UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
AGENCY FOR INTERNATIONAL DEVELOPMENT
Washington, D. C. 20523

ROCAP

PROJECT PAPER

FUELWOOD & ALTERNATIVE ENERGY SOURCES
(Amendment)

AID/LAC/P-031/1

Project Number:596-0089

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT DATA SHEET

1. TRANSACTION CODE: C (A = Add, C = Change, D = Delete) — Amendment Number: 1 — DOCUMENT CODE: 3

2. COUNTRY/ENTITY: ROCAP

3. PROJECT NUMBER: 596-0089

4. BUREAU/OFFICE: Latin America and the Caribbean — 05

5. PROJECT TITLE (*maximum 40 characters*): Fuelwood & Alternative Energy Sources

6. PROJECT ASSISTANCE COMPLETION DATE (PACD): MM 06 DD 30 YY 86

7. ESTIMATED DATE OF OBLIGATION (*Under "B" below, enter 1, 2, 3, or 4*): A. Initial FY 79 — B. Quarter 4 — C. Final FY 85

8. COSTS ($000 OR EQUIVALENT $1 =)

A. FUNDING SOURCE	FIRST FY B. FX	FIRST FY C. L/C	FIRST FY D. Total	LIFE OF PROJECT E. FX	LIFE OF PROJECT F. L/C	LIFE OF PROJECT G. Total
AID Appropriated Total						
(Grant)	(500)	( )	(500)	(8,800)	( )	(8,800)
(Loan)	( )	( )	( )	( )	( )	( )
Other U.S. 1. CATIE		150	150		917	917
Other U.S. 2. ICAITI		76	76		891	891
Host Countries		107	107		1,023	1,023
Other Donor(s)		100	100		742	742
TOTALS	500	433	933	8,800	3,573	12,373

9. SCHEDULE OF AID FUNDING ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE 1. Grant	C. PRIMARY TECH. CODE 2. Loan	D. OBLIGATIONS TO DATE 1. Grant	D. OBLIGATIONS TO DATE 2. Loan	E. AMOUNT APPROVED THIS ACTION 1. Grant	E. AMOUNT APPROVED THIS ACTION 2. Loan	F. LIFE OF PROJECT 1. Grant	F. LIFE OF PROJECT 2. Loan
(1) FN	741B	290		7,500		1,300		8,800	
(2)									
(3)									
(4)									
TOTALS				7,500		1,300		8,800	

10. SECONDARY TECHNICAL CODES (*maximum 6 codes of 3 positions each*): 850 | 878 | 960 | 112 | 160 |

11. SECONDARY PURPOSE CODE: 740

12. SPECIAL CONCERNS CODES (*maximum 7 codes of 4 positions each*)

A. Code	BR	ENV	PART	TECH	TNG		
B. Amount							

13. PROJECT PURPOSE (*maximum 480 characters*)

To develop, demonstrate and make available for transfer (a) improved cultivation practices to increase fuelwood production and supply, and (b) efficient low cost domestic, small community and small and medium industrial fuelwood and non-conventional energy technologies.

14. SCHEDULED EVALUATIONS: Interim MM 08 YY 85 — Final MM 05 YY 86

15. SOURCE/ORIGIN OF GOODS AND SERVICES: [X] 000 [ ] 941 [ ] Local [ ] Other (*Specify*)

16. AMENDMENTS/NATURE OF CHANGE PROPOSED (*This is page 1 of a 41 page PP Amendment.*)

This amendment extends the life of project and increases total AID grant funding in order to permit ICAITI to undertake a more substantial dissemination effort to take full advantage of the specific technologies which have been developed and assure their successful transfer through counterpart institutions and commercial mechanisms.

17. APPROVED BY — Signature: 1. [signature], Acting 2. [signature] — Title: 1. Controller 2. Acting Director — Date Signed: MM 03 DD 29 YY 85

18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION — MM DD YY

AID 1330-4 (8-79)

1

Project Authorization

(Amendment 1)

Name of Entity:	Central American Research Institute for Industry
Name of Project:	Fuelwood & Alternative Energy Sources
Number of Project:	596-0089

1. Pursuant to Section 103 of the Foreign Assistance Act of 1961, as amended, the Fuelwood and Alternative Energy Sources Project for ROCAP was authorized on September 27, 1979. That authorization is hereby amended as follows:

   Section 1 is hereby amended to reflect the addition of $1,300,000 of grant funds and to extend the period of time needed to carry out the project,

   The new amount and time should state:

   "... involving planned obligations of not to exceed $8,800,000 over a seven-year period from date of authorization..."

   Section c. "Covenants" is hereby amended to add the following:

   (6) ICAITI shall covenant to submit to AID not later than May 1, 1985, in form and substance satisfactory to AID, a supplemental implementation plan covering the increased dissemination effort to be carried out during the period from July 1, 1985 to June 30, 1986.

2. The authorization cited above remains in force except as hereby amended.

John R. Eyre
Acting Director
Regional Office of
Central American Programs

FUELWOOD & ALTERNATIVE ENERGY SOURCES
PROJECT PAPER AMENDMENT (AID 596-0089)

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PP AMENDMENT COMMITTEE

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  Honduras - Porfirio Sanchez
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I. PROJECT AMENDMENT SUMMARY

A. Recommendations

The Project Committee recommends that the Acting ROCAP Director approve this amendment to the Project Paper and authorization which will extend the Project Assistance Completion Date through June 30, 1986 and increase total life of project funding from $7.5 million to $ 8.8 million. The justification for the extension, detailed in this PP Amendment, is based on an evaluation of the Central American Research Institute for Industry (ICAITI) component of the project which shows a need for ICAITI to carry out a more substantial dissemination effort than was originally contemplated with particular emphasis on taking advantage of ICAITI's institutional capabilities to assist small and medium sized industries and commercial farms with energy technologies developed under the project.

B. Background

The Fuelwood and Alternative Energy Sources Project supports a regional effort within Central America and Panama to test fast growing tree species and develop alternative production methods for their use as fuel, and test, demonstrate and disseminate improved renewable energy technologies for use in rural homes and communities and by small and medium industry. Project implementation has been split between two regional institutions, with the Tropical Agriculture Research and Training Center (CATIE) responsible for efforts related to fuelwood production and ICAITI responsible for the development and promotion of efficient alternative energy technologies. Project agreements were signed with both institutions, and the original LOP budget was divided with $ 4,260,350 going to CATIE and $3,239,650 to ICAITI.

The original Project Agreement for the ICAITI component, signed on September 27, 1979, calls for ICAITI to carry out design and testing activities on specific technologies which fall into three general technical categories: combustion engineering, biogas and solar energy. The combustion technologies have included sub-technologies on domestic fuelwood stoves, industrial kilns and ovens, and charcoal kilns; biogas includes domestic, farm and industrial digestor systems; and solar energy includes multi-purpose passive solar driers, hot water systems, salt and crude sugar evaporators.

Initial project activities focused on developing or adapting specific technologies to local conditions, testing designs and carrying out demonstration activities with national counterpart institutions. These efforts were spread across all three technical categories although most emphasis went initially to combustion engineering. Within each cateogry, specific technologies have been developed which have proven considerable potential for providing alternative energy sources or minimizing fuelwood consumption (e.g., Lorena stoves, bakery ovens, brick kilns, lime kilns, biogas digestors, solar driers, and solar hot water systems). To date, ICAITI has exceeded the number of demonstration units specified in the Project Paper for each of the technologies and has provided related training for over 3,000 individuals throughout Central America and Panama.

C. Justification for the Project Extension

The Project Agreement for the ICAITI component contemplated a five year implementation period with a PACD of December 31, 1984. A ROCAP review of the ICAITI component and a more formal evaluation carried out with the TDY assistance of Carl Duisberg, Regional Energy Advisor, indicates that while the accomplishments are impressive and consistent with the original objectives of the project, a more substantial dissemination effort is called for to take full advantage of the specific technologies which have been developed and assure their successful transfer through counterpart institutions and through commercial mechanisms.

Most of the sub-technologies developed have been proven effective not only in the research phases of the project, but through pilot demonstration projects and more recent commercial applications as well. Domestic woodstove efficiencies have been improved from 20 to 65 percent in all cases. Bakery ovens have saved 40 to 50 percent of wood while industrial kilns save 35 to 45 percent. Solar hot water heaters have demonstrated a payback of 2 to 3 years. Biogas digestors have a payback of 3 years or less, taking into account both their methane and fertilizer yield. Solar drying of lumber, salt, fruits, grains, spices and vegetables has also shown excellent prospects for improved efficiencies and productivity increases in commercial applications. ICAITI now has a package of proven specific technologies which can be of substantial benefit to the region and national development efforts in both the public and private sectors and in terms of both energy savings and productivity increases.

The effort to establish and strengthen ICAITI's relationship with national and international public and private counterparts having the potential to act as disseminating agents for the alternative energy technologies has been more difficult to accomplish than previously envisioned. In part, this is due to the nature and variety of the sub-technologies involved. Economic and political problems have also added unforeseen complications. Nevertheless, ICAITI has evolved from a technical research oriented facility to one that is now working effectively with a broad range of counterparts and directly with the private sector.

ICAITI's expertise in field extension and counterpart training needs to be continued to assure a more complete transfer. Substantial dissemination work remains to be done with the commercial applications of specific technologies through technical assistance, training and technical publications. As many applications for biogas, solar and improved combustion were developed and tested late in the project and new applications to respond to private sector needs evolved from experience and innovation, the project requires additional time.

Specific technologies for commercial applications now ready for transfer include the following: biogas applications for milk cooling, water heating, cooking, meat chilling, water pumping, grain grinding, forrage chopping, chick incubation and farrowing heating, pottery kilns, electricity

generation and lighting. Solar applications for low cost dryers for grains, spices, shrimp, fish, tropical fruits, forrage, cacao, salt, kilns for lumber and wood products and solar water systems for preheating water for industrial or domestic uses. Improved combustion applications for bakery ovens, kilns for bricks, lime, charcoal, roofing and floor tiles, "panela", and salt cookers, and commercial production and fabrication of domestic stoves and component parts.

ICAITI has developed the institutional capability of carrying out a much more extensive dissemination effort. Technical publications and promotional materials for most of the specific technologies have been developed. Formats and instructional materials for workshops and seminars have been improved and the collaborative arrangements to carry out these activities as well as promotional visits to demonstration projects and commercial applications have been worked out with both public and private sector institutions in the countries. In short, all of the elements are now in place where a modest extension of the project can have a relatively high impact and payoff.

D. Nature of the Proposed Extension and Cost

The PP amendment proposes to extend the PACD of the project from December 31, 1984 to June 30, 1986. The estimated cost of the extension is $1.3 million. The focus of the project during the extension will be almost entirely on a more massive dissemination and extension effort. The project will also focus this effort much more heavily on working with the private sector in the commercial applications of the technologies involved.

The project extension will be very output oriented within the above framework and will emphasize training (seminars, short courses, and workshops) site visits, dissemination of technical publications, and technical assistance for specific commercial applications of the technologies. The major outputs are summarized as follows:

-- Regional and National Seminars: 8 seminars (three or four days each) involving a total of about 400 participants.

-- Short Courses: 70 short courses (one day each) involving a total of about 1,300 participants.

-- Workshops: 24 workshops (one week each) involving a total of about 500 participants.

-- Visits to Project Sites: 200 promotional visits to project demonstration sites for about 500 small business owners and entrepreneurs.

-- Information Dissemination: Distribution of 20,000 promotional brochures on the technologies, and 5,000 technical manuals on construction and operation.

— Technical Assistance for Commercial Applications: Technology designs and/or direct technical assistance for 500 site specific applications of the sub-technologies for commercial applications and response to all technical inquiries received as result of other efforts.

In summary, the outreach effort under the extension would result in about 3,200 individuals being trained directly, the dissemination of about 30,000 technical publications, and in the provision of direct technical assistance to at least 500 commercial applications.

In addition to the above, ICAITI will assist counterpart institutions finish 10 demonstration projects which have been initiated and start and complete an additional 4 demonstration projects, emphasizing those types of projects which show the greatest commercial promises.

E. Summary Financial Plan

(1) ITEM	AMOUNT (000)	ICAITI	HOST COUNTRY
Long-term personnel	440	104	
Short-term personnel	210		
Travel and perdiem	120		
Publications & promotion	69		
Seminars & training	46		10
New application experimentation/demonstration	80		
Dissemination support	132		
Other costs	30	16	170
Overhead (80 percent of long-term personnel)	352		
Contingency (4.7 percent)	71		
(2) TOTAL	1,550	120	180
(3) MINUS ESTIMATED PIPELINE 12/31/84	250		
(4) FUNDS REQUIRED FOR EXTENSION	1,300	120	180
(5) TOTAL COST OF EXTENSION			1,600

F. Summary Findings

The ROCAP Project Committee has reviewed all aspects of the proposed extension and finds that it is technically, financially, socially and economically sound and consistant with those objectives set forth in the ROCAP CDSS strategy and AID/W policy guidance. As this is a PP amendment, much of the material and analysis included in the original PP remains valid. The PP amendment, therefore, focuses on a description of the specific technologies to be promoted in connection with the project's increased emphasis on dissemination and on a detailed implementation plan and financial analysis for the period of the extension. An updated and comprehensive institutional analysis of ICAITI was prepared for ROCAP by Coopers & Lybrand and is available in LAC/DR. Annex I is an updated technical analysis for the project and is based on the evaluation carried out in the fall of 1984 by Carl Duisberg, Regional Energy Advisor, USAID/Ecuador. This evaluation is also available in LAC/DR.

The Project Committee is certain that the extension will not only enhance the achievement of original project goals, but will also relate the project more closely to AID's increasing emphasis on the private sector and "need driven" energy projects. The increased dissemination effort will have an important impact on small and medium sized industries and commercial farms and will permit considerable reinforcement of the technology transfer institutionalization process at the national level. The extension will also permit an evaluation of ICAITI's ability to assist the private sector to increase productivity and may also lead to a future project along these lines which ROCAP has proposed in its FY 1986 CP.

II. BACKGROUND AND DESCRIPTION

A. Summary of Evaluation Findings

An evaluation of the ICAITI component of the Fuelwood and Alternative Energy Sources Project was carried out in the fall of 1984 by Carl R. Duisberg, Regional Energy Advisor, USAID/Ecuador, with the assistance and participation of ROCAP and ICAITI management and staff. This report is available in LAC/DR and Annex 1 to this PP amendment "Technical Analysis of the Status of the AID Fuelwood and Alternative Energy Sources Project and Recommendations for Extension" is based on excerpts from the findings. The conclusions found that ICAITI had been able to respond to the recommendations of the previous evaluation by Volunteers for International Technical Assistance (VITA) and that the major objectives outlined in the PP were being accomplished. The success of the project and the fact that many of the specific technologies were starting to have significant commercial applications provided the basis for recommendations on the extension proposed in the evaluation and this PP amendment.

The evaluation served to help focus efforts under the proposed extension on those specific technologies having the most promising commercial applications, developing a more massive dissemination effort for those technologies aimed primarily at the private sector, relating demonstration projects more toward commercial applications and directing technical publications more toward meeting private sector needs. An industrial survey proposed in the evaluation, and included in the PP Amendment will help bring the emphasis of the project on commercial applications and responding to private sector needs into even sharper focus.

1. Background

The Project supports a regional effort within Central America and Panama to (a) test fast growing trees and shrubs (CATIE), and (b) test and provide new improved energy efficient technologies to conserve or replace fuelwood as an energy source (ICAITI). Under separate Project Agreements, CATIE has been responsible for efforts related to fuelwood production while ICAITI has worked on the development and dissemination of energy efficient and alternative energy technologies. The CATIE component of the Project has progressed satisfactorily and a PID for a follow-on separate project is being developed. The evaluation and this PP amendment, therefore, deals only with the ICAITI component of the Project.

The basic objectives stated in the Project Paper were: (1) 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, and (2) to establish or strengthen relationships with natonal and international public and private organizations which possess the potential to disseminate energy efficient technologies.

The Project Paper did not call for ICAITI to carry out basic research in technology development but rather to evaluate, adapt and transfer existing technologies in use in Central America or outside the region. ICAITI was given responsibility to review existing technologies, modify them for regional applications, and develop and promote new approaches to meet immediate short-term needs with renewable energy sources, as appropriate.

2. Evaluation Highlights

Project related in-country work has been performed in close coordination with national institutions through ICAITI's national project coordinators (delegates). The ICAITI delegates and the technology teams for combustion, biogas and solar energy have been responsible for site selection and construction, testing, demonstrations, and dissemination activities. They work with national counterparts, national energy and technology institutes, PVOs, private industry, cooperatives and domestic users. ICAITI has worked with 71 institutions in the countries in carrying out the project. The number of institutions which have been involved in combustion activities is 33, biogas 24, and solar 38. While obviously these institutions vary in quality and impact, ICAITI is working effectively with most of them and providing the technical backstopping services which they require.

A wide variety of specific technologies have been adapted or developed and tested throughout Central America and Panama. While some efforts and technologies were found to have limited potential because of technical constraints, lack of acceptability or economic factors, most have been widely promoted and accepted.

The specific technologies that have been adapted or developed during the five-year project, including modifications and additions to the Project Paper designated activities which were required to better respond to counterpart and private sector needs, are the following:

Specific Technology	General Classification
1. Conventional Fuelwood Domestic Stoves	Combustion
2. Conventional Fuelwood Institutional Stoves	Combustion
3. Ceramic Stoves	Combustion
4. Sawdust Burning Stoves	Combustion
5. Bakery Ovens	Combustion
6. Brick Kilns	Combustion
7. Lime Kilns	Combustion
8. Salt Cookers	Combustion
9. Crude Sugar "Panela" Cookers	Combustion
10. Charcoal Kilns	Combustion
11. Gasifiers	Combustion
12. Conventional Continuous Biogas Digestors	Biogas
13. Low-cost Biogas Digestors	Biogas
14. Packed Bed Digestors	Biogas
15. Dry Digestors (Batch)	Biogas
16. Solar Hot Water Systems	Solar Energy
17. Solar Fuelwood Driers	Solar Energy
18. Multi-Purpose Driers for Food Products	Solar Energy (1)
19. Lumber Kilns	Solar Energy (1)
20. 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.

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

- 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 17 technologies, 11 are currently in the dissemination phase. The following six are relatively new, but will be ready for dissemination in early 1985:

- Ceramic stoves
- Lime Kiln
- Paella cooker
- Packed bed biogas digestor
- Dry biogas digestor
- Solar lumber kiln

ICAITI's dissemination efforts have increased over the past two years for the above specific technologies. These efforts include technical publications and training activities. The publications involve informative pamphlets, technical reports, and construction and operation manuals. The publications are of very high quality, but their preparation has often lagged behind planned output. Technical publications on the most recent technologies are still being developed. Training activities include national seminars, workshops, short courses, and visits to demonstration sites. ICAITI is becoming increasingly skilled in presenting these types of training events in collaboration with its nacional counterparts. To date, ICAITI has distributed over 39,000 technical publications and has trained over 3,000 participants.

In summary, ICAITI is working effectively with a wide variety of national counterparts in both the public and private sectors, ICAITI has adapted a significant number of specific technologies which have been proven to be appropriate, accepted, and which have applications, for both saving energy and increasing productivity. In quantitative terms, the number of demonstration and dissemination efforts specified in the PP have been met or exceeded. There is now a strong demand for ICAITI's services on the part of national counterpart institutions and from industries and commercial firms and farms in the private sector. Many of the specific technologies show important commercial applications which can be reinforced by a more massive dissemination effort involving practical training, more intensive use of demonstration projects, and greater distribution of technical publications. Commercial applications are in our judgement, the best way to assure that the technologies will have a self-sustaining and significant impact on the development of the region.

The seventeen specific technologies have been grouped according to high, medium and lower priority by ICAITI and ROCAP according to judgements on their potential for commercial applications over the short and medium term and their potential impact on development and energy savings by country . The specific technologies were ranked as follows:

High Priority (6)

Bakery ovens (all countries), multi-purpose solar driers (all countries), lumber driers (all countries), ceramic stoves (all countries), solar salt producers (Guatemala, Honduras), charcoal kilns (Costa Rica, Honduras).

Medium Priority (7)

Conventional biogas digestors (all countries), dry biogas digestors (all countries), low-cost biogas digestors (all countries), conventional domestic stoves (all countries), institutional stoves (all countries, lime kiln (Guatemala, Honduras), panela cookers (Panama).

Lower Priority (4)

Solar hot water systems (Guatemala, Honduras, Costa Rica), packed-bed digestor (all countries), brick kilns (Guatemala, Honduras, El Salvador), salt cooker (Honduras).

B. Specific Technologies Appropriate for Commercial Applications

This section of the PP Amendment briefly discusses the seventeen specific technologies referred to in the previous section which are in the dissemination stage (ten) or are ready for dissemination. It includes (a) a brief description of the technology, (b) potential commercial applications, (c) economic analysis and payback, (d) status of demonstration projects, and (e) status of the dissemination effort and related technical publications.

1. BAKERY OVEN (High Priority All Countries)

a. Description of the Specific Technology

ICAITI has designed a bakery oven whose primary objective is to obtain a higher energy yield from the fuelwood. The design is also easy to operate and relatively inexpensive and simple to construct. The interior part of the oven is divided into 4 sections - 3 grills for the bread trays and one for the fuelwood.

b. Potential Commercial Applications

The potential for the bakery oven is substantial due to the importance of bread in the daily diet. Most bakeries in the Central American region use firewood and thus have a potential interest in this technology.

c. Economic Analysis and Payback Period

The initial investment is about $700. While the payback period depends on the daily production, in almost any bakery it is less than 12 months. The oven designed by ICAITI is very fuel-efficient when compared to the traditional model, saving up to 50% of the wood normally used.

d. Status of Demonstration

A demonstration unit was built at the Instituto Técnico de Capacitación y Productividad (INTECAP) in Guatemala. This unit is being run entirely by INTECAP and is on a regular basis used in bakery classes. Other demonstration units in Central America have been built in El Salvador, Honduras, Costa Rica, and Panama. Two additional demonstration units are under construction in Costa Rica.

e. Status of the Dissemination Effort and Related Technical Publications

Initial short courses and conferences have been given throughout the region. A brochure and a construction and operation manual have been published and are being distributed. A manual is also being prepared on a continuous use bakery oven design.

2. MULTI-PURPOSE SOLAR DRIERS FOR FOOD PRODUCTS (High Priority All Countries)

a. Description of the Specific Technology

ICAITI has designed a low-cost "tent"-type solar drier suitable for small scale drying of grains and two designs of tray-type multi-purpose driers for small and medium scale drying of food products.

b. Potential Commercial Applications

The "tent" type drier is suitable for use on small farms for the drying of grains, e.g. corn, wheat, rice, sorgum, etc. and for drying of livestock forage. The two tray type driers are suitable for use on commercial farms and for small and medium scale industrial use for the drying of fish, shellfish, seeds, fruits, nuts, spices, and other food products.

c. Economic Analysis and Payback Period

In the case of grains, the economic analysis of various types of solar driers show a low benefit/cost ratio when used only during harvest-time. Thus, it is desirable to operate the drier during most of the year, using it also for fruits or vegetables. In the case of fruits, fish and other agricultural products (cacao, plantain, pepper, onion, garlic, etc.), the benefit/cost ratio is much higher and depending on the driers' size and the specific use given to it, the payback period is between one and two years.

d. Status of Demonstration Projects

The demonstration phase started in 1984 and ICAITI now has fish drying demonstrations in operation in Guatemala, El Salvador and a third under construction in Costa Rica. Fruit drying also using the tray type drier is being demonstrated in El Salvador, while the "tent" type drier is being used for grain drying demonstrations in Guatemala and Honduras.

e. Status of the Dissemination Effort and Related Technical Publications

National solar drier seminars followed by practical drier construction workshops have been given in Guatemala, Honduras, El Salvador and Costa Rica. The driers constructed in the workshops are being used locally by counterpart institutions and the Peace Corps for commercial purposes as well as for continued demonstrations. ICAITI is well advanced in preparing the manual: "Solar Drying of Grain and Foods" which will be printed and distributed in the second quarter of 1985.

3. SOLAR LUMBER KILN (High Priority all countries)

a. Description of the Specific Technology

ICAITI has designed and installed an experimental demonstration unit at a door factory in Coatepeque, Guatemala. This unit has a drying capacity of 1,500 board feet per batch and can be used as a finishing drier. Assuming that the drying process begins with lumber that has 25% humidity content, this is lowered to 8-10% in 4 or 5 days. The unit consumes 1 kW/h for ventilation, can operate 8-9 hours per day, and is easy to construct and operate.

b. Potential Commercial Application

Interest has already been expressed by industries in Guatemala, Honduras and Costa Rica. The investment necessary for these systems is in the order of 10 to 15% of the cost of conventional systems with equivalent volume and productivity. Even though they are a bit slower in completing the drying process, the construction, operation and maintenance costs are much lower which makes the systems feasible for medium-sized industries such as wood-toy, furniture, door, boat factories, etc.

c. Economic Analysis and Payback Period

A 1,500 board feet drier prototype has a total cost of about $1,700. The commercial cost of conventional drying is $0.05/board foot while the cost of solar drying is $0.01. Drying a batch of 1,500 board feet using the conventional method costs $75 compared to $15 to dry the same amount using the solar system. The payback period for a solar wood drier is about 4 to 6 months.

d. Status of Demonstration Projects

In Guatemala, requests have been received by ICAITI to design and provide technical assistance for another solar lumber drier at the door factory where the demonstration unit was installed. Interest has also been shown by a wood toy export company in Guatemala City. Requests to build solar lumber driers have also been received from a furniture industry in Honduras and a company building sailboats for export in Costa Rica. ICAITI will provide only technical assistance for these projects, but agreements will be made with the firms so that they can be used for demonstration and dissemination purposes.

e. Status of the Dissemination Effort and Related Technical Publications

A brochure describing the technology has been prepared and will be published in the first quarter of 1985. Enough technical information is available so as to prepare brochures/manuals and to give short courses on the construction and operation of solar lumber driers.

4. DOMESTIC CERAMIC STOVES (all countries)

a. Description of the Specific Technology

Research concerning the efficient fuelwood stoves has led ICAITI to the development of a new pre-fabricated ceramic stove.

b. Potential Commercial Applications

This technology has distinct advantages especially in areas where materials to construct the traditional clay and sand stoves are very scarce or where potential beneficiaries do not have sufficient time or skill to construct their own stoves. This includes suburban areas for existing houses and new housing projects around all the major Central American cities. The technology enables small ceramic in each country to be trained to make the component parts, thus creating new businesses or additional product lines.

c. Economic Analysis and Payback Period

The estimated costs of the stove component parts not including installation labor, ranges from Q14 to Q19 depending on the number of burners on the stove. If the stove reaches a 40% savings on fuel consumed, as is expected, and keeping in mind that the average Central American family spends about $CA 10 per month on firewood, the stove has a payback of 4 or 5 months.

d. Status of Demonstration Projects

Seven prototype demonstration units are being field tested near Guatemala City and the ceramic stove has good operational characteristics.

e. Status of the Dissemination Effort and Related Technical Publications

Once the results of this pilot program are assessed, similar demonstration activities will be carried out in the remaining Central American countries. A manual for construction and operation is being prepared. It is expected that the major users will be low-income housing projects and PVO disseminators.

5. SOLAR SALT PRODUCERS (High priority for Guatemala and Honduras)

a. Description of the Specific Technology

The Fuelwood and Alternative Energy Sources Project has developed and adapted the utilization of black surfaces (cement bricks and plastic materials) to increase the speed at which salt (sodium chloride) crystallizes.

b. Potential Commercial Applications

The use of black plastic materials in salt crystallizers has been enthusiastically accepted, especially by small and medium producers. This acceptance is due to its easy installation, low cost, and higher production per square meter of installed capacity. The use of black cement tiles is used mainly by larger installations.

c. Economic Analysis and Payback Period

The payback period using the black plastic is 6 months, which in terms of any given season is equivalent to two months work. For black cement bricks, the payback period is 9 months or, in terms of a given season, approximately three months.

d. Status of Demonstration Projects

In Guatemala, this technology has demonstration units in the Pacific Coast, especially in the area of Escuintla. In Honduras,, a solar/cooked salt demonstration unit has been installed recently in cooperation with the Program for Rural Technology of the Industrial Development Center (PTR/CDI).

e. Status of the Dissemination Effort and Related Technical Publications

Dissemination has been carried out in Sipacate, Puerto Quetzal, and Tahuesco, Guatemala where 35 salt producers are now using the new technology. In San Lorenzo, Honduras dissemination has interested 30 producers. Work is planned in Costa Rica and Panama.

Due to the educational levels of the average salt producer, only graphic descriptive brochures and plans will be published and used with hands-on, on-site workshops at the above mentioned salt production sites.

6. CHARCOAL KILN (High priority Costa Rica and Honduras)

a. Description of the Specific Technology

Two types of charcoal kilns have been developed by ICAITI:

- A batch beehive type kiln (Brazilian design) with 43 m3 fuelwood capacity, capable of producing 6 metric tons of charcoal and 0.6 m3 of pyrolitic liquids per month.

- A batch metallic transportable kiln, with 5 m3 capacity, capable of producing 2.7 metric tons of charcoal and 3.4 m3 of pyrolitic liquids per month.

b. Potencial Commercial Applications

The kilns are designed for use in energy/wood farms or forests where regular thinning of trees takes place. The beehive kiln is capable of producing 70 metric tons of charcoal and 8 m3 of pyrolitic liquids per year. The metallic transportable kiln is capable of producing 32 metric tons of charcoal and 41 m3 of pyrolitic liquids per year.

The charcoal is being sold locally for domestic and commercial fuel purposes and the pyrolisis liquid has had wide acceptance for preservation treatment of wood.

There is an strong demand for charcoal for exportation that has stimulated the proliferation of charcoal kilns in Costa Rica associated both with forest management activities and the development of new commercial activities by rural cooperatives. Honduras is also a large potential exporter of charcoal.

c. Economic Analysis and Payback Period

- Beehive type kiln

The investment required is:		US$ 3,500
The overall costs, excluding depreciation are:		US$ 10,472/year
Sales income:		13,725/year
Cash flow is:		3,253/year
Payback period:	3,500/3,253 = 1.08 years = 13 months	

- Metallic Kiln

		13 months
Investment required		US$ 2,800
Overall costs exc. depreciation		9,250/year
Sales income		16,328/year
Cash Flow		7,078/year
Payback period	2,800/7078 = 0.4 years = 4.8 months	

d. Status of Demonstration Projects

The beehive kiln entered into the demonstration phase at the end of 1983, and ICAIT now has two units operational in Costa Rica. The metallic kiln was put into operation at the end of 1984. ICAITI plans to construct a demonstration unit in Honduras during the second quarter of 1985.

e. Status of the Dissemination Effort and Related Technical Publications

The charcoal seminar was carried out in Costa Rica for potential charcoal producers, and was attended by 25 small business participants. The seminar included a visit to the demonstration unit.

A construction/operation manual for the beehive type kiln has been published and widely distributed in Costa Rica, and to a lesser extent, in the other Central American countries. Numerous consultations have been held by ICAITI with charcoal producers in Costa Rica and Guatemala.

In Costa Rica several beehive kilns have been constructed as a consequence of the ICAITI demonstration unit. In Guatemala there is one charcoal project being initiated to produce charcoal under ICAITI's technical assistance. A construction/operation manual for the metallic kiln is under development.

7. CONVENTIONAL TYPE BIOGAS DIGESTOR (Medium priority all countries)

a. Description of the Specific Technology

The horizontal displacement continuous type digestor is built of concrete in the ground so as to maintain a constant internal temperature. The fact that the digestor is in the ground also makes the daily loading and unloading operations easier. The gas produced can be stored either inside the digestor or in separate systems such as plastic bags.

b. Potential Commercial Applications

This digestor has been designed to operate with all kinds of animal manure and is simple to construct and operate. Units have been built in sizes ranging from 10 to 55 cubic meters.

c. Economic Analysis and Payback Period

Assuming a minimal biogas production as equivalent to $\frac{0.33 \text{ m3 gas}}{\text{m 3 digestor}}$ and based on the various economic analyses undertaken, the rate of return on the investment is approximately 35-40%. The maintenance costs run at about 10 to 16% of the total cost which gives a payback period on the order of 2 to 3 years. While it is difficult to quantify the value of the fertilizer produced by a digestor, it is significant and often the major reason why cattlemen and farmers decide to install a unit. The digestors also have an important positive impact on the environment.

d. Status of Demonstrations

Three prototype demonstration units have been initially constructed in Guatemala by ICAITI. Subsequently, 24 units were constructed in Guatemala, 3 in El Salvador, 5 in Honduras and 2 in costa Rica. Three units are under construction in Guatemala and one is being built in Panama. Most of these units have been built with private funding with ICAITI providing only technical assistance.

e. Status of the Dissemination Effort and Related Technical Publications

This technology has received significant acceptance throughout Central America. Biogas National Committees have been formed by national dissemination counterparts in Guatemala and Costa Rica. Construction, operation and maintenance manuals have been distributed for the past year as well as other descriptive pamphlets and materials.

8. LOW COST BIOGAS DIGESTORS (Medium priority all countries)

a. Description of the Specific Technology

This digestor has the same production characteristics as the continuous conventional type. It is built using techniques which allow savings in construction materials and labor costs. The digestor's walls and floors are built without reinforcement and the roof uses only chicken wire to reinforce the concrete.

b. Potential Commercial Applications

This low-cost digestor (3-9 m3) is an appropriate alternative in those areas where economic resources are scarce and few animals are available or where the methane gas demand is low. A unit of this size will more than amply satisfy the energy needs of the average family. Commercial application are therefore limited to small farms users.

c. Economic Analysis and Payback Period

Assuming a minimal gas production of 0.33 m3 gas/m3 digestor, and based on the different economic analysis done on digestors of different types and sizes, a rate of return of between 45 and 50% was obtained. The maintenance costs range between 8-11% of the total cost. The payback period averages less than two years.

d. Status of Demonstration Projects

The dissemination phase was begun late in 1983. Two demonstration units were built and a construction and operations manual was published. So far, eight plants have been built in Guatemala, and one in Costa Rica, with two additional units under construction in each of these countries.

e. Status of the Dissemination Effort and Related Technical Publications

This technology has been widely discussed in seminars and short courses that have been held throughout the Central American region. Construction, operational and maintenance manuals have been distributed during the last year.

9. DRY DIGESTORS (BATCH) (Medium priority all countries)

a. Description of the Specific Technology

The abundance of different organic wastes such as coffee pulp, vegetable wastes, wood sawdust, etc., which normally become environmental problems, provided the idea to develop digestors capable of breaking down these and similar wastes. The dry digestors are concrete receptacles with plastic covers or plastic bags. The wastes are deposited and mixed with substrates that improve the carbon-nitrogen relationship, pH, and contain enough bacterias to initiate the fermentation process. The gas production depends on the materials used and can last from 3 to 5 months per batch.

b. Potential Commercial Applications

It is expected that these digestors will be accepted by industries and commercial farms as the materials used are a source of bad odors, insect breeding places, and lose their fertilizer value when exposed to the elements. All of these problems can be eliminated when using a digestor, and, the gas produced can be used as an energy source.

c. Economic Analysis and Payback Period

Data for this type of analysis will be obtained from a digestor that is currently under construction in Costa Rica for processing of banana and plantain wastes.

d. Status of Demonstration Projects

To date, this type of digestor has only been laboratory tested in 55 gallon barrels. The preliminary data obtained have resulted in the construction of a 20 m3 digestor in Costa Rica which will be operating in early 1985, using banana wastes.

e. Status of Dissemination Effort and Related Technical Publications

Results obtained from the 55 gallon digestors operating with different types of wastes will be published shortly, as will results from the 20 m3 digestor that will operate with banana wastes. Dissemination will commence when sufficient economic data becomes available.

10. DOMESTIC WOODSTOVES

a. Description of the Specific Technology

These domestic woodstoves are improved stoves designed to substitute present primitive cooking techniques in Central America. After field testing 16 different models from throughout the world, two designs are being disseminated - the Ghula and the Lorena stoves. Both stoves have chimneys to eliminate smoke and both reduce fuel consumption by 15-40%. These stoves are currently being disseminated by 60 national institutions and PVOs in Central America. National committees to coordinate dissemination activities are established in Guatemala and El Salvador.

b. Potential Commercial Applications

The only potential commercial application is the training of professional stove builders who can carry out this activity as small business enterprises.

c. Economic Analysis and Payback Period

Institutionally disseminated stoves are usually partially subsidized. Stoves built on a commercial basis currently average Q25 per unit. A typical commercial builder nets approximately Q100 per month. Fuelwood savings by owner result in a payback period of about 4 months.

d. Status of Demonstration Units

All ICAITI demonstration units (450 in Central America) have been turned over to counterparts. No further demonstrations are planned by ICAITI.

e. Dissemination Efforts and Related Technical Publications

Massive dissemination of stoves by extension personnel will be the responsibility of national institutions and PVO groups. ICAITI has already trained 400 extensionists in the region. ICAITI still plans to backstop Peace Corps training projects for individuals who will construct stoves on a commercial basis (small business enterprises). This latter effort is already under way in Guatemala and will be replicated in Costa Rica and Honduras. ICAITI has to this date distributed 3,811 construction and operations manuals.

11. INSTITUTIONAL-SIZE WOODSTOVE (Medium priority all countries)

a. Description of the Specific Technology

ICAITI has designed a low-cost institutional size woodstove which can be used in restaurants, schools, and other operations where food must be cooked in large containers.

b. Potential Commercial Applications

The institutional type stove can be used where large amounts of food must be cooked using fuelwood. These stoves can handle containers with capacities up to 80 and 100 liters for the preparation of food for school children, field workers, or in hospitals, refugee camps or medium-sized restaurants.

c. Economic Analysis and Payback Period

The total cost for the institutional-size stove is $91.00. Comparing the cost of operation of a fuelwood stove with propane gas, the savings using fuelwood is $0.45/day which gives a payback period of seven months, when the stove is used once a day. If used three times a day, the initial investment on the stove is paid back in about two months. Propane gas also requires a higher investment for the burner and storage tank. In many rural communities, the availability of propane gas is not reliable.

d. Status of Demonstration Units

The demonstration phase for this technology began in 1984 with ICAITI providing technical assistance in the construction and operation to schools, medium-sized restaurants, cooperatives, refugee camps and government agencies in Guatemala and Costa Rica.

e. Status of the Dissemination Effort and Related Technical Publications

To date, demonstrations on these stoves' construction and operation have been given in Guatemala to the technical personnel of FYDEP (Empresa de Fomento y Desarrollo de El Peten - a national development agency) and to health technicians from the National Hospital of Jutiapa. A construction and operations manual has been published and distributed in Central America and Panama.

12. LIME KILN (Medium priority Guatemala and Honduras)

a. Description of the Specific Technology

Rural lime production is carried out in wood burning kilns of various types in which the limestone is cooked at extremely high temperatures. ICAITI has designed an improved kiln to carry out this process more efficiently. The design modifies the traditional operational system of the region by going from batch systems to a continuous production one. The kiln is a vertical type unit which allows the flow of limestone from the upper to the lower part of the same. The heat rises from the lateral burners to the upper part of the oven. The limestone is cooked while flowing against the air current. The design allows for the daily loading to be done in the upper part of the oven while the unloading is done at the lower end.

b. Potential Commercial Applications

Lime is used in the production of cement and in other industries in the region, thus a great demand for it prevails. The improved kilns were designed mainly for the small and medium sized lime producers. The new design can also be adapted for larger-scale operations. Besides burning fuelwood the kiln can be adapted to burn coffee wastes, sawdust and sugar cane bagasse.

c. Economic Analysis and Payback Period

The construction of this kiln requires an investment in materials and in skilled labor. The experimental and demonstration unit which was built by ICAITI in San José Poaquil, Chimaltenango, Guatemala has the following costs:

Materials	$2,100.00
Labor	5,170.00
TOTAL COST	$7,270.00

According to available data, the payback period is approximately 8-9 months.

d. Status of Demonstration Projects

The construction of additional kiln depends on the results of the field tests presently being carried out.

e. Status of the Dissemination Effort and Related Technical Publications

Dissemination efforts and publication of a construction and operations manual will be undertaken as soon as results from the experimental unit are completed.

13. CRUDE SUGAR "PANELA" COOKER (Medium priority Panama)

a. Description of the Specific Technology

ICAITI designed a special cooker to be used to evaporate water from sugar cane juice to obtain crude sugar. It has two large burners and is supported by a firebox. This cooker uses the sugarcane bagasse as fuel which replaces fuelwood.

b. Potential Commercial Applications

This cooker is very appropriate to increase crude sugar production and reduces fuelwood consumption. In countries such as Panama, where very primitive methods are still used in the process and where fuelwood consumption must be reduced, the panela cooker appears to be very appropriate.

c. Economic Analysis and Payback Period

The initial prototype required an initial investment of US$1,200. Data to determine costs and returns on investment are being developed.

d. Status of Demonstration Projects

The demonstration phase of this technology began late in 1984 with the construction, operation and evaluation, by ICAITI, of a unit in Panama.

e. Status of the Dissemination Effort and related Technical Publications

To date this design has been used only in La Pintada, Penonomé, Province of Coclé, in Panama, but there is interest on the part of government institutions and development agencies to build other units elsewhere in the country as the prototype is tested and sufficient data is developed, a dissemination program will be developed for specific "panela" areas, mostly in Panama.

14. SOLAR HOT WATER SYSTEMS (Lower priority all countries)

a. Description of the Specific Technology

ICAITI has designed and tested eighteen different solar water heater models and selected three prototypes as the most viable. The models selected by ICAITI are: dynamic open system with a buffered tank, hot box system and plastic poliduct coil system. The dynamic open system used in institutions (1,000 to 1,200 gallons per day). The hot box system was designed for homes and other installations where there is no additional energy source (a 50 gallon passive system). The plastic coil system was designed mainly to heat swimming pools and to preheat water for industrial use due to its low cost per foot of construction and because of its easy installation.

b. Potential Commercial Applications

The solar hot water systems have been accepted in most of the Central American regions, and entrepreneurs trained by the Project are now involved in the construction and sale of these systems. In essence, the technology is now considered totally transferred to the private sector which is now providing the services as private endeavors. The models can be adapted to existing heating systems in hotels, hospitals, clinics, cafeterias, laundromats, dry cleaning operations and can be modified so as to heat the water to much higher temperatures and used in tanneries, canning factories, bottling installations, etc.

c. Economic Analysis and Payback Period

The costs investment involved are as follows:

Dynamic Open System	$12-16/gallon (installed)
Hot Box	$6-7/gallon (installed)
Plastic Coil	$0.05/gallon (installed)

The payback period is on the order of 2 to 3 years for the active systems and 2 years for the passive systems.

d. Status of Demonstration Projects

There are institutional demonstration units operating in Guatemala, Honduras, El Salvador, and Costa Rica.

e. Status of the Dissemination Effort and Related Technical Publications

Twelve theoretical seminars and six short workshops have been given where the solar hot water prototypes have been built. Two manuals covering the construction of flat collectors and on the design and installation of the systems will be published and distributed in early 1985.

15. PACKED-BED DIGESTORS (Lower priority all countries)

a. Description of the Specific Technology

This laboratory-tested technology is now being field tested. These high-productivity digestors differ from the conventional digestors in that they are partially filled with packing materials to which the bacteria adhere. This, in turn, results in a greater bacteria population per cubic meter and a higher rate of fermentation.

b. Potential Commercial Applications

These digestors are highly stable, able to absorb changes in the composition of materials fed, and of high dilution, thus they are ideal to process wastes such as sewer waters from hospitals, schools, industries, etc. The effluent has a low-contamination effect.

c. Economic Analysis and Payback Period

Being that these are relatively small digestors when compared to their gas production and that the packing material which is used to retain the bacteria is very low in price, one can expect a highly favorable economic analysis. Data is being collected to quantify the economic returns.

d. Status of Demonstration Projects

At present, the technology is in a field research phase. Once the results are evaluated, the construction of demonstration units will be considered.

e. Status of Dissemination Effort and Related Technical Publications

Once this technology has been field evaluated, the results obtained will be published, including an economic analysis, and a construction manual will be prepared for dissemination.

16. BRICK KILN (Lower priority Guatemala, Honduras and El Salvador)

a. Description of the Specific Technology

The kiln designed by ICAITI consists of two firing chambers built at different levels and connected by ducts which allows the heat from the lower chamber to be used in the upper level for preheating.

b. Potential Commercial Applications

Brick is a material which is widely used in the construction industry in the region. The production of bricks is done mainly in small-scale operations in traditional ovens. This technology is aimed at those small operations that have no financial capacity to implement higher levels of technology and whose ovens utilize firewood as a source of fuel. The kiln can also be used for roofing and floor tiles and other applications.

c. Economic Analysis and Payback Period

The initial investment is about $2,200 and the payback period is estimated to be 14 months.

d. Status of Demonstration Projects

Four units have been built in Guatemala, El Salvador and Honduras.

e. Status of the Dissemination Effort and Related Technical Publications

The dissemination of this technology has been carried out with the assistance of local counterparts through courses and workshops. A brochure has been published and a construction, operations and maintenance manual will be published in 1985.

17. SALT COOKER (High priority Honduras)

a. Description of the Specific Technology

ICAITI designed a brick salt cooker with a cascade firebox. It holds two or three metal containers and has a firebox and corresponding grill. The saline solution is placed in these containers and the combustion of firewood or other biomasses evaporates the water and crystallizes the salt.

b. Potential Commercial Applications

This new design makes it possible to reduce operation time and double or triple production. The amount of firewood consumed is also reduced. This technology has potential among "cooked-salt" producers in the Gulf of Fonseca, Honduras, and in the Southeast Coast of Guatemala.

c. Economic Analysis and Payback Period

Costs and return on investment are not available as this model is presently undergoing field testing.

d. Status of Demonstration Projects

This technology was started up in 1984 when ICAITI assessed CDI/PTR in Honduras in the construction of a privately-sponsored cooker.

e. Status of the Dissemination Effort and Related Technical Publications

The Salt Cooker designed by ICAITI is currently in operation in San Lorenzo, Honduras. This area is highly dependant on its salt operations so the unit is quite frequently visited by neighboring producers.

C. Description of Increased Dissemination Effort

The purpose of the project extension will be to:

Disseminate the most promising commercial fuelwood and non conventional energy technologies through technical publication, conferences, seminars and short courses designed around demonstration projects.

Strengthen the capabilities of national counterpart organizations to disseminate improved and non-conventional energy sources.

The end-of-project conditions which will indicate that the project extention has achieved its purpose will be specified in the supplemental Implementation Plan referred to below.

During the extension period, ICAITI will need to continue to respond to the technical and extension needs of the counterpart institutions with which it has established close ties, respond to specific requests from the private sector for technical information and concentrate initially on finishing up demonstration projects and technical publications. Many of the specific technologies described in the previous section have sufficient promise to merit an increased dissemination effort which is described in this section as well as a higher priority for related demonstration and technical publication efforts which are described in the PP amendment sections which follow. This increased dissemination effort will be the focus of the extension, particularly during the last 12 months.

The increased dissemination effort will involve national seminars, short courses, workshops, visits to demonstration project sites, information dissemination and technical assistance for commercial applications. The general nature of this effort and planned outputs are described here. As a covenant to the Project Agreement Amendment, ICAITI will provide in form and substance satisfactory to ROCAP, a detailed plan for the period 6/30/85 to 6/30/ 86 supplementing the overall implementation plan which it has submitted in connection with this PP Amendment. This supplemental Implementation Plan will describe the training and other dissemination efforts events by country, specific technology, and include planned dates for their implementation.

— Regional and National Seminars: ICAITI plans 3 regional and 5 national seminars involving a total of about 400 participants. The seminars are usually a three or four day event covering one basic technology, i.e. solar, biogas or combustion, with the purpose of developing institutional support and familiarizing local personnel and businessmen with the particular technology. The seminars are given jointly by ICAITI, a counterpart institution, private sector business associations and the banking community.

-- Short Courses: ICAITI plans 70 short courses involving a total of about 1,300 participants. The short courses are ordinarily one full day and cover one basic technology, i.e., combustion, or one specific technology, i.e., bakery ovens, with the purpose of training counterpart personnel or extension

workers, e.g., Peace Corps Volunteers, in the technology and convincing specific groups, e.g., cattlemen, dairymen, brickmakers, bakers, farmers, etc., on using a specific technology. The primary emphasis under the extension will be on commercial operations which can expand and create additional employment.

-- Workshops: ICAITI plans 24 workshops involving a total of about 500 participants. The workshops are usually one-week event where participants are given practical training in one of the specific technologies, e.g., construction of a solar dryer for wood products, salt, grains, nuts, etc. Primary emphasis under the extension will be on training individuals who can later use the specific technology for commercial purposes, e.g., a mason who will sell and construct bakery ovens or institutional stoves for profit.

— Visits to Project Sites: ICAITI plans to promote and carry out about 200 guided visits to project demonstration sites for about 500 small business owners and entrepreneurs.

-- Information Dissemination: ICAITI plans to distribute 20,000 promotional brochures on combustion, biogas, and solar technologies: 5,000 technical reports on the specific technologies, and 5,000 detailed construction manuals.

-- Technical Assistance for Commercial Applications: ICAITI plans to provide technology designs and/or direct technical assistance for 500 site specific applications of the technologies for commercial applications and will respond to all technical inquiries received from the private sector as a result of its other efforts.

In summary, the outreach effort under the extension will result in about 3,200 individuals being trained directly, the dissemination of about 30,000 technical publications, and the provision of technical assistance to at least 500 commercial applications.

D. Description of Efforts Needed to Complete Demonstration Projects and Transfer Responsibilities to National Counterparts

1. Ongoing Demonstration Projects

ICAITI has already turned over responsibility to counterparts and beneficiaries 439 domestic stoves, 28 industrial ovens, 39 biogas digestors, 5 solar hot water systems, 22 solar driers, and 40 solar salt evaporation systems. These include 489 demonstration units financed by ICAITI, and 84 units constructed by counterparts and the private sector with ICAITI technical assistance.

The following operational demonstration units are still being totally or partially managed by ICAITI:

		Date Programmed To Be Turned Over To Counterpart
1.	Barcenas Biogas Demonstration & Testing Center,Guate.	End of Project
2.	ENA Biogas Demo Center, El Salvador	July 1, 1985
3.	Coronado Biogas Demonstration, Costa Rica	July 1, 1985
4.	Black-pigmented tile solar salt, Sipacate, Guatemala	May 1, 1985
5.	Solar fruit-drier, CENTA, El Salvador	April 1, 1985
6.	Solar fish drier, Tahuexco, Guatemala	May 1, 1985

The following demonstration units have been constructed, but are presently in the start-up phase:

1.	Lime kiln, Guatemala	July 1, 1985
2.	Biogas digestor, Santa Lucía, El Salvador 1/	June 1, 1985
3.	Biogas digestor, Tres Rios, Costa Rica	June 1, 1985
4.	Bakery Oven, Heredia, Costa Rica	April 1, 1985
5.	Solar plantain drier, Limón, Costa Rica	April 1, 1985
6.	Portable charcoal kiln, Turrialba, Costa Rica	May 1, 1985

1/ Digestor being converted to new gas applications.

The construction of the following four demonstration units was initiated in 1984, but has not been completed:

	Date Programmed To Be Turned Over To Counterpart
1. Bakery oven, Guanacaste, Costa Rica	July 1, 1985
2. Biogas digestor, Panamá	July 1, 1985
3. Biogas digestor, La Lima, Honduras	June 1, 1985
4. Dairy Project, Choluteca, Honduras	August 1, 1985

The above lists include all ICAITI financed (or partially financed) demonstration projects. Not included is ongoing technical assistance to construction by others of units also used for demonstration purposes.

2. New Demonstrations Related to Highest Priority Specific Technologies in Terms of Commercial Applications

ICAITI's Workplan calls for the construction of only four project sponsored new demonstration units in 1985: one dry biogas digestor, one charcoal kiln, and two solar lumber driers. However, ICAITI technical assistance to private sector operations will undoubtedly result in additional projects which will be used for demonstration purposes.

Of the four programmed demonstration units, construction of the dry digestor (banana wastes) will be initiated in Limón, Costa Rica, on February 15, 1985, and is scheduled for completion on May 1, 1985.

ICAITI's Delegate in Costa Rica is presently investigating alternative locations for a solar lumber drier in that country, and CDI (Honduras) is selecting sites for the charcoal kiln and the other solar lumber drier demonstrations. A deadline of April 15, 1985 will be given to complete site selection, otherwise the demonstrations will be dropped. No new project financed construction will start after May 1, 1985.

In general, ICAITI and ROCAP agree that all ongoing and new demonstration projects will be completed by June 30, 1985 and that no AID funds will be used for expenditures accrued after that time, except for mutually agreed upon commercial or industrial "need driven" demonstration projects which may merit small subsidies. ICAITI will continue to provide technical assistance for demonstration projects funded by counterpart institutions and for private sector projects that could be used for demonstrations, but the final year of the project will be devoted almost entirely to the dissemination effort and in responding to specific private sector needs for technical assistance and information.

E. Description of Efforts Needed to Complete Technical Publications

ICAITI has published and distributed five promotional brochures on solar energy uses, brick kilns, bakery ovens, biogas applications and fuelwood stoves. Ten manuals have been published and distributed on domestic stoves (4), biogas (3), solar energy applications, bakery ovens, and charcoal kilns. A newsletter, technical reports, studies, and other publications have also been prepared and distributed. In general, these publications have been of very high quality although in some cases the economic analysis has been less than desired. Timing for many of the publications has often fallen behind schedule and ICAITI will need to make a special effort to complete the publications listed in the following paragraph for preparation during the extension period, as most are essential in carrying out an increased dissemination effort. ICAITI will also need to strengthen the economic analysis for several of the specific technologies in order to provide information needed for investment decisions.

All draft technical publications will be written by the Technology Dissemination Teams, while the Promotion Team will concentrate on case studies, newsletters, articles, evaluations and special reports. All technical publications will be edited by ICAITI's Technical Edition Division and published under the supervision of this Division. The 1985 Technical Publications Plan submitted by ICAITI is as follows:

TECHNICAL PUBLICATIONS PLAN

Publications	Date to be Published
1. Low-cost Biogas Digestor Data Sheet*	February 28, 1985
2. Ceramic Stove Installation Manual*	February 28, 1985
3. Solar Drier Manual (Grains and Foods)*	March 22, 1985
4. Information Brochure - Continuous Bakery Oven	March 22, 1985
5. Informative Brochure - Solar Lumber Drier	March 22, 1985
6. Ceramic Stove Development Report*	March 29, 1985
7. Informative Brochure - Solar Salt	April 12, 1985
8. Informative Brochure - Solar Fruit Drier	April 12, 1985
9. Informative Brochure - Solar Fish Drier	April 12, 1985
10. Brick Kiln Construction Manual*	May 3, 1985
11. Biogas Applications Manual	May 24, 1985
12. Continuous Bakery Oven Construction Manual	June 14, 1985
13. Solar Hot Water Systems Installation Manual*	June 14, 1985
14. Tent and Wengert Solar Drier Construction Manual	June 15, 1985
15. "Panela" Cooker Construction Manual	July 12, 1985
16. Solar Fuelwood Drier Technical Report*	August 2, 1985
17. Amatitlán Hospital-Solar Hot Water Technical Report*	August 23, 1985
18. Lime Kiln Construction Manual	September 20, 1985
19. Lorena Stove Materials Study	October 4, 1985
20. Flat Plate Solar Collector Manual*	October 25, 1985
21. Dry Biogas Digestor Construction Manual	November 22, 1985

* Drafts already completed by Technology Dissemination Teams and submitted to ICAITI's Technical Edition Division for editing and publication.

III. IMPLEMENTATION PLAN (1/1/85 to 6/30/86)

A. A Description of Proposed Level of Effort by Technology and Country

Regional dissemination of the high and medium priority technologies listed will be the principal activity of ICAITI's 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 1985-86.

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 [illegible] domestic stoves.

Although dissemination techniques may vary depending upon the technology and the type of market; the primary dissemination mode will be promotion through short courses/demonstrations to develop interest in the private sector. Individuals, industries, cooperatives, etc., who have adequate financial resources to put the technology to immediate use will be given direct technical assistance by ICAITI. Others who may be interested in the technology, but lack financing, will undoubtedly be identified during the dissemination effort, and ICAITI will periodically inform ROCAP and investigate possible sources of financing for these needs.

Practical workshops will be carried out for those technologies which can be implemented through do-it-yourself construction (small solar driers, stoves) and to train individuals (masons, carpenters) who have the potential to construct these and the more complicated technology applications on a commercial basis.

Some experimentation and design changes will continue at a lower priority level, exclusively on those new technologies and new applications of existing technologies which could be incorporated into a possible new project.

The specific activities planned by technology are as follows:

1. Combustion Dissemination

Conventional Domestic and Institutional 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 feedback 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 1985-86 the following conventional stove activities are planned:

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

b. 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 Stove Committees by dissemination personnel. Peace Corps Guatemala plans to expand this activity and ICAITI will provide technical backstopping.

- Ceramic Stoves

Prototype testing, preparation of drawings, and the production of a pilot lot of ceramics components has been completed in Guatemala. Eight small ceramics industries are involved. Training in this technology will be provided to counterpart institutions throughout the region.

- 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 Panama is just starting.

The scope of the dissemination program in each country will be increased in 1985-86, through more short courses given by combustion technologies disseminators in different geographical zones, taking advantage of the demonstration units in place. More training of construction supervisors (masons) is needed in all countries. Considerable effort will be required by Delegate and Assistant in each country 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.

Combustion engineers will concentrate on kiln dissemination in El Salvador in 1985-86, where short courses will be given at Turicentro Balboa, taking advantage of the demonstration unit located at that site. 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 in early 1985. Assuming satisfactory results, [illegible] lime producers in other areas will be transported to the site and trained in this technology. Major emphasis will be placed in tying the small lime producers to the major cement producers in each country under contractual arrangements to purchase increased lime production.

- 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. Since PTR/CDI has given a high priority for solar salt promotion, little ICAITI input will be required for the salt cooker project in 1985-86.

- Panela Cooker

The panela cooker is presently under test in Panama, the only country where this technology appears to be urgently needed. Preliminary test results have been excellent, and a short course program will be carried out to promote this technology in sugarcane areas in Panama.

- 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. A portable metal kiln is under test in Turrialba, Costa Rica. Charcoal engineers will continue to provide technical assistance to the Costa Rica dissemination program in 1985-86. The engineers will also demonstrate this technology in Honduras, and will assist PTR/CDI in organizing a dissemination program.

2. Biogas

Biogas digestors using animal manure substrates have been demonstrated in Guatemala, El Salvador, Honduras and Costa Rica, and will be demonstrated in Panama early in 1985. Gas applications include cookstoves, ovens, heaters, lamps and internal combustion engines which can be used for electricity generation, running pumps, grinders, etc. 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 ongoing dissemination programs in Guatemala and Honduras.

b. Biogas technology disseminators will promote additional dissemination through the short course/demonstration dissemination mode throughout Central America for commercial applications.

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

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

e. 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 cooperatives managed by CENDEPESCA.

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 IGSS, Guatemala, and a private hotel on Roatan Island, Honduras. As this technology has become a private sector endeavor, the only activities planned for 1985-86 are continued technical assistance by the Solar Team in response to requests by public and private institutions and individuals who wish to start or expand their businesses.

- 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, shrimp, spices, copra and other products in Costa Rica. The dissemination is being carried out principally through promotional short courses followed by practical workshops in diverse agricultural zones (i.e. cacao-growers Limón, Costa Rica), with subsequent technical assistance to those enterprises who request the technology. Construction projects effected by these enterprises later serve as demonstrations to promote greater technology acceptance in the immediate geographical zone. This is proving very successful in Limón Province, Costa Rica, and ICAITI's Technology Dissemination Team plans to use this method throughout Central America.

- Solar Lumber Drier

The first solar lumber drier is now being demonstrated in Guatemala, with excellent results. Dissemination of this technology to Guatemalan lumber guilds and wood-working industries will start in 1985, with selected industrialists transported to the Coatepeque site for demonstration purposes. This new technology will be demonstrated in Honduras and Costa Rica in the first half of 1985, and dissemination programs will be initiated in the third quarter based upon the Guatemalan experience.

- Solar Salt

The black plastic technology has been demonstrated on the Pacific Coast 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 1985-86, technical assistance will be provided to those large commercial salt producers who wish to convert to the black plastic or pigmented tile technologies. A follow-up evaluation of the large number of small and medium producers already using this technology will be effected.

In Honduras, PTR/CDI considers the San Lorenzo solar salt project to be of very high priority, but they are having difficulty convincing entrepreneurs. PTR/CDI, therefore, plans to install a commercial size demonstration with their own funds, and ICAITI will provide technical backstopping for their project.

B. ICAITI's Organization and Personnel Requirements

The project personnel required to carry out the 1985 activities are listed with the budget included in Section IV, Financial Plan. The project will continue to be coordinated by Ing. Justin H. Whipple; deputy chiefs will be Lic. Manuel Recinos (budget-personnel), Ing. Oscar Maldonado (field operations) and Lic. Sandra Smith (promotion). The technology dissemination 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 promotion assistant is contemplated to allow the present assistant, Ing. Ivan Azurdia, to dedicate an almost full time effort to report writing. Due to the expanded activities in dissemination, three new technology dissemination team members will be hired, one to replace Ing. Jose Silva, and two additional. An Organization Chart is also included in Section V, Project Personnel.

C. Need for 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 solar drier applications. Consultants will also assist in training counterparts and in preparing reports for their respective technologies. Consulting services for carrying out an industrial survey to establish the potential impact by technology to focus targeting for the dissemination effort, and for a project evaluation are also needed and have been included in the budget

The short-term consulting services will be controlled by the Work Order method used in past years, and will be programmed on a quarterly basis. In the first quarter of 1985, 10 person-days of solar consulting are planned, principally for technology dissemination efforts in geographical zones not previously promoted, and 5 person days of biogas consulting to train ICAITI's biogas engineers in the development of much larger biogas projects than those presently in effect. ICAITI has already received a request for technical assistance in this field. The tentative program (person-days) for the 2nd, 3rd and fourth quarters is as follows:

	CALENDAR QUARTERS (1985)		
	SECOND P/D	THIRD P/D	FOURTH P/D
Solar	15	15	10
Biogas	10	10	5
Others	5	10	5

D. Publications

The schedule for publication of technical/promotional material (21 publications) has been previously discussed.

In addition to the above, ICAITI will publish case studies and other informative reports in response to ICAITI and ROCAP needs. A trial project newsletter has recently been published, and this will be continued on a quarterly basis after March 31, 1985.

E. Seminars and Training

The seminar, short course and workshop programs developed in past years, will be expanded to support counterpart dissemination activities and to transfer the newer technologies in 1985-86.

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 with maximum utilization of existing demonstration units. Approximately 70 events of this type will be carried out in 1985, with highest priority given to the solar drier, biogas and industrial oven technologies.

The seminars, short courses and workshops will be programmed initially on a quarterly basis and on an annual basis for the period 6/30/85 to 6/30/86. However, programs will be flexible enough, to permit ICAITI to respond to those requests received from the field that appear most promising for the creation of new small business enterprises.

F. New Applications and Dissemination Support

Funds included in the budget in these categories will cover the following activities in 1985-86:

- Research and development of new technologies and applications for existing technologies;
- 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, chacoal kilns in Honduras, solar lumber driers in Honduras and Costa Rica, and modified biogas systems in Costa rica;
- Limited financial support for the start-up of counterpart dissemination programs for all proven technologies, funds to be used for promotion and training exclusively.

G. Fees

In the first quarter of 1985, ICAITI will develop a fee schedule for seminars, workshops and technical services and manuals with the idea of making the project activities more self-supporting and demand proven.

H. Industrial Survey and Evaluation

To assist ICAITI in its efforts to increase private sector involvement in Project-related activities, a survey of industries in the region will be conducted. The survey will be designed to give ICAITI 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.

The 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, either kilns, combustion chambers, solar driers, biogas digestors or gasifiers will be presented. Because the results of the survey will provide valuable information for the design of the dissemination effort during the final year of the project and a possible follow on new project, the survey will be completed during the first two quarters of CY 1985.

During the third quarter of 1985, ROCAP and ICAITI will conduct a project evaluation. The evaluation will cover all aspects of administration, organization, operation, utilization and effectiveness of the Project. The evaluation report will also serve as useful input into the design and analysis of a possible follow-on project.

A final evaluation of the project will be carried out in the second quarter of 1986. This evaluation will focus on the project's results in terms of disseminating the technologies and the impact that the project has had in the participating countries.

I. Revised Listing of Project Outputs

	First 60 Months	18 Month Extension	TOTAL
Seminars	15	8	23
Short courses	73	70	143
Workshops	22	24	46
Persons Trained	3,163	3,200	6,363
Institutions Provided Training	67	30	97
Demonstration Units	487	4*	491
Publications Distributed	39,694	30,000	69,694

*Does not include 500 small business enterprises to be assisted during the extension period, which will also result, in effect, in increasing the number of demonstration projects or counterpart institution demonstration projects receiving ICAITI's technical assistance.

J. Replicability

The technologies, applications and dissemination methods have been transferred to the national counterparts and adapted to local conditions. At the end of the project ICAITI will have trained the national counterparts to continue all technology transfer and have formed national technology transfer councils in the appropriate technologies as requested by the Central American countries.

IV. FINANCIAL PLAN

	First Five Years	18 Month Extension	TOTAL
A. ROCAP			
Long-Term personnel	960,720	440,000	1,400,720
Short-Term Personnel 1/ & 2/	394,433	210,000	604,433
Travel and Perdiem	410,795	120,000	530,795
Publications and Promotion	55,000	69,000	124,000
Seminars and Training	90,000	46,000	136,000
Experimentation/Demonstration	125,000	80,000	205,000
Dissemination Support	25,000	132,000	157,000
Other Costs	154,989	30,000	184,989
Overhead (80% of long-term personnel)	765,795	352,000	1,117,795
Contingency	-	78,918	78,918
TOTAL	2,981,732	1,557,918 3/	4,539,650
B. ICAITI & Host Countries			
Long-Term personnel	454,550	104,000	558,550
Short-Term Personnel	85,000	-	85,000
Travel and Perdiem	150,000	-	150,000
Publications and Promotion	-	-	-
Seminars and Training	-	10,000	10,000
Experimentation/Demonstration	422,524		422,524
Dissemination Support	-	-	-
Other Costs		186,000	186,000
Overhead (80% of long-term personnel)	-	-	-
Contingency	-	-	-
TOTAL	1,112,074	300,000	1,412,074

1/ End of project external financial audit and overhead analysis costs will be applied to line item "Short-Term Personnel".

2/ Two project evaluations are planned for the middle and at the end of the project. These evaluation costs will be applied to line item "Short-Term Personnel".

3/ ROCAP envisions that the project financing methods will be through direct reimbursements to ICAITI and cost reimbursements for outside contract services.

V. PROJECT PERSONNEL

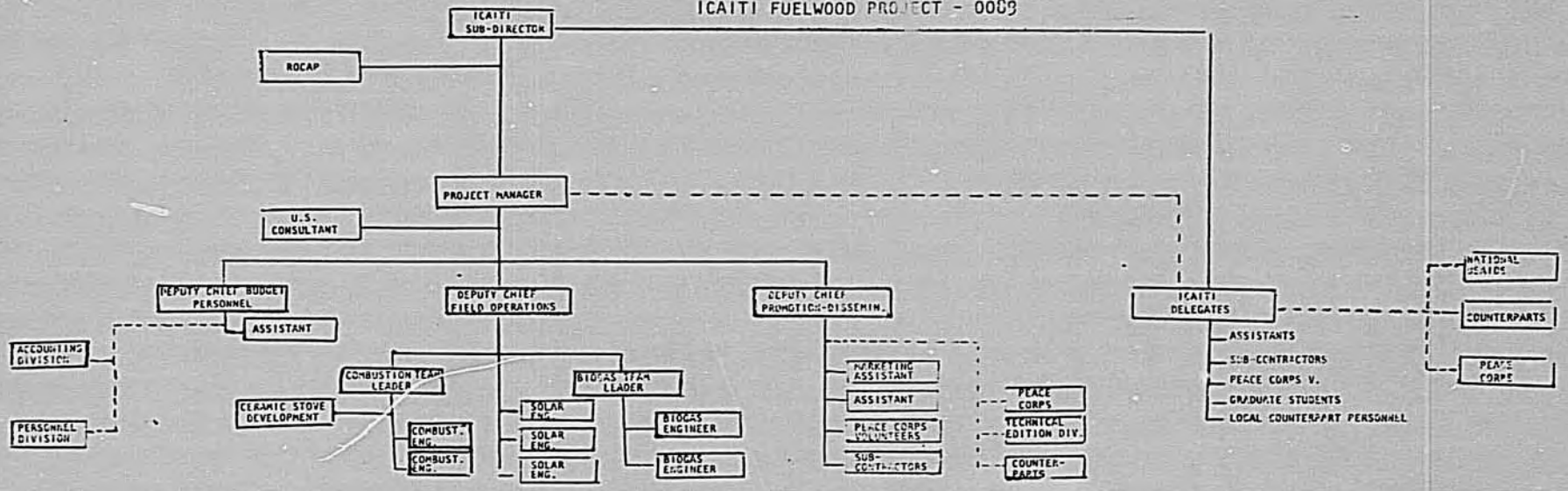
A. Professional

Deputy Chief (Lic. Manuel Recinos)
Deputy Chief (Lic. Oscar Maldonado)
Deputy Chief (Lic. Sandra Smith)
Technical Editor (Ing. Hugo Masaya)
Technical Writer (new hire)
Chief Combustion Disseminator (Ing. Miguel Zetina)
Combustion Dissemination Engineer (Ing. Manuel Recinos)
Biogas/Solar Disseminator (Now hire)
Biogas/Solar Disseminator (Now hire)
Biogas Dissemination Engineer (Ing. Victor Burgos)
Solar Dissemination Engineer (Ing. Otto de Leon)
Charcoal Dissemination Engineer (Ing. Oscar Gil)

B. Non-Professional

Marketing Assistant (Ing. Ivan Azurdia)
Marketing Assistant (new hire)
Promotion Assistant (new hire)
Combustion/Promotion Assistant (Ing. Carlos Vargas)
Solar/Biogas Promotion Assistant (new hire)
Administration Assistant (Sr. Joel Gamarro)
Secretaries
Draftsmen
Combustion/Dissemination Assistant (Ing. Byron Rosales
Solar Dissemination Assistant (Ing. Ivan Arriola)
Biogas Dissemination Assistant (Ing. Romulo Rosal)
Charcoal Dissemination Assistant (Ing. Alfredo Dieguez
Assistant Delegate El Salvador (Sr. Alejando Maldonado
Assistant Delegate Costa Rica (Sr. Agustin Rodriguez)
Assistant Delegate Honduras (new hire)

TABLE 3
ORGAHIZATIONAL CHART
ICAITI FUELWOOD PROJECT - 0009



AREAS OF RESPONSIBILITY

- Budget Control Syster
- Continuous Budget updates
- Expenditures chart
- Specific operation budget chart
- Paperwork for funding (liaison) w/Accounting Division
- Personnel Contracts (liaison) w/Personnel Division)
- Control Absences - Vacations

AREAS OF RESPONSIBILITY

- General Technical Supervision
- Coordinate Joint technology operations
- Visits and monthly reports
- Maintain site directory
- Control travel
- Operations Chart (travel, events, const. progress)
- Technical reports and manuals
- Program courses - seminars

AREAS OF RESPONSIBILITY

- Liaison National Committess & Industrial counterparts
- Publications programming with Tech. Ed. Division
- Liaison Peace Corps
- Preparation promotional brochures
- Preparation case study reports
- Supervise surveys (Esp. industry survey)
- Exhibits - publicity
- Periodic progress repires on dissemination

ANNEX I

TECHNICAL ANALYSIS OF THE STATUS OF THE AID FUELWOOD AND ALTERNATIVE ENERGY SOURCES PROJECT (NO.596-0089) AND

RECOMMENDATIONS FOR EXTENSION[1]

1/This Technical Analysis is based on excerps from the evaluation prepared for ROCAP by Carl Duisberg, Regional Energy Advisor, USAID/Ecuador, in October, 1984.

TABLE OF CONTENTS

I. 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.

II. 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.

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 under a proposed project extension to assure a smooth transition to a planned follow-on project which ROCAP has included in the FY 1986 Congressional Presentation.

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 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.

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

Technolcgy 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 early in 1985.

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 [illegible] and DJC (Save the Children). Except for CEL, all of these [illegible]tutions 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 [illegible]ttee in El Salvador. This activity was temporarily suspended due to [illegible]ection-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.

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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 [illegible] 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.

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.

(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.

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.

January 1985 - June 1986

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. CDI, 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 [illegible] 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.

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.

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

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 RCCAP, 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 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.

(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.

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 Committee, 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 [illegible] visiting a very small-scale dissemination program when ICAITI's project was [illegible]. The units being disseminated were continuous-operating bag [illegible] from plastic sheet produced in Costa Rica. ICAITI, [illegible] demonstrated the concrete digestors in Costa Rica as an alternative [illegible], [illegible] transferred the technology to the experienced national [illegible]s. ICAITI has sponsored two biogas seminars in Costa Rica, and has offered technical assistance to the Biogas Center, once they are ready to [illegible] 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.

bp

- 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.

III. 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 [illegible] Table 1 is a list of counterparts with whom ICAITI has [illegible] working agreements over the years to work with those [illegible] are also reported to be defunct. During the next year ICAITI [illegible] reviewing its experience with each entity and developing a more complete report on the effectiveness of that counterpart, or group of [illegible] in advancing the dissemination and utilization of ICAITI's tech

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 becomе 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.

[illegible] ally funded by the AID/Honduras, is the Centro de [illegible]rial (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.

[illegible]

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.

IV. 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.

Table 2 illustrates 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

Table 3 conveys a sense of the number and range of training and demonstration activities the ICAITI Fuelwood Project team has realized. 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.

V. OTHER

1. 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.

2. 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.

[illegible] technologies with which ICAITI has had experience they [illegible] 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.

3. ICAITI's 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 [illegible] 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.

4. 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.

5. 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.

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS	IMPORTANT ASSUMPTIONS
Outputs			
1. Complete demonstration projects.	1. Barcenas Biogas Center 2. ENA Biogas Demo Center 3. Coronado Biogas Demonstration 4. Solar Salt 5. Solar fruit-drier 6. Solar fish drier 7. Lime kiln 8. Biogas digestor El Salvador 9. Biogas digestor, Tres Rios 10. Bakery Oven, Heredia 11. Solar plantain drier, Limón 12. Portable charcoal kiln, Turrialba	1. ICAITI will develop a work-plan with counterparts to demonstrate and disseminate results for the period of July 1, 1985 to June 30, 1986.	
2. Strengthen and complete economic analysis of all technologies in order to provide information for investment decisions.	2. ICAITI will develop a standardized format and have all economic analysis on 17 technologies completed by June 1, 1985.	3. ICAITI records and publications.	
3. Disseminate technical applications to industries and commercial farms.	(a) Provide technical assistance to at least 500 commercial applications. (b) Publish twenty one (21) technical publications and distribute 30,000 copies. (c) Train 3,200 individuals through eight (8) seminars, seventy (70) short courses, twenty four (24), workshops.	National counterpart and ICAITI records demonstrate a self sustaining and significant impact on the development of the region.	
4. Establish a fee schedule for seminars, workshops, and technical services and manuals.	4. All ICAITI services will require participant financial contribution to make project activities more self-supporting and demand driven.	ICAITI records.	
5. Industrial survey to increase private sector involvement in project-related activities.	5. ICAITI, with consultant assistance, will conduct an industrial survey to determine the range of industries and the potential interest in increasing production or reducing energy and costs per unit of output.	6. Survey report.	

REVISED LOGICAL FRAMEWORK
PROJECT TITLE & NUMBER: FUELWOOD AND ALTERNATIVE ENERGY SOURCES 596-0089

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Sector Goal			
Improve productivity and welfare of small and medium sized rural industry and low income groups, and increase the supply of low cost energy through improved fuelwood combustion and alternative energy systems.	Increase use of energy efficient technologies by the small and medium sized industries and reduce energy costs.	National statistics ICAITI records, and Project evaluation	
Project Purpose	End of Project Status		
(a) Disseminate the most promising commercial fuelwood and non conventional energy technologies through technical publcation, conferences, seminars and short courses designed around demonstration projects.	(a) Technologies to be disseminated will be specified by June 1, 1985. (b) Organizations which will be recipients of technology will be specified by June 1, 1985. (c) National counterpart organizations to be strengthened will be specified by June 1, 1985.	National documents and plans. Project evaluations.	Non-conventional and improved energy technologies can be disseminated and accepted by the end user. Increased government interest in reducing fuelwood consumption & fossil fuel imports.
(b) Strengthen the capabilities of national counterpart organizations to disseminate improved and non-conventional energy sources.		National energy development plans to include non-conventional energy applications.	

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS

Inputs

($000)

	AID		ICAITI			
	To Date	Ext Period	To Date	Ext. Period	Total	The inputs will be verified as part of project implementation, monitoring, and final evaluation.
1. Long-term personnel	960.7	440.0	265.0	104.0	1,769.7	
2. Short-Term Personnel	394.4	210.0	-	-	604.4	
3. Travel and Perdiem	410.8	120.0	-	-	530.8	
4. Publications & Promotion	55.0	69.0	-	-	124.0	
5. Seminars & Training	90.0	46.0	-	-	136.0	
6. Experimentation/ Demonstration	125.0	80.0	-	-	205.0	
7. Dissemination Support	25.0	132.0	-	-	157.0	
8. Other Costs	155.0	30.0	422.0	16	623.0	
9. Overhead	765.8	352.0	-	-	1,117.8	
10. Contingency	-	71.0	-	-	71.0	
	2,981.7	1,550.0*	687.0	120.0	5,338.7	

*Includes $250,000 in existing pipeline.