr. Rajvanshi will be leaving. Unless this leads to a significant reduction in the utilization of outside guests, one must be concerned about work loads.

Dr. Farber carried the heaviest teaching load in the TAET Program. He teaches nine separate three-hour sessions over a 15-week period. This 27-hour teaching load may be a bit high when Dr. Farber is also expected to provide administrative guidance and supervision. The TAET Program picks up 25 percent of Dr. Farber's salary.

Dr. Farber explained the relatively light formal teaching loads for his faculty on the basis of the need for very significant student contact outside of normal classes. We were not able to observe this non-classroom activity because our review took place after formal classes had ended. We had no reason to doubt that Drs. Pagano, Rajvanshi, and Ingley spent a considerable amount of time in contact with participants. One might still debate whether that is the most effective utilization of faculty time.

### 3. Teaching Materials

Each participant is provided with several textbooks and a large amount of printed material. After inspecting the non-textbook materials provided to each participant, we have some serious concerns. One major handout is composed of articles written by Dr. Farber. These articles range from fairly recent to some of relatively old vintage. There does not appear to be an attempt to provide a balanced picture of the technologies covered in this major handout. The focus of most of the material in this handout is solar thermal.

Many of the papers in the large handout are not relevant to LDC applications or technology choices. No use is made of the wealth of papers written especially for LDC applications available from or through USAID, the World Bank, the U.N., and many other channels.

In the non-solar thermal area there is no systematic handout of materials. Some guest speakers provided material for all participants - usually just reports - not really course materials. In other situations participants were told to inspect materials and identify those they would like copied. This approach seems less than satisfactory.

There is no consistent set of handout or course material, background reading, or data on product availability. A brief review of the materials provided on the non-solar thermal technology also demonstrated weaknesses. Much of the material was U.S. in its orientation. There was little or no emphasis on implementation problems in the LDCs.

The organization and presentation of handout material was not in a format that would maximize utility to the participants.

The participants felt that it would have been useful to have more exposure to information on commercially available equipment (company profiles, costs, performance characteristics, etc.). The TAET management indicates that such information is available in the reading room and is copied, on request. As a practical matter, however, it appears that the fact that this information is not presented formally and in an organized way to the participants makes it difficult for them to get a balanced overview of commercial availability. More emphasis, we believe, should be placed on taking the initiative to provide participants with commercial information in the form of company catalogues, product data sheets, etc., which can be useful additions to their libraries.

This treatment of commercial data highlights another problem. Participants had very little feeling for nor understanding of what is available in the way of U.S. or foreign technology. The focus on using locally available materials seems to weigh unnecessarily against the identification of commercially available and economically justifiable off-the-shelf technology.

#### E. ADMINISTRATIVE STAFF AND SERVICES

The TAET Program runs smoothly and the administration seems to have developed a system that works. The administrators appear to have all aspects of the program under control. The recruiting, admissions, housing and other nonacademic matters are handled in a very satisfactory manner.

The academic administration works well. Schedules are prepared and followed. People seem to know what is going on and are able to anticipate problems.

Two areas of the administrative structure, however, cause us concern. First is the lack of delegation of authority and the second is an apparent excess of administrators.

The administration of the TAET Program is highly centralized. Few, if any, decisions can be made by anyone other than Dr. Farber. This situation seems to be impeding the staff's willingness to innovate and be responsive to the changing needs of participants.

This lack of decentralization or delegation is creating some obvious weak spots in academic administration. With Dr. Farber's other activities outside of TAET he does not have time to get sufficiently involved in all aspects of academic administration. This has left areas such as classroom notes, handouts, quality control over guest lecturers and briefing of lecturers in relatively poor condition. Flexibility in classroom scheduling, changes in weekly sequencing of material and possible changes in course content are discouraged, if not made very difficult, because of the highly centralized management system.

There also appears to be an excessive number of administrators for the amount of work to be done. A careful re-evaluation of job duties and assignments might show that as many as two administrative staff could be eliminated.

The impression one got during interviews was that at least one administrator had few, if any, real responsibilities and that at least one or two others had less than full-time jobs. It also seemed plausible that the current staff could fairly easily handle a sequence of three training sessions per year.

The following positions currently make up the administrative (non-teaching) structure of the TAET Program:

Program Director	Dr. Farber - in overall charge reporting to the Dean of the School of Engineering.
Technical Director	Reports to Dr. Farber and has basic responsibilities for classroom activities.
Program Administrator	Unclear reporting relationship. Seems to prepare budgets and write reports. Little contact with daily program routine or students.
Staff Assistant	Reports to Program Administrator. Performs wide variety of functions from admissions to traditional student affairs activity. Key member of administrative staff.

Information Specialist	Reports to Staff Assistant. Takes pictures, arranges public relations, plans student parties.
Fiscal Assistant	Reports to Staff Assistant. Keeps financial records of program.
Librarian	Unclear reporting relationship. Orders books for students and is building library.
Secretary	Reports to Staff Assistant. Performs general secretarial duties for everyone.
Word Processing Operator	Reports to Staff Assistant. Operates word processor.
Laboratory Manager	Reports to Technical Director, supervises laboratory activities.

#### F. PARTICIPANT SELECTION

The process for selecting participants to attend the TAET Program seems to be fairly well organized. Nominations come from AID Missions to the University. The TAET administration reviews these nominations and passes their recommendations on to USAID in Washington.

One issue in the area of participant selection caused the review team some concern. Participants have widely varying backgrounds and reasons for attending the TAET Program. Qualifications range from Ph.D.s in some areas of alternative energy to undergraduate engineering or economics degrees. This heterogeneity makes it very difficult to focus a course or to identify the appropriate level at which to teach the technological subjects. Conversely, it is not clear that a homogeneous group of participants would be a desirable program attribute. Greater attention to the issue of heterogeneity would most likely resolve this issue to the extent that one can solve the problem. A number of possible avenues are open to deal with the problem. One would be a series of seminars near the end of the program for those individuals with special interests. Another would be to conduct laboratory sessions on two levels - one for generalists and the other for specialists.

#### G. PARTICIPANT LIFE

One measure of the program's success must always be the level of participant satisfaction. By this measure the TAET Program is doing very well. Almost all participants were enthusiastic about the program. Individual problems did not override the participants' general level of satisfaction. Participants were enthusiastic about recommending the program to their colleagues.

The largest single complaint voiced by the participants was their sense of isolation from the main University campus. The Days Inn location was

neither near the TREEO Center nor the main campus. Participants found it difficult to utilize the resources available on the main campus, and because of transport limitations, they could not stay at the TREEO Center late into the day if they wanted to continue work there.

Most participants claimed that they had very serious problems trying to set up appointments with non-TAET faculty on the main University campus. The difficulty in setting up the meetings quickly discouraged those individuals who would have benefited.

There was, in addition, a feeling of isolation from the mainstream of community life. Living in a motel that is not centrally located prohibits participants from gaining any real sense of Gainesville and its people.

Balancing this sense of isolation is the fact that the participants get to meet a wide cross-section of the American community, particularly since the TAET Program makes very extensive use of outside guest lecturers. These individuals represent a wide variety of institutions and this variety of exposure is valuable to the participants. From this variety of individuals the participants see that there are no simple or absolute answers to an energy problem and they get different perspectives on the entire subject of alternative energy. The participants also come into contact with a wide variety of individuals on their field trips and site visits.

#### H. UNIVERSITY REVIEW COMMITTEE

After the visit of USAID's first review team, the University of Florida established an Advisory Committee for the TAET Program. The Committee expressed some degree of satisfaction in gaining acceptance from TAET Program management of some of the ideas in the first review team's report.

We are, however, not overly confident of the Advisory Committee's abilities to get others of its suggestions implemented under present circumstances. The process of negotiating change in the TAET Program is slow and very much constrained by the tradition of non-interference in the academic prerogatives of colleagues. Perhaps a more serious problem is that the Advisory Committee does not have in its membership anyone who has comprehensive understanding of the issues that need to be faced in the TAET Program. Members of the Committee are technologically competent and are experienced in University teaching and administration. Sensitivity to and experience in applying the total system approach to RER development which we feel is so necessary does not appear to be a major strength of this Committee.

We also have the impression that the Committee has not as yet been very active and does not have an agenda involving rigorous review of the TAET Program with adequate staff support.

APPENDIX V  
WEEKLY SCHEDULES, 1981  
 TRAINING IN ALTERNATIVE ENERGY TECHNOLOGIES  
 SCHEDULE FOR WEEK 1, 9 THROUGH 13 FEBRUARY 1981

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SCHEDULES SETTING FORTH DETAILS OF THE PROGRAM  
 ACTIVITIES WILL BE DISTRIBUTED EACH WEEK.

DAILY PICKUP AT THE DAYS INN IS AT 8:15 A.M.,  
 EXCEPT WHERE OTHERWISE NOTED.

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Monday 02/09		ORIENTATION AT THE TREEO CENTER
		Participants in small groups will be briefed by the TAET program staff on a rotating schedule. Following the briefing, each group will be taken to the bank to arrange services, and then to the grocery store. Refer to the Information Package for details.
Tuesday 02/10	08:30	Pick-up at Days Inn
	09:00	LIBRARY ORIENTATION AND TOUR OF THE UNIVERSITY OF FLORIDA LIBRARIES. J. Ray Jones, Jr., University Librarian.
	11:30- 13:30	Lunch
	13:30- 15:30	TOUR OF CAMPUS
Wednesday 02/11	08:30	OPENING CEREMONIES
		Welcoming remarks by University of Florida officials and a brief overview of the TAET program by representatives of the U.S. Government.
		Orientation Presentation - TAET program staff
	13:30- 16:30	PARTICIPANTS' INTRODUCTION
		The participants are invited to introduce themselves and talk briefly about their work.
Thursday 02/12	08:30- 11:30	TECHNICAL ORIENTATION - TAET Technical Staff
	13:30- 16:30	SEMINAR
		Alternative Energy Technologies in Perspective Dr. Erich A. Farber
Friday 02/13	08:30- 11:30	TOUR OF GAINESVILLE
	13:30- 16:30	LECTURE
		Characteristics of Solar Radiation (Rescheduled from 02/16/81) Dr. Erich A. Farber
		WELCOMING PARTY AT THE TREEO CENTER

TRAINING IN ALTERNATIVE ENERGY TECHNOLOGIES  
 SCHEDULE FOR WEEK 2, 16 THROUGH 20 FEBRUARY 1981

LUNCHTIME RUNS TO CAMPUS AND EVENING RUNS TO THE LIBRARY  
 (MONDAY, TUESDAY, THURSDAY) BEGIN THIS WEEK

Monday 02/16	08:30	SEMINAR: Global Energy Resources Harry Perry Resources for the Future, Inc. Washington, D.C.
	13:30- 16:30 (Rescheduled from 2/13)	TOUR: Energy Research and Education Park, University of Florida Dr. Skip Ingley
	16:30 19:00 22:00	SHOPPING LIBRARY
Tuesday 02/17	08:30- 11:30	LECTURE: Characteristics of Solar Radiation Dr. Pagano
	13:30 16:30	LAB: Solar Measurements
	15:00- 15:30	Informal Discussion on Visa Matters Dr. Richard D. Downie Assistant Dean of Student Affairs University of Florida
	19:00- 22:00	LIBRARY
Wednesday 02/18	08:30- 11:30	LECTURE: Characteristics of Solar Radiation Dr. Pagano
	13:30- 16:30	SEMINAR: Economic Growth -- A World View Dr. William Woodruff Department of History University of Florida
Thursday 02/19	08:30- 11:30	LECTURE: Characteristics of Solar Radiation Dr. Pagano
	13:30- 16:30	LAB: Thermocouple Measurements
	15:00- 15:30	Presentation on the STAC Computer Information System Professor Hal Ingman University of Florida
	19:00 22:00	LIBRARY

TRAINING IN ALTERNATIVE ENERGY TECHNOLOGIES  
 WEEK THREE SCHEDULE, THIRD SESSION  
 23 FEBRUARY THROUGH 27 FEBRUARY 1981

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Monday 02/23	8:30-11:30  and  13:30-16:30	SEMINAR:	Hydropower - An Assessment of an Alternative Source of Energy Richard J. McDonald Institute for Water Resources U.S. Army Corps of Engineers
	16:30	SHOPPING	
	19:00-22:00	LIBRARY	
Tuesday 02/24	8:30-11:30  and  13:30-16:30	SEMINAR:	Wind Energy Dr. William R. Barchet Pacific Northwest Laboratory Batelle Memorial Institute
Wednesday 02/25	8:30-11:30  13:30-16:30	SEMINAR:	Photosynthesis and Productivity Dr. George E. Bowes University of Florida
	13:30-16:30	LAB	Properties of Materials
Thursday 02/26	ALL DAY	TOUR OF SOLAR GAINESVILLE	Pick-up 9:00; Lunch Stop on Road
	19:00-22:00	LIBRARY	
Friday 02/27	8:30-11:30  13:30-16:30	SEMINAR:	Geothermal Energy Dr. Chuck Bufe U.S. Geological Survey
	13:30-16:30	LAB	Thermal Conductivity

TRAINING IN ALTERNATIVE ENERGY TECHNOLOGIES  
 SCHEDULE FOR WEEK 4, 2 THROUGH 6 MARCH 1981

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Monday 03/02	0830 - 1130	Group Projects
	1130	Bank
	1330 - 1630	Lecture: Principles of Heat Transfer and Fluid Flow. Dr. Farber
	1630	Shopping
	1900 - 2200	Library
Tuesday 03/03	0830 - 1130	Lecture: Heat Transfer and Fluid Flow
	1330 - 1630	Lecture: Flat Plate Collectors Dr. Farber
	1900 - 2200	Library
Wednesday 03/04	0830 - 1130	Lecture: Heat Transfer and Fluid Flow
	1330 - 1630	Lab: Flat Plate Collectors, Construction
Thursday 03/05	0830 - 1130	Lab: Flat Plate Collectors, Performance
	1330 - 1630	Group Projects
	1330 - 1500	Optional Tour: The Gainesville Climatological Station, Including the Class A Weather Station Dr. Franklin P. Gardner Nandini Nimbkar Rajvanshi Department of Agronomy
		Please note that this is an optional tour intended for participants with specialized interests. Participants who are not interested in the tour may devote the entire afternoon to their group projects.
	1900 - 2200	Library
Friday 03/06	0830 - 1130	Seminar: Appropriate Technology and Renewable Energy Developments. Professor Thomas A. Lawand Brace Research Institute McGill University
	and	
	1330 - 1630	
	1630	BARBEQUE AT THE TREEO CENTER At the request of many of our participants, we will be holding a repeat cookout at TREEO.

TRAINING IN ALTERNATIVE ENERGY TECHNOLOGIES  
 SCHEDULE FOR WEEK 5, 9 THROUGH 13 MARCH, 1981

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Monday 03/09	0830 - 1130 1130 1330 - 1630 1900 - 2200	LECTURE: Flat Plate Collectors -- Dr. Rajvanshi BANK LAB: Agricultural Collector LIBRARY
Tuesday 03/10	0830 - 1130 1330 - 1630 1900 - 2200	LECTURE: Unconventional Collectors Dr. Rajvanshi LAB: Thermal Storage LIBRARY
Wednesday	0830 - 1130 1330 - 1430 1500 - 1630	LAB: Pipes-In-Sand Collector SEMINAR Renewable Energy Applications in Nepal Gyani Shakya SEMINAR Historical Development of Energy Crises Dr. Robert B. Caither Professor and Chairman Department of Mechanical Engineering University of Florida
Thursday 03/12	FIELD TRIP:	U.S. Solar Corporation
and		
Friday 03/13		A detailed schedule of the field trip is attached Pickup is at 0800 on both Thursday and Friday

TRAINING SCHEDULE WEEK 5, 9 THROUGH 13 MARCH, 1981

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Thursday 03/12/81	0800	Pickup at Days Inn
	0900	Arrive at U.S. Solar Corporation
	0900 - 1030	Presentation on Collector Design Parameters, Materials and the U.S. Solar Manufacturing Process
	1030 - 1200	Tour of Manufacturing Plant
	1200 - 1315	Lunch at Starke, Florida
	1315 - 1500	Presentation on the Design and Operation of Water Heating Systems, Equipment and Applications
	1500 - 1700	Inspection of Testing Facilities
	1800	Arrive at Days Inn
Friday 03/13/81	0800	Pickup at Days Inn
	1000	Arrive at Patterson Enterprises
	1000 - 1130	Inspection of Solar System
	1130 - 1330	Return to U.S. Solar with Lunch Stop on the Way
	1330 - 1500	Presentation on Marketing of Solar Equipment
	1500 - 1630	Demonstration of Installation Technology
		1730

## FIELD TRIP TO U.S. SOLAR CORPORATION

In the course of this field trip, we will tour the production and testing facilities of a manufacturer of solar equipment and inspect a solar space heating system at an industrial plant. We will drive to Hampton, Florida, located approximately 30 miles (50 kilometers) to the northeast of Gainesville, on Thursday and spend the day at the U.S. Solar Corporation, a manufacturer of flat plate collectors designed to produce hot water for residential, commercial and industrial applications. On Friday morning we will drive 70 miles (110 kilometers) to Jacksonville, Florida to visit Patterson Enterprises' plant, where a system of 40 U.S. Solar Collectors provides part of the space heating needs of the general offices. We will spend Friday afternoon at the U.S. Solar Corporation before returning to Gainesville.

Contact: Webb W. Farber  
U.S. Solar Corporation  
P.O. Drawer K  
Hampton, Florida 32044  
Telephone (904) 468-1517

TRAINING IN ALTERNATIVE ENERGY TECHNOLOGIES  
SCHEDULE FOR WEEK 6, 16 THROUGH 20 MARCH 1981

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Monday 03/16	0830 - 1130	LAB:	Concentrating Collectors
	1130	BANK	
	1330 - 1630	LECTURE:	Concentrating Collectors - Dr. Farber
	1630	SHOPPING	
	1900 - 2200	LIBRARY	
Tuesday 03/17	0830 - 1130	LECTURE:	Concentrating Collectors - Dr. Pagano
	1330 - 1630	LAB:	Photovoltaic Cells
	1900 - 2200	LIBRARY	
Wednesday 03/18	0830 - 1130	LECTURE:	Concentrating Collectors - Dr. Rajvanshi
		SEMINAR:	Engineering Economy - Capital Expenditure Analysis Dr. Richard S. Leavenworth Department of Industrial and Systems Engineering University of Florida
Thursday 03/19	0830 - 1130	DEMONSTRATION:	Visit of the Silicon Cell Research Lab at the University of Florida Dr. Arnost Neugroschel Department of Electrical Engineering
	1330 - 1630	SEMINAR:	Basic Principles of Photovoltaic Conversion Dr. F. A. Lindholm Department of Electrical Engineering University of Florida
	1900 - 2200	LIBRARY	
Friday 03/20	0830 - 1130	SEMINAR:	Photovoltaics - An Overview of Developments and Applications Professor Joseph J. Loferski Brown University

TRAINING IN ALTERNATIVE ENERGY TECHNOLOGIES  
 SCHEDULE FOR WEEK 7, 23 THROUGH 27 MARCH 1981

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Monday 03/23	0830 - 1130 and 1330 - 1630	SEMINAR:	Conservation of Energy Critical Resources in the Industrial Sector James F. Lowry Hagler, Bailly and Company Washington, D.C.
	1130	BANK	
	1630	SHOPPING	
	1900 - 2200	LIBRARY	
Tuesday 03/24	0830 - 1130	LECTURE:	Thermal Storage - Dr. Ingley
	1330 - 1630	PARTICIPANTS' SEMINARS	
	1330-1400		The Energy Program in the Philippines Ascelina Antonio Concepcion Inductivo Norberto A. Orcullo, Jr.
	1400-1430		Jordan and the Jordan Electricity Authority Rashad Abdelmuti Aburas
	1430-1500		Perspectives on Energy in India Jai Ram Meena
	1530-1600		Problems in Photovoltaic Technology and Its Economic Feasibility under Indian Circumstances Dr. Shruti Kumar Shil
	1600-1630		Project Implementation through Institutions Lynn C. Sheldon USAID/Panama
	1900 - 2200	LIBRARY	

TAFT SCHEDULE FOR WEEK 7, 23 THROUGH 27 MARCH 1981

Wednesday 03/25	0830 - 1430	PARTICIPANTS' SEMINARS:
	0830-0900	Some Alternative Energy Resources Conversion R&D Activities in Ghana Benjamin L. Lartey
	0900-0930	SEVPP - Solar Energy for Villages Pilot Project in Tanzania Salvatory J.S. Mushi
	0930-1000	Technology Integration in Papua New Guinea Kipa Maleva
	1030-1100	Thermosyphon Flow in Solar Collectors Don B.J. Ranatunga, Sri Lanka
	1100-1130	Solar Thermo-Pump Dr. Oran Ratanaprakarn, Thailand
	1130-1200	Charcoal-Making in Honduras Rolando Pinzon Peyrefitte
	1330-1400	Oil-and Hydrocarbon- Plants: Survey and Evaluation of Philippine Plant Species Dr. Elvira C. Fernandez
	1400-1430	Fuel from Vegetable Oils Dr. Paulo Pedreira da Silva, Brazil
	1430 - 1630	GROUP PROJECTS
Thursday 03/26	0830 - 1200	PARTICIPANTS' SEMINARS:
	0830-0900	Energy Programs at the National Research Center of Egypt Dr. Gad Hussein Talat
	0900-0930	An Overview of the Energy Situation in Jamaica Edward C. Alexander
	0930-1000	Design and Construction of a Medium Size Rural Biogas Plant-- Adelphi Biogas Project in Jamaica Alwin L. Hales

**FIELD TRIP: Solar Installations in the Jacksonville Area**

We will travel to Jacksonville, Florida, located approximately 70 miles (110 kilometers) from Gainesville, to visit two solar installations---one at the Jacksonville Naval Air Station and one at the Anheuser-Busch Brewery. In the first of these, a system of flat plate collectors with booster mirrors supplies hot water for a medical-dental complex. While on the base, we will inspect a solid waste disposal facility in which steam is generated by burning refuse. At the brewery we will inspect a system comprising evacuated tube collectors and a phase-change storage medium designed to provide hot water for pasteurization in the brewing process. This system is not expected to be operational at the time of our visit.

**CONTACTS:** Bill Roach  
Jacksonville Naval Air Station  
(904) 772-2114

Al Cormier  
Anheuser Busch Company  
111 Busch Boulevard  
Jacksonville, Florida  
(904) 751-0700

**SCHEDULE:**

0800	Leave Days Inn
0930 - 1130	Tour of Jacksonville Naval Air Station
1130 - 1400	Lunch
1400 - 1600	Tour of Anheuser-Busch Plant
1730	Return Home

TRAINING IN ALTERNATIVE ENERGY TECHNOLOGIES  
 SCHEDULE FOR WEEK 8, 30 MARCH THROUGH 3 APRIL 1981

Monday 03/30	0830 - 1130	LECTURE:	Thermal Loads of Buildings - Dr. Ingley
	1130	BANK	
	1330 - 1500	PARTICIPANTS' SEMINARS:	
	1330 - 1415		Energy Problems in Malawi Gladson Komani Kayira
	1415 - 1500		Some Restrictive Aspects of the Parallel Beam Model Dr. Emerson Jaguaribe, Brazil
	1500 - 1630	GROUP PROJECTS	
	1630	SHOPPING	
	1900 - 2200	LIBRARY	
Tuesday 03/31	0830 - 1130	LECTURE:	Thermal Loads of Buildings - Dr. Ingley
	1330 - 1430	PARTICIPANTS' SEMINARS:	
			An Overview of the Energy Situation in Guyana Ukarran Bhimsen
	1430 - 1630	GROUP PROJECTS	
	1900 - 2200	LIBRARY	
Wednesday 04/01	0830 - 1130	LECTURE:	Thermal Loads of Buildings - Dr. Ingley
	1330 - 1630	SEMINAR:	Social and Economic Aspects of Renewable Energy Technology Transfer Elizabeth Cecelski Volunteers in Technical Assistance
Thursday 04/02	0830 - 1130 and 1330 - 1630	SEMINAR:	Energy Conservation in Architecture Prof. Gary D. Ridgill College of Architecture University of Florida
	1900 - 2200	LIBRARY	
	ALL DAY	FIELD TRIP:	Florida Solar Energy Center Details of the field trip are attached
Friday 04/03			

## FIELD TRIP: Florida Solar Energy Center

In the course of this field trip we will visit the Florida Solar Energy Center, an entity within the State University System of Florida dedicated to research and development, to educational and information services and to other developmental and demonstration activities related to solar energy. Among the facilities we will be inspecting are an all-electric residence equipped with a photovoltaic system, a solar-powered lithium bromide-water air conditioning system, collector testing systems and a small wind turbine. While in the Cape Canaveral area, we will have the opportunity to visit the Kennedy Space Center where an optional 2-hour bus tour will be available at a charge of \$3 per person. A museum housing an interesting collection highlighting the United States achievements in the exploration of space is located at the space center and may be visited free of charge. We will leave Gainesville early in the morning and travel a total of approximately 350 miles (600 kilometers) before returning home late in the evening, making this a long but interesting and enjoyable day.

### SCHEDULE:

0600	Leave Days Inn
0930	Arrive at the Kennedy Space Center
1000	Optional Bus Tour
	Lunch at the Space Center Cafeteria
1300	Leave Space Center
1330	Arrive at the Florida Solar Energy Center
1700	Leave Florida Solar Energy Center
2030	Return to Days Inn

CONTACT: Dr. Subrato Chandra  
Florida Solar Energy Center  
Cape Canaveral, Florida  
305-783-0300



TRAINING IN ALTERNATIVE ENERGY TECHNOLOGIES  
SCHEDULE FOR WEEK 9, 6 THROUGH 10 APRIL 1981

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Monday 04/06/	0830 - 1130	LECTURE: Refrigeration and Air Conditioning -- Dr. Farber
	and	
	1330 - 1630	
	1130	BANK
	1630	SHOPPING
	1900 - 2200	LIBRARY
Tuesday 04/07	0830 - 1130	LAB: Refrigeration and Air Conditioning
	and	
	1330 - 1630	
Wednesday 04/08	0830 - 1130	LECTURE: Refrigeration and Air Conditioning -- Dr. Farber
	1330 - 1630	LECTURE: Conversion of Thermal Energy to Mechanical Energy -- Dr. Farber
Thursday 04/09	0830 - 1130	LECTURE: Conversion of Thermal Energy to Mechanical Energy -- Dr. Farber
	1900 - 2200	LIBRARY
Friday 04/10	0830 - 1130	SEMINAR: Food Preservation Dr. Robert P. Bates Department of Food Service and Human Nutrition Inst. of Food and Agricultural Sciences University of Florida
	1330 - 1630	GROUP PROJECTS

TRAINING IN ALTERNATIVE ENERGY TECHNOLOGIES  
 SCHEDULE FOR WEEK 10, 13 THROUGH 17 APRIL 1981

Monday 04/13	0830 - 1130	SEMINAR:	Solar Air-Heating Systems
	and		Dr. George O. Lof
	1330 - 1630		Solaron Corporation Englewood, Colorado
	1130	BANK AND K-MART PLAZA	
	1630	SHOPPING	
	1900 - 2200	LIBRARY	
Tuesday 04/14	0830 - 1130	SEMINAR/ DEMONSTRATION	Mechanical Power from Alternative Sources of Energy William T. Beale Sunpower, Inc. Athens, Ohio
	1330 - 1630	GROUP PROJECTS	
	1900 - 2200	LIBRARY	
Wednesday 04/15	0830 - 1130	SEMINAR:	Mechanical Energy from Low Grade Sources of Heat
	and 1330 - 1630		J. Hilbert Anderson J. Hilbert Anderson, Inc. York, Pennsylvania
Thursday 04/16	0830 - 1130	SEMINAR	Wind Turbines and Storage of Energy Dr. Vernon P. Roan Dept. of Mechanical Eng. University of Florida
	1330 - 1630	SEMINAR:	Power System Planning with Wind Dr. Robert L. Sullivan Dept. of Electrical Eng. University of Florida
	1900 - 2200	LIBRARY	
Friday 04/17	ALL DAY	FIELD TRIP:	U.S. Department of Agriculture's Southern Agricultural Energy Center Tifton, Georgia

DETAILS OF THIS FIELD TRIP ARE ATTACHED. EACH PARTICIPANT IS URGED TO CONSIDER CAREFULLY WHETHER HE OR SHE HAS SUFFICIENT INTEREST IN THE TYPE OF FACILITIES WE WILL BE VISITING TO WARRANT SPENDING A LONG DAY ON THE ROAD. THOSE PARTICIPANTS WHO CHOOSE NOT TO GO ON THE TRIP SHOULD DEVOTE THE DAY TO THEIR GROUP PROJECTS.

TRAINING IN ALTERNATIVE ENERGY TECHNOLOGIES  
SCHEDULE FOR WEEK 11, 20 THROUGH 24 APRIL 1981

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Monday 04/20	0830 - 1130	GROUP PROJECTS	<p>At the request of several of the participants, arrangements have been made with the U.S. Solar Corporation to have one or more representatives visit the TREEO Center to answer questions concerning the export/import options offered by the company. These representatives will be here at 0830 to talk to anyone who is interested.</p>
	1130	BANK	
	1400 - 1630	SEMINAR:	<p>Fuels from Biomass -- The Issues Dr. Louis A. Paganini Department of Geography University of Florida</p>
	1630	SHOPPING	
	1900 - 2200	LIBRARY	
Tuesday 04/21	0830 - 1130	SEMINAR:	<p>Drying Agricultural Products with Solar Energy Dr. Khe Van Chau Inst. of Food and Agricultural Sciences University of Florida</p>
	1130	WOOLCO PLAZA	<p>The campus van at lunchtime will continue on to Sunshine Shopping Center: WOOLCO, CENTURY HOUSE, SKEETER'S (Departs promptly at 1310).</p>
	1330 - 1630	SEMINAR:	<p>A Solar Greenhouse Heating System and Cooling and Storage of Fruits and Vegetables Dr. C. D. Baird Inst. of Food and Agricultural Sciences University of Florida</p>
	1900 - 2200	LIBRARY	

Wednesday 04/22	0830 - 1130	SEMINAR:	Energy Use in the Food System Dr. David Pimentel Cornell University
	1330 - 1415 (Rescheduled from 03/25/81)	PARTICIPANTS' SEMINARS:	Charcoal-Making in Honduras Rolando Pinzon Peyrefitte
	1415 - 1630	GROUP PROJECTS	
Thursday 04/23	0830 - 1130	SEMINAR/ DEMONSTRATION:	Methane Production from Agricultural Residues Dr. Roger A. Norstedt Inst. of Food and Agricultural Sciences University of Florida
	1330 - 1630	SEMINAR/ DEMONSTRATION:	Solar Energy Conversion through the Production of Algae Dr. E. P. Lincoln Inst. of Food and Agricultural Sciences University of Florida
	1900 - 2200	LIBRARY	
Friday 04/24	0830 - 1000	SEMINAR/ DISCUSSION:	Aquatic Biomass as a Source of Energy Dr. Azizollah Shiralipour Inst. of Food and Agricultural Sciences University of Florida
	1000 - 1130	GROUP PROJECTS	
	1330 - 1630 (Rescheduled from 5/05/81)	SEMINAR:	Financing Biomass Energy Projects in the Developing World Isaac Sam World Bank

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PLEASE NOTE THAT WE WILL CHANGE FROM EASTERN STANDARD TIME TO EASTERN DAYLIGHT  
TIME AT 0200 ON SUNDAY 26 APRIL. CLOCKS WILL BE SET 1 HOUR FORWARD, THAT IS,  
TO SHOW 0300 EDT AT 0200 EST

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TRAINING IN ALTERNATIVE ENERGY TECHNOLOGIES  
SCHEDULE FOR WEEK 12, 27 APRIL THROUGH 2 MAY 1981

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Monday 04/27	0830 - 1130	LECTURE:	Solar Distillation -- Dr. Rajvanshi
	1130	BANK	
	1330 - 1500	SEMINAR:	Role of Coal and Enhanced Oil Recovery as a Short-Term Solution to the Energy Crisis Dr. D. O. Shah Department of Chemical Engineering University of Florida
	1500 - 1630	GROUP PROJECTS	
	1630	SHOPPING	
	1900 - 2200	LIBRARY	
Tuesday 04/28	0830 - 1100	SEMINARS:	An Overview of Ethanol Feedstock Production in Florida Dr. Wayne Smith Inst. of Food and Agricultural Sciences University of Florida  Fuel Alcohol in an International Perspective Dr. William H. N. Paton Visiting Professor Inst. of Food and Agricultural Sciences University of Florida  Ethanol Conversion Technologies Dr. William H. N. Paton
	1100 - 1630	DEMONSTRATIONS:	
	1100 - 1200	Ethanol Feedstocks at the Energy Research and Education Park	
	1200 - 1300	Lunch Break on Campus	
	1300 - 1400	Research in Ethanol Feedstocks at the Horticultural Unit	
	1400 - 1630	Alcohol Production Facility at the Hatch Brothers Farm, Branford, Florida	
	1900 - 2200	LIBRARY	

Wednesday 04/29	0830 - 1200	SEMINAR: Forest Biomass as a Source of Energy  Presented by Members of the Faculty of the School of Forest Resources and Conservation (SFRC) Inst. of Food and Agricultural Sciences University of Florida
	0830	Overview of Forest Biomass; Species Selection for Woody Biomass Production Dr. Donald L. Rockwood, SFRC
	0915	Silvicultural Practices; Woody Biomass Productivity Dr. Richard F. Fisher, SFRC
	1030	Economics and Energetics of Woody Biomass Production Dr. Katherine C. Ewel, SFRC
	1100	Environmental Impacts of Woody Biomass Production Dr. Hans Riekerk, SFRC
	1130	Characterization and Utilization of Woody Biomass Dr. Shih-Chi Wang, SFRC
	1330 - 1630	DEMONSTRATIONS
	1330	Pickup at Days Inn, Leave for Austin Cary Forest
	1400	Woody Biomass Plantations
	1430	Water Use Assessment
	1500	Gasification of Woody Biomass, Don Post, SFRC
	1600	Visit Lake Mize (If Time Permits)
Thursday 04/30	ALL DAY	FIELD TRIP: CLEARWATER - BARTOW - KISSIMMEE
Friday 05/01	ALL DAY	Details of this field trip are attached
Saturday 05/02	ALL DAY	

TRAINING IN ALTERNATIVE TECHNOLOGIES  
FIELD TRIP: CLEARWATER- BARTOW-KISSIMEE

We will leave early on Thursday morning and travel first to Clearwater, Florida approximately 150 miles (240 kilometers) from Gainesville. We will visit the Clearwater Times Building, where a solar system provides space heating and cooling and a Darrius wind machine generates 20 kilowatts of electrical power under favorable conditions. From Clearwater, we will travel 60 miles (110 kilometers) to Bartow, Florida, stopping for lunch on the way. We will spend the afternoon visiting Kaplan Industries' cattle feed lot and meat packing plant. A biogas digester at the site generates methane from cattle wastes to supply part of the energy needs of the processing plant. Also of interest are the waste water treatment facilities at the plant. Following this visit, we will drive 60 miles (110 kilometers) to Orlando, Florida where we will spend the nights of Thursday and Friday.

On Friday morning, we will inspect the solar heating and cooling system installed in the general office building of the Reedy Creek Utilities Company, a subsidiary of Walt Disney Productions which provides electrical energy and other utility services to Walt Disney World. In addition, we will inspect the waste water treatment facilities on the complex.

We will have the opportunity to visit the Magic Kingdom on Friday afternoon and all day Saturday before leaving the Orlando area and returning to Gainesville. Details of this part of the field trip will be announced during the week.

CONTACTS:	Clearwater Times:	Mr. Bill England	(813) 893-8691
	Kaplan Industries:	Mr. Don Kaplan	(813) 533-0685
	Walt Disney World:	Ms. Glenna Hancock	(305) 828-3453
	Quality Inn Motel:		(305) 351-1600

SCHEDULE:

Thursday 04/30/81

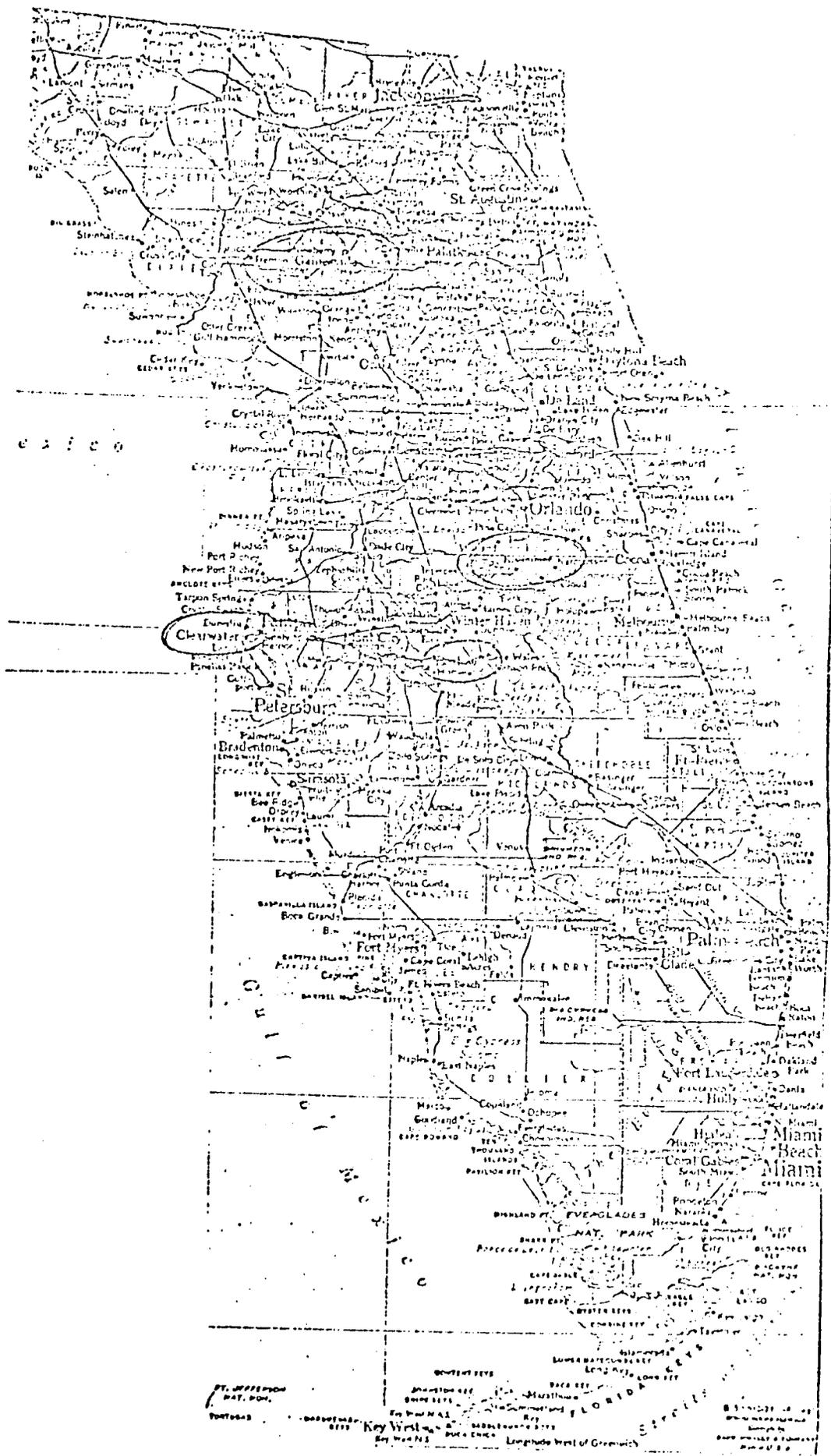
0630	Leave Days Inn
1000 - 1130	Visit Clearwater Times Building
1130 - 1400	Travel to Bartow, Lunch Stop on the Way
1400 - 1600	Visit Kaplan Industries Plant
1600 - 1730	Travel To Orlando
1730	Arrive at Quality Inn 7600 International Drive Orlando, Florida

Friday 05/01/81

0830	Leave Quality Inn
0915 - 1330	Visit Reedy Creek Utility Company
1330	Meet at the Transportation and Ticket Center
1330 - 1900	Visit the Magic Kingdom Theme Park
1900	Meet at City Hall, Main Street USA and Return to the Vans
1930	Arrive at Quality Inn

Saturday 05/02/81

0830	Check out of Quality Inn
	PLEASE LEAVE KEYS IN THE ROOMS
0900 - 1800	Visit Magic Kingdom Theme Park
1800	Meet at City Hall and Return to Vans
2100	Arrive at Days Inn, Gainesville



TRAINING IN ALTERNATIVE ENERGY TECHNOLOGIES  
SCHEDULE FOR WEEK 13, 4 THROUGH 8 MAY 1981

TIME IS ALLOCATED TO THE GROUP PROJECTS DURING THIS WEEK TO ALLOW FOR THE COMPLETION OF THE PROJECTS AND THE PREPARATION OF REPORTS AND PRESENTATIONS. GROUP MEETINGS WITH DR. FARBER WILL BE SCHEDULED DURING THIS WEEK. THE GROUP PRESENTATIONS ARE SCHEDULED FOR THE FINAL WEEK OF THE TRAINING SESSION.

Monday 05/04	ALL DAY	GROUP PROJECTS
	0830-0930	PREVIEW OF NEXT WEEK'S FIELD TRIP TO NEW MEXICO AND ARIZONA - Inky Loketek
	1130	BANK
	1630	SHOPPING
	1900-2200	LIBRARY
Tuesday 05/05	0830-1130	SEMINAR: Economic Aspects of Alternative Energy Systems Dr. Seymour Baron Burns and Roe Oradell, New Jersey
	1130	WOOLCO PLAZA (PICKUP 1310)
	1330-1630	GROUP PROJECTS
	1900-2200	LIBRARY
Wednesday 05/06	0830-1130	GROUP PROJECTS
	1330-1630	Inflation in Financial Analyses Dr. Richard S. Leavenworth Industrial and Systems Engineering
Thursday 05/07	ALL DAY	GROUP PROJECTS
	1900-2200	LIBRARY
Friday 05/08	ALL DAY	GROUP PROJECTS
	1800	INTERNATIONAL DINNER PARTY AT THE TREEO CENTER

TRAINING IN ALTERNATIVE ENERGY TECHNOLOGIES

SCHEDULE FOR WEEK 14, 10 through 15 MAY 1981

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FIELD TRIP TO ALBUQUERQUE AND PHOENIX -- REFER ALSO TO DETAILED TRIP SCHEDULES

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Sunday 05/10	0530	Pickup at Days Inn
	0705	Leave Gainesville on Eastern Airlines, Flight EA 792 Connecting in Atlanta with EA 525
	1110 Mountain Daylight Time	Arrive Albuquerque, New Mexico
		Transfer to the Sheraton Old Town
Monday 5/11	0800	Leave motel to tour Sandia National Laboratory
	1700	Return to motel
Tuesday 05/12	0630	Check out of motel to travel to Phoenix, Arizona
	1630 Mountain Standard Time	Arrive at Thunderbird Lodge, Grand Canyon
Wednesday 05/13	1200	Leave Grand Canyon
	1730	Arrive at Double Tree Inn, Scottsdale, in the Phoenix area
Thursday 05/14	0800	Leave motel to tour Arizona Solar Pumping Experiment, near Coolidge, Arizona
	1300	Visit John Long Homes
	1500	Visit Professor Yellott's residence
	1700	Return to motel
Friday 05/15	0800	Check out of motel and travel to Solar Power Irrigation System near Gila Bend, Arizona
	1330	Tour Photovoltaic Village Power Project, Schuchuli, Arizona
	1700	Arrive at Tucson Hilton
Saturday 05/16	0800	Check out of motel and visit University of Arizona Campus
	1330	Leave Tucson on Eastern Airlines, Flight EA 860 Connect in Atlanta with EA 629
	2312 Eastern Daylight Time	Arrive in Gainesville

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NOTE THAT THE STATE OF NEW MEXICO IS ON MOUNTAIN DAYLIGHT TIME (2 HOURS BEHIND EASTERN DAYLIGHT TIME) AND THAT THE STATE OF ARIZONA IS ON MOUNTAIN STANDARD TIME (3 HOURS BEHIND EASTERN DAYLIGHT TIME)

TRAINING IN ALTERNATIVE ENERGY TECHNOLOGIES  
REVIEW TEAM'S VISIT -- DR. ARNOLD WEINSTEIN AND DR. PETER TEAGAN

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Monday 05/18/81

0900 Meet with Dr. Farber, Program Director  
in Dr. Farber's Office, Room 338  
Mechanical Engineering Building

1100 Meet with Dr. Wayne H. Chen, Dean  
College of Engineering

1200 Lunch with Dr. Farber

1330-1630 Interview Participants at the TREEO Center

Interviews

1330-1400 Dr. Elvira Fernandez, Philippines  
1400-1430 Mr. Benjamin Lartey, Ghana  
1430-1500 Mr. Don Ranatunga, Sri Lanka  
1500-1530 Coffee Break  
1530-1600 Dr. Emerson Jaguaribe, Brazil  
1600-1630 Mr. Edward Alexander, Jamaica

Tuesday 05/19/81

0830-1630 Monitor Activities and Interview Participants  
at the TREEO Center

Presentations on the participants' group projects  
are scheduled from 0830 to 1630 today. Details are  
given in the program schedule for Week 15, copy attached.

Interviews

Dr. Weinstein

Dr. Teagan

0830 - 0900	Dr. Gad Hussein Talat, Egypt	Dr. Shruti Kumar Shil, India
0900 - 0930	Mr. Rashad Aburas, Jordan	Miss Concepcion Inductivo, Philippines
0930 - 1000	Mr. Byssang Bodoombossou, Togo	Dr. Sukuavit Phoomvuthisarn, Thailand
1000 - 1030	Coffee Break	
1030 - 1100	Mrs. Sohair Abdel Halim, Sudan	Dr. Ahmed El Ashmawy, Egypt
1100 - 1130	Mr. Cladson K. Kayira, Malawi	Mr. Jai Ram Maena, India
1130 - 1330	Lunch	
1330 - 1400	Mr. Ukarran Bhimsen, Guyana	Mr. Pablo Dominguez Navarro, Honduras
1400 - 1430	Mr. Rolando Pinzon, Honduras	Mr. Augustin Leon Pena, Dominican Republ
1430 - 1500	Dr. Oran Rutanaprakarn, Thailand	Mr. Mohammed E. Mansour, Sudan
1500 - 1530	Coffee Break	
1530 - 1600	Mr. Lynn Sheldon, USAID Panama	Mr. Norberto Orcullo, Philippines
1600 - 1630	Mr. Alfred M'Imanyara, Kenya	Mr. Juan Francisco Lara, Panama

1900 Dinner at Mr. Han's Restaurant with  
Dean Chen, Dr. Ohanian and Dr. Farber

Wednesday  
05/20/81

0830-1630

Monitor Activities and Interview Participants  
at the TREEO Center

A round table discussion on means of resolving the global energy crisis is scheduled from 0830 to 1130. The remaining presentations on the group projects are scheduled from 1330 to 1630.

Interviews

Dr. Weinstein

Dr. Teagan

0830 - 0900  
0900 - 0930  
0930 - 1000  
1000 - 1030  
1030 - 1100  
1100 - 1130

Mr. Ramon Pichardo, Dominican Rep.  
Mr. Deogratias Mbesherubusa, Burundi  
Mr. Jose Maria Palacios, Honduras  
Coffee Break  
Mr. Alwin Hales, Jamaica  
Open

Mr. Salvatoro J.S. Mushi, Tanzania  
Mr. Md. Shafiul Islam, Bangladesh  
Mr. Brian Silvera, Jamaica  
Mr. Kipa Maleva, Papua New Guinea  
Miss Ascelina Antonio, Philippines

1200 - 1400

Working Luncheon with the TAET Advisory Committee  
Dr. M. Jack Ohanian, Chairman, Associate Dean  
for Research, College of Engineering  
Dr. Hunt Davis, Jr., Director of African Studies  
Dr. John P. O'Connell, Professor of Chem. Eng.  
Dr. Hugh L. Popenoe, Director of International Programs  
Institute of Food and Agricultural Sciences  
Dr. Vernon P. Roan, Jr., Professor of Mech. Eng.  
Dr. Wayne Smith, Director, Ctr. for Biomass Energy Systems,  
Institute of Food and Agricultural Sciences

1430 - 1630

Spillover and Rescheduled Interviews

Thursday  
05/21/81

0830 - 1600

Monitor Activities and Interview the Staff at the  
TREEO Center

A question-and-answer session with Dr. Farber and a  
course-evaluation session are scheduled today.

Interviews

0930 - 1030  
1030 - 1130

George Shipp, Program Administrator  
Dianne Wright, Staff Assistant

Interviews with members of our technical  
staff will be scheduled at the review  
team's convenience.

1330 - 1600

Wrap-up Session

1830

Banquet and Awards Ceremonies

TRAINING IN ALTERNATIVE ENERGY TECHNOLOGIES  
 SCHEDULE FOR WEEK 15, 18 THROUGH 22 MAY 1981

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Monday 05/18	ALL DAY	SEMINAR: Sociological Aspects of Introducing Alternative Technologies in the Developing Countries. Dr. Daniel C. Dunham Columbia University
	1130	BANK
	1630	SHOPPING
	1900 - 2200	LIBRARY
Tuesday 05/19	ALL DAY	GROUP PROJECTS: PRESENTATIONS
	0830 - 1000	Solar Refrigeration and Air Conditioning  A. Refrigeration Mr. Don Ranatunga, Sri Lanka, Coordinator  B. Air Conditioning Mr. Lynn Sheldon, USAID Panama, Coordinator
	1030 - 1130	Solar Crop Drying Mr. Benjamin Lortey, Ghana, Coordinator
	1330 - 1400	Solar Cooker Mr. Deogratias Mbeshherubusa, Burundi Mr. Salvatory Mushi, Tanzania
	1400 - 1430	Gasification of Wood Dr. Elvira Fernandez, Philippines, Coordinator
	1430 - 1500	Solar Distillation Dr. Emerson Jaguaribe, Brazil, Coordinator
	1530 - 1630	Flat Plate Collectors Dr. Oran Ratanaprakarn, Thailand, Coordinator
	1900 - 2200	FINAL RUN TO THE LIBRARY

Wednesday 05/20	0830 - 1130	GROUP DISCUSSION:      Towards a Solution of the Global Energy Crisis Dr. Pagano, Moderator
		Each participant is urged to attend this round table discussion and comment on the energy problem in his or her home country. A transcript of the discussion will represent the joint statement of the participants in the third session of the TAET program. It will be made available to our sponsor, the U S Agency for International Develop- ment, for dissemination to the USAID Missions and their host governments.
	1330 - 1630	GROUP PROJECTS:      PRESENTATIONS
	1330 - 1430	Photovoltaic Project
		A.    Prospects of Photovoltaic Applications in Egypt and India. Dr. Gad Hussein Talat, Egypt Dr. Shruti Kumar Shil, India
		B.    PV Array Characteristics and Performance Mr. Ramon A. Pichardo, Dominican Republic Mr. Rashad Abdelmuti Aburas, Jordan Dr. Sukunvit Phoomvuthisarn, Thailand
	1430 - 1500	Wind Project Mr. Byssang Bodbombossou, Togo
	1530 - 1600	Biogas Systems Mrs. Sohair Abdel Halim, Sudan, Coordinator
	1600 - 1630	Resource Assessments Mr. Edward Alexander, Jamaica, Coordinator
Thursday 05/21	0830 - 1130	QUESTION AND ANSWER SESSION WITH DR. FARBER
	1330 - 1630	PROGRAM EVALUATION
	1800	AWARDS BANQUET Holiday Inn, West University Avenue at 13th Street
Friday 05/22	ALL DAY	OPEN FOR WINDUP BUSINESS

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DR. FARBER AND ALL THE MEMBERS OF THE PROGRAM STAFF JOIN IN WISHING OUR PARTICIPANTS A SAFE AND PLEASANT JOURNEY HOME.

APPENDIX VI

COMPLIANCE WITH COOPERATIVE AGREEMENT NO. AID/DSAN-CA-0188

The University of Florida is in compliance with the terms of the cooperative agreement with USAID and a program of the type being offered is clearly within its scope. The few minor departures from literal requirements appear to flow principally from ambiguity or differences in interpretation. Specifically:

Paragraph B(2) of the Program Description can be interpreted as requiring the Program to provide support for activities abroad and D(2) to call for visits to AID Missions. Up to this time members of the teaching faculty have not traveled, under the contract, to the LDCs to see and study specific problems, to consult with LDC governments, AID Missions and former participants "on an on-going basis". However, there appears to have been an understanding, from the outset, that these overseas activities would be held in abeyance until the domestic program was well underway.

The TAET Program as described in Appendix V also could arguably be said not to meet the requirement of the cooperative agreement that there be four hours of classroom work per week in the social, economic, and cultural implications of transferring alternative energy technology. We have been informed, however, that much of such material is presented in course work that is not labeled in a way to permit a measure of this kind to be applied and the University apparently believes that the Program is fully responsive in this area.

We believe that there could also be said to be some departure from literal requirements on the staffing of the TAET Program. The cooperative agreement calls for a "Program Administrator" who, we believe, was intended to be Dr. Farber. As the University has interpreted this clause, however, a relatively low-level individual holds the formal position of Program Administrator, acting under Dr. Farber's direction (Dr. Farber is de facto the Program Director).

## APPENDIX VII

### ANALYSIS OF TAET PROGRAM COSTS

Our review of costs is based on the proposed TAET budget for January 1, 1982 - December 31, 1982 (Table 2) rather than on an expensive reconstruction of the details of 1981 cost records.

Depending on the overhead rate that is accepted by USAID as opposed to that required by the University of Florida, the proposed budget is either \$1,090,628 or \$1,168,297. Taking the lower figure and assuming a student body of 40 in each of the two 1982 sessions, the per-month student cost is about \$3,500. If we use a more realistic number of 35 participants per session, the per-month participant costs go to about \$3,900. These costs are within the guidelines attached to the April 23, 1981, Indefinite Quantity Contract AID/SUD/PDC-C-390.

While program costs seem to be reasonably in line with guidelines, we find that there is a significant opportunity for cost reduction or re-direction to more useful functions.

Specific areas that could be investigated as sources of possible savings are:

1. Reduction of full-time instructors by one; savings - \$22,000.
2. Elimination of two administrative positions; savings - \$27,000.
3. Paid visit to manufacturing site; savings - \$16,800.
4. Consultants' travel; savings - \$4,000.
5. Gasoline expense for vans; savings - \$5,000.

These potential savings of \$73,800 in direct charges plus related overheads and fringe benefits would total around \$100,000.

We do not believe that any of these savings would reduce the quality of the TAET Program. Staff reduction might, in fact, lead to some qualitative improvements.

TABLE 2

TAET BUDGET JANUARY 1, 1982 - DECEMBER 31, 1982

	<u>Operating Support</u>	<u>Direct Participant Support</u>	<u>Non Overhead</u>
I. <u>Salaries</u>			
Farber	\$16,950		
Ingley	7,649		
Shipp	17,200		
Pagano	33,060		
Laketeek	20,741		
Agerwal	21,715		
Bush	22,733		
Garretson	14,477		
Natour	13,755		
Tech III	12,511		
Wright	14,886		
Green	14,216		
Klemonn	10,057		
Taylor	10,057		
Smith	11,458		
Guttinger	<u>13,433</u>		
Sub-Total	\$254,898		
Fringe @ 16%	40,784		
Insurance	<u>7,308</u>		
Total	\$302,990		
II. Temporary (OPS)			
Student Assistants	12,528		
Post Doctoral	<u>3,000</u>		
Sub-Total	\$ 15,528		
Fringe .015	<u>233</u>		
Total	\$ 15,761		
III. Consultants			
40 @ \$193/day for 2 days	15,440		
Manufacturing Facility	<u>16,800</u>		
Total	\$ 32,240		

TABLE 2 (Continued)

	<u>Operating Support</u>	<u>Direct Participant Support</u>	<u>Non Overhead</u>
IV. Travel			
Consultants	\$ 24,000		
Staff (domestic)	8,000		
Staff (foreign)	<u>8,000</u>		
Total	\$ 40,000		
V. OCO	500		\$ 19,500
VI. Expenses			
NASA Stac (Biblio Service)	1,000	\$ 8,000	
Copy Service	5,000	3,000	
Supplier	3,000	18,400	
Telephone (service)	3,600		
(long distance)	2,000		
(telegram)	12,000		
Shop/Laboratory	7,500	20,000	
Printing	3,000	5,000	
Mail	2,400	2,400	
Gas	5,000	15,000	
Photographic	2,000	2,000	
Miscellaneous	<u>3,000</u>	<u>3,000</u>	
Sub-Total	\$ 49,500	\$76,800	
Total Expenses (\$126,300)			
VII. Student Support			
Travel (to U.S.)			120,000
Field Trip Travel			60,000
Housing \$425/mo. x 8 mos. x 20			68,000
Stipend \$125/wk x 80 x 15			<u>150,000</u>
Total			\$398,000
Total by Column	\$440,991	\$76,800	\$417,500
Overhead based on Columns 1 and 2			
Total	\$517,791		
A) Rate 45%	233,006		
B) Rate 30%	155,337		
<u>Project Total</u>			
Based on A Rate	\$1,168,297		
Based on B Rate	\$1,090,628		

## APPENDIX VIII

### REVIEW OF 1980 AID MANAGEMENT REVIEW REPORT

In 1980, a team from USAID conducted a brief in-house review of the TAET Program which was summarized in a document, "Training in Alternative Energy Technology - Site Assessment". This review identified several issues which merited near-term attention and resolution. Several of the major issues identified in this first review and the extent to which they appear to have been addressed by the TAET management are discussed briefly below.

#### A. CURRICULUM

##### 1. Technology Focus

The first review team (FRT) found that the course overly emphasized solar thermal technologies and gave relatively little attention to other important technology areas.

In an attempt to rectify this situation the TAET management has placed somewhat more emphasis on guest speakers from both within the University of Florida energy departments and from outside organizations. For example, members of the University of Florida staff and outside lecturers deal with wind, photovoltaics, biomass and hydropower technologies.

A brief review of the notes and limited handouts of these lecturers suggests that they are not tailored in any significant way to the needs of the TAET participants. Moreover, most of the guest lecturers are not particularly knowledgeable about the somewhat special technology and application needs of the LDCs, an observation that was frequently made by the participants during the interviews.

Some progress has clearly been made in this area of giving a more balanced view of technology options. However, it still appears that the almost exclusively solar thermal orientation of the TAET staff works against having these alternative technology options integrated into the course structure.

##### 2. Technical Emphasis

The FRT noted in rather strong terms that the course was heavily technology oriented and did not adequately address economic, implementation, and institutional issues which are important in the overall assessment of a technology option. The review team went so far as to state that a "resident social scientist is needed as a member of the instruction staff".

Progress has been made in addressing the above concerns by:

- Having a professor from the University of Florida School of Economics present two seminars on methods of economic analysis, and
- Having a guest lecturer in the field of the social and institutional implications of technology transfer to LDCs (one day).

The measures indicated above are certainly a step in the right direction. However, the present evaluation team agrees with the first review team's observation that "there is no substitute for attention to this<sup>1</sup> dimension throughout the course". It still does not appear that the TAET staff or most of the technology-oriented guest lecturers are in a position to address economic and implementation issues on a consistent basis and in a way that integrates such matters tightly into the curriculum.

### 3. Course Materials

The situation relative to course materials does not appear to have improved since the first review. The major single handout is still a large loose-leaf notebook of papers authored by Dr. Farber. The FRT noted that there is a wealth of other literature dealing with renewable energy resource applications in developing countries. There is no indication that the TAET management responded to this observation by integrating such publications into the course.

Also, there is no formal course material provided to illustrate the use of RER systems in LDCs by using "case materials illustrating the social, cultural, economic, and political considerations involved in technology choice and transfer...". In fact, there is very little in the way of well-thought-out formal handout material provided by either the TAET staff or guest lecturers.

In summary, there has been only limited progress made in addressing the specific concerns raised by the FRT in this important area.

### B. FACULTY (INCLUDING GUEST LECTURERS)

#### 1. TAET Faculty Composition

The FRT commented that "the entire program is clearly a reflection of Dr. Farber's convictions about solar energy and opinions about the potential of other alternative sources of energy". Despite the unanimous opinion that Dr. Farber is an outstanding teacher and leader in solar energy development, the degree of personalization of the course was considered to be a barrier to having the course balanced both as to technology emphasis and treatment of cost, economic, and institutional issues.

The present review team found that this situation has not changed in any significant way. It is clear that all important decisions regarding course content and philosophy are still guided by Dr. Farber and that there is no intention of bringing in senior staff with a high degree of independent capability or responsibility.

The FRT met with Drs. Roberto Pagano and Anil Rajvanshi. It was observed that these key members of the TAET staff were enthusiastic and technically competent - an observation with which this evaluation team agrees. It should be added, however, that Dr. Rajvanshi was a student of Dr. Farber

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<sup>1</sup>Referring to socio-economic issues.

which might tend to contribute to a like view of technology options. Dr. Rajvanshi is scheduled to return to India and will be replaced by Dr. Martin Bush. A review of this new staff member's resume indicates that he has an excellent academic background in chemical engineering. However, his background in renewable energy resources technologies and their application appears to be limited.

Dr. Pagano's major teaching responsibilities are related to the technical characteristics of solar energy, a subject which is treated for over one week in the course. Dr. Pagano's background prior to joining the TAET Program was in nuclear engineering and he does not appear to have had experience in RER technologies or their application.

The FRT questioned whether it was necessary to have such a large permanent teaching staff, all of which emphasize solar thermal technologies, given the large number of guest lecturers. This question is even more relevant now since two new staff (Dr. V. Agarwal and Dr. Bush) are being added in June 1981 and only one (Dr. Rajvanshi) is leaving. The backgrounds of the new staff are narrowly technical and it does not appear that their addition will significantly affect the need for outside lecturers.

It appears, therefore, that concerns in this area raised by the FRT have not been significantly addressed by the TAET management.

## 2. Other Issues Relative to Teaching Staff

Other issues relative to course staffing raised by the FRT included the following:

- Developing Country Experience

The FRT expressed concern that the faculty by and large did not have significant experience working with RER systems in developing countries.

As far as could be determined, this situation has not been dealt with in any significant way. In particular, neither of the two new staff members has such experience. Also, the participants interviewed during this evaluation commented on this issue both as it relates to the permanent staff and to most of the guest lecturers.

- Socio-Economic Analysis

The FRT's observations relative to a lack of emphasis on socio-economic issues by the permanent faculty still appear to be valid.

- Guest Lecturers

Guest lecturers are utilized to address most of the non-solar thermal technologies. Partly in response to observations made by the FRT, an increasing number of the lecturers are from departments within the University of Florida itself. This certainly has the desired benefit of making the lecturers more available for follow-up discussions, and of lowering costs.

The comments of participants relative to the performance of guest lecturers appears, however, to have changed relatively little between the interviews of the FRT and our evaluation. In particular, the performance of the guest lecturers is uneven and they often do not deal with subjects relevant to the needs of course participants.

One reason for this may be that neither the University of Florida or outside lecturers appear to be provided with a background briefing, be disciplined to bring their material into an overall curriculum, or given resources to adequately prepare for this particular audience in this way. In fact, outside guests are given little time for seminar preparation. This is consistent with Dr. Farber's contention that people who know their subject should not require any preparation time.

We believe that the concerns raised by the FRT on guest lecturers have been only partly addressed and that the situation will not improve substantially unless the guests (whether from within or outside the University) are given adequate resources and directions to prepare properly for meeting the specialized needs of TAET participants.

#### C. ADMINISTRATIVE STAFF

The FRT commented favorably on the degree of commitment shown by Mrs. Diane Wright (Administrative Assistant) and Mr. George Shipp (Program Administrator). We also found, via the participant interviews, that the administrative staff was effective in serving the needs of participants. The FRT did, however, express concern whether there is need for a full-time information specialist. As noted elsewhere in this report, the size of the administrative staff has further increased to seven members with the addition of a "Publications Acquisition" specialist (Mr. Don Guttinger). The issues raised by the FRT as to the size of the support staff and the functions of each member appear, if anything, to be more important now than at the time of the first review process.

#### D. FACILITIES

The FRT raised questions as to the cost effectiveness of using the TREEO Center rather than establishing facilities at the University or within the Energy Park.

The SRT's concern was that there are some practical difficulties with the isolation of the TREEO Center from the campus and some duplication of equipment may result.

However, the TREEO Center is a functional facility for this purpose and allows the participants exclusive use of machine shop and experimental facilities - a situation which would not exist if they had to share such facilities with the student body on campus.

The TAET management has elected to remain at the TREEO Center and to address participants' needs to visit the campus facility (libraries, etc.) via a van system. We believe that this arrangement, although not ideal, is a reasonable one given the range of options available.

E. SUMMARY

The TAET management appears to have made an effort to address the concerns raised by the FRT relative to course content and technology emphasis. This has been done primarily by including a broader range of guest lecturers to address a variety of technologies and socio-economic issues. Although progress has been made in this area, we agree with the FRT that these subjects should be treated as an integral part of the curriculum.

Issues raised by the FRT as to the size and background of the TAET faculty do not appear to have been addressed by subsequent actions of the TAET management. In fact, the size of the staff has been increased by one and a review of the resumes of the two new staff members indicates that little effort has been made to broaden the perspective of the faculty.

No actions were initiated by TAET staff to address the concerns raised by the FRT as to the size and function of the support staff. This staff has, in fact, been increased and work-load responsibilities appear, if anything, to be less well-defined than at the time of the first review.

It appears, therefore, that the response to the issues raised by the FRT has been selective and that many of these issues remain alive.

## APPENDIX IX

### RELEVANCE OF TAET PROGRAM TO LDC NEEDS

There is a great deal of discussion taking place within international development organizations on the most appropriate ways for LDCs to develop and use renewable energy resource systems. The LDCs obviously do not want to be in a position of having to import large amounts of sophisticated equipment with negative balance of trade implications. Consequently, there is strong emphasis in many LDCs on initiating research and development programs in order to establish indigenous capabilities and thereby reduce dependence on outside resources for technology and/or equipment. There is certainly merit in this approach if it properly addresses needs and applications unique to the individual countries. On the other hand, it is undesirable for LDCs to expend limited financial and manpower resources duplicating technology development effort taking place in industrial countries or, in some cases, other LDCs. The relevance of the TAET course to LDC needs can, in large part, be measured by how it addresses these issues and helps prepare participants to rationally evaluate courses of action relative to RER technology research and development, system implementation, and commercialization projects, taking into account country-specific technical and economic factors.

The course as presently constituted emphasizes the engineering principles of RER system options. Clearly this is necessary background in order to properly scope R&D activities and understand important technical issues pertaining to system performance. The laboratory work, in particular, may help some participants better organize and execute similar experimental programs at their national scientific institutions.

There is a strong built-in bias within the course toward "small-scale" technologies. The presumption behind this bias is that such technologies are most appropriate for use in LDCs. It should be emphasized, however, that the energy needs of the LDCs are not uniformly "small scale" and that there are participants from LDCs with relatively advanced industrial infrastructures (e.g., Brazil, Egypt, India). In many countries, the prospects for significant power generation via solar or wind systems (possibly in parallel with fuel-fired generation) might be equally as "relevant" as small-scale crop dryers.

It is not clear, therefore, that the almost exclusive emphasis on small-scale technology necessarily leads to a more relevant course for LDC participants.

Another emphasis of the course is the use of indigenous resources for system fabrication. Clearly, those technology options that tend to utilize a high percentage of in-country resources have advantages over those that are dependent on imports. However, a key question facing both technical and planning staff from LDCs is how to leverage the use of specialized materials and components from industrial countries in assembling RER systems so as to result in overall low cost and high reliability. After all, not every country in the world will end up making wind turbine blades, semiconductor-grade silicon, or clear plastic sheets. As indicated in a recent paper written for the U.N. Nairobi Conference, one of

the most important issues facing LDCs is how to adapt technologies developed in industrial countries for assembly, installation, and use in their countries. This process, while not precluding the use of imported products, does require a knowledge of the impact of such imports on overall system economics. The TAET course does not appear to adequately address this technology adaptation issue - which might be viewed as a serious shortcoming, given the needs of the LDCs.

As mentioned several times in this report, the TAET course still places major emphasis on solar thermal technologies. Interviews with past and present participants suggest, however, that in many countries the most relevant technologies may be wind pumping, biomass (fuelwood, gasifiers, etc.) or small-scale hydro. In many of the countries of the participants fuelwood is the most common energy form, which makes its efficient use of worldwide importance. In the countries of Latin America hydropower (large and small) is often the most attractive approach to generating electricity.

The present bias toward thermal systems must, therefore, be viewed as reducing the relevance of the course to many of the participants.

Based on the considerations sketched in above, there are several questions that can be raised about course content and its relevance to LDC needs. Such questions include:

- Does the course contribute to the capability of technically-oriented decision-makers to identify which technologies merit R&D to adapt them for use and manufacture in-country?
- Does the course provide planners with an approach for determining which RER systems merit attention for widespread use?
- Does the course expose the participants to equipment status and developments on a worldwide basis to discourage excessive duplication of effort (how many hundreds of crop-drying R&D projects are necessary)?
- Is the relative emphasis given to technology options appropriate to best address the needs of most of the LDCs?

The evaluation team poses these questions since it is not clear that they are adequately addressed in the TAET course as now constituted.

## APPENDIX X

### SAMPLE TECHNOLOGY DISCUSSION OUTLINE:

#### WIND POWER SYSTEMS FOR USE IN LDCS

##### 1.0 RESOURCE CHARACTERISTICS

- Wind Availability
- Energy Content
- Variability

##### 2.0 TYPES OF EQUIPMENT

- Low-Speed Multiblade Pumps
- High-Speed Wind Electric System (horizontal Axis)
- Vertical Axis Machines

##### 3.0 PERFORMANCE CHARACTERISTICS

- Effects of Wind Speed
- Time Constants
- Start-Up and Control

##### 4.0 SYSTEM CONSIDERATIONS

- Energy Storage
- DC to AC Conversion
- Controls and Safety
- Utility Interface

##### 5.0 EQUIPMENT AVAILABILITY

- Wind Turbine
- Companies
- Special Components (Generators, Towers, etc.)
- Operating Experience

## 6.0 SYSTEM COST STRUCTURE

- Blades
- Generators and Controls
- Tower
- Site Preparation
- O&M

## 7.0 ECONOMIC CONSIDERATIONS

- Effect of Wind Availability
- Effect of Financing Arrangements
  - Payback Period
  - Rate of Return
  - Cost of Energy
- Comparison with Conventional Alternatives
  - Animal Power
  - Diesel Engines
  - Utility Power

## 8.0 CASE STUDIES

- Water Pumping
- Fuel Saver (in parallel with a Diesel Generator)
- Cold Storage Facilities

## 9.0 IMPLEMENTATION ISSUES

- Local Manufacturing Options
- Utility Interface
- National Energy Savings
- Rural Development Implications
- Installation and Service Infrastructure Requirements

## APPENDIX XI

### AID MISSION COMMENTS ON TAET PROGRAM

This Appendix summarizes the response of nine USAID Missions to the following cable message sent through AID asking for feedback on the University of Florida TAET Program:

"Arthur D. Little, Inc., is presently working on behalf of USAID to evaluate the effectiveness of the 'Training in Alternative Energy Technologies' (TAET) course which is given by the Solar Energy Laboratory at the University of Florida.

"If you are in contact with candidates who have been TAET participants and if you have suggestions which you would like to make that bear on our evaluation, please send them by return cable, if your schedule permits.

"Specific questions which the Arthur D. Little, Inc., Review Team would be interested in having addressed are:

"What contact has the AID Mission had with the participant(s) since their return?

"Does it appear that the TAET course experience is helping the participants be more effective - If so, how?

"Does the AID Mission have specific suggestions on how the course should be modified to better meet USAID objectives?"

The overall consensus is that the Program is good and that it was well received by the participants. A number of suggestions were made by the AID Missions who responded, indicating improvements that can be made in the TAET Program.

A summary of these suggestions is as follows:

- A wider range of small-scale technologies should be addressed.
- The Program should focus more on appropriate and useful technologies for widespread rural applications in developing countries.
- The Program should use the metric system since it is the officially used system in most developing countries.
- The participants can be grouped (in labs, on group projects) by similar country needs and resources for maximum benefit.
- The curriculum should continually develop as experience increases to best meet developing country needs.
- Participants should receive a written copy of all lectures.
- The Program can be offered in other "major languages" to reach more qualified professionals.
- The number of seminars should be reduced.

- More library and laboratory equipment should be made available to participants.
- There should be less participants per lab session with more time devoted to lab work.
- Participants should receive a directory of equipment, suppliers, and prices.

The complete individual mission responses to our cable are briefly summarized below.

#### Sudan

Although the Mission feels it has not had sufficient contact with the participants to evaluate the Program, the Program is widely known in Ministry of Energy and University circles. Several participants are likely to be associated with the USAID Village RER Project which is presently in the design stage. The Mission suggests that given Sudan's needs, the Program focus on appropriate technology for widespread rural use, since "comparatively high" technologies like "PV cells and solar collectors" have only a limited potential presently.

#### Bangladesh

The Mission comments that the participants feel the Program is of high quality and of great value to their work. The Mission feels that the participants are not able to fully utilize their training because of limitations of budgets and resources, authority in their positions, and availability of project designs. The AID Mission is looking to identify appropriate project efforts and feels that training specific to one or a small group of technologies for such projects is needed. "If the University of Florida TAET Program is capable of providing this type of training", the Mission would like details.

#### Panama

Since the third session was the first one in which Panama participated, both Panamanian participants were interviewed by the Arthur D. Little Review Team in Florida. The program has influenced the participants' positions and work to some extent. The Mission feels that the course concept is good and that the curriculum should continually develop from session to session to best suit the needs of the developing world. Participants should receive a written version of all class lectures. By the next session, identification of an existing (or preparation by staff of an) equipment directory containing suppliers and prices should be accomplished. The Mission suggests AID offer assistance in selecting and reviewing guest speakers and field trip visits. The Mission will continue nominating participants and requests a copy of the Arthur D. Little evaluation report.

#### Jordan

Two participants attended the first session, one attended the third session. The participants are enthusiastic about their training and have

been working on solar projects since their return from the Program. The participant who attended the third session (and was interviewed by the Arthur D. Little Team) suggested that more library and laboratory facilities be made available to the participants. The supervisor to the first two participants commented to the Mission that he is pleased with the practical approach to problem-solving learned by the participants which he attributes to the TAET requirement that students actually build experimental units. He also feels more time should be devoted to photovoltaic applications. The Mission has limited energy involvement, but deduces from conversations with participants and the supervisor that the TAET Program is serving a useful purpose in promoting alternative energy technology, and "the lessons learned will be applied" in Jordan.

### Egypt

Mission contacts with two participants elicited the criticism that the full range of solar technologies is not adequately covered due to the Program concentration on "technologies reflecting the personal bias of the Program Director". The Mission suggests course modifications so that participants can be exposed in a useful way to all the solar technologies "in which the U.S. has proven expertise", and would like to be advised of these revisions.

### Rwanda

The Mission is in frequent contact with all three participants. One is the Director of the National University's Centre D'Etudes et D'Applications De L'Energie au Rwanda, the agency which implements AID's renewable and improved traditional energy projects and the other two are researchers there. Due to the participants' strong scientific background (physics, engineering), much of the TAET technical material was found to be "repetitive" for them, but they have gained new insights into energy technology which are directly applicable to their work. The participants' trip reports (in French) are available from the Mission.

### Bolivia

Due to the present situation in Bolivia, the Mission has had no official contact with the two participants. The Mission sees the experience gained by participants through the TAET Program as extremely beneficial to the country, demonstrated by the following government activities supported by one of the participants:

- June 5th has been declared Energy Day. A two-day workshop in preparation for the World Energy Conference in Kenya (August 1981) was held.
- One participant has been assigned the task of creating a national solar energy association which is presently in the organizational stage.
- The Latin American Energy Organization approved financing for energy activities such as experimental biogas digesters and rural mini-hydroplants.

The Mission suggests that the TAET Program be offered "in other major languages for the benefit of well-qualified scientists who lack proficiency in English", that the metric system be introduced into the Program since it is the officially used system in most developing countries, and that Program participants be grouped by similar country needs during sections pertaining to specialized training.

#### Sri Lanka

Since Sri Lanka has had only one participant in the most recent session, the Mission feels it is "too early to comment". However, discussion with the participant revealed that the TAET Program is quite relevant to developing countries. The Mission suggests that the Program concentrate more on small-scale applications of hydropower and wind power.

#### Tunisia

The two participants are members of the National Energy Commission and have participated in the energy plan for the Sixth Development Plan. Both participants were contacted by the Mission upon their return and had the following comments. They were satisfied with the Program. It provided knowledge in AET's and the background necessary to develop and evaluate (mainly solar thermal) systems. Their better understanding of energy sources enables more effective discussion on energy policy issues. They appreciate the availability of documentation on the Program.

The Mission recommends that the number of seminars be reduced while the time devoted to laboratory work be increased, that the number of participants per laboratory session be reduced to produce a more beneficial working situation, and that increased consideration be given to a broad range of technologies appropriate to developing countries (particularly since present emphasis is principally on solar thermal conversion), for example, biomass and wind power.

## APPENDIX XII

### SELECTED COMMENTS FROM DR. ERICH FARBER ON EVALUATION DRAFT REPORT

- With reference to Table 1 on page 30:

A more careful examination of the curriculum and more realistic definition will indicate that solar energy is not as large a portion of the course as indicated. The general subject matter, and many of the devices such as heating, crop drying, refrigeration, air-conditioning, engines, should be classified as thermal, and not solar thermal, since they can and were operated with many other sources such as gas produced by the wood gasifiers in the laboratory and wood, and agricultural waste (biomass) directly.

Such a more fitting definition would change table IV-1 drastically and gives the course a completely different complexion from the one presented.

- With reference to the exposure of participants to commercially available equipment in the laboratory, page 33:

The recommendation that the participants should work on commercial systems also is actually done. The material is discussed in the classroom and then the participants run experiments on such commercial equipment as:

- A. Solar flat plate collectors
- B. A commercial solar water heating system
- C. Photovoltaic panels
- D. A photovoltaic pump
- E. A thermoelectric cooler
- F. A refrigeration system
- G. A Servel Absorption refrigeration system
- H. A Windmill
- I. A Zeolite Refrigerator
- J. A Vapor Engine
- K. A free piston stirling engine

- With reference to the composition of field trips and site visits, page 34:

Most of the sites visited on the field trips have working systems but a few really shocked the participants after they had read glowing reports about them and then observed that they actually did not work.

A few of the working systems visited are listed:  
Airport (largest solarly operated building in the World)  
Married Student Housing Apartment Buildings  
Bank  
Low Cost Housing Complex (28 units)  
Multi Family Dwellings (Apartment Houses)  
Various Residences  
Over 1 doz. different systems operating at USSC  
Industrial System (Jacksonville)  
Medical/Dental Complex  
Energy from Municipal Refuse Plant (NAS)  
Large Solar Cooking System  
Photovoltaic Residences (Florida, Arizona, different because  
of climate)  
Solar Test Facility (FSEC)  
Peanut drying system  
Microwave vacuum crop dryer  
Fuel Alcohol Distillation plant  
Commercial Bldg (Solar & Wind)  
Large Biogas Plant  
Innovative Waste Water Treatment System  
Solar Air Conditioning Systems  
Water Hyacinth Treatment, biomass project.  
Woody Biomass Plantation  
and others

APPENDIX XIII

MEMBERSHIP OF ARTHUR D. LITTLE  
EVALUATION TEAM

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Dr. Arnold K. Weinstein	Dean and Vice President Arthur D. Little Management Education Institute
Dr. William A. W. Krebs	Vice President - Economic Development Arthur D. Little, Inc. (Project Director)