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A PROGRESS REPORT ON

FUELWOOD AND ALTERNATIVE ENERGY SOURCES
AID PROJECT NO. 596-0089

AND

RECOMMENDATIONS FOR EXTENSION

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ACKNOWLEDGEMENTS

First, abundant thanks go to the ROCAP staff and particulaly Ed Nadeau (GDO/ROCAP) for the confidence to bring me to Guatemala to conduct this review. It is a pleasure for me to see that, after nearly four years of arduous work and several false starts in a new area of technology adaptation and transfer, the fruits of ICAITI's efforts are beginning to ripen and multiply.

It is hoped that the following report, prepared during a two week TDY, fairly reflects the optimism with which I have come to view this project. An enormous debt for the contents of the report is owed to David Chavez (Project Advisor) and to Justin Whipple (Project Manager at ICAITI) and the project staff at ICAITI for the information and documentation that was generously and profusely provided.

Special appreciation and thanks also go to Dora Del Valle, who worked numerous hours preparing a series of drafts for this report.

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I. INTRODUCTION

This report is an update of the project status on the "Fuelwood and Alternative Energy Sources Project", Project No.596-0089. In July 1982, this project received a full mid-term evaluation prepared by the Volunteers in Technical Assistance (VITA). This document reviews the comments and recommendations made in the mid-term evaluation, discusses the current status and suggests future project activities. This is not the final project evaluation which was anticipated in the original PP implementation plan for September 1984. The focus for the following discussion is entirely on the ICAITI sub-project component of the Fuelwood & Alternative Energy Sources Project. The CATIE portion of the project is being reviewed and extended under separate documentation.

This report includes sufficient supporting information to prepare an amendment to the original Project Paper. This amendment proposes an eighteen month extension for the ongoing activities in the ICAITI sub-project. The current Expiration Date for the ICAITI component is December 31, 1984. This report justifies an extension through June 30, 1986 with an additional 1.3 million dollars. These 1.3 million dollars, combined with an anticipated pipeline of approximately $250,000 at year end, will provide ICAITI with approximately $1,550,000 for the project operating period from January 1, 1985 to June 30, 1986.

ROCAP staff believes that an eighteen month extension of the current ICAITI activities is highly appropriate. Indeed, ROCAP suggested that ICAITI should begin to prepare the basis for a new project during the 1985 year of operation. This new project which would commence in FY 1986 is tentatively entitled Industrial Energy Technology. A rough outline of the scope and possible program for this project is included as the last section of this report.

II. BACKGROUND

The Fuelwood and Alternative Energy Sources Project was initiated by ICAITI in January, 1980, in accordance with the guidelines contained in Project Paper AID/LAC/P1031, Project No.596-0089.

The basic objectives as expressed in the Project Paper are to:

- Procure and produce technologies for testing and demonstration, which promise to either increase the efficiency with which wood is used as a fuel or to use renewable substitute fuels.

- Establish or strengthen relationships with national and international public and private organizations having the potential to act as disseminating agents for energy efficient technologies.

The Project Paper did not include any basic research in technology development; however, evaluation, modification, and transfer of existing technologies now in use in Central America or elsewhere was contemplated. ICAITI's responsibility was to review existing experiences, adopt technology as necessary and develop and disseminate new approaches to meet immediate short-term energy needs with renewable energy sources, as appropriate.

The Project Paper states that all project-supported, in-country work was to be performed in close coordination with national institutions, through national project coordinators. CATIE and ICAITI representatives, working with national counterparts, have been responsible for site selection and construction, testing demonstration and dissemination activities. ICAITI currently has one representative and 2 assistants in both El Salvador and Costa Rica, 1 representative and 1 assistant in Honduras (with a second assistant to be hired in 1985) and one part-time representative in Panama. The use of Peace Corps volunteers also was anticipated, and has strongly impacted the project in Guatemala and Costa Rica.

Assuming successful and socially acceptable demonstration of energy-efficient technologies, ICAITI was to utilize seminars, workshops and other means of orienting national technology, agricultural and other extension personnel towards the adoption of proven alternative technologies.

The specific technologies identified in the Project Paper fell into three general technical categories: combustion engineering or biogas, or solar energy. ICAITI's Fuelwood Team was organized in accordance with this classification. The project staff in ICAITI now has a project manager, operations manager, dissemination advisor and assistant, 4 combustion engineers, 3 solar engineers, 3 biogas engineers and several junior level assistants, plus in-country field staff. The combustion technologies included domestic fuelwood stoves, industrial kilns and ovens, charcoal kilns and biomass pyrolysis. Biogas included both small farm and industrial digestor systems. Solar energy included crop and vegetable dryers, hot-water systems, salt and crude sugar (panela) evaporators.

The project accomplishments during the 5-year period, compliance with Project Paper goals, and recommended activities for 1985 are discussed for each sub-technology in later sections of the report. The next section deals with changes and improvements that have succeeded the VITA Evaluation in 1982.

III. REVIEW OF PROGRESS SINCE MID-TERM EVALUATION OF JULY 1982

The first evaluation of Project 596-0089 was conducted by VITA over a one-month period during April and May of 1982. A Four member team visited headquarters of ICAITI and CATIE and conducted country visits to: Panama, Honduras, Nicaragua, Costa Rica and Guatemala. The comments and recommendations of their evaluation report have been distilled out of that report and are presented below. After the statement of each of the major evaluation findings there is a brief response to that particular concern of the evaluation report. The recommendations have been grouped by subject area and the response follows.

Management

1. (VITA) Original work schedule was too ambitious.

a. Too many simultaneous activities in spite of revision.

b. Reluctance by management to consider program modification.

(RESPONSE) The original work schedule was indeed ambitious. However, after the first two years of operation and development of the technical skills of the ICAITI staff and their increased experience on working in the field, project implementation has accelerated rapidly. The problem of too many simultaneous activities has obviously been overcome in the light of the fact that the project has already exceeded the goals of the original project plan in many areas. In terms of management considering program modification, there has been an increasing evolution in project orientation over the last year of work. The evolution of these activities will be discussed in more detail later.

2. (VITA) Project activities dependent on part-time national counterparts.

a. Project team and management spending too much time in negotiations and problem solving.

(RESPONSE) During the initial years of the project the team, both based in ICAITI and the national counterparts spent a great deal of time in planning and organizing their approach. It appears that these "negotiations and problem solving" exercises have been beneficial for the long-term implementation of the project. A great deal had to be

learned in those initial years of the project and there is no doubt that future problems will occur and that their learning process will go on. What is clear is that ICAITI has come a long way from being a technical-research oriented facility to one that now is more successfully establishing relationships and working with a great number of national counterparts in the majority of the countries in the region and has developed the necessary expertise in field extension and counterpart training.

3. (VITA) Long distance implementation and fire fighting hinders research and training functions.

(RESPONSE) Long distance implementation continues to be a problem for the relatively small staff at ICAITI. It seems to be the "nature of the beast" that it is difficult to be in two or more places at one time. Research to the extent it is considered research, is actually applied research in the field. The training functions in the field are continuing apace and are closely linked with applied research activities. ICAITI's efforts to adopt and adapt technology to existing problems must be conducted in the field. It appears that ICAITI is making a good transition to working more actively throughout the region, despite the implications for increased travel costs in their budget. With the project extension, ICAITI will be reinforcing the permanent field staff, outside of Guatemala to further reduce future implementation problems.

4. (VITA) Management makes few, if any, field inspections.

(RESPONSE) Field inspections have increased concommitant to the increased activity of the ICAITI engineers throughout the region. A home office operations manager was hired to allow project management to travel to each country at least three times per quarter.

5. (VITA) Lack of interaction between ICAITI and other organizations performing like, rural technology programs.

(RESPONSE) This point of the evaluation team still has relative validity. Although ICAITI has made considerable efforts to work with a large range of counterparts throughout the region, there still exist some groups, particularly in Guatemala, with whom ICAITI has not established fuller working relationships. This situation cannot be easily overcome due to a history of institutional rivalry and not just a little bit of resentment from other institutions that are or have been competing with ICAITI in some areas. Now, with the formation in Guatemala of a national cookstove committee all rural development agencies are cooperating to a greater extent. In the other countries of the region, ICAITI has also built good working relationships with most of the possible rural extension entities. More details on this are contained in Section V of this report.

6. (VITA) Day-by-day tighter and more involved management leadership required.

(RESPONSE) Management and direction of the project has increased considerably over the last two years. Currently extensive work plans are developed at all levels for the control and monitoring of project implementation. This factor is no longer a problem in the project. In addition, the appointment of a full-time operations manager has streamlined all contracting and administrative procedures.

7. (VITA) Delays in program implementation partially caused by hiring and training of personnel.

(RESPONSE) This comment by the evaluation team is no longer relevant. ICAITI has hired and trained a strong and committed project staff.

Institutional Relationships

8. (VITA) ICAITI lacks extensive understanding of the technology transfer process in rural areas.

(RESPONSE) This point is no longer a major problem. ICAITI has learned a lot in the technology transfer process and probably could serve as an example for a number of other institutions both within and without the region in terms of working in extension in the rural areas. With the employment of a two-person dissemination team during the last year ICAITI's ability to effectively realize "technology transfer" has advanced considerably.

9. (VITA) ICAITI has overlooked combustion and alternative energy technology development undertaken by other institutions which have wide dissemination activities in similar technologies.

(RESPONSE) This point is closely related to point number 5 above. As stated above, this is becoming less and less of a problem and it appears that ICAITI, though conducting similar activities, has not actually been competing with these other institutions. ICAITI is aware of other similar developments in the region and is cooperating with these groups where possible and appropriate.

10. (VITA) No interaction with other institutions decreases the perceived value of the ICAITI project.

(RESPONSE) The perceived value of the ICAITI project has apparently increased considerably throughout the region. The demand for ICAITI technical assistance and support has grown to exceed the ability of ICAITI staff to service all the requests. In the discussion of institutional relationships and dissemination activities in Sections V and VI of this report, there are more details which point to the improving "perceived value" of the project.

11. (VITA) ICAITI performing research activities in isolation from other similar activities.

(RESPONSE) True, ICAITI did conduct applied research activities in relative isolation from other similar activities. Perhaps this is part of the development or technology transfer process. It was necessary for ICAITI to learn from its own mistakes in a number of areas. The process of selecting and adapting designs may have been hindered through its isolation, but the end result seems to be very positive and has increased the confidence, credibility, and acceptance of ICAITI's role in the region. In addition, ICAITI now regularly exchanges information with a broad range of development institutions and PVOs in North America, Europe and Asia.

12. (VITA) Weak linkages between ICAITI central staff and actual field operations resulting from lack of full-time field staff.

(RESPONSE) Lack of full-time field staff continues to constrain any further increases in ICAITI Fuelwood Project demonstrations, dissemination and field support. However, the links produced between ICAITI central staff and the field operations through national counterparts have been reinforced over the continuing years of working together. Communication and interaction between programs in El Salvador and Honduras are excellent. As ICAITI is currently working more actively in Costa Rica and even in Panama, those relationships are also improving. In addition, ICAITI has one or two field engineers in each country for project implementation and counterpart assistance and will assign engineers on a permanent basis to countries other than Guatemala.

13. (VITA) Weak relationship between ICAITI and CATIE.

(RESPONSE) Relationships between ICAITI and CATIE have improved greatly in cooperative seminars and workshops. The reality of the project is that ICAITI and CATIE have quite separate and distinct responsibilities. Initially there was a great need for coordination due to the fact that some of the fuelwood production activities needed to take place in the same areas where the fuelwood efficiency work was going on. Now, with the success of the woodstove programs and the growing initiative of the national counterparts to continue those efforts, the coordination will take place on a national level. The need for increased communication between ICAITI and CATIE is minimal. The real work of cooperation between CATIE and ICAITI activities must take place at the national or local level.

Site Selection, Demos/Experimentation

14. (VITA) Domestic digestor technical data not yet published after more than one year of operation.

a. Performance reading taken infrequently.

b. Data collection records not well oganized and appear inadequate.

c. Neither digestor functional as self-perpetuating systems.

d. Domestic demonstration run risk of failure on inconclusive results by spreading technical teams too thin.

(RESPONSE) This concern was very legitimate at the time. It is true that the biogas program had been in operation for one year at the time of the VITA evaluation but most of that first year was dedicated to design and construction of the demonstration models. Performance data records, reading, and reporting are now better organized and data has been collected by ICAITI and counterparts from 15 different size digestors located in different climatic zones and with different substrates. The ICAITI biogas digestor is a continuous feed digestor and is now the most widely copied model in Central America. Presently, there are 55 of this model throughout the region. The hiring of

additional engineers for all of the field offices has allowed the biogas team to concentrate on the technical and development aspects of the project and two additional technical writers are needed to publish reports, manuals, plans, and other dissemination materials. There now exist eight (8) substantive publications on aspects of biogas systems construction, and on economic and technical aspects. In total, ICAITI has published twenty five (25) publications on all of the technologies. More details on biogas and on publications are contained elsewhere in this report.

15. (VITA) Little mention (in quarterly) of problems, planned future activities, or their relationship to annual work plan.

(RESPONSE) Work plans and quarterly report forms were redesigned to better reflect problems, planned activities, and their relationship to the annual work plans. In addition, project management reviews the work plans and goals with each technical team and each country team and ROCAP on a quarterly basis. The aspects of information dissemination are discussed in more detail later.

Counterpart Interactions

17. (VITA) National ICAITI representatives in each country are too far removed from actual implementation to be of much real help.

(RESPONSE) In January of 1982 all promotional and dissemination responsibility in each country was given to the respective ICAITI representative and additional field staff assigned to each country. Communication between management, the technical teams and the field staff is constant. As the project has advanced, the ICAITI staff in Guatemala has spent more and more time in the field working on the implementation of specific activities in conjunction with the national counterparts. Eventually, the national counterparts will assume increased responsibility for the execution and success of the projects in their area.

18. (VITA) Cooperating agreements with 20 national institutions and no permanent field staff negatively impacts project implementation.

(RESPONSE)

Permanent field staff now exist in each country, however, the limitations of their being spread too thin as mentioned in point 17 still exist. As the project has progressed, many counterparts are no longer involved in the project because their effectiveness as extension agents was judged to be insufficient. Those with whom ICAITI works are those proven to have the necessary resources and capabilities. The situation with counterparts continues to evolve and is explained more thoroughly in Section V of this report.

19. (VITA) Peace Corps assistance not as great as anticipated during project development.

(RESPONSE) Initially, Peace Corp assistance was not as great as desired. However, subsequent to the evaluation, strong relationships with Peace Corp in Guatemala and Costa Rica have helped considerably in the advancement of the project, particularly in the area of dissemination and application of more efficient fuelwood stoves, small farm biogas applications, and solar crop driers.

IV. PROJECT ACHIEVEMENTS AND CURRENT STATUS

1. Overall Comments

The following presentation deals separately with each of the major technical components of the project; combustion engineering, solar technologies and biogas[1]

In addition to discussing the current status of the Project in each of the technical areas, the commentary below also includes recommendations on the type and nature of activities that would give continuity through 1985 and the first half of 1986 to assure a smooth transition to the planned follow-on project. These recommendations are repeated again in section VII.

In sub-section VII.4. there is a brief description of some suggestions for new reporting. In the future, these new reports would rapidly aid those only superficially acquainted with the project to acquire a fuller comprehension of the technical, economic and institutional experience ICAITI has had over the course of the project.

(1) Credit for this portion of the paper goes to ICAITI which had already assembled a lot of the information.

2. Combustion Engineering

A. Domestic Fuelwood Stoves (Lorena Type)

Project Paper Goals for this technology were as follows:

- Effect literature search and survey of cooking devices in Central America and other areas, analyzing approximately 20 designs.

- Select at least 10 designs for construction and laboratory testing at ICAITI.

- Based upon test results, select five designs for demonstration in Central America, constructing, in collaboration with national institutions, approximately 75 stoves in each country, 15 in each of 5 villages.

- Monitor and evaluate demonstration units; disseminate technology through workshops, written reports and other means.

During the first two years of project implementation the ICAITI combustion team spent most of their time on developing and advancing the stove program. After this work was well underway, ICAITI began to work on larger, more commercial applications of the combustion technologies, such as ovens and kilns discussed later.

All of the above activities specified in the Project Paper have been completed. Sixteen different designs were constructed and tested at ICAITI with positive results obtained[1]. In collaboration with national counterparts, approximately 450 demonstration stoves (75 per country) have been constructed in Central America. This program was initiated with five

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(1) Detailed information in ICAITI report "Estufas Domesticas: Pruebas de Eficiencia Energetica".

stove designs (Lorena, Chulah, Singer, Adobe and Block); however, counterparts were given a free hand to select only those models that were best adapted to local consumer needs. Since low demand existed for the adobe and block models, these have now been dropped from the program while the Lorena and Chulah stoves have been emphasized.

The majority of the information received from the field shows good consumer acceptance for the Lorena-type stoves. This was confirmed by an independent evaluation contracted by ICAITI. Quantitative data presented by some counterparts show average fuelwood savings between 20 and 66 per cent in comparison with the open fire cooking methods. Elimination of smoke and cooking convenience are also cited as important factors in consumer acceptance. The Ministry of Energy in Guatemala is currently conducting a survey of stove efficiencies and acceptance.

Technology transfer in the stove field has been accomplished through meetings with counterparts, stove construction workshops and technical assistance in the field. To date, ICAITI has given 16 formal stove workshops to counterpart personnel in Central America. These personnel in turn have trained others in their respective countries. In Guatemala, six Peace Corps volunteers have been assigned full time to conduct stove construction courses for counterpart personnel and campesinos. A similar arrangement with Peace Corps is anticipated in Honduras and Costa Rica.

ICAITI has provided all counterparts with construction manuals for the Lorena and Chulah stoves, as well as promotional brochures. A special construction manual for large institutional stoves has also been prepared and is being disseminated.

The domestic stove activity can now be considered in the dissemination phase throughout the region. Present status of the dissemination activity by country is as follows:

Guatemala

Stove dissemination has advanced most rapidly in Guatemala. Over 20 national and PVO organizations have helped with training courses and construction of stoves. ICAITI assisted the Ministry of Energy in creating a National Stove Committee to coordinate these activities, arranging the initial contacts and organizing the first meetings in 1983. The committee is now functional and is conducting program evaluations and the training of additional extension personnel, including 300 extensionists from DIGESA (MAG).

The Ministry of Energy reports over 7000 stoves constructed in Guatemala to date. A total of 26 institutions have attended Committee meetings, although only 6 or 7 are participating actively in committee programs. ICAITI is continuing to provide technical assistance to the committee, however, a gradual withdrawal is planned as the committee becomes self-sufficient.

In addition to the National Committee dissemination mode, ICAITI is sponsoring a Peace Corps project in two villages near Antigua, where stove constructors are being trained to carry out this activity on a commercial basis (Q20.00 per stove). The village Cooperatives manage a rotating fund to provide loans to home owners for stove construction. A preliminary evaluation of this project should be available by December, 1984.

Honduras

In Honduras, ICAITI transferred the domestic stove technology to its principal national counterpart CDI (Corporacion de Desarrollo Industrial), who had a rural technology project sponsored by AID Honduras, in 1981-1982. Since then, CDI reports the construction of over 2,400 stoves.

CDI has also modified the Singer stove design so that it may cook cassava, an important staple food of the black population of the Atlantic Coast's black population. With support from ICAITI's Fuelwood Project, 100 of these cassava stoves have been constructed on the Atlantic Coast, and another 50 are under construction on Roatan Island.

Although CDI has developed a well-executed stove dissemination program, some other interested national institutions have not yet participated. In 1984, CDI, with ICAITI, trained personnel from DIFOCOOP (National Cooperative Institution) in stove construction. The possibility of replicating Guatemala's National Committee dissemination mode in Honduras will be explored by December 1984.

El Salvador

ICAITI has trained personnel in stove construction from CEL (Comision Electrica del Rio Lempa), CENTA (MAG), DIDECO (MOI), PRODECA (Programa de Desarrollo de Cabanas), Recursos Naturales (Chalatenango project sponsored by FAO), and DJC (Save the Children). Except for CEL, all of the these institutions are carrying out independent stove dissemination programs. In addition, DJC is training personnel primarily from other PVO organizations, under sponsorship of ICAITI's Fuelwood Project.

In 1983, preliminary attempts were made to organize a national stove Committee in El Salvador. This activity was temporarily suspended due to extensive election-related personnel changes in the National institutions. However, renewed efforts have resulted in the formation of a National Committee with the participation of at least seven national institutions. It is programmed to start up in November.

Costa Rica

The first counterpart organizations trained by ICAITI in stove construction (Caravanas de Buena Voluntad and the 4-H Clubs of Costa Rica) have lacked resources to effect more than very small local stove projects.

ICAITI reports that the best dissemination programs underway in Costa Rica are those of the Peace Corps, where volunteers trained by ICAITI are incorporating Lorena stoves in low-cost housing projects. In addition, MAG

extension personnel in Guanacaste are constructing stoves in areas where CATIE is developing fuelwood plantations. It should be noted that woodstoves are not a high priority in much of Costa Rica and Panama because few people use wood for domestic cooking. Those who do aspire to LPG or kerosene.

Panama

After completing the demonstration projects, ICAITI transferred the stove technology to RENARE personnel through workshops. Due to lack of resources, RENARE has only developed one small dissemination program near the city of Santiago. Another group in Panama, associated with RENARE, has recently expressed interest in disseminating stoves, and a training workshop of their personnel has been programmed for October 22-26, 1984. AID Panama has also requested assistance in developing a stove demonstration project; details will be discussed in October. Panama, because it is not a traditional ICAITI client and is located far from Guatemala, has been a slow starter. However, the growing interest there indicates increased activity in domestic stoves during the next 18 months.

January 1985 - June 1986

The activities for the Lorena type stove recommended for the extension period are the following:

- Multi-institutional extension-type dissemination models have been successfully developed in all three of the northern Central American countries (Guatemala, Honduras and El Salvador), with a strong AID sponsored counterpart providing leadership in Honduras, and National Stove Committees organized in Guatemala and El Salvador. Except for routine liaison and some trouble-shooting, the requirements for further assistance from ICAITI in this field in 1985 should be minimal in Guatemala and Honduras. In El Salvador, however, the National Committee will only be formed in late 1984. ICAITI personnel should work closely with the Committee, assisting in the preparation of programs for at least the first six months of 1985.

- The stove project so far has had much less impact in Costa Rica than in the northern Central American countries. Nevertheless, four institutions are involved in stove dissemination, and several others have expressed interest. ICAITI's project dissemination team has been documenting the successful development of the National Stove Committee in Guatemala, with a view towards replicating this dissemination mode in Costa Rica. This idea will be presented to MOE, Costa Rica, in late 1984. If results are positive, ICAITI should be prepared to offer technical assistance to the Costa Rican National Committee during 1985.

- In Panama, follow-up of the recently trained personnel will be needed in 1985 to determine if a worthwhile dissemination program can be developed. Also, ICAITI should be prepared to provide AID/Panama with all assistance required to make their stove program a success.

- The special Peace Corps commercial-type dissemination mode presently under test in Guatemala will be ready for preliminary evaluation by the end of the year, but at least the first three months of 1985 will be needed to verify promising results. If this mode proves successful, ICAITI dissemination personnel will prepare necessary documentation and, during 1985, promote this type of dissemination through presentations to the National Committees in Guatemala and El Salvador (possibly also in Costa Rica), CDI in Honduras, Peace Corps Honduras, and Peace Corps Costa Rica.

B. Ceramic Fuelwood Stoves

The ceramic cookstove is a relatively new development not considered in the Project Paper. ICAITI began work on this device in 1983 to respond to the following problems identified by stove disseminators in the field:

- Many campesinos found the Lorena stove too complex for "do-it-yourself" construction, thereby requiring extension workers and Peace Corps volunteers to do most of the construction work.

- Flaking of the pot station openings resulted in major maintenance problems.

- Several institutions involved in low-cost housing projects (i.e. CEL, El Salvador; ICE, Costa Rica), indicated a need for a modular standardized[1] stove which can be incorporated into low-cost houses and easily built by housing construction workers.

The ICAITI ceramic stove consists of three ceramic pot stations and all connecting ducts pre-fabricated by a ceramics industry. These parts can be easily assembled at the end-use site, packed into a block of sand and clay. This eliminates the "art" of excavating pot stations and ducts, provides a hard ceramic pot station surface, and represents a standardized stove suitable for low-cost housing projects.

ICAITI has completed the design and laboratory tests of the ceramic stove. The efficiency improvements achieved by this model are expected to exceed those of the "customized" Lorena Stove. Results of a five-unit preliminary field test were promising. Local ceramic manufacturers have been contacted, and a pilot lot of 50 units ordered. By the end of 1984, an evaluation of the ceramics industry experience will be available, and field-testing of the 50 units by counterparts in process.

January 1985 - June 1986

In early 1985, the acceptability of the ceramic stove by Guatemalan institutions should be established. Assuming positive results, ICAITI should then train at least one ceramics industry and one field counterpart in the technology in each of the other countries (2). The ceramic stoves will also be promoted through the National Committees, Peace Corps, and other major stove counterparts. Dissemination personnel will present the technology to as many institutions involved in low-cost housing projects as possible.

(1) The Lorena Stove usually is custom built with the homeowner's cooking utensils used as models for the pot station openings.
(2) Engineering drawings suitable for ceramics industry use have already been prepared. An assembly manual for the end-user will be available at the end of the year.

C. Industrial Ovens

As stated in the Project Paper, ICAITI was to investigate "state-of-the art" in Central America, and develop seven fuelwood efficient designs, covering brick and ceramic kilns, lime kilns, bakery ovens, salt evaporators, and crude sugar producers; construct demonstration units for each of the seven designs; prepare reports and disseminate technology to national extension agencies, PVO's and industrial users throughout the region.

Due to the emphasis on domestic stoves early in the Project, start-up of the industrial oven work was delayed; nevertheless, the number of demonstration units presently constructed exceeds the number specified in the Project Paper, and includes the following:

- Five bakery ovens, one each in Guatemala, Honduras, El Salvador, Costa Rica, and Panama.
- Three brick kilns, one each in Guatemala, Honduras and El Salvador.
- One lime kiln in Guatemala.
- One salt cooker in Honduras.
- One crude sugar (panela) cooker in Panama.

Work on the bakery oven and brick kiln technologies was initiated earliest, and is furthest advanced. Tests of the demonstration units show fuelwood savings in comparison with traditional equipment of 35 to 45 per cent for the brick kilns and 40 to 50 per cent for the bakery ovens. Preliminary cost estimates show reasonable payback for both technologies. The demonstration activity for brick kilns and bakery ovens was just completed this year, nevertheless, good dissemination programs in the bakery oven field are already starting in El Salvador and Costa Rica.

The salt cooker demonstration unit has been operated for one season in Honduras. Verbal reports from PTR engineers indicate considerable fuel savings and good owner acceptance. This equipment, however, at the present time appears to be appropriate only for Honduras, where a significant market exists for "cooked" salt.

The lime kiln demonstration unit in Guatemala, and the panela cooker in Panama have just been constructed. Test information will be available by the end of 1984.

a. Bakery Ovens

Post-demonstration dissemination of the bakery oven technology moved most rapidly in El Salvador, where many of the bakeries are organized in a national cooperative (COMAPAN). ICAITI engineers, collaborating with COMAPAN conducted several short courses, including a demonstration of the oven, and provided interested bakers with construction manuals in early 1984. At the present time, at least six ovens have been constructed by local bakeries, and another four are under construction. Most of these have been built by the mason trained by ICAITI during the demonstration phase of the project; construction manuals were provided by ICAITI. It is reported that the ICAITI trained mason has hired two full time assistants to help him and that several bakers are attempting to construct new ovens based on the short courses and the manuals.

Interest in the bakery oven technology in Costa Rica has probably been as high as in El Salvador, however, bakers in this country do not have a production cooperative as effective as COMAPAN, and ICAITI has been working directly with individual bakers. Two ovens have been constructed by bakeries in the San Jose area. Construction of a third unit on the Peninsula of Nicoya is being initiated as a demonstration unit to be used for training masons needed to fulfill eight requests for ovens received in this region. Before the end of 1984, a series of short courses covering the bakery oven technology will be effected in principal population centers in Costa Rica.

In Guatemala, the first demonstration unit was located at an INTECAP vocational school, where training courses for bakers are conducted. The oven, however, is used sporadically and has not been as useful a demonstration unit as hoped. ICAITI has since started to work with the National Cooperative Institute for promotion of the bakery oven technology. This has led to the construction of an oven by a private bakery in Jutiapa. Using this latter unit for demonstration purposes, a local dissemination program in the Jutiapa area is now starting.

In Honduras, considerable non-technical problems were encountered with the demonstration unit constructed in Danli, due primarily to labor management conflicts in the bakery. This delayed dissemination startup, however, CDI personnel have been thoroughly trained in the technology, and they provided technical assistance to a private bakery in Tela for the successful construction and start-up of an ICAITI bakery oven in mid-1984. CDI has received three additional requests for ovens, and are now promoting the technology throughout the country.

The first bakery oven in Panama is under construction, and will be operational before the end of the year.

January 1985 - June 1986

During the extension period, much remains to be done to upgrade the dissemination efforts in Guatemala, El Salvador, Honduras and Costa Rica, which just started in 1984, and to initiate a program in Panama. Probably less effort by ICAITI personnel will be required in Honduras, were CDI personnel are already well involved.

In El Salvador, although the program is off to an excellent start, more masons should be trained, and additional short courses given in areas outside of San Salvador, to increase the scope of the project. Also, in Costa Rica, follow-up of the Guanacaste demonstration and the "itinerant" short course

program to be effected before December, 1984, will require considerable effort by ICAITI's Delegate Assistants as well as planned visits by combustion engineers.

The program just starting in Guatemala, restricted at present to the Jutiapa area, should be expanded nationwide through short courses and on-the-job training of construction personnel. In Panama, post-demonstration short courses should be initiated in collaboration with a local institution that can assist in promotion and supervision. AID Panama also wishes to demonstrate the bakery oven in conjunction with its stove program, and ICAITI should provide necessary technical assistance.

b. Brick Kiln

Fuelwood efficient brick kilns have been demonstrated in Guatemala, El Salvador and Honduras. Costa Rica was not considered since the brick industry in that country is of lesser importance, and ICAITI combustion engineers' time was needed for higher priority activities.

After the demonstration, three institutions (Army Engineers, Honduras; Tourism Institute and Ministry of Public Works, El Salvador) have accepted the design and are presently constructing units for their own use. Dissemination in the private sector has not yet started. The brick kilns represent relatively high investments (four times the cost of a bakery oven) and the small industries in this sector lack financing. Most interest in the technology by industry has been shown in El Salvador where the demonstration kiln is being used to produce export-quality tile, a product that apparently cannot be fabricated in traditional kilns.

<u>January 1985 - June 1986</u>

During the project extension, assuming no change in the perspectives for financing, ICAITI will limit itself to including the brick kiln technology in seminars, and offering technical assistance upon request to individuals or institutions interested in building kilns.

During 1984, however, ICAITI personnel discussed the financing problems with IDB and various foundations, and latest information indicates that IDB might be willing to provide a revolving fund of $300,000 to be managed by ICAITI for financing small industry technologies. This fund, of course, would not be restricted to brick kilns, but could also be used for bakery ovens, biogas digestors, solar driers, etc. If this possibility becomes reality in early 1985, the dissemination picture would be greatly improved.

There is also hope that EEC and IDB loan funds that would be managed by the Central American Bank (CABEI) could also be used by small industries. If this sort of arrangement can be achieved, it would relieve ICAITI of the need to become a financier. ICAITI would assist small industries in conducting financial feasibility studies to help justify the loans.

c. Lime Kiln

A fuelwood efficient lime kiln has been designed and constructed in Guatemala in 1984. The kiln presently is under test and results will be available before the end of the year.

Assuming successful test results, the lime kiln technology will be promoted in Guatemala in 1985. Also, CDI of Honduras has requested a demonstration of the technology in Honduras as soon as positive test results have been obtained. Lime production is an important industry in several areas of Central America. Some lime is actually imported to the region so the potential for this application is significant.

d. Salt Cooker

Salt traditionally has been produced on the Pacific Coast of all of the Central American countries, both by solar evaporation and by cooking brine with fuelwood. In Costa Rica, production is principally solar, and in Guatemala, since legislation was passed prohibiting the cutting of mangrove

(traditional fuel for cooked salt), production is now totally solar. The present situation in El Salvador is unknown since this activity takes place in "conflict" areas.

In Honduras, however, a considerable "cooked salt" industry still exists, using mangrove fuelwood, and the Honduran Government apparently is reluctant to put this industry out of business by prohibiting the cutting of mangrove. ICAITI, collaborating with CDI, designed and installed a fuelwood efficient salt cooker near San Lorenzo, Honduras, the last salt production season (December 1983-April 1984). Due to personnel changes in CDI precise test data was not obtained; nevertheless, operation of the unit was very successful, with the owner claiming a 75 per cent reduction in fuelwood consumption per volume of salt produced.

Recently, the Honduran Government has become concerned about the depletion of the mangrove forests along the Pacific Coast. CDI, therefore, plans to initiate a program to encourage producers to switch to solar evaporation methods or, as an intermediate step, to at least use the most efficient fuelwood salt cookers available[1] (solar salt production is discussed under Solar Technologies). During the next season (December-April), CDI plans to build at least two more salt-cooker demonstration units in the zone, and have requested additional ICAITI's technical assistance.

January 1985 - June 1986

Due to the high priority and the environmental implications for this Project, ICAITI should provide all assistance necessary to CDI during the first four months of 1985. Elsewhere in the region, the emphasis will be on using solar technologies for drying salt.

(1) Apparently the possibility of passing legislation, in Honduras, to force the use of the ICAITI wood-fired salt cooker is being considered.

e. Panela Cooker

Crude sugar (panela) is produced in all of the Central American countries (although on a lesser scale in El Salvador) by evaporating sugar cane juice in cookers. In Guatemala, the sugar cane bagasse is used almost exclusively as the fuel for cooking panela, while in Honduras and Costa Rica, bagasse is also used with a fuelwood supplement.

In Panama, the equipment used is more primitive; fuelwood is used exclusively with the bagasse being discarded since the producers feel its heat value is inadequate.

ICAITI designed and built a panela cooker in Panama in mid-1984. One test was made as a demonstration to local producers using 100 per cent bagasse fuel, with completely satisfactory results. Continuous testing of this unit, however, cannot be accomplished until November or December, when the next sugar cane crop is available.

January 1985 - June 1986

Assuming satisfactory continuous testing results, ICAITI, in 1985, should prepare a construction manual and give a high priority to disseminating this technology in Panama, since this could represent a 100 per cent fuelwood savings in the Panamanian panela industry. AID Panama also intends to demonstrate the panela cooker in conjunction with its stove and bakery oven projects.

D. Charcoal and Pyrolysis

Project Paper goals were to effect a literature review and construct prototype improved charcoal kiln and pyrolytic conversion units, test and demonstrate units in appropriate areas; prepare reports and disseminate technology.

This activity did not start until 1983, due to higher priorities for stoves and industrial ovens. After completion of the literature search and local investigation, ICAITI decided to concentrate on charcoal kilns and small gasifiers for rural applications. ICAITI has constructed two experimental prototypes at its headquarters in Guatemala. The first, a novel charcoal kiln design for producing charcoal from sawdust, was constructed and tested in response to requests from Costa Rica. Except for some problems with the sawdust feeding system, technical results were promising; however, later information received from counterparts in Costa Rica indicated less sawdust availability in that country than expected and, as a result, testing of this unit has been suspended. The other prototype, a small gasifier using either wood or corncobs as fuel, is now under test.

During the initial survey, more interest in charcoal was detected in Costa Rica than in any other Central American country. For this reason, the demonstration activity was initiated in this country. ICAITI now has one conventional "igloo" or "bee-hive" charcoal kiln in operation as a demonstration unit in Coris, near San Jose. Data is now being collected to establish productivity and cost effectiveness. By the end of the year, two additional units will be constructed, another conventional kiln in Guanacaste in collaboration with CATIE, and a portable metal kiln on a private farm in Turrialba.

ICAITI has prepared a construction manual for the conventional charcoal kiln, and will present a charcoal seminar in Costa Rica in October. A private enterprise near Puerto Limon has constructed two kilns based on the ICAITI design; these were built by the same mason who constructed the ICAITI demonstration unit.

January 1985 - June 1986

During the extension, ICAITI should continue to collaborate with CATIE in Costa Rica in the dissemination of charcoal kilns in areas where CATIE plantations are located. Interest in other local institutions capable of

providing technical assistance to private industry in the charcoal field, should also be developed in Costa Rica to reduce requirements for ICAITI's services.

CDI, Honduras, has also requested ICAITI to introduce this technology in Honduras in 1985.

ICAITI will prepare a report covering test results and economic analysis for gasifiers, and will explore possible interest in this technology, which may be somewhat complex for rural Central America. Gasifiers would receive more attention under the new project that would commence in mid-1986.

3. Solar Energy Technologies

A. Project Paper Goals

The following goals were shared in the Project Paper;

- Evaluate three primary applications: solar wood and bagasse driers; solar evaporators for salt production and solar water heaters.

- Design and test simple solar driers to dry wood for both domestic and small industry use.

- Demonstrate two industrial units and at least six domestic driers.

- Work with solar salt producers to design and construct solar evaporators.

- Demonstrate three solar hot water systems - two applications for rural clinics or schools; possibly third unit to heat biogas digestor.

- Build various test units and determine the cost and performance of the designs.

- Construct field test units and disseminate results.

B. Accomplishments to Date

a. Solar Driers

Two fuelwood drier prototypes were constructed early in the project and tested in highland and lowland environments. Although test results were positive (35 per cent reduction in drying time), the local survey conducted simultaneously showed little demand for this technology[1] and, after discussion with ROCAP, it was decided not to enter into a demonstration phase. Later surveys, however, showed considerable interest throughout Central America for other solar drier applications, such as the drying of fish, grains, fruits, vegetables, spices and lumber.

In response to the above, ICAITI has designed a low-cost "tent"-type solar drier suitable for small-scale drying of grains, two designs of tray-type multi-purpose driers for fish, fruits, spices and other food products (small and medium scale operations) and one drier design for the industrial drying of sawmill lumber.

In 1984, this project entered into the demonstration phase, and ICAITI now has fish drying demonstrations in operation in Guatemala and El Salvador, and a third under construction in Puerto Limon, Costa Rica. Fruit drying is now being demonstrated in El Salvador at the National Agricultural School, and grain drying in Guatemala and Honduras. An industrial scale lumber drier is

(1) Although the solar drying of fuelwood has been proven to be cost effective, the barriers to wide scale field acceptance are numerous. The major users are campesinos who cannot afford the cost of constructing the dryers nor can they see the long-term benefits. Despite the proven cost effectiveness and the possible impact use of solar wood dryers could have on fuelwood consumption, the acceptability of this technology has been disappointing. Wood in the rural areas when sold is sold by the piece, not by its relative moisture content (wetness). Most wood users only have a supply for a few weeks and, therefore, for reasons of cash flow could not invest in the larger stock needed for drying. The campesino user has a very short time horizon for his money. The period of time required to realize the return of investment by the drying of his fuelwood is too great to justify the investment cost. It is interesting to note that despite the relative failure of this application for solar drying, that the experience gained in developing the technology has led ICAITI rapidly into a number of other far more saleable applications.

being demonstrated at a private wooden door factory in Coatepeque, Guatemala, with excellent results. Engineers from CDI have already visited this demonstration site and are anxious to replicate the unit in Honduras.

Solar drier seminars followed by practical drier construction workshops have been effected in Guatemala, Honduras, El Salvador and Costa Rica. The driers constructed in these workshops are being used locally by counterparts and the Peace Corps for practical purposes as well as demonstrations. ICAITI will publish construction manuals as dissemination aids by the end of this year.

b. Solar Hot Water

After completing the literature search and visits to United States installations, the solar team developed a low-cost collector design which could be fabricated in Central America, and designed solar hot water systems for both residential and institutional use.

At the present time, over 12 different types of residential hot water systems and collector designs have been tested and demonstrated at ICAITI, Guatemala. Five institutional hot water system demonstration units have been installed in Central America, one each in Guatemala, Honduras and El Salvador and two in Costa Rica.

Cost effectiveness analyses prepared by consultants from Energy Associates International, Albuquerque, New Mexico, show satisfactory results for the hot water systems (excellent results for solar driers), and the technical performance of the demonstration units has been successful. On both domestic and institutional levels, all installations have proven cost effective. This technology has developed to the point that a module-type solar collector has been designed, developed, and proven. The data is now well established because of the numbers of installations in Guatemala, Honduras, El Salvador, and Costa Rica. The cost payback period is less than four years in all cases and less than three years in several cases, depending on the size and location of the system and the local price for electricity.

The acceptance of solar hot water heaters has also been very strong. The institutional solar hot water heating plants have had no operational problems. The domestic systems have also done very well. Currently many households in Central America cannot afford hot water of any sort. However, solar hot water technologies could eventually make hot water more afordable to such lower income households. The real hurdle is the large initial investment cost required to purchase a solar hot water system.

There does appear to be a need for further study by ICAITI engineers of the solar collector module in order to improve its manufacture ability and utility. Designs for more simple and cheaper passive water heating systems for the lower economic strata of the population might also be considered. Counterparts have been trained in collector construction, and the ICAITI design is being used by at least two private industries in Guatemala, and one in Costa Rica.

c. Solar Salt

The solar salt activity was started with the use of black plastic sheets as an efficient low-cost means of providing crystallization "patios". This technology was already in extensive use in Costa Rica, so ICAITI's efforts were oriented principally towards Guatemala and Honduras, where the black plastic technology was relatively unknown. No investigation of the salt production situation was made in El Salvador, since this activity is presently carried out in conflict areas.

Transfer of the black plastic technology was accomplished in Guatemala through the construction of demonstration patios, discussions with individual proprietors, and short courses given to members of the salt producers' cooperative. This activity was limited to the salt producing seasons (December-April) during the last two years. Acceptance of the black plastic technology by small and medium salt producers in Guatemala has been very satisfactory. Latest information reveals that 32 medium sized salt operations

are now using black plastic in Guatemala, and an undetermined, but very large, number of small operations. Acceptance has also been good in Honduras, but dissemination has moved much more slowly, principally due to the virtual loss of one season caused by personnel changes in the Honduran counterpart institution. The payback period for the black plastic investment is about 50 days and it has a useful life of two years.

The black plastic technology has not yet been accepted by the large salt producers who consider it too labor intensive, and prefer permanent tile patios(1). Work was initiated, therefore to improve the efficiency of the tile patio using various types of black paint coating on the tile. Although a 40 per cent improvement in efficiency was obtained, the coating did not last enough for cost effectiveness, and this technology was discarded. Black pigmented cement tiles were then tried with promising results. One demonstration patio of this type is now under test in Guatemala to determine effective life. The payback for the investment is calculated to be about 90 days and the tiles may have a useful life of over 5 years.

C. Present Status of Dissemination Activities

a. Solar Driers

Since the solar drier technology only entered the demonstration phase in 1984, no organized nationwide dissemination programs have been effected as yet. Interest of private enterprise, cooperatives, PVO's, Peace Corps and some national institutions in this technology, however, has been excellent, possibly greater than any of the other Fuelwood Project technologies, and no problem is expected in setting up dissemination activities.

At the present time, the principal demonstration/dissemination activities in the field are the following:

(1) In september, 1984, the first large Guatemalan salt producer requested ICAITI's assistance in converting his operation to black plastic.

Guatemala

- Seventy ICTA extensionists are being trained by ICAITI for the dissemination of solar grain driers. This agricultural institute will also be assisted by ICAITI in the construction of a solar drier for seeds.

- The solar fish drier is presently being operated by a Peace Corps volunteer on the Pacific Coast. A local fisherman's cooperative is collaborating.

- The solar lumber drier in Coatepeque is being operated by a private industry, and is being used by ICAITI as a high priority demonstration unit for other industries in the wood-processing field. No national institution is involved in the project as yet.

El Salvador

- CENTA is testing ICAITI's solar fruit drier at the National Agricultural School. Very satisfactory results have been obtained with plantain and cashew, and the drier design should soon be turned over to the CENTA Extension Division for dissemination.

- The solar fish drier is under test as a joint project between ICAITI and the Banco Nacional de Fomento Agropecuario. This institution is interested in transferring the technology to 10 fishing cooperatives presently being financed by the Bank.

Honduras

- CDI has an ongoing nationwide dissemination program for low-cost solar grain driers, and, as mentioned previously, wishes to initiate lumber drier dissemination as soon as possible.

- ICAITI has given solar drier workshops on Roatan Island, off the Atlantic Coast, and in Choluteca on the Pacific Coast. These may lead to CDI dissemination programs for fish and fruit driers on the North Coast, and cashew driers in the Choluteca area.

Costa Rica

- A solar drier workshop given in Puerto Limon was exceptionally well received with numerous requests for assistance from private farmers and small industries. ICAITI has since entered into an agreement with JAPDEVA, the National Port authority, who will act as the disseminating counterpart. ICAITI/JAPDEVA projects underway are the following:

  - Cacao. This is considered a critical problem in Puerto Limon. Combined solar-combustion driers will be tested on two farms, with owners providing all material and labor.

  - Plantain. Dried and ground plantain is a product which can be marketed locally and abroad through JAPDEVA's marketing facility. ICAITI is providing assistance for the construction of a solar drier on a small farm for demonstration purposes.

  - Fish. JAPDEVA has held various meetings with local fishing cooperatives, and the lack of proper equipment for proper drying is considered a major drawback for this industry. ICAITI will provide technical assistance.

  - Shrimp. JAPDEVA has also requested ICAITI's assistance for the drying of shrimp. This product would be exported to the United States.

b. Solar Hot Water

Probably due the relatively high capital cost for the solar hot water equipment, practical dissemination has not taken off as in the case of most other technologies. The only major possibilities at the present time are a project proposed by IGSS, Guatemala, for the installation of institutional solar hot water systems in 17 national hospitals, and a private hospital on Roatan Island, Honduras. Pending more counterpart interest, ICAITI will concentrate its efforts on the solar drier applications, working on solar hot water only in response to direct requests for assistance.

c. Solar Salt

Although no national institutions were involved, dissemination of the black plastic technology has been satisfactorily effected in the Sipacate area of Guatemala by the producers themselves. ICAITI presently has a Peace Corps volunteer permanently stationed on the Pacific Coast, who will assist producers in this technology in areas other than Sipacate.

D. Recommended Activities for the Extension Period

a. Solar Driers

It is not possible for ICAITI to respond to all requests already received for assistance in the solar drier field in 1985., Efforts, therefore, will be restricted to developing the capabilities of key counterpart institutions to handle such requests for assistance, and concentrating on a few of the more important demonstration/dissemination projects already identified. Response to other requests for assistance will be provided when possible.

The principal counterparts to be trained are the following:

- Guatemala. A recently-formed National Solar Energy Group organized by the Ministry of Energy with ICAITI assistance has the potential to be an effective disseminating agency in Guatemala. ICAITI also is training Peace Corps volunteers in this field, and is working on a grain drier dissemination program with ICTA.

- El Salvador. CENTA appears to be the best possibility.

- Honduras. CDI is already an effective counterpart in solar energy.

- Costa Rica. JAPDEVA will be the disseminating institution on the Atlantic Coast. Peace Corps volunteer in Guanacaste have been trained by ICAITI in this technology. A national institute covering other areas is needed.

The principal projects to be emphasized as demonstration activities by ICAITI during the extension are the following:

- Guatemala. The solar lumber drier technology with private industry in Coatepeque. This technology will be thoroughly demonstrated to appropriate Guatemalan industries, and will be transferred to Honduras and Costa Rica.

- El Salvador. Fish drying project in collaboration with the Banco Nacional de Fomento Agropecuario. The experimental project should be expanded to include combined solar/biogas driers, and transferred to 10 fishing cooperatives.

- Honduras. Cashew fruit drying in the Choluteca area. This will provide a good overall solar energy demonstration, considering the proximity of the Choluteca Dairy Project using solar hot water, and the solar salt operations near San Lorenzo.

- Costa Rica. One large combination of solar drier projects in collaboration with JAPDEVA on the Atlantic Coast near Puerto Limon., These will include the drying of cacao, copra, plantain, fish and shrimp. Combined solar/combustion driers are included.

b. Solar Hot Water

During the project extension, ICAITI should limit itself to providing technical assistance upon request to projects such as IGSS (Guatemala) and the Roatan Hotel (Honduras) presently in process. Also, the solar hot water technology will continue to be included in the project seminar material.

c. Solar Salt

Spontaneous dissemination of the black plastic technology has already taken place among small and medium salt producers in the Sipacate area of Guatemala. During the next season, December-April, ICAITI should provide assistance as requested by large producers, and complete evaluation of the black-pigmented tile experiment. ICAITI's Peace Corps volunteers can assist small producers dissemination in other Pacific Coast areas of Guatemala.

Since Honduras has established a high priority for solar salt dissemination, ICAITI should be prepared to provide all assistance needed to CDI for this purpose in the first four months of 1985.

In Puerto Limon, JAPDEVA has requested assistance to initiate a small scale solar salt operation on the Atlantic Coast to provide salt for the fishing cooperatives who presently use salt shipped from Puntarenas. Due to climate differences, solar salt production on the Atlantic Coast of Central America normally cannot compete with Pacific Coast producers. However, a very small scale operation strictly for local consumption could prove worthwhile, and ICAITI should provide assistance for this project, if cost evaluations presently being carried out prove satisfactory.

4. Biogas

A. Project Paper Goals

The following goals were listed in the Project Paper:

- Review available literature;
- Visit local installations and United States facilities;
- Construct prototype domestic and industrial units with assistance from United States consultants;
- Evaluate different substrates and examine fertilizer value of the digestor effluent;
- Develop final designs based upon prototype tests, conduct workshop for counterpart personnel, and install 10 domestic and three industrial demonstration units in Central America;
- Monitor for two year and prepare final report.

2. Accomplishments to Date

The literature search, visits to the United States installations and local investigations were accomplished early in the Project. Based upon information obtained, a continuous operation-horizontal displacement type digestor design was selected as most appropriate. The basic model can be constructed in various sizes with gas used for domestic, farm, semi-industrial or industrial applications. ICAITI constructed three prototype units of this type for experimentation with capacities of 15 m^3 (Nueva Concepcion), 3 m^3 and 70 m^3 (Barcenas). These units were tested to determine design parameters with substrates consisting of cattle, hog and chicken manure with vegetable matter added up to 20 per cent of the total mix. A locally-produced native rubber impregnated fabric was used for gas storage bags, and cooking and lighting equipment were developed. This work led to the publication of a technical data sheet, and reports covering general biogas information and test results.

The digestor selected for the principal demonstration program is of conventional construction (block or brick walls, reinforced concrete roof); however, ICAITI developed a low-cost alternative design (soil-cement, chicken wire reinforced roof) which can be used in smaller sizes in appropriate locations.

At the present time, 13 biogas demonstration units of the conventional type have been installed in Central America (3 in Guatemala, 4 in Honduras, 3 in El Salvador, and 3 in Costa Rica). The Honduran units include two 30 m^3 modules constructed near Choluteca for operation of a new dairy/cheese factory. Another demonstration unit is planned for Panama later this year.

The low-cost digestor unit has been demonstrated in Guatemala, and the construction of similar units in El Salvador and Honduras are planned this year.

In all demonstration sites, the use of biogas for cooking and illumination is being demonstrated. The use of biogas in internal combustion engines has been demonstrated in Guatemala and El Salvador.

During the demonstration activity, ICAITI prepared construction manuals covering both the conventional and low-cost digestor designs, and these have been distributed to counterparts and interested individuals. National biogas seminars have been effected in Guatemala, Honduras, El Salvador, and Costa Rica; the first biogas seminar in Panama is scheduled for the latter part of 1984. Dissemination programs for biogas have been initiated in Guatemala (well-advanced) and Honduras (just starting).

To broaden the scope of the biogas dissemination activity, ICAITI has started another applied research program with the assistance of United States consultants. These experiments include a "packed-bed" digestor for use with dilute liquid wastes and; "dry" digestors for use with various types of vegetables substrates. The United States consultants have also effected an

economic evaluation of the biogas digestors being disseminated in Guatemala (with favorable results) and have trained ICAITI personnel in the methodology for future reports.

3. Present Status of Dissemination Activities

Guatemala

After demonstration of the biogas technology in 1982, personnel from the national institutions: INTECAP and DIGESEPE (MAG), were trained in digestor construction, and initiated dissemination programs in 1983. Dissemination was oriented towards small, medium and large cattle/dairy operations, and promoted through a series of short courses given by ICAITI/INTECAP/DIGESEPE in various appropriate geographical areas. DIGESEPE, due to a lack of resources, has only worked on two or three digestor construction projects, but continues to participate in promotional activities. INTECAP, on the other hand, by mid 1984 had supervised the construction of 40 biogas systems throughout the nation. INTECAP also reports some seven digestors constructed by private individuals using ICAITI's construction manuals, without technical assistance. Despite ICAITI's program, they have been unable to respond to the heavy demand for digestors in Guatemala, and have a waiting list of some 30-35 requests. It is notable that all the digestors built in Guatemala have had the materials and labor paid for by the owners. This success is the best indication of "cost-effectiveness

In mid 1983, with ICAITI's assistance, INTECAP entered into an agreement with Peace Corps, Guatemala, and two volunteers were assigned to the biogas project, thereby increasing supervision capability. Unfortunately, INTECAP was not able to sign an agreement with the Peace Corps in 1984. These volunteers, then, have now been assigned to DIGESA (MAG), another institution ready to start biogas dissemination.

The scope of INTECAP's dissemination effort can probably be expected to decline due to the loss of the Peace Corps connection. DIGESA, however,

should take up the slack, and ICAITI has signed an agreement with this latter institution, offering to train the Peace Corps volunteers and DIGESA extensionists.

The 1983-84 biogas dissemination programs have had sufficient impact to enable the Ministry of Energy to organize a National Biogas Group, with ICAITI technical assistance. This committee has only recently been formed, and is not yet fully functional. It can be a very useful tool in coordinating field activities, and most important, serve as a means of obtaining financial support for biogas dissemination. In addition to MOE and ICAITI, the group members include INTECAP, DIGESEPE (MAG), DIGESA (MAG), University of San Carlos, Municipal Government of Guatemala City, the National Office of Professional Engineers (OPINA), CEMAT, the Mennonite Central Committe FUNDACED and a private biogas firm (BIOENERG).

Honduras

After demonstration of the technology in 1983, two dissemination programs have been initiated, one by PTR/CDI and another by the National Resources Division of MAG under a project sponsored by FAO. Both institutions have participated with ICAITI in biogas seminars, and ICAITI has been providing technical assistance to both programs. These institutions, in addition to providing construction supervision to farmers desiring biogas systems, are attempting to reactivate some 20 biogas digestors already existing in Honduras. These were built by OLADE, but have not been operational for some time.

In Honduras, a special project involving the use of biogas (as well as solar energy) for the operation of a small dairy/cheese industry near Choluteca, is underway with PTR/CDI providing direct supervision, and ICAITI, technical assistance. This project has been delayed due to the executing organization's (Asociacion San Jose Obrero) problems in obtaining IDB financing for building construction. These problems have been resolved, and

all construction activities should be completed by the end of the year. This project has the potential to be an important demonstration center with good possibilities for replication in other parts of Central America.

El Salvador

Significant dissemination of the biogas technology has not yet started in El Salvador, despite the fact that ICAITI has given several seminars, and considerable interest was shown during these events by cattle men, farmers, and dairymen. ICAITI has been working with three institutions in the biogas field, CEL, CENTA (MAG), and PRODECA. Of these, CENTA appears to have the best potential of becoming the major disseminating counterpart. One of ICAITI's biogas demonstration units was installed in 1983 at CENTA's experimental center, where it is being operated by CENTA's Experimental Division. This Division is expected to transfer the technology to the CENTA Extension Division by the end of the year, with dissemination starting in 1985.

Costa Rica

Costa Rica was the only country that had a National Biogas Center supervising a very small-scale dissemination program when ICAITI's project was initiated. The units being disseminated were continuous-operating bag digestors fabricated from plastic sheet produced in Costa Rica. ICAITI, therefore, demonstrated the concrete digestors in Costa Rica as an alternative design, and transferred the technology to the experienced national institutions. ICAITI has sponsored two biogas seminars in Costa Rica, and has offered technical assistance to the Biogas Center, once they are ready to increase the scope of their biogas dissemination activity.

Panama

The Project Paper did not include biogas activities in Panama, since this country already had a program in this field at the initiation of the Fuelwood Project. However, several reports later were received indicating that Panama

had encountered problems with the development of this technology. In 1984, therefore, at the request of the Panamanian counterpart, RENARE, and with the approval of ROCAP, ICAITI decided to effect a demonstration in this country. Construction of the demonstration unit was initiated in September, and the digestor should be operational by the end of the year. Both RENARE and IRHE are involved in the project, and will participate with ICAITI in a National Biogas Seminar.

4. Recommended Activities During Project Extension

The following biogas activities should be considered for 1985:

a. Dissemination of conventional biogas digestors (manure substrate)

- Guatemala has the best dissemination program, with a National Committee organized. Since the Committee is just starting to function, ICAITI should provide continued assistance with seminars and training during the first half of 1985. ICAITI should also provide the support necessary for the successful start-up of the new DIGESA/Peace Corps dissemination program.

- In El Salvador, start-up of the CENTA dissemination effort will require technical assistance from ICAITI biogas engineers, dissemination advisor, and local delegate assistants for most of 1985 and the first half of 1986.

- Dissemination of conventional digestors by the Honduran counterparts is under reasonable control, nevertheless, CDI continues to request ICAITI help for occasional trouble-shooting, and some of this assistance will still be needed throughout 1985.

- Although construction work for the Choluteca Dairy Project in Honduras will be completed in 1984, start-up assistance should be provided by ICAITI in the first six months of 1985, and the project be converted into a demonstration and visiting center for combined alternative energy seminars.

- In Costa Rica, assistance to local dissemination programs will only be provided upon request.

- Demonstration of the technology in Panama should be completed by the end of 1984. Nevertheless, considerable effort will be required in 1985 to transfer the technology to counterparts and to initiate a dissemination program.

b. New Developments

- The packed bed prototype digestor is presently under test at the ICAITI Test Center at Barcenas, Guatemala. This device would permit the use of very dilute substrates (industrial wastes, sewage, slaughter houses), and would be useful in increasing the scope of biogas dissemination efforts, presently limited to animal manure substrates. Digestors of this type in the United States use ceramic elements as media for bacteria support. Since these elements are costly, crushed screened stone is being tested in the Barcenas prototype as a low-cost alternative. This innovation must be thoroughly tested before the technology can be disseminated. Good preliminary results should be available by the end of the year, but tests would be more reliable if continued into 1985. If results are satisfactory, the technology should then be transferred to counterparts throughout Central America.

- Experimentation with dry digestors using different types of vegetable substrates (coffee pulp, banana residue, market wastes) was initiated in 1984 with the assistance of United States consultants. Digestors of this type can also be very useful in increasing the scope of dissemination efforts. Experimentation is now at the point where demonstration of a dry digestor using coffee pulp can begin. This is programmed to start by the end of 1984 in Guatemala. Dry digestors using banana wastes should be available by February, 1985, and this technology can be demonstrated very effectively near Puerto Limon, Costa Rica. The availability of dry digestor systems for other substrates can follow as part of a continuous experimentation program throughout the year.

V. NATIONAL COUNTERPARTS AND TECHNOLOGY TRANSFER

The effectiveness of national institutions, Peace Corps and other organizations in advancing project objectives is an important concern. Working relationships with national counterparts did not come easily in the early stages of project implementation. Through a careful and concerted effort during the last four years, ICAITI has developed a growing network of competent entities in each country with whom they can work. Several of the counterparts ICAITI originally cooperated with are no longer active in the project as ICAITI has found more capable and committed institutions.

The following presentation describes, country by country, each technology and the involvement of various counterparts in that particular technology transfer process. At the end of this section there is a list of counterparts with whom ICAITI has signed "convenios" or working agreements over the years to work with those particular technologies. Although many of these convenios are still active, many of them are also reported to be defunct. During the next year ICAITI will be reviewing its experience with each entity and developing a more complete report on the effectiveness of that counterpart, or group of counterparts, in advancing the dissemination and utilization of ICAITI's technologies.

Guatemala

Stoves

During the last half of 1984, ICAITI assisted the Guatemala MOE to organize a National Improved Stove Committee. The committee is composed of all of the institutions, groups, PVOs, and Peace Corps Volunteers, who are involved in the construction and dissemination of Lorena type stoves. Of the nineteen members, the majority have been trained by ICAITI and have some resources and the trained personnel to independently carry on their own programs with some technical assistance from ICAITI. With the exception of the newly developed ceramic stove, ICAITI has transferred the domestic stove technology in Guatemala to national counterparts.

Biogas

The seven institutions and groups who are disseminating the biogas technology in Guatemala have organized into a National Biogas Committee and are ready to continue their own programs. Their time table is approximately six months behind the stove committee. ICAITI has transferred the basic domestic and small farm biogas technology and applications to its counterparts and will now be able to continue with limited assistance to the counterparts in new biogas technologies such as fixed film, and dry matter digestors for small industrial and commercial use.

Solar

A solar committee has also been formed in Guatemala and will eventually be independent. At present, they are concentrating their efforts on the collection of solar insolation information and wind velocity data. The solar committee is composed of technical and academic individuals who are not "hands-on types" and, therefore, could never be in a position to disseminate the low-tech systems required for rural energy development.

The domestic and institutional solar hot water heating technology has been completely transferred to the private sector in Guatemala. Five small Guatemalan firms currently construct collectors, import the control systems, and locally purchase their tanks. They have the trained personnel to design and install solar hot water systems and will only need limited assistance from ICAITI on advanced solar hot water technologies.

The solar salt evaporator black plastic and black tile technologies were tested and disseminated during the last salt season at the Pacific Coast site. The preliminary results appear promising but another season of testing of both technologies is necessary to make the necessary improvements before the technologies are fully tested. The technology has been accepted and used by thirty two producers. No counterpart will be necessary as the technology sells itself through word of mouth within the production groups.

The lumber, grain, fruit and vegetable dryer technology has been introduced during the last year and is having great success, but as of yet, there are no counterparts who have demonstrated an interest in taking charge of the technology transfer. It is anticipated that it will take most of the extension period to develop the necessary hands-on type counterparts to assume the required technology transfer capability for the dissemination of the simpler types of solar driers (i.e. "tent" driers for grains). The more sophisticated drier equipment, for lumber, fruit and fish drying are oriented towards industrial or semi-industrial applications, and a private initiatives dissemination mode may be more appropriate for these latter driers than institutional extension. Commercial solar drying and processing applications in Central America are just beginning and additional time will be required for dissemination of these new applications and evaluation of results.

Ovens and Kilns

The MOE has shown little interest in establishing a committee for this activity nor have they shown an interest in including the dissemination of these technologies in the Stove Committee. Units have been constructed and demonstated in bakery ovens, lime kilns, and brick kilns, and have shown substantial savings in energy and production costs. During calendar year 1985, ICAITI will work with the few existing trade associations and cooperatives in Guatemala in an attempt to develop counterparts and also train masons and small rural construction companies in oven and kiln construction and operation. It is anticipated that these technologies will never become a governmental counterpart endeavour but should develop through small, private sector initiatives and will result in a multitude of individual masons or small companies constructing ovens and kilns on a fee basis. The energy savings and employment generation potential requires that ICAITI concentrate on these commercial applications.

Charcoal Kilns, Gasifiers, etc.

The development and transfer of these technologies is occurring in the other Central American countries and has not been scheduled for Guatemala until late 1985 or early 1986.

Honduras

Honduras is the only country where ICAITI has a counterpart that has the financial resources and the trained personnel capable of transferring and disseminating all of the technologies developed by ICAITI as soon as the technologies or technology applications hit the market.

The counterpart, fully funded by the AID/Honduras, is the Centro de Desarrollo Industrial (CDI). CDI is a semi-autonomous governmental

institution chartered by the Honduran government to assist the small business and rural communities in their economic development through CDI directly, or through CDI's rural development group, Programa de Tecnologia Rural (PTR).

Since the inception of the Fuelwood Project, ICAITI and PTR have been jointly working in Honduras. ICAITI provides the technical assistance and product development, and PTR does the extension and dissemination. Jointly, they have developed training seminars and workshops specifically tailored for the Honduran environment. Excellent examples of this relationship have been the development and dissemination of a lorena stove specially designed for cooking cassava in the north coast of Honduras, and the institutional lorena stove designed to prepare large quantities of food in the Honduran refugee camps.

No additional assistance by ICAITI in Honduras would be necessary to continue the PTR rural domestic extension work but ICAITI's assistance in the development of new technologies and applications, during the life of the Fuelwood Project is necessary for fuel savings, employment generation and small private sector development.

Also, PTR/CDI so far has not had experience in setting up private initiative dissemination modes, which appear to be best suited for some technologies. ICAITI assistance in this field will be required.

El Salvador

Stoves

ICAITI has trained personnel from seven institutions in stove construction, and six of these presently have active stove dissemination projects. Save the Children foundation conducts additional training courses financed by ICAITI. A meeting of the six institutions has been programmed for the week of December 3-7, at which time a formal National Improved Stove Committee will be formed. By early 1985 ICAITI will then have transferred the

stove technology to counterparts in El Salvador but will continue to assist the newly-formed Committee in the development of dissemination programs and new stove technologies.

Biogas

None of the three national institutions involved in the demonstration phase of the project have yet initiated effective dissemination programs. The best possibility appears to be CENTA, a division of MAG, Ministry of Agriculture, which has been testing the ICAITI digestor at its Experimental Center. In 1985, ICAITI will have to train personnel from CENTA's extension division, and assist them in organizing a dissemination program.

Solar

Multi-purpose solar driers are just being introduced in El Salvador. Once again, CENTA is the principal counterpart for the drying of agricultural products and is presently testing the ICAITI demonstration drier prior to initiating dissemination. The "Banco Nacional de Fomento Agropecuario" is collaborating with ICAITI in testing a fish drier; this technology will be transferred directly to 10 private fishing cooperatives on the Pacific Coast.

Ovens and Kilns

Although several institutions in El Salvador are constructing ICAITI designed brick kilns for their own use (Tourism Institute, Ministry of Public Works), no national institution has shown interest in dissemination of oven technologies.

With the assistance of the private Baker's Cooperative (COMAPAN), direct dissemination of the bakery oven technology has been initiated very successfully, with over 10 ovens to date.

Costa Rica

Stoves

ICAITI has trained personnel from three national institutions, and has given two stove workshops to Peace Corps Volunteers. The Peace Corps is conducting a good stove dissemination program, but the national institutions appear to have more interest in the more sophisticated technologies, and have started only small-scale stove dissemination efforts. The possibility of replicating Guatemala's National Committee dissemination mode in Costa Rica will be explored.

Biogas

Costa Rica already had a "Biogas Center" organized at the initiation of ICAITI's Fuelwood Project. ICAITI has demonstrated its digestor design in Costa Rica and has transferred the technology to the appropriate national institutions.

Solar Energy

Solar hot water systems have been demonstrated in Costa Rica, and the technology for the construction of flat-plate collectors transferred to private industry and vocational schools.

Solar driers, a relatively new technology, is being introduced very effectively along the Atlantic Coast with the collaboration of the National Port Authority (JAPDEVA). JAPDEVA has the potential to be very useful for promotion, financing and marketing activities, but its lack of technical expertise will mean a heavy input required for ICAITI engineers.

Ovens and Kilns

To date, only the bakery oven technology has been demonstrated in Costa Rica. Spontaneous dissemination by private enterprise has started. No national institutions are involved. Once again, considerable ICAITI time is required for follow-up activities.

Panama

Stoves

No effective stove dissemination program has been developed in Panama to date. Training of a new counterpart is in process, and AID Panama may become involved.

Other Technologies

Biogas digestors, bakery ovens and panela cookers are just now being introduced into Panama. RENARE is involved in all projects, and IRHE in biogas. AID/Panama also wishes to demonstrate the bakery oven and panela cooker.

NATIONAL COUNTERPARTS

SOLAR

En Guatemala

1. CII, Centro de Investigaciones de Ingenieria
   Ciudad Universitaria, Zona 12
   Ciudad de Guatemala

2. INDE, Instituto Nacional de Electrificacion
   6a. Avenida 2-73, Zona 4

3. INSIVUMEH, Instituto de Sismologia, Vulcanologia, Metereologia e Hidrologia
   7a. Avenida 14-57, Zona 13

4. MEM, Ministerio de Energia y Minas
   Diagonal 17, 29-78, Zona 11

5. CUNOR, Centro Universitario del Norte
   Coban, Guatemala

6. CUNSUR, Centro Universitario del Sur
   Escuintla, Guatemala

7. INTECAP, Instituto Tecnico de Capacitacion y Productividad
   Calle Mateo Flores, 7-51, Zona 5
   Ciudad de Guatemala

8. ICTA, Instituto de Ciencia y Tecnologia Agricola

9. Cooperativa de Pescadores de Tahuesco

10. Asociacion de Salineras de Guatemala

11. CUNORI, Centro Universitario de Nororiente

12. CONSURORI, Centro Universitario de Suroriente

13. COPRINSA, Compania Procesadora de Madera

14. DIGESA, Direccion General de Productos Agricolas

15. SOS, Aldeas Infantiles S.O.S.

16. IGSS, Instituto Guatemalteco de Seguridad Social

En El Salvador

1. ASI, Asociacion Salvadorena de Industriales

2. CEL, Comision Ejecutiva Hidrolectrica del Rio Lempa

3. CENTA, Centro Nacional de Tecnologia Agricola

4. BFA, Banco de Fomento Agropecuario

5. U.P., Universidad Politecnica

6. COOPT, Cooperativa de Pescadores del Lago de Ilopango

En Honduras

1. PIR, Programa de Tecnologia Rural

2. CDI, Centro de Desarrollo Industrial

3. ASJO, Asociacion San Jose Obrero

4. INFOP, Instituto de Fomento Profesional

5. CAAVA, Centro de Adiestramiento Artesanal del Valle de Angeles

6. Asociacion de Salineras de San Lorenzo

En Costa Rica

1. CTICB, Colegio Tecnico Industrial Calle Blancos Goicochea, San Jose, Costa Rica

2. Union Costarricense de Camaras y Asociaciones de la Empresa Privada

3. UNA, Universidad Nacional Autonoma de Costa Rica

4. JAPDEVA, Junta de Administracion Portuaria y Desarrollo de la Vertiente Atlantica

5. INCAE, Instituto Centroamericano de Administracion de Empresas

6. CCSS, Caja Costarricense del Seguro Social

7. CIGRAS, Centro de Investigacion de Granos y Semillas

8. CITA, Centro de Investigacion de Tecnologia de Alimentos

9. PEACE CORPS, Cuerpo de Paz

10. Camara de Industrias de Costa Rica

BIOGAS

En Guatemala

1. ITA, Instituto Tecnico de Agricultura
   Barcenas, Villa Nueva

2. INTECAP, Instituto Tecnico de Capacitacion y Productividad
   Calle Mateo Flores 7-51, Zona 5

3. DIGESEPE, Direccion General de Servicios Pecuarios
   Edificio Galerias Reforma, Guatemala Ciudad

4. ICTA, Instituto de Ciencia y Tecnologia Agricolas

5. CARE, Comision Americana de Recursos al Exterior

6. INAFOR, Instituto Nacional Forestal

7. DIGESA, Direccion General de Servicios Agricolas

8. PEACE CORPS, Cuerpo de Paz

9. MEM, Ministerio de Energia y Minas

En El Salvador

1. PRODECA, Proyecto de Desarrollo de Cabanas

2. CEL, Comision Ejecutiva Hidroelectrica del Rio Lempa

3. ENA, Escuela Nacional de Agricultura

4. CENTA, Centro de Tecnologia Agricola

5. ISTA, Instituto Salvadoreno de Transformacion Agraria

En Honduras

1. CIMEQH, Colegio de Ingenieros Mecanicos, Electricos y Quimicos de Honduras

2. CDI, centro de Desarrollo Industrial

3. PTR, Programa de Tecnologia Rural

4. MNR, Ministerios de Recursos Naturales

5. FAO, Organizacion de las Naciones Unidas para la Alimentacion y la Agricultura

En Costa Rica

1. Camara de Industrias de Costa Rica

2. MIEM, Ministerio de Industria, Energia y Minas

3. CNB, Centro Nacional de Biogas

4. ITRC, Instituto Tecnologico de Costa Rica

En Panama

1. IRHE, Instituto de Recursos Hidroelectricos

COMBUSTION

En Guatemala

1. MEM, Ministerio de Energiay Minas
   Diagonal 17, 29-78, Zona 11

2. INTECAP, Instituto Tecnico de Capacitacion y Productividad
   Calle Mateo Flores 7-51, Zona 5

3. CII, Centro de Investigaciones de Ingenieria
   Facultad de Ingeniera, Ciudad Universitaria, Zona 12
   Ciudad de Guatemala

4. Vision Mundial
   7a. Avenida 7-73, Zona 9

5. CEMAT, Centro de Estudios Mesoamericanos sobre Tecnologia Apropiada
   18 CAlle 22-52, Zona 12

6. DIGESA, Direccion General de Servicios Agricolas
   12 Avenida 19-01, Zona 1

7. CUERPO DE PAZ
   6a. Avenida 1-46, Zona 2

8. CCM, Comite Central Menonita
   Apartado Postal 1779

9. ICADA-CHOQUI, Investigaciones Asociados del Altiplan
   Apartado Postal 159, Quetzaltenango

10. REDH-I, Fundacion Redh Integral
    12 Calle 12-42, Zona 1

11. CETA, Centro de Estudios de Tecnologia Apropiada
    Facultad de Ingenieria, USCA
    Ciudad Universitaria, Zona 12

12. COGAAT, Cooperacion Guatemalteca-Alemana de Alimentos por Trabajo Apartado Postal 2943, Salama, Guatemala

En El Salvador

1. DIDECO, Direccion de Desarrollo de la Comunidad

2. PRODECA, Proyecto de Desarrollo de Cabanas

3. ISTA, Instituto Salvadoreno de Transformacion Agraria

4. CENTA, Centro de Tecnologia Agricola

5. DJC, Desarrollo Juvenil Comunitario

6. FAO, Fondo de las Naciones Unidas para la Alimentacion (Cuenca del Tamalusco)

En Honduras

1. CDI, Centro de Desarrollo Industrial

2. PTR, Programa de Tecnologia Rural

3. Asociacion San Jose Obrero

4. DIFOCOOP, Direccion de Fomento Cooperativo

En Costa Rica

1. 4H Clubs

2. Cuerpo de Paz

3. Caravanas de Buena Voluntad

4. Ministerio de Agricultura

5. MEP, Ministerio de Educacion Publica

6. CATIE, Centro Agronomico Tropical de Investigacion y Ensenanza

7. ICE, Instituto Costarricense de Electricidad

8. UCR, Universidad de Costa Rica

En Panama

1. RENARE, Recursos Naturales Renovables

2. DIGEDECOM, Direccion General de Desarrollo de la Comunidad

3. MIDA, Ministerio de Desarrollo Agropecuario

VI. PUBLICATIONS AND DISSEMINATION ACTIVITIES

1. Publications

During the last two years ICAITI has begun to aggressively develop informative pamphlets, technical reports and construction manuals on the technologies being developed in the Alternative Energy and Fuelwood Project. These publications initially dealt mostly with domestic stoves and increasingly include biogas, ovens and kilns and solar technologies. The most recent innovations in commercial applications of the combustion, solar and biogas technologies have yet to be analyzed and published.

The great majority of these publications have been distributed directly by ICAITI headquarters in Guatemala. More recently a growing number of certain documents are being solicited directly from the offices of the ICAITI delegates in each of the countries.

The attached pages illustrate the total number of various publications that have been printed and give an idea of the extent of their distribution.

An increased effort in report writing, technical editing, and publication is needed. During the extension, ICAITI will hire additional writers to work with the technical groups to assist in preparation of a broad range of useful documentation. Through ICAITI's experience much has been learned about a variety of adaptations to the technologies they have developed. Much of this information has not been yet available and would be useful not only to projects in the region, but also to renewable energy projects throughout the world. In addition, ideas for two new reports that would briefly summarize much of ICAITI's experience to date are presented in Section VII.4. of this report and a dissemination data base should be established and systems, put into effect to better monitor and tabulate all dissemination activities.

2. Workshops, Seminars, Demonstrations and Training

In order to convey a sense of the number and range of training and demonstration activities the ICAITI Fuelwood Project team has realized, the

EDITED PUBLICATIONS AND THEIR DESTINATION

CLAVE	CENTRAL AMERICAN DELEGATES						OTHER OFFICES AND INDIVIDUALS	TOTAL DELIVERED	TOTAL EDITED	ACTUAL BALANCE
	GUATEMALA	EL SALVADOR	HONDURAS	NICARAGUA	COSTA RICA	PANAMA				
D 104	734	43	230	-	51	1	52	1111	1500	389
D 101	821	81	83	6	47	12	--	1050	1500	450
D 102	810	63	127	5	61	1	16	1083	1500	417
D 105	108	42	-	-	16	-		166	500	334
D 202	244	33	50	-	--	-	--	327	775	484
D 209 a	1027	64	220	25	80	-	--	1416	1500	84
D 209 d	1440	441	140	27	179	68	100	2395	3000	605
D 210	338	35	70	20	21	--	--	484	750	266
D 305	651	25	110	--	45	--	26	857	1350	493
D 201	232	70	20	22	20	--	51	415	1000	585
D LFAE	200	25	50	--	--	--	2	277	300	23
D 206	223	225	--	2	188	10	109	757	1500	743
D 701	97	--	--	--	76	5	--	178	500	322
	6925	1147	1100	107	784	97	356			

		TOTAL DELIVERED	TOTAL EDITED	ACTUAL BALANCE
Descriptive pampnlets	D 306	4 700	6 000	1 300
"	D 204	3 700	5 000	1 300
"	D 205	5 000	6 000	1 000
"	D 103	4 100	5 000	900
"	D 207	4 950	6 000	1 050
"	D B84	3 800	5 000	1 200
Technical DAta Sheet	D H100	2 928	5 000	2 072

R Marny

05 de Octubre de 1984

EDITED PUBLICATIONS

CODE	NAME
D 306	Descriptive Pamphlet, "Solar Energy Uses"
D 204	Descriptive Pamphlet, "Economic Oven for Brick Kilns"
D 205	Descriptive Pamphlet, "Economic Oven for Bakery"
D 103	Descriptive Pamphlet, "Biogas" (83)
D 207	Descriptive Pamphlet, "Fuelwood Stoves"
D B84	Descriptive Pamphlet, "Biogas" (84)
D 104	Biogas Manual: General Information
D 101	Manual on Construction and Operation of an Economic Biogas Plant
D 102	Manual on Construction and Operation of a Biogas Plant
D 202	Manual on the Study on Introduction and Adoption of Efficient Fuelwood Stoves in Five Guatemalan Communities
D 305	Manual on Solar Energy Applications
D 201	Manual on Domestic Stoves: Energy Efficiency Tests
D LFAE	Manual on Fuelwood and Alternative Energy Sources - Study on Laws and Policies in Central America
D 206	Manual on Construction and Operation: . Bakery Oven
D 210	Manual for Collective Stoves - Construction and Operation
D 209 a	Manual on Chulah Stove - Construction and Operation
D 209 d	Manual on Lorena Stove - Construction and Operation
D 105	Manual on Technical Biogas Report
D 701	Manual for Vegetal Coal Oven - Construction and Operation

DISSEMINATION ACTIVITIES ON OVENS & KILNS

ACTIVITY	COUNTRY				
	Guatemala	El Salvador	Costa Rica	Honduras	Panama
Workshop-Seminar	-	-	-	1	-
Short Course**	9	1	1	-	2
Trained Persons	303	25	20	15	40
Institutions Trained	6	1	1	2	3
Demonstration Units					
Lime Kiln	1	-	-	-	-
Bread Oven	3	9	3	1	1
Panela Cooker	-	-	-	-	1
Charcoal Kiln	-	-	4	-	-
Brick and Ceramic Kilns	1	2	-	1	-
Salt Cookers	2	-	-	1	-

**Includes conferences and radio programs

DISSEMINATION ACTIVITIES ON IMPROVED STOVES

ACTIVITY	COUNTRY				
	Guatemala	El Salvador	Costa Rica	Honduras	Panama
Workshop-Seminar	6	1	2	-	1
Short Course	20	4	3	1	2
Trained Persons	250	65	37	20	28
Institutions Trained	10	5	4	1	3
Demonstration Units*	93**	65	77	[illegible]	71

*Does take into account all units functioning; nor 30 units in Nicaragua

** initial 75, including workshop units in ICAITI, Health Centers and Ceramic Stoves

NOTE: 275 stoves have been built in Guatemala.

DISSEMINATION ACTIVITIES ON SOLAR PROTOTYPES

ACTIVITY	COUNTRY				
	Guatemala	El Salvador	Costa Rica	Honduras	Panama
Seminar	7	1	1	1	-
Short Courses	11	1	1	1	-
Workshop-Seminar	3	-	6	3	-
Trained Persons	1092	115	221	132	-
Institutions Trained	8	2	2	3	-
Demonstration Units					
Water Heaters	36	10	24	15	-
Grain Dryers	4	-	7	-	-
Fish Dryers	2	1	-	-	-
Fuelwood Dryers	7	-	-	-	-
Wood Dryers	1	-	-	-	-
Shrimp Dryers	1	-	-	-	-
Fruit Dryers	-	1	8	7	-

DISSEMINATION ACTIVITIES ON BIODIGESTORS

ACTIVITY	COUNTRY				
	Guatemala	El Salvador	Costa Rica	Honduras	Panama
Seminars	1	1	1	1	-
Short Course	14	2	-	6	1
Trained Persons	450	114	63	100	6
Trained Institutions	6	4	3	2	1
Demonstration Units	42*	3	2	6	1
Beneficiaries	36	2	2	4	1

*8 funded by ICAITI, 34 funded by INTECAP/User Agreement

FUELWOOD AND ALTERNATIVE ENERGY SOURCES PROJECT

OTHER DISSEMINATION AND PROMOTION ACTIVITIES (PROJ. 1680)

CARRIED OUT BY THE TEAM - GUATEMALA

ACTIVITY	GUATEMALA
A. Promotional Conferences	
Combustion Sub-Project	22
Solar Energy Sub-Project	9
Biogas Sub-Project	9
B. Demonstration Visits to International Agencies	
Combustion Sub-Project	16
Solar Energy Sub-Project	9
Biogas Sub-Project	13
C. Demonstration Visits to National Agencies	
Combustion Sub-Project	20
Solar Energy Sub-Project	8
Biogas Sub-Project	10
D. Exhibits*	
Combustion Sub-Project	3
Solar Energy Sub-Project	3
Biogas Sub-Project	15
E. Seminars	1

*At Scientific fairs, national fairs, and seminars and meetings.

accompanying tables are attached. The frequency and organization of these dissemination activities has improved considerably since the hiring of a dissemination coordinator approximately one year ago.

The dissemination coordinator, who now has a qualified, full-time assistant, has been responsible for extensive promotional and preparatory work related to workshops, seminars, demonstrations and training. This team, over the last year, has focussed much of its attention on wood stove work. They are an integral part of the national cookstove committee in Guatemala and are encouraging the development of similar coordinating groups in El Salvador and Costa Rica. They have been responsible for the publication of numerous unique training manuals oriented towards the campesinos, who are often illiterate.

In the future, dissemination programs will focus increasingly on applications of the technologies to more commercial and potentially productive and profitable uses.

VII. ACTIVITY PLAN AND BUDGET FOR EXTENSION THROUGH JUNE 30, 1986

1. General Activity Plan

During the period of this review of project status, ICAITI was requested to prepare an implementation plan and budget for the continuation of the project through their annual planning cycle for calendar year 1985. The budget is presented in Section VII.2. ICAITI has done an excellent job in preparing an overview of the primary activities for 1985. The program during the first 6 months of 1986 will be the logical extension of those activities described in the following pages which are presented intact as prepared by the ICAITI Fuelwood Project Manager. It is also useful to refer to Section IV of this report where the progression of events and indications for activities during the project extension are also discussed.

The following activity plan does not specify or quantify many of the actions to be implemented during the project extension. During the preparation of the PP Amendment the ROCAP Energy Advisor will be working with ICAITI Project Management to determine the number and quantify the types of interventions that will be completed (e.g. demonstration, seminars, workshops, technologies replicated, transfer to counterparts, etc.).

1985 IMPLEMENTATION PLAN

January 1 - December 31, 1985

A. PRESENT PROJECT STATUS

By the end of 1984, project paper goals relating to experimentation, design and demonstration activities will be completed. Dissemination of proven technologies will be underway, effected by personnel from National Institutions, PVOs, Cooperatives and private enterprises trained through ICAITI seminars, workshops and field technical assistance.

The specific technologies that have been worked on during the five-year project, including modifications and additions to the project paper designated activities which were required to better respond to counterpart needs, are the following:

Specific Technology	eneral Classification
1. Conventional Fuelwood Stoves (Domestic and institutional)	ombustion
2. Ceramic Stoves	Combustion
3. Sawdust Burning Stoves	Combustion
4. Bakery Ovens	Combustion
5. Brick Kilns	Combustion
6. Lime Kilns	Combustion
7. Salt Cookers	Combustion
8. Panela Cookers	Combustion
9. Charcoal Kilns	Combustion
10. Gasifiers	Combustion
11. Conventional Continuous Biogas Digestors	Biogas
12. Low-cost Biogas Digestors	Biogas
13. Packed Bed Digestors	Biogas
14. Dry Digestors (Batch)	Biogas

Specific Technology	General Classification
15. Solar Hot Water Systems (domestic and institutional)	Solar Energy
16. Solar Fuelwood Driers	Solar Energy
17. Multi-purpose Driers for Food Products	Solar Energy (1)
18. Lumber Driers	Solar Energy (1)
19. Solar Salt Producers	Solar Energy

Of the above technologies, the following three have been dropped from the program:

- Solar fuelwood driers - technically promising, but little or no market for this technology in Central America.
- Sawdust-burning stoves - not considered appropriate for the types of foods presently cooked in Central America.
- Gasifiers - present level of technology may be too complex for rural Central America.

Of the remaining 16 technologies, 10 are currently in the dissemination phase. The following six are relatively new, but are expected to be ready for dissemination in 1985:

- Ceramic stoves
- Lime kiln
- Panela cooker
- Packed bed biogas digestor
- Dry biogas digestor
- Solar lumber drier

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(1) Includes combination of solar energy with combustion or biogas technologies.

B. 1985 ACTIVITIES

Regional dissemination of the technologies listed above will be the principal activity of the Fuelwood Project personnel. Due to the large number of technologies and the widely dispersed geographical areas of application, ICAITI and ROCAP have established a priority system for the technology/country activities, so that ICAITI can concentrate in the most promising areas in 1985.

Conventional domestic stoves represent the simplest technology, and multi-institutional dissemination modes are in effect in most of the Central American countries. It is expected that ICAITI can gradually disengage itself from this activity, with counterpart extension personnel taking over the responsibility for local dissemination. Project personnel can then give greater emphasis to completing development of the ceramic stove, and to the dissemination of the other technologies which are oriented towards private industry, a sector which requires a different dissemination approach to that used for domestic stoves.

Experimentation and design work will continue, principally in response to needs identified in the field for new or modified applications of the basic demonstrated activities. This will include biogas innovations (packed-bed digestor, dry digestors, new substrates), solar driers for diverse agro-industrial activities, and biomass combustion systems for industries.

The specific activities planned by technology are as follows:

1. Combustion Engineering

- Conventional Fuelwood Stoves

Dissemination programs in effect at the end of 1984 include multi-institutional efforts in Guatemala, El Salvador and Honduras, and some dissemination in Costa Rica by the Peace Corps and local organizations (Guanacaste) collaborating with CATIE.

Guatemala has the best program of this type with field activities, evaluations and information feed-back gradually being coordinated by a National Stove Committee organized by MOE with ICAITI assistance.

A Peace Corps program in Guatemala, where private individuals are being trained in stove construction as a commercial business, and village cooperatives set-up to provide financing for their services, is also being supervised by ICAITI.

In 1985 the following conventional stove activities are planned:

a. Combustion engineers will continue to provide technical assistance to the National Stove Committee and the Peace Corps as requested. This activity will gradually decline during the year.

b. The Dissemination Coordinator and assistants will work with ICAITI's Delegates in attempting to replicate Guatemala's National Committee dissemination mode in the other countries. Combustion engineers will provide technical assistance to newly formed committees as required.

c. Assuming succesful 1984 results, the commercial dissemination mode being evaluated by Peace Corps Guatemala will be transferred to the Peace Corps in Costa Rica and Honduras, and offered to National Committees by dissemination personnel.

- Ceramic Stoves

By the end of 1984, the ceramic stove plans and manuals should be completed, and counterpart dissemination initiated in Guatemala.

In 1985, the technology will be introduced in the other countries, with emphasis given to low-cost housing projects. Ceramics industry and counterpart personnel will be trained. This activity will be carried out by Combustion engineers, with heavy input from the Delegate Assistants in each country.

- Bakery Ovens

After demonstration, small scale dissemination of bakery ovens has started in Guatemala, El Salvador, Honduras and Costa Rica, principally effected by private individuals constructing ovens in accordance with plans and manuals provided by ICAITI. The best program is in El Salvador where the Baker's Cooperative (COMAPAN) is collaborating. Demonstration of the oven in Panamá is just starting.

In 1985, the scope of the dissemination program in each country will be increased through more short courses given by combustion engineers in different geographical zones. More training of construction supervisors (masons) is needed in all countries. Considerable effort will be required by the Delegate Assistants to follow-up and evaluate field activities.

- Brick Kilns

Brick kilns have been demonstrated in Guatemala, El Salvador and Honduras. Public institutions in Honduras (Army Engineers) and El Salvador (Tourism, Public Works) have accepted the design and are constructing units for their own use. Private sector interest appears highest in El Salvador, where the kiln is being used to produce export-quality tile in addition to bricks.

In 1985, combustion engineers will concentrate on kiln dissemination in El Salvador, possibly in collaboration with the Banco Nacional de Fomento Agropecuario. Activities in other countries will be limited to providing construction manuals and technical assistance upon request.

- Lime Kilns

Testing and demonstration of the new lime kiln technology should be completed in Guatemala by the end of 1984.

Assuming satisfactory results in Guatemala, combustion engineers, at the request of PTR/CDI, will demonstrate this technology in Honduras in 1985. Preparation of plans and construction manuals will be required.

- Salt Cooker

At the request of PTR/CDI, a salt cooker was designed and satisfactorily demonstrated in Honduras. This technology is not appropriate in Guatemala where little "cooked" salt industry exists, and may not be needed in the other countries.

Due to the interest of the Honduran Government, PTR/CDI has recently established a high priority for this activity, and ICAITI technical input will be required.

- Panela Cooker

The panela cooker is presently under test in Panamá, the only country where this technology appears to be urgently needed.

Assuming successful testing, combustion engineers will assist local counterparts in setting up a dissemination program in early 1985.

- Charcoal Kiln

By the end of 1984, two conventional (stationary) kilns will have been demonstrated in different geographical zones in Costa Rica (Guanacaste and "Zona Central"). Dissemination of this technology on the Atlantic Coast of Costa Rica has been initiated. Design of a portable metal kiln is in process.

In 1985, charcoal engineers will continue to provide technical assistance to the Costa Rica dissemination program. The engineers will also demonstrate this technology in Honduras, and will assist PTR/CDI in organizing a dissemination program.

2. Biogas

Continuous-operating biogas digestors using animal manure substrates have been demonstrated in Guatemala, El Salvador, Honduras, and Costa Rica, and will be demonstrated in Panamá by the end of 1984. Gas applications include cookstoves, ovens, heaters, lamps and internal combustion engines. Dry digestors using vegetable substrates are under test and should soon be available for dissemination.

The packed-bed digestor (high productivity) is also being tested in Guatemala. Dissemination of the conventional digestors is underway in Guatemala and Honduras. A National Biogas Committee has been formed in Guatemala.

The biogas activities planned for 1985 are the following:

a. Biogas engineers will continue to provide assistance to on-going dissemination programs in Guatemala and Honduras.

b. Dissemination personnel and biogas engineers will attempt to organize National Biogas Committees in Honduras and El Salvador based upon the Guatemalan experience.

c. In early 1985, testing of various vegetable substrates in dry digestors will continue as well as "packed-bed" experimentation. These technologies will be transferred to counterparts through short courses in order to broaden the scope of the dissemination efforts.

d. As a "case study" project, a dry digestor using banana residue as raw material will be demonstrated on the Atlantic Coast of Costa Rica.

e. After demonstration of the first biogas digestor in Panamá, efforts will be made to initiate a dissemination program.

f. Biogas engineers will work with the Solar Team in the development of combined biogas/solar drying equipment. The key project for applications of this technology will be fish-drying in El Salvador in collaboration with the Banco Nacional de Fomento Agropeocuario.

3. Solar Energy

- Solar Hot Water

Institutional solar hot water systems have been demonstrated in Guatemala, Honduras, El Salvador and Costa Rica. Collector technology has been transferred through seminar/workshops to personnel from private industry and vocational schools in all four countries.

Requests for technical assistance in the design of institutional systems have been received from IGGS, Guatemala, and a private hotel on Roatán Island, Honduras.

The only activities planned for 1985 are continued technical assistance talks by Solar Engineers in response to requests by public and private institutions.

- Multi-purpose Solar Driers

Solar driers for various types of food products have been demonstrated in Guatemala, El Salvador, Honduras and Costa Rica. Dissemination programs now starting include solar grain and fish driers in Guatemala; solar grain driers in Honduras; solar fish and fruit driers in El Salvador; and solar driers for cacao, copra and other products in Costa Rica.

In 1985, Solar Engineers will continue to provide technical assistance to counterparts in all four countries. Maximum effort, however, will be given to the following key projects:

a. Atlantic Coast, Costa Rica - cacao, copra, shrimp, fish, rice.
   Counterpart: JAPDEVA.

b. Pacific Coast, El Salvador - fish, fruits.
   Counterparts: CENTA and Banco Nacional de Fomento Agropecuario.

c. Pacific Coast, Guatemala - fish.
   Counterparts: Peace Corps and private cooperative.

- Solar Lumber Drier

The first solar lumber drier is now being demonstrated in Guatemala, with excellent results. Dissemination of this technology to Guatemalan wood-working industries will start in 1985.

In 1985, solar and combustion engineers will demonstrate this technology in Honduras in collaboration with PTR/CDI, and will initiate dissemination in the other countries through short courses. Technical assistance will be provided upon request in El Salvador and Costa Rica.

- Solar Salt

The black plastic technology has been demonstrated on the Pacific Coasts of Guatemala and Honduras. Black pigmented tile "patios" are under test in Guatemala. Massive dissemination of the black plastic technology has been effected in the Sipacate area of Guatemala, and some dissemination has been initiated near San Lorenzo, Honduras.

In the early part of 1985, solar engineers will continue to provide technical assistance to PTR/CDI in Honduras, and, with the collaboration of Peace Corps Volunteers, will introduce the black plastic technology in areas other than Sipacate along the Guatemalan coast. If the black pigmented tile experiments prove successful, this technology will be promoted through short courses in both countries.

C. PERSONNEL

The project personnel required to carry out the 1985 activities are listed in the attached budget. The project will continue to be coordinated by Ing. Justin H. Whipple; key administration personnel will be Lic. Manuel Recinos, Operations Manager; Lic. Sandra Smith, Dissemination Advisor, and Ing. Hugo Masaya, Technical Writer. The Line Teams will remain essentially the same, except that Ing. Carlos Vargas, Combustion Assistant, will be gradually shifted to the Dissemination Team, as stove activities are reduced.

Hiring of a second dissemination assistant is contemplated to allow the present assistant, Ing. Iván Azurdia, to dedicate an almost fulltime effort to report writing. Due to the expanded activities in the solar drier technology, a new dissemination/solar assistant will be hired to facilitate field dissemination. A new assistant is also included for ICAITI's Delegate in Honduras due to the increased workload in that country.

D. CONSULTING SERVICES

Continued United States consulting services will be required, especially for biogas (new technologies and combined solar-biogas devices) and for the large number of variable solar drier applications. Consultants will also assist in training counterparts and in preparing evaluation reports for their respective technologies.

E. PUBLICATIONS

Construction manuals, plans and promotional brochures needed for dissemination purposes are complete for conventional stoves, bakery ovens, brick kilns, charcoal kilns, continuous-operating biogas digestors, multi-purpose solar driers and solar hot water systems. The ceramic stove material should also be completed by the end of 1984.

In 1985, Line Team personnel will have to complete the dissemination material for the newer technologies: lime kiln, salt cooker, panela cooker, packed-bed biogas digestor, dry digestors, and the solar lumber drier.

Final reports for the entire project will be completed by the end of 1984. These will be up-dated in the last months of 1985. The reports include economic evaluation data developed by United States consultants.

Case study reports will be published in 1985 covering the more important specific project accomplishments. These will be written by the project dissemination personnel with assistance from the Line Teams.

ICAITI with ROCAP assistance will prepare short reports in English, covering each sub-technology and each dissemination counterpart.

Line Team personnel will also complete routine technical reports presently in process.

A trial project Newsletter covering aspects of social impact will be published in 1984. If counterpart reaction proves worthwhile, this will be continued in 1985.

F. SEMINARS AND TRAINING

In 1985, the seminar, short course and workshop programs developed in past years, will be continued as required to support counterpart dissemination activities and to transfer the newer technologies.

General seminars covering all aspects of the biogas and solar energy technologies have been given in all participating countries, principally for the purpose of developing counterpart interest, and repetition of these events in 1985 is not considered necessary. Greater emphasis will be given to short courses and practical seminar-workshops, most of which will be effected directly in appropriate application areas outside of the capital cities. Approximately 40 events of this type will be carried out in 1985, with highest priority given to the solar drier, biogas and industrial oven technologies.

G. NEW APPLICATIONS AND DISSEMINATION SUPPORT

Funds included in the budget in these categories will cover the following activities in 1985:

- Experimentation with modified biogas systems (packed-bed and dry digestors).

- Development of combined solar/biogas driers, combined solar/combustion driers and biomass combustion systems for diverse industrial applications.

- Demonstration and transfer of latest developments to counterparts. These include ceramic stoves in all countries, lime kilns and charcoal kilns in Honduras, solar lumber driers in Honduras and Costa Rica, and modified biogas systems in Guatemala, El Salvador and Costa Rica.

- Limited financial support for the start-up of counterpart dissemination programs for all demonstrated technologies.

2. Tentative Budget

ICAITI has prepared the following tentative budget for the operation of the Fuelwood Project during the year of 1985. The budget reflects the strong effort that the project team will be making during the coming year to provide technical assistance and continue the promotion and dissemination of the successfull demonstrations.

SUMMARY OF PRINCIPAL BUDGETARY ITEMS

1985 IMPLEMENTATION PLAN

January 1 through December 31, 1985

Item		Amount
1.	Long term personnel	293 550
2.	Short term personne	195 000
3.	Travel and per diem	114 000
4.	Publications and promotion	69 000
5.	Seminars and training	46 400
6.	New applications experimentation/demonstration	64 500
7.	Dissemination support	131 500
8.	Other costs	20 000
9.	Overhead (80% of long term personnel)	234 840
10.	Contingency (6.1%)	71 210
	Total	1 240 000

DETAILED PROJECT BUDGET

January 1, 1985 - December 31, 1985

	P/M	Amount
1. Long Term Personnel		
A. Professional		
Operations Manager (Lic. Manuel Recinos	12	19 840
Dissemination Advisor (Lic. Sandra Smith)	12	14 670
Project Report Writer (new hire)	12	14 400
Technical Editor (Ing. Hugo Masaya)	12	18 620
Combustion Engineer (Ing. Miguel Zetina)	12	15 980
Combustion Engineer (Ing. M. Augusto Recinos)	12	15 800
Solar Engineer (Ing. Oscar Maldonado)	12	17 030
Solar Engineer (Ing. Otto de León)	12	11 770
Biogas Engineer (Ing. José Silva)	12	17 030
Biogas Engineer (Ing. Víctor Burgos)	12	11 300
Charcoal/Gasifier Engineer (Ing. Oscar Gil)	5	11 950
Total Professional	125	168 390
B. Non-Professional		
Dissemination Assistant (Ing. Iván Azurdia)	12	8 110
Dissemination Assistant (new hire)	12	7 200
Dissemination/Combustion Assistant (Ing. Carlos Vargas)	12	9 500
Dissemination/Solar Assistant (new hire)	12	8 400
Administration Assistant (Sr. Joel Gamarro)	12	8 150
Secretaries	24	15 740
Draftsmen	24	12 360
Combustion Assistant (Ing. Byron Rosales)	12	10 290
Solar Assistant (Ing. Iván Arriola)	12	9 000
Biogas Assistant (Ing. Rómulo Rossal)	12	8 110
Charcoal Assistant (Ing. Alfredo Diéguez)	6	5 500
Assistant Delegate El Salvador (Sr. Alejandro Maldonado)	12	7 200
Assistant Delegate Costa Rica (Sr. Augustín Rodríguez)	12	7 200
Assistant Delegate Honduras (new hire)	12	8 400
Total Non-Professional	186	125 160
Total Long Term Personnel	311	293 550

		Amount
2.	Short Term Professional (Technical Consultants)	
A.	U.S. Consulting Services (EAI)	
	Consulting services, including seminar and workshop participation, in combustion, biogas, solar and other technologies pertinent to the Project, including fees, travel to Central America, information gathering in the U. S., telecommunications and reports	105 000
B.	Local Consulting Services	
	Individuals or institutional personnel for local supervision of technical projects, training, and preparation of reports	35 000
	Individuals or institutional personnel to conduct surveys and/or evaluations in their respective countries on a sub-contract basis. Five countries at $ 5 000 per country	25 000
	Sub-total Local Consultants	60 000
C.	Evaluation	
	Mid-year Project Evaluation	30 000
	Total Short-Term Personnel	195 000
3.	Travel and Per Diem	
A.	Air travel and per diem Central America and Panama	75 000
B.	Internal transport	30 000
C.	Air travel and per diem U.S.	9 000
	Total Travel and Per Diem	114 000

		Amount
4.	Publications and Promotion	
A.	Manuals and reports	15 000
B.	Descriptive brochures	4 000
C.	Posters, materials for exhibits	4 000
D.	Subcontracted services and materials for promotion and publications in Guatemala	20 000
E.	Subcontracted services for Project Newsletter	12 000
F.	Subcontracted services and materials for promotional purposes in El Salvador, Honduras and Costa Rica ($ 4 000 per country)	12 000
G.	Subcontracted services for promotional purposes in Panama	2 000
	Total Publications and Promotion	69 000
5.	Seminars and Training	
	Eight formal seminars at $ 1 000 each	8 000
	30 short courses at $ 100 each	3 000
	2 workshops at $ 700 each	8 400
	Technical conferences: 30 person-trips at $ 300/trip	9 000
	Support for counterpart training courses	8 000
	Support for National Committees	10 000
	Total Seminars and Training	46 400
6.	New Applications Experimentation, Design and Demonstration Activities	
	Demonstration unit for introduction of the lime kiln technology in Honduras	7 500
	Demonstration unit for introduction of charcoal technology in Honduras	4 000

	Amount
Operational expenses for Barcenas test center - biogas innovations - new substrates	15 000
Development of combined technology applications (solar/biogas, solar/combustion)	20 000
Demonstration units for the introduction of solar lumber kilns in Honduras, El Salvador and Costa Rica ($ 3 000/country)	9 000
Demonstration units for the introduction of dry digestors in Guatemala, Honduras and Costa Rica ($ 3 000/country)	9 000
Total New Applications	64 500

7. Dissemination Support

A. Combustion Engineering

Support for counterpart dissemination of conventional fuelwood stoves; five countries at $ 2 000 per country	10 000
Support for start-up of ceramic stove programs; five countries at $ 5 000 per country	25 000
Support for counterpart dissemination of bakery ovens; five countries at $ 3 000 per country	15 000
Support for counterpart dissemination of brick kilns in Honduras and El Salvador ($ 4 000 per country)	8 000
Support for the dissemination of lime kilns in Guatemala	3 500
Support for the dissemination of charcoal kilns in Costa Rica	4 000
Support for the dissemination of panela cookers in Panama	4 000
Assistance to counterparts for biomass combustion in various small industry applications. Throughout Central America	10 000
Sub-total Combustion	79 500

	Amount
B. Biogas and Solar Energy	
Support for counterpart dissemination of conventional biogas systems in Guatemala, El Salvador, Honduras and Panama, for agro-industrial activities ($ 3 000 per country)	12 000
Support for counterpart dissemination of "dry" biogas digestors in Guatemala, El Salvador and Costa Rica at $ 4 000 per country	12 000
Support for dissemination of solar salt technologies in Guatemala	2 000
Support for the dissemination of multi-purpose solar driers, including combined technology driers, in Guatemala, El Salvador, Honduras and Costa Rica, at $ 5 000/country	20 000
Support for the dissemination of solar lumber kilns in Guatemala and Honduras at $ 3 000/country	6 000
Sub-total Biogas and Solar Energy	52 000
Total Dissemination Support	131 500
8. Other Costs	
Telecommunications	10 000
Photocopies and purchase of printed materials	10 000
Total Other Costs	20 000
9. Overhead	
80% of long-term personnel	234 840
10. Contingency	
6.1%	71 210
Total Budget Cost:	1 240 000

3. Project Evaluation Summer 1985

During the summer or early fall of 1985 ROCAP and ICAITI should plan for a full end of project evaluation. the evaluation will cover all aspects of administration, organization, operation, utilization and effectiveness of the project. The evaluation report if properly directed could serve as a very useful element to the analysis, design and development of the follow-on project.

4. Anticipated New Reporting

Growing success of this renewable energy project makes it essential that ICAITI begin to document and publish the experience for the edification of AID personnel worldwide and to generally improve the recognition of their work within and beyond the region. Although more and more information is available in ICAITI, much of it is in the form of internal field reports and is not presented with a consistent methodology that would make it easily accessible to an outside reader.

Therefore as part of the future activities ICAITI must develop a reporting system for its progress and specific experiences. It is expected that a lot of reporting on general project activities can be extracted and amplified from the quarterly reports and field reports. Much of this type of information will go into the newsletter that ICAITI is currently initiating. However, it will be very useful for ICAITI to prepare special reports on the technologies and institutional relationship. Some ideas follow.

In terms of the technologies with which ICAITI has had experience they should plan to develop a one or two-page commentary on each one. This concise technology by technology brief should include:

- technology type
- specific name or application
- where it comes from or is it an improvement on an indigenous technology;

- short description of the technology and its use;
- materials and labor needed for construction;
- variations in terms of material and size;
- costs
- the number ICAITI has built or the number existing in various countries;
- potential for more;
- the relative efficiencies and merits/why it is good or bad;
- aspects of improved quality or productivity
- Cost/benefit ratios as applicable
- Sociological aspects and acceptability.

Depending on the technology and its applications other information may be included. In some cases certain information may not be relevant. It has been agreed that the ROCAP Project Advisor and the ICAITI Project Manager will work together on the production of a useful, tight and systematic format for consolidating what the experience of ICAITI has been with each technology and each application.

Another reporting exercise should be developed to relate the breadth and depth of ICAITI's working relationship with its counterpart institutions in all the countries. This document which could be prepared on an institution by institution basis would be very useful to ROCAP. Because of the possible sensitivity it may need to remain an internal document. The kind of information it would report is:

- Institution name
- type of institution
- size of institution
- principal activity
- relationship with ICAITI
- length of contract
- ability to disseminate or promulgate project goals
- relative success/effectiveness or transfer agent
- future prospects
- etc.

These two new reports systems might be augmented to include other information or new reporting mechanisms may be desired as ROCAP or ICAITI see a need. What is immediately evident is that both items described above have considerable potential to help ICAITI and ROCAP in advancing the project on a number of levels. Both would also be useful references for persons working in similar projects both within and outside the region.

VIII. FUTURE PROJECTS

1. Comparative Advantage and New Directions

ICAITI, through its facilities in Guatemala and the technical services they offer, has actively supported industrial development and applied technology in Central America since its establishment in 1955. It provides a variety of services including, product research and testing the collection of technical information and its distribution standard setting, quality control and certification, and training and technical assistance.

According to an institutional evaluation report prepared by a Coopers and Lybrand Consulting Team in January 1984, ICAITI is "sound". The report stated that "its services, based on our interviews with private sector industrialists and national government representatives, are of high quality, and its certification is widely accepted in the region as well as internationally. The report also states that ICAITI is a very useful organization that offers unique services with economies of scale: "each country does not have to create and maintain facilities for testing, standards setting, certification, etc. It provides a continuance of outreach, problem solving, technology introduction, technical support, and demonstration activities that are beneficial to industrial development and technology dissemination in the region."

After a slow start, ICAITI has begun to be very successful in the implementation of the Fuelwood Project. The Fuelwood Project and a previous project financed by ROCAP through ICAITI, Rural Technology Transfer, Project No.596-0066, have advanced ICAITI's skills and ability well up the development or "learning" curve. Through the process of implementation of these projects, ICAITI has become much more capable of conducting field work and extension. ICAITI has the potential to provide numerous services to industry in the region, that are unavailable elsewhere, in a relatively inexpensive and effective manner. To insure the continued growth and development of these skills and services, it is important that a new and continuing project with ICAITI be considered to realize a greater long-term impact.

ICAITI's activities under the Fuelwood Project have evolved considerably over the course of four years. Beginning with a focus on small-rural-domestic applications of renewable energy technologies, ICAITI is now moving more towards the application of the same technologies to more commercial ventures. Project work during 1984 and the coming extension, will create an invaluable expertise for technical dissemination of a variety of innovations to industry, particularly small and medium size industry, in the region.

As the ICAITI project staff have gradually achieved greater and greater success in working with technologies for their original low income rural target, they have had more time to begin to work on more commercial and productive applications of these technologies. This trend is not indicative of any neglect, but rather a natural process towards areas where ICAITI has greater comparative skills. Although ICAITI would still attent to the rural family and community level activities, the primary responsibility will be left increasingly with the local and national counterparts. The latter have a daily relationship with these rural populations and now have the capability to help construct, use and maintain the ICAITI demonstration models. For example, woodstoves and domestic solar hot water heaters are being transferred almost entirely to national entities.

In order not to lose this growing effectiveness in extension throughout the region, a new project should be designed to support the continuation of ICAITI's renewable energy efforts. This new project, Industrial Energy Technology, would allow ICAITI and the national counterparts to expand on the skills and experience achieved during the implementation of the fuelwood project. In responding to increasing requests from commercial establishments for renewable energy technologies, ICAITI and the national counterparts, will be strengthening their contacts with numerous industries throughout the region. Using their current skills in energy technology applications it is proposed that the ICAITI engineers also begin to look at other aspects of resource use in the small industries. It is probable that advice from ICAITI engineers to various industries could contribute significantly to improve design, maintenance, productivity, and quality control throughout the region. In addition, the application of these new technologies to small industries could create new jobs to provide and maintain these new technologies. Also, as in the case of the demonstration ceramic kiln in El Salvador, it is possible that new products for export will be discovered. Likewise, many of the activities related to fish, fruit and lumber drying all lead to new products of better quality for consumption within the region and for the export market.

2. Industry Survey

To obtain a better idea of the range of industries and the potential interest in increasing production or reducing energy and material costs per unit of output, ICAITI will conduct a survey of industries in the region during 1985.

This survey will be accompanied by data sheets and promotional material that report on the usefulness of specific renewable energy technologies to increase production efficiency and product quality control. Depending on the industrial activity kilns, combustion chambers, solar dryers, biogas digestors or gasifiers will be presented.

The results of the survey would provide a valuable basis for the design of the new project.

3. Issues

There are three prominent issues that arise with any discussion of an ongoing project that would build upon the substantial foundation that has been formed by the ICAITI component of the Fuelwood and Alternative Energy Project. The following is a short presentation on each of these issues, which are:

A. Delinking from CATIE

The original Fuelwood Project design outlined what seemed to be a useful and natural marriage of ICAITI and CATIE so that they could work towards a reduction of the fuelwood stress on the region's rapidly diminishing forest resources. The concept was noble, and remains valid; ICAITI would address demand management, while CATIE would concentrate on supply issues. For a number of reasons, not the least of these being what might be described as "antagonistic" locations, the relationship between the institutions never became as open and productive as hoped.

Despite the relative lack of success at a formal institutional linkage, both ICAITI and CATIE are cooperating admirably at the local country level. Both ICAITI and CATIE are participants at all relevant seminars and workshops. This informal connection in the field has allowed both headquarters to keep up with the others activities.

As the new Fuelwood Production project for CATIE and this Industrial energy Technology Project for ICAITI begin, it can be expected that a technical level working relationship will be maintained. As CATIE begins to worry about the processing and utilization of its multi-purpose species it will be logical for ICAITI to assist with aspects such as: lumber drying (using solar and combustion technologies), power for sawmills (possible use of gasifiers), productive disposal of wood residues (as fuelwood, charcoal, or

composite board). Likewise, as ICAITI projects augment the demand (albeit an efficient demand) for fuelwood in special cases (ceramic and brick kilns, bread ovens, etc.) CATIE, through the national forestry offices, may advise on sustained fuelwood production on nearby woodlots.

Because it is assured that the coordination of wood production and wood use activities will take place locally it will be unnecessary to force any formal linkages between these two competent regional entities in the future. In addition, as ICAITI's focus is directed more towards commercial interventions it will become increasingly the role of the private sector to seek forestry assistance as needed.

B. Complementing the Industrial Energy Efficiency Project

The Energy Efficiency Project (AID Project 596-0095), which now has over 18 months of operation, has begun to realize the importance of the expertise in the Fuelwood Project staff. The Energy Efficiency team will need to continue to concentrate all their efforts on the education and training of industrial managers and engineers in the region. The promotion and conducting of energy audits and the reporting and dissemination of energy efficiency improvements will occupy virtually all of their attention. Energy efficiency demonstration activities, will be conducted entirely for the sake of saving petroleum and electricity in the production process.

The contribution from the alternative energy experience of the Fuelwood Project to the increased conservation of commercial energy is significant. Project management for the Energy Efficiency Project have indicated that they will be looking forward to receiving assistance from the energy technology group in the Fuelwood Project. This assistance with adaptation, design and demonstration could include: industrial solar water preheat, biomass fired boilers for process heat, biogas applications for waste treatment, solar assisted drying, and gasifiers for thermal and mechanical requirements. All these innovations will further reduce industrial oil costs.

As the Energy Efficiency Project and the Energy Technology Project evolve, it should be expected that they cooperate to offer a more complete package of energy related assistance to all industries in the region. The complementarity of these two projects, coupled with ICAITI's acknowledged expertise in other technical aspects of industrial process design, productivity and quality control, will allow ICAITI to perform as a strong promoter of competitive industrial production in the region.

C. Financing

The availability of financial credit to the industries in the region wanting to adopt new energy and productivity technologies will have to be examined in detail at the time of the Project Paper design. As the situation stands today, the EEC is giving CABEI $12 million to establish a special fund for small business loans. Whether such a fund will be accessible by target industries with whom ICAITI will work remains to be determined.

ICAITI has also had extensive talks with the IDB and PADF on the possibility of creating a small revolving fund for loans to client industries. ICAITI is not anxious to assume a banking role and hopes that alternative arrangements might be made with existing national credit institutions.