PD-AAG-025

596-11

UNCLASSIFIED

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DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
Washington, D.C. 20523

ROCAP

PROJECT PAPER

FUELWOOD AND ALTERNATIVE ENERGY SOURCES

AID/LAC/P:031

Project Number:596-0089

UNCLASSIFIED

R O C A P

P R O J E C T P A P E R

FUELWOOD AND ALTERNATIVE ENERGY SOURCES

596-0089

August 16, 1979

DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D.C. 20523

ASSISTANT
ADMINISTRATOR

PROJECT AUTHORIZATION

Name of Entities: Tropical Agricultural Research and Training Center (CATIE)

Central American Research Institute for Industry (ICAITI)

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, I hereby authorize the Fuelwood-Alternative Energy Sources Project for the Tropical Agricultural Research and Training Center (CATIE) and the Central American Research Institute for Industry (ICAITI) (the "Grantees"), involving planned obligations of not to exceed $7,500,000 in grant funds over a six year period from date of authorization, subject to the availability of funds in accordance with the AID OYB/allotment process, to help in financing certain foreign exchange and local currency costs for the project.

2. The Project consists of supporting a regional effort within Central America and Panama (1) to test and provide new energy-efficient technologies for use in rural homes and communities, and (2) to test alternate species and alternate patterns of production of fast-growing trees and shrubs.

3. The Project Agreements which may be negotiated and executed by the officers to whom such authority is delegated in accordance with AID regulations and Delegations of Authority shall be subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as AID may deem appropriate.

4. <u>Source and Origin of Goods and Nationality of Services</u>

Goods financed by AID under the project shall have their source and origin in the Central American Common Market or in the countries included in AID Geographic Code

000, except as AID may otherwise agree in writing and except as set out in subparagraph d below. Suppliers of services, except for ocean shipping, financed by AID under the Project shall have their nationality in the Central American Common Market or in the countries included in AID Geographic Code 000, except as AID may otherwise agree in writing and except as set out in subparagraph d below. Ocean shipping financed by AID under the project shall, except as AID may otherwise agree in writing, be financed only on flag vessels of the United States.

b. Conditions Precedent to Disbursement

(1) Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreements, ICAITI and CATIE shall furnish, in form and substance satisfactory to AID, a coordinating agreement between ICAITI and CATIE.

(2) Prior to any disbursement, or the issuance of any commitment documents under the Project Agreement with CATIE, to finance the procurement or use of pesticides, CATIE shall (a) furnish, in form and substance satisfactory to AID, a plan ensuring that proper safeguards, consistent with the nature and purposes of the Project, are established and followed in the procurement and use of pesticides; and (b) obtain the written approval of AID prior to the procurement or use of any pesticide.

(3) Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreement with ICAITI to finance ICAITI-related activities, except for contracting of a financial/management consultant and for expenditures incurred for travel and per diem costs incurred in Cooperating Countries by ICAITI related to the preparation of time-phased implementation plans for the Project for each Cooperating Country, ICAITI shall furnish in form and substance satisfactory to AID a time-phased implementation plan, including budgets, for its portion of the Project which details actions to be taken and procurement arrangements to be made during the first year of the Project.

(4) Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreement with ICAITI to finance the contracting of engineering staff not already on the ICAITI staff, ICAITI shall furnish evidence to AID, in form and substance satisfactory to AID, that it has contracted for the services of a financial/management consultant.

(5) Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreement with ICAITI for operations in Panama, ICAITI shall furnish, in form and substance satisfactory to AID, evidence that the Government of Panama will permit it to implement project-related activities within its territories.

(6) Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreement with CATIE for anything other than expenditures incurred (1) at Turrialba, Costa Rica by CATIE for hiring staff, or (2) for travel and per diem costs incurred in Cooperating Countries by CATIE related to the preparation of time-phased implementation plans for the Project for each Cooperating Country, CATIE shall furnish, in form and substance satisfactory to AID, a time-phased implementation plan, including budgets, which details actions to be taken and procurement arrangements to be made for its portion of the Project during the first year of the Project.

(7) Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreement with CATIE, for expenditures incurred in initiating field experiments in a Cooperating Country, CATIE shall obtain from such country's counterpart national agency or agencies and furnish, in form and substance satisfactory to AID, time-phased implementation plans, including a budget, for activities to be carried out in such country, detailing actions to be taken and procurement arrangements to be made during the first year of the Project.

(8) Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreement with ICAITI for expenditures incurred in initiating field experiments in a Cooperating Country, ICAITI shall obtain from such country's counterpart national institution(s) and furnish, in form and substance satisfactory to AID, a time-phased implementation plan, including a budget, for activities to be carried out in such country, detailing actions to be taken and procurement arrangements to be made during the first year of the Project.

c. Covenants

(1) CATIE shall covenant to continue to collect data and distribute results on those experiments or portions thereof which require monitoring beyond the life of the Project.

(2) CATIE shall covenant to use its best efforts to ensure that its counterpart national agencies will continue to collaborate with it in the collection of data and distribution of results on those experiments or portions thereof which require monitoring beyond the life of the Project.

(3) ICAITI shall covenant to use its best efforts to implement the recommendations of the financial/management consultant to be hired under the Project and to submit, within 90 days of receipt of such consultant's final report, an implementation plan for the consultant's recommendations.

(4) CATIE shall covenant to submit to AID, in form and substance satisfactory to AID, annual implementation plans for its own activities under the Project prior to November 15 of the year preceeding the year in which each plan is to take effect for every year of the Project except the first. CATIE shall also covenant to use its best efforts to obtain and to submit to AID annual implementation plans from its counterpart national agencies for their activities under the Project prior to November 15 of the year preceeding the year in which each is to take effect for every year of the Project except the first.

(5) ICAITI shall covenant to submit to AID in form and substance satisfactory to AID annual implementation plans for its own activities under the Project prior to November 15 of the year preceeding the year in which each plan is to take effect for every year of the Project except the first. ICAITI shall also covenant to use its best efforts to obtain and to submit to AID annual implementation plans from its counterpart national institutions for their activities under the Project prior to November 15 of the year preceeding the year in which each plan is to take effect for every year of the Project except the first.

d. Waivers

The following waivers to AID regulations are hereby approved:

Waiver of source, origin and nationality requirements for goods and services is approved to permit procurement of goods from AID Geographic Code 941 and of services from suppliers whose nationality is in AID Geographic Code 941 countries. In addition, short-term technical assistance services in silviculture techniques to be provided to CATIE may be procured from suppliers whose nationality is in AID Geographic Code 935 countries.

Acting Deputy Administrator

9/25/79
Date

Clearances:

AA/LAC, A. Valdez		date	9/26/79
LAC/DR, C. Peasley		date	9/25/79
LAC/DR, M. Brown		date	9/26/79
LAC/CEN, P. Farley		date	[illegible]
AA/PPC, C. Paolillo		date	[illegible]
SER/COM, W. Schmeisser		date	9/26/79
GC, M. Ball		date	9/25/79
GC/LAC, J. Kessler		date	9/26/79

GC/LAC:SWhitman:ew:9/25/79:x29182

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT PAPER FACESHEET

1. TRANSACTION CODE: A (A = ADD, C = CHANGE, D = DELETE)

PP

2. DOCUMENT CODE: 3

3. COUNTRY ENTITY: ROCAP - CENTRAL AMERICAN REGIONAL

4. DOCUMENT REVISION NUMBER:

5. PROJECT NUMBER (7 digits): 596-0089

6. BUREAU OFFICE: A. SYMBOL: LAD; B. CODE: 05

7. PROJECT TITLE (Maximum 40 characters): Fuelwood, Alternative Energy Sources

8. ESTIMATED FY OF PROJECT COMPLETION: FY 86

9. ESTIMATED DATE OF OBLIGATION: A. INITIAL FY 79; B. QUARTER 4; C. FINAL FY 84 (Enter 1, 2, 3, or 4)

10. ESTIMATED 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	7,500		7,500
(LOAN)						
OTHER XX 1. CATIE		150	150		917	917
OTHER XX 2. ICAITI		76	76		687	687
HOST COUNTRIES		107	107		927	927
OTHER DONORS		100	100		742	742
TOTALS	500	433	933	7,500	3,273	10,773

11. PROPOSED BUDGET APPROPRIATED FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE C. GRANT	PRIMARY TECH. CODE D. LOAN	E. 1ST FY 79 F. GRANT	E. 1ST FY 79 G. LOAN	H. 2ND FY 80 I. GRANT	H. 2ND FY 80 J. LOAN	K. 3RD FY 81 L. GRANT	K. 3RD FY 81 M. LOAN
(1) FN	741B	290		500		745		1,300	
(2)									
(3)									
(4)									
TOTALS									

A. APPROPRIATION	N. 4TH FY 82 O. GRANT	N. 4TH FY 82 P. LOAN	Q. 5TH FY 83 R. GRANT	Q. 5TH FY 83 S. LOAN	LIFE OF PROJECT T. GRANT	LIFE OF PROJECT U. LOAN
(1) FN	1,400		1,500		7,500	
(2)						
(3)						
(4)						
TOTALS						

12. IN-DEPTH EVALUATION SCHEDULED: MM 12, YY 80

13. DATA CHANGE INDICATOR. WERE CHANGES MADE IN THE PID FACESHEET DATA, BLOCKS 12, 13, 14, OR 15 OR IN PRP FACESHEET DATA, BLOCK 12? IF YES, ATTACH CHANGED PID FACESHEET.

2 (1 = NO, 2 = YES)

14. ORIGINATING OFFICE CLEARANCE

SIGNATURE: Harry Pickerman

TITLE: Director, ROCAP

DATE SIGNED: MM 8, DD 16, YY 79

15. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION: MM 3, DD 31, YY

AID 1330-4 (3-76)

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT IDENTIFICATION DOCUMENT FACESHEET

TO BE COMPLETED BY ORIGINATING OFFICE

1. TRANSACTION CODE: C (A = ADD, C = CHANGE, D = DELETE)

PID

2. DOCUMENT CODE: 1

3. COUNTRY/ENTITY: ROCAP - CENTRAL AMERICA

4. DOCUMENT REVISION NUMBER: 1

5. PROJECT NUMBER (7 DIGITS): 596-0069

6. BUREAU/OFFICE: A. SYMBOL LAC; B. CODE 05

7. PROJECT TITLE (MAXIMUM 40 CHARACTERS): FUELWOOD AND ALTERNATIVE ENERGY SOURCES

8. PROPOSED NEXT DOCUMENT: A. 3 (2 = PRP, 3 = PP); B. DATE MM 8 YY 79

9. ESTIMATED DATE OF AUTHORIZATION/OBLIGATION: a. INITIAL FY 79; b. FINAL FY 85

10. ESTIMATED COSTS ($000 OR EQUIVALENT, $1 = CA$1)

FUNDING SOURCE		LIFE OF PROJECT
A. AID APPROPRIATED		7,500
B. OTHER	1. CATIE	917
	2. ICAITI	687
C. HOST COUNTRIES		927
D. OTHER DONOR(S)		742
	TOTAL	10,773

11. PROPOSED BUDGET AID APPROPRIATED FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE C. GRANT	PRIMARY TECH. CODE D. LOAN	E. FIRST FY 79 F. GRANT	E. FIRST FY 79 G. LOAN	LIFE OF PROJECT H. GRANT	LIFE OF PROJECT I. LOAN
(1) FN	741B	160		500		7,500	
(2)							
(3)							
(4)							
			TOTAL	500		7,500	

12. SECONDARY TECHNICAL CODES (maximum six codes of three positions each)

875	878	876	096	977	

13. SPECIAL CONCERNS CODES (MAXIMUM SIX CODES OF FOUR POSITIONS EACH)

						14. SECONDARY PURPOSE CODE
BR	ATNL	RESA	ENVR	LTRG	ENER	770

15. PROJECT GOAL (MAXIMUM 240 CHARACTERS)

To improve the welfare and the productivity of low income groups and increase the supply of low cost energy for rural and urban poor.

16. PROJECT PURPOSE (MAXIMUM 400 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.

17. PLANNING RESOURCE REQUIREMENTS (staff/funds)

18. ORIGINATING OFFICE CLEARANCE

Signature: Harry Johnson

Title: Director, ROCAP

Date Signed: MM 8 DD 16 YY 79

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

AID 1330-2 (3-70)

FOREWORD

"In 1963 when the last world forestry survey was completed, 29% of the earth's surface was tree covered. Subsequent regional surveys have been of variable quality but all seem to indicate that deforestation is advancing quickly in the Third World. Half of the wood cut in the world and the great majority of the wood cut in the Third World is used as fuel. Except for a few countries, this resource is reaped more rapidly than it is sown."

"Few countries have started successful reforestation programs, notwithstanding the fact that it is probably the most lucrative potential investment for energy production. Reforestation would give work to many people, requires little capital and produces a high energy yield (especially with fast growing species, as the eucalyptus). If reforestation is combined with extensive programs oriented to the goal of having each campesino owning a more efficient fuelwood stove, reforestation work would invert the terrible ascending spiral of environmental deterioration."[1]

"The kind of world that could develop around energy sources that are efficient, renewable, decentralized, simple, and safe cannot be fully visualized from our present vantage point. Indeed, one of the most attractive promises of such sources is a far greater flexibility in social design than is afforded by their alternatives. Although energy sources may not dictate the shape of society, they do limit its range of possibilities; and dispersed solar sources are more compatible than centralized technologies with social equity, freedom, and cultural pluralism. All in all, solar resources could power a rather attractive world."[2]

"The energy system of the truly poor contains no easily trimmable fat such as that represented by four-to five thousand-pound private automobiles. Furthermore, a global recession does little to dampen the demand for firewood as it temporarily does in the case of oil. The regrettable truth is that the amount of wood burned in a particular country is almost completely determined by the number of people who need to use it. In the absence of suitable alternative energy sources, future firewood needs in these countries will be determined largely by population growth. Firewood scarcity will undoubtedly influence the urgency with which governments address the population problem in the years ahead.

Even if the demographers are surprised by quick progress on the population front over the next few decades, the demand for basic resources like firewood will still push many countries to their limits. Fortunately trees, unlike oil, are a renewable resource when properly managed. The logical immediate response to the firewood shortage, one that will have many incidental ecological benefits, is to plant more trees in plantations, on farms, along roads, in shelter belts, and on unused land throughout the rural areas of the poor countries. For many regions, fast-growing tree varieties are available that can be culled for firewood inside of a decade." 3/

This project owes its genesis to the pioneer and brilliant writings of Denis Hayes and Erick Eckholm of the Worldwatch Institute, Washington, D.C., and to Sandra Bregman of the U.S. Dept. of Energy who brought to our attention the innovative work of the Worldwatch Institute.

1/ "Energy in the Developing World" by Denis Hayes. Facetas Vol. 11, No. 3, International Communication Agency, pp. 28-9. (Translation: ROCAP).

2/ Denis Hayes: Rays of Hope. New York, W.W. Norton & Company, Inc. 1977, p. 159.

3/ Erick P. Eckholm: Losing Ground. New York, W.W. Norton & Company, Inc. 1976, p. 107.

Guatemala City, July 29, 1979 - El Gráfico

(Informal Translation)

40 MEN INVADED A FARM
THEY CUT 250 TREES AND ESCAPED

Forty men armed with machetes and axes invaded a farm on Km. 5 of the Atlantic Highway. They cut 250 trees which they chopped for fuelwood and then left for an unknown destination.

The administrators of the farm "Miraflores", located at the above mentioned address, informed the police that unknown persons suddenly appeared at the farm and proceeded to cut the trees.

When they had cut 250 trees, they chopped them for fuelwood and then escaped. It is not known where these men came from.

There had been some earlier incidents of cutting a few trees, but more than 250 were cut this time.

AN INSPECTION REQUESTED

The neighbors of that sector asked the reforestation institutions to inspect the area.

It can easily be seen how in a few hours the trees were cut by strangers who invaded the private property.

FUELWOOD AND ALTERNATIVE

ENERGY SOURCES

596-0089

TABLE OF CONTENTS

	Page
I. PROJECT SUMMARY AND RECOMMENDATIONS	
A. Recommendations	1
B. Summary Project Description	2
C. Issues	4
D. Project Committee	11
II. BACKGROUND AND DETAILED DESCRIPTION	
A. Background	13
B. Energy and Fuelwood in Central America and Panama	16
C. Efforts to Date: Energy and Technology	22
D. Regional Rationale	25
E. Beneficiaries	28
F. Other Donors	29
G. Detailed Description	
1. Goal	30
2. Purpose	31
3. Outputs	
a. ICAITI Element	33
b. CATIE Element	53
III. PROJECT ANALYSIS	
A. Technical Analysis	66
1. ICAITI Element	66
2. CATIE Element	70
B. Economic Analysis	73
C. Financial Analysis	80
1. ICAITI Element	80
2. CATIE Element	86
3. Financial Plan	88
D. Social Analysis	89
E. Summary Institutional Analysis	
1. ICAITI	104
2. CATIE	105

Page

IV. IMPLEMENTATION ARRANGEMENTS

A. AID's Role and Responsibility 108
B. Implementation Plan
1. ICAITI Element 109
2. CATIE Element 113
C. Request and Justification for Source and Origin Waiver 115
D. Evaluation Plan 116
E. Conditions, Covenants and Negotiation Status 117

ANNEXES

I	Application Letters A. CATIE B. ICAITI
II	Statutory Checklists
III	Draft Authorization
IV	Initial Environmental Examination (IEE)
V	Logical Framework
VI	PID Approval Message
VII	White House Perspective on Deforestation (State 209967)
VIII	Congressional Perspective on Deforestation (State 183721)
IX	The Lorena Stove
X	Evaluation of the Fuelwood Conserving Alternative Energy Technologies*
XI	Fuelwood Survey In Central America*
XII	ICAITI Detailed Institutional Analysis
XIII	COMENER Acuerdos
XIV	Detailed Financial Analysis
XV	Peace Corps Cooperation
XVI	CATIE Detailed Institutional Analysis
XVII	Government of Guatemala Letters
XVIII	Map: Possible Critical Areas in CAP
XIX	Shrub and Tree Species for Energy Production
XX	CATIE: Fuelwood Production Implementation Plan

* Annexes X and XI can be found in the LAC/DR official file.

I. PROJECT SUMMARY AND RECOMMENDATIONS

A. Recommendations

1. Approval by the LAC Bureau DAEC of the Project described herein for a total cost to A.I.D. of $7,500 ,000 in grant funds (Food and Nutrition).

2. Approval of a 72-month project period with a project activity completion date of December 31, 1985.

3. Notification to Congress of the above actions.

4. Authorization of FY 1979 funding of $500,000 to provide the first A.I.D. contribution.

5. Waiver of source/origin requirements to allow procurement of primarily long-term services from Code 941 countries and some short-term service from Code 935 countries and some short-term service from Code 935 countries.

B. Summary Project Description

1. Grantees

Two regional institutions will implement the Project: the Tropical Agricultural Research and Training Center (CATIE), with headquarters at Turrialba, Costa Rica, and the Central American Research Institute for Industry (ICAITI), with headquarters in Guatemala City, Guatemala. Both regional institutions operate throughout Central America and Panama and are mandated to support national development efforts in their areas of expertise. CATIE's Natural Renewable Resources Division will provide expertise and implement the Project with regard to fast growing trees and shrubs. ICAITI's Technical and Industrial Services Division will implement the Project with regard to energy efficient technologies. They will consult and coordinate their activities as appropriate.

2. Project Summary

The Project supports a regional effort within Central America and Panama to (1) test and provide new energy efficient technologies for use in rural homes and communities and by small and medium industry, and (2) to test alternate species of fast growing trees and shrubs and alternate patterns for their production for use as fuel. A survey will be conducted to identify areas within the region where the supply of fuelwood is critically short. Alternate production trials and technology demonstrations will be conducted in such critical areas throughout the isthmus. The results will help determine the impact that large scale introduction of new technologies may have on the accessibility of fuelwood and cost to consumers, and on more efficient use of fuelwood or other renewable energy resources in households and small or medium industries, and in the community as a whole.

CATIE's Division of Natural Renewable Resources will work through national coordinating agencies

with small farmers, community leaders and national forestry or agricultural research institutions or both. CATIE will collect available experiences within the region and worldwide and provide assistance in the conduct of production trials using selected fast-growing species. These trials will be conducted in critical,potentially critical or in other appropriate areas including farms, communities and protected research stations. Experiments will be conducted in all participating countries. Long and short-term training in new production methods will be offered to over 200 cooperating national agency technicians.

ICAITI's Technical and Industrial Services Division will work with national project coordinators, national energy and technology institutes, private manufacturers, and home owners. It will procure or produce technologies for testing and demonstration which promise either to increase the efficiency with which wood is used as a fuel or to use renewable substitute fuels. Some of these technologies because of cost and environmental factors (such as biomass and solar) will be demonstrated in as few as three selected critical areas while others will be demonstrated in all six participating countries.

Both institutions will establish or strengthen relationships with national and international public and private organizations having the potential to act as disseminating agents for either fuelwood production or energy efficient technologies. These include such organizations as national extension services, agricultural production and marketing cooperatives, electric institutes, VITA, the Peace Corps, etc.

The A.I.D. contribution to this activity, over six years, is proposed to be $7.50 million. Details of the project budget, institution counterpart and national contributions appear in Annex XIV and in Part III.C, Financial Analysis.

C. Project Issues

DAEC Issues: The issues raised by the DAEC review of the PID (Annex VI) are covered in various sections of the paper and summarized here:

1.A. Fuelwood vs. Alternative Energy Sources: Although data are somewhat contradictory, the extent to which cutting for fuelwood contributes to regional deforestation appears to rank significantly behind the effects of commercial lumbering and land clearing for new farms. However, there is considerable variation within countries. The project goal no longer includes reforestation as a principal objective. Although the project attacks one of the root causes of deforestation, and has the potential to ameliorate its rate, the problem of reforestation is a larger, principally country-specific one in nature. Fuelwood related activities will for the most part thus be limited to identified areas of actual or potential critical shortages of fuelwood.

This Project will begin with the identification of actual and potential critical areas of fuelwood scarcity. Surveys and experiments will be carried out to find the most appropriate fast growing species of plants for the various ecological conditions encountered in the isthmus. Species will be judged on their ability to satisfy rural requirements for fuelwood and offer potential for use in agroforestry, timber and fence poles. Investigations and field trials of technologies utilizing fuelwood more efficiently or using alternative energy sources will be carried out.

This project is being presented before MITRE personnel visit Central America to carry out the proposed regional energy assessment. Thus no direct coordination has been possible. However, work undertaken in developing this project will be of great utility to the MITRE team. In addition, we are confident that fuelwood will be identified as a priority area by the MITRE analysis. This Project also responds to parts of the Central American Energy Commission's resolutions (Annex XIII). Seminars to be given throughout the region by CATIE and ICAITI will address the regional energy situation linking it to this Project. These discussions should assist in increasing regional awareness of energy and natural resource problems.

1.B. Small Industry vs. Home Fuelwood Use: This activity will subject about ten energy efficient cooking stoves to scientific analysis and modification before approximately 450 in-home units are tested and demonstrated. Demonstration will be carried out in all six countries and coordinated through cooperating national institutions and voluntary agencies. The Peace Corps will cooperate in this project where there are Peace Corps programs. To our knowledge this Project is subjecting some of these alternatives to scientific testing, demonstration and evaluation for the first time in the Isthmus. Progress and final reports on Project activities will be given to the above institutions, USAIDs and other private and public institutions for country dissemination.

1.C. Research vs. Application and Dissemination: Consultation with Solar America, ICAITI and CATIE confirm the DAEC view that considerable research has already been done in areas of project concern. No basic research is contemplated by ICAITI in technology development; evaluation, modification and transfer of existing technologies now in use in Central America or elsewhere will take place, however.

Under the CATIE portion of the Project a survey of existing research will be carried out to identify species that have already been tested and found suitable for the region. It is expected that approximately 15 species will be identified.

All Project-supported in-country work will be performed in close coordination through national project coordinators and with national institutions who, with CATIE and ICAITI, will be responsible for site selection and all construction, testing, demonstration and dissemination activities. These responsibilities will be confirmed in writing prior to execution of in-country activities. Four project countries are CATIE members and contribute $50,000 per year. Guatemalan and Salvadorean agreements have not yet been completed although El Salvador's is before its Congress at this writing. CATIE does, however, obtain Memoranda of Understanding detailing the country counterpart from each national agency. This permits CATIE to operate in each country even without a signed umbrella agreement.

The Peace Corps has participated in the conduct of energy-use surveys used to prepare this proposal; four volunteers are presently assigned to CATIE's Natural Renewable Resources Division. Others, such as those in Guatemala, are involved in tree production programs with national forestry institutes. We anticipate using PCVs to assist national counterparts in demonstration and dissemination activities, in carrying out production research and in evaluating receptivity to the various technologies and methodologies (Annex XV). The AID-Peace Corps PASA (AC/DSB-5711-1-79) may produce useful energy alternatives which this Project can help test, demonstrate and disseminate. PCVs trained in renewable energy technologies under this PASA will also be useful depending upon when available and where assigned. In addition, PVOs and the Peace Corps will be encouraged to become involved in dissemination; reactions of Central American Peace Corps staff and of such experienced PVOs as CARE, CEMAT and Choquí are very encouraging.

2. Coordination: A series of coordination linkages are detailed in the body of the paper. In addition, annual implementation plans will be developed on a cooperative basis between the regional institutions and their counterpart national institutions. With regard to Panama's Alternative Energy project (525-0207), ICAITI will coordinate activities with IRHE. The Panama project specifically excludes firewood efficiencies and stove development, and looks to such activities to be included under this Project as well as training and related activities. CATIE wood production activities will take note of tree production efforts in the AID Panama Watershed program (525-0191), which the Natural Renewable Resources Division helped design, and in the AID Costa Rica Natural Resources project (515-0145).

3. Social Analyses: The Social Analysis is based upon the results of use and attitude surveys conducted by PCVs in four of the countries, upon an attitude survey in five areas in three countries conducted by an AID contractor, a review of relevant literature, and the analysis by a Guatemalan anthropologist of the foregoing and other materials. Sociologists will be employed under the Project to help design and evaluate preferences regarding the selection of fuelwood species and technologies and the effects of the Project on residents within the critical areas.

4. Institutional Capabilities: With the assistance of AID consultants, and based upon subsequent review, substantial increases in technical assistance to both CATIE and ICAITI were added to the Project. Based upon on-site surveys conducted by AID consultants, technologies having high-cost efficiency potential have been selected. Specific criteria employed in this selection process appear in the Technical Analysis.

5. Landsat Component: Based upon further review with CATIE and Central American technical personnel, and taking into account the elimination of reduction in deforestation as a project goal, Landsat will not be used under this project, nor will other aspects of the extent or causes of deforestation be pursued.

Mission Issues: ROCAP has identified the following additional issues during Project design:

6. Peace Corps participation: As presented in Annex XV, ROCAP and Peace Corps Offices in Central America have consulted at various stages of Project development. Volunteers and Staff have provided invaluable advice and assistance to ROCAP. During implementation ROCAP estimates that the services of 46 PCVs will be particularly useful in enhancing program implementation both in the field and at the headquarters of the two regional institutions. Nevertheless, the Peace Corps no longer operates in Panama and their Nicaraguan program is presently suspended. The issue arises regarding the effect on Project implementation in countries where Peace Corps participation is limited or unavailable.

ROCAP has attempted to involve the Peace Corps because volunteers provide enthusiastic, capable and on-the-spot resources in rural areas. Volunteers speak not only our language but that of their communities. PCVs are ideal transfer agents. Other options exist at the local level, however, including community organizations, cooperatives, PVOs, teachers and government extension agents in agriculture, health and community development. These alternate sources of Project support will be mobilized as necessary by the regional institutions working through the national counterparts. The small number of volunteers proposed for assignment at the two institutional headquarters means that their services, while extremely useful, are not critical to Project success.

7. Continuance of Project activities after termination of A.I.D. support: This Project will be completed in six years. Nevertheless, in-country dissemination of results to target populations will only be beginning to have an impact. Both cooperating institutions will exert significant and increasing effort in technology transfer during the Project. Both regional institutions have as major responsibilities in their charters that of imparting their knowledge and skills to national governments who have resources and personnel to apply new technologies nationwide. Support and interest already evidenced for this activity is strong; two unsolicited letters from Guatemala (Annex XVII) express strong interest in the activity. USAID officials with whom we have consulted likewise are anxious to use the results of CATIE and ICAITI interventions

in ongoing and proposed bilateral programs. Past national support for CATIE activities in all six Isthmian countries has been strong and continuous. ICAITI, in recent years, has made great strides in expanding its services throughout the region. It has full-time resident representatives in the five Central American republics. Central American interest in technology related to all levels of energy is growing apace. We are confident that these demonstrations of willingness to apply project conclusions within the region augur well for continuance of the activity at the national level.

ICAITI and CATIE, as stated in the appropriate institutional and financial annexes, are dependent on support they receive from their members and from international and private donors. Both continue to be innovators in their fields. CATIE's pioneering work in multi-disciplinary small farming systems research has attracted world-wide attention and support. ICAITI is linked to research institutions worldwide. It provides services unique in the region to both public and private sectors. In technology matters ICAITI frequently speaks for the region and is a leader in gasohol. Its Director will speak for the region at the forthcoming New Orleans International Gasohol Conference. ICAITI is a recipient of aid from a number of assistance agencies in these efforts and ROCAP is confident that resources will continue to be available to support future activities. Even if this proves incorrect, both institutions are committed to continue work in this subject matter using their own resources, albeit at a reduced pace.

8. Viability of ICAITI: ICAITI's financial problems are serious and should not be belittled. Nor should they be overemphasized. Technology is a subject of increasing concern in Central America. ICAITI's Board of Directors are the region's five Ministers of Economy; their support is firm and unswerving. While it is not always translated into as much financial support as may be desirable, ICAITI and the other CACM institutions represent resources rare to the developing world and lend an increasingly important sense of unity within the region.

This Project proposes a program of financial/management assistance for ICAITI. ICAITI's new leadership strongly supports this initiative as part of <u>their</u> efforts

to improve ICAITI's performance and outreach. This coincides with our own objectives. Given continuing strong interest in ICAITI's services within Central America, the donor community and fellow technology institutes, ICAITI's present financial problems should not have a detrimental impact on the Project.

D. Project Committee

CATIE

Gerardo Budowski	Head, Natural Renewable Resources Division
Gustavo Delfino	Associate Sub-Director for Administration
William Dyson	Forester Geneticist
Nico Gewald	Research Forester
Héctor Muñoz	Sub-Director for Research

ICAITI

Ludwig Ingram	Sub-Director
Mario Santos	Chief Accountant
Justin H. Whipple	Division Sub-Chief for Technical and Industrial Services

ROCAP

Donald R. Fiester	Regional Rural Development Officer
Robert Hechtman	Program Officer
William H. Naylor Jr.	Controller
Gustavo Ruiz	Economist
Alejandro Sundermann	Chief Engineer
Thomas Totino	Regional Financial Analyst

AID/W

Jerome Bosken	DS/EY, Physical Science Officer
Norman M. Chapin	LAC/DR, Social Scientist
Robert Mathia	LAC/DR, Finance Officer
Robert Maushammer	LAC/DR, Chief Economist

DOE

José Andres Chacón	Science & Technology Advisor (PASA)

Solar America, Inc.

David Chavez	Project Director
Leon Cooper	Technical Consultant
Job Ebenezer	Solar America, Mechanical Engineer
Joe Klose	Solar America, Mechanical Engineer

Summer Intern

Andrew B. Sisson	Fletcher School, Tufts University

II. BACKGROUND AND DETAILED DESCRIPTION

A. Background

In its first meeting, held in June of this year, the Central American Energy Commission (COMENER) (Annex XIII) recommended:

"The desirability of promoting the use of natural energy sources, mainly those which are renewable, to diminish dependance on imported energy and the utilization of non-renewable resources", and

"The need to obtain international cooperation in the transfer of technology and experiences on tapping new energy sources which are within the reach of the majority of the Central American countries".

The first step specifically mentioned was:

- "Accelerate the utilization of renewable natural resources, especially hydraulic and geothermal, as well as biomass, solar energy and fuel alcohol (alcohol carburante)".

Another step called for is "to provide to the national and regional organizations the resources which allow them to increase their technical capacity in the energy field."

This project responds to these recommendations and will help the region achieve some of its energy goals, including (again quoting COMENER):

- "Establish a program for biogas production at the rural and small community level"

- "Promote the utilization and adaptation of new technologies for utilization of other renewable energy sources in the region"

- "Promote ...development of fast-growth forests for utilization as fuel, especially at the rural level and for small isolated communities", and

- "Promote utilization and adaption of the new world technology for use of solar energy."

Concern for reduction in petroleum use and development of energy substitutes in Central America is reflected in ongoing Central American programs. Electrical interconnections between the five republics and current expansion of the region's hydroelectric and geothermal potential is underway as part of the Central American Energy program. Major large-scale hydroelectric programs are underway in all countries of Central America and Panama. Exploitation of petroleum reserves within the region, principally in Guatemala, proceeds apace. Exploration for petroleum and natural gas are continuing in Guatemala and several offshore areas of the region, and will begin or resume in others, some of which might be supported by the insurance and guaranty authority under the proposed IDB Energy and Minerals Development Fund. Nevertheless, projections of future energy import costs into the region are alarming. In 1960 the region (excluding Panama) paid $40.5 million, equivalent to about six percent of traditional exports. In 1977 the cost rose tenfold to $463 million or about 20 percent of traditional export earnings. At current prices and at current demand trends the region will pay $754 million in 1985 (27 percent of traditional earnings) and an astounding $2.1 billion (roughly half traditional export earnings) in the year 2000. And recent OPEC pricing trends give scant hope that current prices will hold constant during the period. In addition to impacting on foreign exchange, increasing energy costs also impinge on national budgets, such that, other things being equal, fewer resources are available for expanding socio-economic development expenditures, especially for A.I.D. and host country target groups.

In addition to efforts accelerating a shift away from petroleum in the "commercial" energy sector[1/], the "non-commercial" sector[2/], representing 40 percent of the

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1/ Commercial energy consists of electricity and the use of combustibles derived from petroleum.

2/ Non-commercial energy includes wood and vegetable products for domestic heat and cooking, use of sugar cane bagasse for sugar processing, the burning of coffee waste, sawdust and wood for heat or for industrial use.

Isthmus' total energy consumption in 1975, is receiving increasing concern. Activities, supported bilaterally by USAID Missions and the Peace Corps, regionally by institutions such as Appropriate Technology International (ATI), as well as many independent efforts, share this project's objective of improving access of low-income groups in the region to affordable energy supplies or to making energy-efficient technology alternatives available to them.

Although data are unclear as to the extent of the contribution of wood cutting for fuel to the region's heavy annual lost of forest cover, what is known indicates a pattern of both increasing cost of wood due to increasing scarcity, and limited knowledge of more efficient uses of, or affordable and efficient alternatives to, wood. The pattern of wood use in Central America is varied. Dependance on it is highest among the rural poor, with a gradual switch to charcoal in slightly higher income groups in villages, and a continuing progression as income increases from charcoal to kerosene, and, where available, to electricity and gas. In a very real sense, however, wood, along with shelter and clothing, continues to be one of the three necessities of life for large segments of the Central American population. Most of the Central American diet is cooked, and it is wood for cooking and in certain areas for home heating, upon which, according to a census[3/] 80 percent of Central Americans depend.

Wood is the fuel of choice for the vast majority of Central Americans. It is the most readily available fuel for their major energy requirement -- cooking. It is the traditional fuel and one requiring little sophistication in use. Given the circumstances of increasing shortages and cost of its principal alternatives - kerosene, electricity and propane - and the difficult task of demonstrating cost-effective and energy-efficient alternatives affordable and acceptable to the Central American poor, it is likely to remain the principal fuel for some time.

Wood and bagasse are a major industrial fuel. In rural areas they are used as a fuel to evaporate sea water from salt, in kilns to produce bricks and clay utensils,

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3/ SIECA: La Situación Energética en Centro América y Perspectivas para el Futuro, August 1978

and to dry agricultural products. In cities too, wood is a major fuel. The 36 small bakeries included in ROCAP's industrial survey used a total of 1224 tons of wood per year.

Wood is an increasingly expensive fuel. Surveys throughout the Isthmus reflect similar patterns, viz. increasing cost to both the homemaker in either time spent in gathering or purchasing wood, and for the industries which depend upon it. Although experiments with fast growing species have been undertaken, their results have many times been lost, and the usefulness of these species as fuel, if once tested, is still unknown. Alternate cultivation practices designed to leave the maximum amount of land in food production either through mixed production (agroforestry) or by production through live fences, on-farm, woodlot, community woodlots and plantations, remain largely untested.

This project, consequently, supports two related approaches to the problem of the increasing cost and scarcity of woodfuel. It will demonstrate alternate cultivation practices for fast growing high caloric trees and shrubs, and will test and demonstrate technologies which either reduce fuelwood consumption, in the home and for small and medium industry, either through improved efficiency or through provision of renewable energy alternatives. A methodology will be developed and tested under the project whereby a community can assess its fuelwood production and use situation ("energy balance"), estimate probable levels of future needs and develop a strategy and program for changing the imbalance.

B. Energy and Fuelwood in Central America and Panama

Central America's total energy requirement (including Panama) has been growing 6-7 percent per year in the last 10 years, approximately double the rate for the United States. This annual increase is expected to continue or possibly increase in the future. The total energy requirement is provided by commercial energy, consisting of electricity and combustibles derived from petroleum, and non-commercial energy, consisting of fuelwood for domestic and industrial uses, sugar cane bagasse for sugar processing,

and to a minor extent, burning of coffee waste and sawdust for heat. In 1975, as shown in Table I, the total energy consumption in the region consisted of 60 percent of commercial and 40 percent of non-commercial energy.

The Central American countries import all their petroleum needs, except for a small amount of oil production in Guatemala which is used primarily by the cement industry. Thus the countries are concerned with the continued increases in the cost of petroleum. The 1979 foreign exchange cost of imported petroleum for Central America (excluding Panáma) is estimated by SIECA at US$685 million compared to US$77.1 million in 1971. In order to reduce the demand for petroleum, the countries are primarily involved in maximum development of their hydroelectric and some geothermal energy sources. In addition, the investigation and development of possible oil reserves continues to be done through leases to private oil companies. Some countries are also promoting possible coal and other bituminous natural resource locations for private investment exploration and development. Unfortunately, the massive investment required for hydroelectric projects and geothermal energy development for electrical generation, along with limited resources, has resulted in little regional or national effort in developing alternate energy sources to satisfy other energy consuming sectors, particularly the non-commercial energy sector. Based on estimates by the Economic Commission for Latin America (ECLA) and the Permanent Secretariat for Central American Integration (SIECA), the use of non-commercial energy is expected to continue increasing at a rate of about three percent annually. By the year 2000, the annual use of fuelwood and vegetable products (biomass) for fuel is thus expected to double, with their increased impact in deforestation.

Low income groups (rural and urban) are almost entirely dependent on fuelwood and are the principal users of non-commercial energy. In rural areas, fuelwood is used for 80 to 95 percent of all energy needs. All domestic uses of fuelwood and charcoal account for about 67 percent of total non-commercial energy use. The remaining 33 percent is industrial and agricultural processing, using fuelwood, charcoal, and sugar cane bagasse. About 82 percent of all fuelwood in Central America is consumed in

TABLE I

PERCENTAGES OF TOTAL ENERGY CONSUMPTION
IN CENTRAL AMERICAN ISTHMUS
1975

	Fuelwood and Charcoal	Bagasse	Oil	Geothermal and Hydro.	Total
Guatemala	41%	7%	49%	3%	100%
El Salvador	37	9	48	6	100
Honduras	45	6	45	4	100
Nicaragua	25	12	58	5	100
Costa Rica	28	14	50	8	100
Panama*	13	6	79	2	100
Central American Isthmus Unweighted Average	31	9	55	5	100

*Does not include the Canal Zone

Source: March 1978 SIECA Energy Planning Publication and Economic Commission for Latin America data.

the home (Table II), predominantly for cooking. In fact, approximately 80 percent of all households in Central America reportedly use wood or charcoal for cooking (see Table III). Based on ECLA and SIECA estimates, consumption of fuelwood and charcoal for energy in the region amounted to the equivalent of about 2.4 million tons of oil in 1975. It should be noted however, that fuelwood practices are highly inefficient and most of the calorific heat is wasted. For example, it is estimated that less than 10 percent of the heat output of fuelwood is actually utilized in the most commonly used three-rock stove, although some of the escaping heat is needed for home heating in certain areas.

Most low income families and small industries use fuelwood because they simply cannot afford or do not have access to electricity or oil-based fuels for their energy needs. Many rural communities beyond the electric grids have only a few hours of diesel-driven electrical generation for lighting in the evening. In rural areas, fuelwood is either purchased or gathered from traditional sources such as national, commercial, or private forests, or from trees and brush along roads and trails or large farms. In urban areas, fuelwood and charcoal is mostly purchased from dealers. Heavy dependence on wood and charcoal as a source of energy is contributing to dwindling supplies, as is increasing demand due to population growth and growing industrial needs. As nearby forests thin out, the amount of family labor devoted to gathering firewood increases, transport costs increase, and the price of fuelwood rises. The price increases are most severe in urban areas, where 100 pounds of wood now cost between $3.00 and $4.50, an increase in excess of 200 percent in ten years (a price rise about 50 percent higher than other price increases).

According to the Food and Agricultural Organization (FAO), the production of fuelwood and charcoal in the region in 1977 accounts for 80 percent of roundwood removals (see Table IV where figures apparently do not include removals for agricultural land clearing, road construction, etc.). Using a conservative average gross standing volume of 160 m^3 per hectare, the annual cutting of trees amounts to 106,081 hectares or 409 square miles of forest.

TABLE II

USES OF FUELWOOD IN THE CENTRAL AMERICAN ISTHMUS
(Expressed as percent of Total Use of Fuelwood)

	DOMESTIC	TOTAL AGRICULTURAL PROCESSING AND INDUSTRY*	
	Wood and Charcoal	Wood and Charcoal	TOTAL
Guatemala	83%	17%	100%
El Salvador	86	14	100
Honduras	85	15	100
Nicaragua	89	11	100
Costa Rica	85	15	100
Panama**	64	36	100
Central America Unweighted Average	82%	18%	100%

Source: March 1978 SIECA Energy Planning Publication, & Economic Commission for Latin America (ECLA) data

* Totals for agricultural and industrial use do not fully account for use of wood and charcoal by small industries. Statistics are based on registered industries whereas there are many small unregistered industries using fuelwood.

** Does not include Canal Zone.

TABLE III

PERCENTAGE OF HOUSEHOLDS IN CENTRAL AMERICA
USING FUELWOOD FOR COOKING

(Based on Household Survey)

	Number of Households	Fuel-wood	Elec-tricity	Kerosene LPG	No Response
Costa Rica	231,000	66%	25%	5%	4%
El Salvador	654,000	77	2	16	5
Guatemala	801,000	88	1	8	3
Honduras	463,000	81	1	15	3
Nicaragua	302,000	75	1	19	5
Panama	Not available	-	-	-	-
	2,451,000	80%	3.5%	12.5%	4%

Source: November 1978 SIECA Renewable Energy Report, based on household census.
NOTE: Totals are weighted averages

This amounts to about 1 percent of the forested area in the region. With forests being depleted at an alarming rate, having been reduced by almost half since 1950, low income groups in both rural and urban areas dependent on fuelwood will find it more difficult to meet their energy needs.

TABLE IV

FUELWOOD AS A PERCENTAGE OF TOTAL VOLUME OF TREE REMOVALS IN CENTRAL AMERICA AND PANAMA

1977
(in 1000 cubic meters)

	Total Roundwood Production	Fuelwood and Charcoal	Commercial and other
Costa Rica	3,805	2,371 (62%)	1,434 (38%)
El Salvador	3,026	2,947 (97%)	79 (3%)
Guatemala	5,606	5,120 (91%)	486 (9%)
Honduras	4,175	3,000 (72%)	1,175 (28%)
Nicaragua	3,015*	2,135 (71%)	880 (29%)
Panama	1,520*	1,400 (92%)	120 (8%)
Totals	21,147	16,973 (80%)	4,174 (20%)

*FAO Estimates

Source: FAO, 1977 Yearbook of Forest Products.

C. Efforts to Date: Energy and Technology

Existing national goals and plans place a high priority on energy development in response to the growing demand for commercial electricity and the rising cost of imported oil. Total public investments in the energy sector are expected to average $550 million per year in the six countries during the next five years. These investments, partially financed by the World Bank and the IDB, are planned primarily for hydro and geothermal electric generation. In

addition, the Central American Bank for Economic Integration (CABEI) is promoting and financing electrical interconnections between the Central American countries. Low income populations, however, are not expected to be major beneficiaries of these investments. The poor are not expected to be able to afford the cost of electricity or oil-based fuels (unless subsidized) given their low incomes. Thus, the fuelwood problems of the poor are expected to continue and increase.

Very little has been done nationally or internationally to increase the supply and availability of wood for fuel, or to develop efficient and affordable energy alternatives. Deforestation has recently become a popular political issue in Central America; however, reforestation efforts are aimed at increasing the supply of commercial timber or have purely ecological purposes. Results of programs supporting development of new cultivation practices for fast-growing high calorie species, where actually conducted, have but rarely been disseminated for region-wide use.

In Guatemala, for example, 1979 is the "Year of the Tree". Plans to plant 50 million trees this year have been announced. However, lacking the technical and financial capacity for a well-planned reforestation program, the trees are being planted by students, community groups, and ecology-minded groups or individuals along highways, in reserves, in parks, green areas, etc. It is estimated in Guatemala that reforestation costs about $120 a hectare. The annual cost of merely keeping pace with deforestation is estimated to be $4 million. Forestry laws require permits from national forest services before cutting of trees for any purpose. However these laws, though designed to prevent irresponsible cutting of forests, have had a negative effect on the poor who are dependent on fuelwood for energy. The poor continue to obtain and use fuelwood, and the lack of sufficient government manpower and resources prevents any real control of tree cutting. For example, in Guatemala the 1977 permitted cuttings amounted to 127,458 m^3 1/ whereas the fuelwood and charcoal production was 3.4 million m^3 (FAO estimate).

1/ Boletin 10, INAFOR-Guatemala (March 1979), Memoria Año 1978.

Efficiency in use of fuelwood or use of alternative renewable energy sources has suffered from a lack of substantial funding commitment by the Central American governments, inadequate information exchange and limited coordination with other on-going activities. National and regional programs to develop alternative energy technologies, while receiving increasing support, still suffer from funding and skilled manpower shortages. The UNDP is currently financing a $1.5 million energy sector program in Central America, focussing on development of petroleum and large-scale geothermal resources. Only $20,000 of those funds are programmed for non-conventional energy research (solar, biogas, wind power) at the Costa Rica National University. The IDB has provided a $650,000 grant to ICAITI, which includes support for the development of solar crop dryers and research in biogas production from coffee pulp. ICAITI is also conducting a pre-feasibility study for a Gasohol Plant in Guatemala under the Regional UNDP Energy Project. The World Bank is financing a feasibility study in Honduras of the use of wood waste to generate electricity. In Guatemala, the Mesoamerican Center of Appropriate Technology (CEMAT) and the Experimental Station "Choqui" (small non-profit appropriate technology groups) are experimenting with solar heaters and dryers, wind-powered devices to produce mechanical energy, and biogas production. Choqui developed a more efficient mud stove (the Lorena stove) which is now being disseminated by many groups in Guatemala and Honduras, including CEMAT, Save the Children Foundation, Peace Corps, Community Development Groups, etc. (See Annex IX for a brief history of this stove). A private consulting engineer in Guatemala is contructing commercial biogas plants which convert organic wastes into methane gas and fertilizer. Some of his plants have been operating for up to 20 years; however, his work has been primarily on medium to large farms. In El Salvador, CENTA (the National Center for Agro-Industrial Technology) is promoting the use of an alternate improved stove design (the fogón). A private consultant in Honduras has reportedly developed prototype solar water heaters and dryers. The National Universities in the region are involved in solar, biogas, and wind energy research. Also, international donors (Canada, Germany, France, Switzerland) are involved in small alternative energy experiments in Central America, as are voluntary organizations such as VITA (improved lime and brick kilns in Honduras), and the Peace Corps (solar fish and fruit dryers, for example).

Except for the recent Panama Alternative Energy Sources project (525-0207) where micro-hydro, biomass, biogas, and solar energy applications will be studied or demonstrated, the USAID bilateral Missions of the Central American region do not have immediate plans for major approaches on the fuelwood problem, or development of alternative energy sources. In Honduras, a small part of a proposed USAID Rural Technologies (522-0157) project includes investigation of small farmer renewable energy units. Also, some of the research to be conducted under the recently approved Costa Rica Science and Technology project (515-0138) is expected to include renewable energy research.

In sum, while there are many private, national, and international actors involved in the area of woodland conservation and renewable energy technologies in Central America, no coordinated effort to address the fuelwood problem is apparent. The Panama Alternative Energy Sources project specifically excludes efforts to improve efficiency in the use of fuelwood in anticipation of ICAITI assistance in this area under the proposed project.

The first technical meeting of the Central American Regional Energy Commission (COMENER), (Annex XIII), held in June 1979, resulted in a positive step towards the development of a regional alternative energy policy. The COMENER technical committee, among other things, specifically urged that increased attention be given to promoting the use of renewable energy sources.

COMENER's recommendations for regional action represent a departure for the region towards a new energy policy. This Project will respond to this regional consensus by introducing fuelwood production techniques, fuelwood efficiencies, and renewable energy source applications specifically designed to meet the needs of the poor. It will coordinate with and build upon the disparate efforts already ongoing and support a program of trials and demonstrations in fuelwood production and energy efficient technology for home and small industry use -- things heretofore unseen in the Isthmus.

D. Regional Rationale

The March 1979 review of ROCAP's first CDSS refined the criteria for defining the nature and scope of regional

projects. These criteria have been satisfied by this Project:

a) That there be a common problem and regional solution: COMENER's resolutions, our own investigations, as well as those conducted by SIECA, by AID consultants and reflected in the activities of a variety of public and private sector institutions indicate a region-wide pattern of increasing concern for the cost of petroleum-based fuels, and a decreasing supply - and consequent increasing cost - of an important energy source, fuelwood. Although the severity of the problem varies among the countries, investigations reveal that all participating countries have critical or potentially critical areas of fuelwood depletion and that the impact of this tends to be greatest on the rural poor, which are almost totally dependent on fuelwood for energy.

Regarding regional applicability of solutions, the production and technology trials and demonstrations to be conducted by the two grantees within the region will be designed for the broadest replication. Both institutions' scope and experience within the Isthmus, working with national institutions, help assure broad program ocverage. Because of climatic similarities, fast growing BTU yielding trees found suitable for production in one country are likely to prosper under similar conditions in other Central American republics. The technologies to be tested and disseminated under the Project are not country specific. The CATIE Small Farm Production Systems project is testing means of transfering solutions between analogous areas.

b) That there be a competent regional institution committed to work with national entities: Both CATIE and ICAITI have many years of Central American experience behind them, CATIE's forest science experience extends over 28 years; both are represented and currently are implementing activities in all five republics.1/ CATIE is also active in Panama, which is a paying CATIE member. ICAITI is well established in energy research, and its mandate to

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1/ Activities temporarily suspended in Nicaragua

inter alia "undertake technical experiments using regional raw materials..." make it the logical choice for a regional approach. Whereas ICAITI does not normally operate in Panama since that country is not a CACM member, contacts between the GOP and ICAITI do exist and ICAITI has advised ROCAP that there are no impediments to their participation in Panama under the Project.

c) That the regional problem to be solved is of high priority in the bilateral strategies of the country missions: Every Central American CDSS directly identifies natural resource degradation, sometimes in combination with alternative technology or energy, as a major problem area. Congressional and Presidential guidance (Annexes VII and VIII) encourage development of "energy reforestation" programs by AID. Development of alternate energy programs has been the subject of earlier guidance. This Project will carefully coordinate with related area USAID supported activities, discussed elsewhere.

d) That national delivery systems exist: CATIE has negotiated and signed agreements with four of the six isthmian Ministers of Agriculture under which CATIE will operate. CATIE possesses and utilizes its extensive contacts with national agricultural research and extension systems, will strengthen its relationships with forestry services, and, where available, will utilize Peace Corps and other services in both the conduct and dissemination aspects of the activity. ICAITI, with technology transfer agents stationed in the five Central American republics, has functioning relationships with national technology and productivity centers, and is mandated to support them. Assuming successful and socially acceptable demonstration of energy-efficient technologies, ICAITI will utilize seminars, workshops and other means of orienting national technology, agricultural and other extension personnel to the proven alternative technologies.

e) That the regional and national combination of efforts is feasible and cost-effective: This activity obviates the need for five separate bilateral efforts. The combination of two regional institutions interacting with national counterparts, to be strengthened under this Project, offers a breadth and depth of skilled manpower

and facility resources not otherwise available upon whose experience all the Isthmus will benefit. These relationships are largely in-place and have been used in other activities; discussions with institution representatives reflect a high degree of interest in the activity which augurs well for the project success.

f) That the project does not duplicate or by-pass national institutions set up for similar purposes: This activity helps national institutions to 1) focus attention on a major development problem, 2) benefit from experiences of prior activities and progress in sister Isthmian republics and from outside the region, 3) utilize the expertise of CATIE and ICAITI, and 4) improve the region's technical and planning resource base. Neither duplication of effort nor by-passing of national institutions is possible under this approach.

E. Beneficiaries

Both the CATIE and ICAITI elements of this activity support applied research and demonstrations. The relationship between this Project and the target population is discussed in the Social Analysis. The Economic Analysis discusses the nature of economic benefits.

CATIE

Techniques will be developed to increase productivity on small farms. More appropriate land use patterns including more effective on-farm cultivation practices such as coffee shade and fence rows, and the use of land not presently economically productive, will be supported. On-farm research should produce results directly beneficial to a minimum of 500 small farm families or about 3000 rural poor. Community woodlots are expected to make fuelwood more readily available to at least 10,000 rural people.

The Project will also directly affect small farm and rural poor family labor patterns. In cases where time is now being devoted to obtain fuelwood from distant sources, more readily available supplies from nearby small farms and community woodlots should release labor for income producing activities.

Indirect benefits are difficult to measure at this time. Fuelwood is expected to be a continuing basic source of energy for the region's rural poor well into the next century. Improved knowledge of economic, social and silvicultural aspects of this Project element will permit areas of similar ecological conditions to develop similar activities. Plant material identified by CATIE as having potential for a range of ecologies will be available at Turrialba and in several countries. Project trainees as well as in-service trained students -- and their students -- can expand the design of fuelwood intervention regionwide.

ICAITI

The Project will support a number of energy efficient technology alternatives. The most widespread of these, having direct application in the home, is the stove demonstration program. Four hundred fifty units will be tested in rural homes during the Project, reaching over 3100 family members. In addition, while the exact location of demonstration sites of other energy efficient devices is to be determined, these too will have a direct impact on the target group.

Seminars, workshops and on-site reviews will be conducted to encourage dissemination of those socially acceptable, durable and inexpensive models by national extension agents throughout the Isthmus.

F. Other Donors

This Project builds upon knowledge and experience at CATIE and ICAITI which result from years of investigation in their respective fields.

CATIE

CATIE's ongoing forestry and natural resource research, which complement this Project, and which is supported by other donors, includes:

- Swiss Government: Two full-time forestry research and information specialists.

- Great Britain (Overseas Development Ministry): One full time forestry geneticist and one management specialist, the latter assigned to the forestry school at Siguatepeque, Honduras.

- Holland: One full-time forest researcher in fast-growing tree species and provenances.

- Rockefeller Brother Fund: One full-time specialist in wildlife management.

- Peace Corps: Five volunteers in soil conservation, agroforestry, nitrogen fixation, nursery management and entomology.

- U.N. University: The UN University is supporting a research and demonstration project in "Agroforestry in the Wet Tropics". Work is now underway at the La Suiza plantation near CATIE.

ICAITI

ICAITI's technology dissemination work of relevance to this Project includes:

- IDB: A recent grant of $650,000 supports *inter alia*, research and development into production of fuel from agricultural wastes, solar grain dryers, and biogas from coffee waste.

- IRDC (Canada): A recent grant supporting a biogas production demonstration using coffee wastes will soon begin implementation.

- In addition, ICAITI's regional technology reference center is being strengthened under a number of ongoing programs.

G. Detailed Description

1. Goal

The goal of this Project is to improve the welfare and productivity of low income groups and increase the supply of low cost energy for rural and urban poor. The target is the estimated 12 million Central Americans and Panamanians who depend upon wood as a fuel in their homes, on their farms or in the small and medium size industries where they work.

The Project will increase knowledge about new fuelwood cultivation practices and demonstrate them throughout the project area. It will test, disseminate and evaluate non-conventional and low-cost technologies which use wood and alternate renewable energy sources for use in the home, on the farm and by small and medium industry. Working with and through existing national extension services and other public and private institutions, and using in-country seminars and training programs, the Project will make new cultivation practices and technologies available for promulgation. The target group will benefit directly in cases where technologies and cultivation practices are demonstrated in their homes or communities, or on their farms. Others will learn about these technologies either directly from observation of demonstrations or through national dissemination services. The Project will also strengthen existing institutions and personnel who will be able to continue cultivation and technology development, and dissemination in order to expand availability of low-cost energy technologies for production and consumption.

2. Purpose

The purpose of the Project is 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. To achieve this purpose requires a concerted and coordinated effort linking regional institutions with national public and private research and extension agencies. Such effort will significantly increase regional knowledge about the impact of the energy problem and regional experience with what can be done to reduce its impact on the region's low income groups. Existing scientific expertise in the region will be strengthened, linkages between regional and national institutions expanded and technologies will be tested and provided for demonstration.

The purpose of the Project will have been achieved when:

a. The specified cultivation and farm management practices developed by CATIE with national counterparts

are found acceptable by target populations, the national counterparts are using these new practices in their extension programs, and national research institutions and CATIE are continuing research programs in this material.

b. Demonstration and research programs regarding fuel efficient technologies are proven acceptable by target populations and development work is continued by ICAITI, and national counterparts in the areas of energy efficient technologies, especially those exploiting renewable sources.

3. Outputs

Project activities are centered around two major components: (a) the identification of suitable alternative sources of energy and more efficient means to utilize fuelwood (ICAITI Element), and (b) the development of improved supplies of fuelwood (CATIE Element). Fuelwood is currently the major source of energy for the rural poor. As a result of the project they will have greater access to fuelwood and to alternative energy sources.

a. ICAITI Element

Introduction

This portion of the project is focussed on one aspect of the energy problem of Central America - the use of fuelwood and other similar energy sources principally by the urban and rural poor which comprises about 40 percent of the total energy use in the Central American isthmus. As population grows and as deforestation continues (due to a number of causes, only one being collection of firewood), the availability of fuelwood is decreasing and its cost increasing. A recent survey by Donovan, Hamester and Rattien indicated that the cost of firewood tripled over the past ten years. Another survey by a ROCAP contractor, Andrew Sisson (Annex XX) showed that, in selected areas, the price increased 100-150 percent over the past five years. As the price of fuelwood continues to rise, and it becomes more scarce and time consuming to obtain, low income groups in both urban and rural areas dependent on fuelwood will find it more difficult to meet their energy needs.

Although this Project primarily concerns fuelwood, the Mission also recognizes the critical situation in the commercial energy sector (especially in petroleum) which accounts for the remaining 60 percent of energy use in the region. The Central American energy assessment planned for the Fall 1979 will provide important insights and guidance to formulating future bilateral and regional projects that will address this important sector.

In the Project, ICAITI will a) evaluate existing fuelwood-using technologies, b) develop needed modifications to improve their efficiencies, c) develop alternative approaches to the use of fuelwood and d) field-test and demonstrate the most promising techniques. The existing technical expertise of ICAITI will be considerably strengthened in order to develop a cadre of experts focussed on technical solutions to the fuelwood problems of the region* ICAITI's contacts with government and private groups will be used to increase the attention given to and skills employed in this problem area throughout the region. Local training, seminars, workshops and information services will be used to disseminate the results of ICAITI's work in order to develop regional competence in the proven technologies.

*It is anticipated that the technical experts funded by the grant will be hired on a permanent basis by ICAITI. However, this will depend upon the demand for their services by the CAP countries and the countries' ability to pay for such services.

The Project is not a basic research activity - basic research will not be conducted. Rather, ICAITI will apply existing knowledge, adopt technology as necessary and develop new approaches to meet immediate and short-term needs. As in any research project however, there will be a significant amount of evolution of ICAITI's activities as it gets more deeply involved in the fuelwood problem of the region.

The activities that are proposed in this Project are based on various studies conducted by ROCAP and ICAITI over the past six months. They seem to be appropriate areas of effort based on available information of non-commercial energy use in Central America and on the energy interaction and interchange between rural and urban areas and between fuelwood and commercial energy sources. The continued development of energy technology in both developed and developing countries and increased emphasis in the region on energy assistance will possibly identify new areas of effort in the future.

In order to ensure that ICAITI's efforts are being properly directed, the Project will incorporate both project evaluations and management reviews. The evaluations will occur at the end of the first, third and fifth years (see Evaluation Plan). The Project management reviews will be semi-annual sessions in which the ROCAP project manager will meet with ICAITI personnel to review progress to date and plans for the future. As needed, the ROCAP project manager will give guidance and direction to ICAITI so that the Project will maintain its focus on the fuelwood problem and simultaneously incorporate technology and information developments that are appropriate.

ICAITI's activities will encompass five areas:

1 - Improved Fuelwood Efficiencies
2 - Alternate Renewable Energy Sources
3 - Policy Study
4 - Training of Regional Personnel
5 - Financial/Management Assistance to ICAITI

1) <u>Improved Fuelwood Efficiencies</u>

The determining factor in the selection of activities to improve efficiency in use of fuelwood is the number of consumers, both domestic and industrial. The primary consuming

group is the rural and low-income urban household where fuelwood (and in some instances, charcoal) is used for cooking. Industrial activities that use significant amounts of fuelwood are principally rural. They include bakeries, brick and tile kilns, pottery and ceramic kilns, quick lime kilns, charcoal production, coffee grain drying, salt production and panela (crude sugar) production. Other primarily rural industrial activities such as natural rubber, edible oil, textile dying, blacksmith shops and confectioners are of lesser importance.

1a.) Domestic Use

The majority of cooking by the rural and urban poor is done over an open fire. In terms of energy use, an open fire is usually very inefficient for cooking. Between five to ten percent of the energy potential of the wood is productively used to cook the food. The rest is radiated, goes up in smoke, or is used up in removing moisture in the wood. Many stove designs have been developed that promise a much greater cooking efficiency than traditional open fire cooking. Such stoves can productively use 40-65 percent of the energy potential of the wood. Even relatively simple stoves for use in developing countries could double the efficiency of fuelwood use. For example, the Lorena stove (see Annex IX) has been described as needing up to 50 percent less fuelwood than current cooking practices.

The Project will examine as many designs as practical in order to determine the most acceptable designs for Central America. Maximum cooking efficiency is not necessary; improved cooking efficiency, as well as acceptability and consequent use by the local populace are the goals. Furthermore, cooking efficiency will be only one of several selection criteria since, for example, cook fires frequently satisfy space heating needs in which cases the total efficiency of the fire is significantly higher than the 5-10 percent for cooking alone. Total efficiency would vary considerably with local custom, climate, weather, etc.; as far as we can determine, total fuelwood efficiency has never been examined for the fuelwood uses of a culture or sub-culture as a whole.

The first ICAITI activity will be the evaluation and selection of the most appropriate low-cost fuelwood burning cooking stoves for dissemination throughout Central America. ICAITI will conduct an information search for low

cost cooking stove designs developed in the region as well as in other parts of the world. Published literature will be examined; regional and international appropriate technology groups such as VITA (Volunteers in Technical Assistance), IDRC (Canada's International Development and Research Center) and ITDG (Intermediate Technology Development Group) will be contacted. In particular there will be close interaction with VITA which is the recent recipient of an AID/W (DSB) contract to work on low cost energy technologies. It is expected that at least twenty stove designs will be obtained. Of these designs, special attention will be given to two stoves developed in the region, the Lorena stove and the "Fogón (a mud stove developed in the region).

From this collection of stove designs, ICAITI will select approximately ten designs to be constructed at ICAITI and will conduct controlled tests of fuel efficiency of each, compared with present no-stove cooking techniques in Central America. The ten designs will include the two local stoves, the Lorena and the "Fogón". The selection process will take into consideration: cost, use of locally available materials for construction, local manufacturing capability (as appropriate), maintenance requirements, ease of construction, anticipated consumer convenience and probable acceptance. Various types of wood will be used as the fuel for these tests - to be selected in consultation with CATIE.

The laboratory testing and selection procedure is expected to be completed by the ninth month of the Project. Based upon the considerations above and the measured efficiency of the units, approximately five stove designs will be chosen for field testing in each of the six Central American countries. Host country personnel, plus Peace Corps Volunteers, will be trained at ICAITI in the construction, operation and maintenance of the models selected and these personnel will be responsible for the direct supervision of the activities in each country. ICAITI will be responsible for the overall supervision of the field tests, the evaluation of the results and the preparation of the final report. In conjunction with the national counterpart agencies, ICAITI will select the field test sites.

The field test procedure will be the same for each country. In each country, five locales will be selected, in each of which the five stove designs will be tested with at least three units of each design. Thus each locale will

support fifteen separate acceptance tests, and each country seventy-five. The locales will be determined on a case-by-case basis. They will be small enough so that one person (e.g., a resident Peace Corps volunteer or host country extension agent) can effectively monitor the test yet contain enough households so that a sufficient number of willing participants can be found. In some cases this may be a single village; in other cases it may entail several communities in reasonable proximity. Flexibility will be an essential ingredient in the field tests.

Each field test will extend over 12 months, at the end of which a final report will be prepared. A report will be prepared for each country and will include: construction, operation and maintenance experience, costs, changes in the amount of wood used compared to traditional cooking techniques; user acceptance and utilization; and possible development of rural stove construction industry in that region. ICAITI will synthesize the reports, publish a final report on the tests and disseminate it to national extension agencies, private volunteer organizations, USAIDs and other interested groups. This report will include construction plans for the acceptable stove designs and an analysis of the potential for the development of appropriate rural stove industries. At this time ICAITI will conduct a regional seminar on the results of the stove test program.

To summarize, this element of the Project will: examine 20 stove designs, laboratory test approximately ten designs and field test approximately five designs. Each of six countries will test in five locales the five designs (with three units of each design); a total of approximately 450 separate household tests will be conducted. This will be a 24 month effort.

At the end of this testing phase, three Critical Areas (See Section II G3b) will be selected for a concerted field demonstration program of the most appropriate stove model(s). In these areas, the national counterparts with ICAITI assistance and drawing upon the results of the field tests, will plan and conduct a two year program designed to be a large scale promotion of the models that were most successful in the field tests. At the end of this demonstration phase, ICAITI

will update its two-year stove test report and prepare a final stove report which will include the results of the demonstration efforts in the critical areas.

1b.) Industrial Use

The recent ICAITI Regional Small Industry Survey has shown that small bakeries, kiln operations and salt and sugar production are significant users of fuelwood and significant generators of employement. The Traditional techniques used in these mostly rural industries are not very efficient users of energy, and opportunities exist for substantial improvement in these operations through simple improvements in construction and operation. Use of energy efficient techniques would conserve fuelwood, help to lower the cost of the final product and help protect the source of employment for many inhabitants of the region.

Current estimates are that about 15 percent of the fuelwood consumed in the region is used in small industrial and agricultural enterprises. For example, a 20 percent increase in efficiency in energy use in these activities would result in a three percent decrease in total fuelwood consumption, which is the rate at which wood use rises each year. While such equivalences could not be maintained indefinitely, the point is that modest improvements in the efficiencies of traditional industrial processes can have a significant impact on the regional fuelwood needs.

Such efficiency improvements should be easily attainable. For example a recent VITA project in Honduras showed that inclined chimneys can yield a 15 percent savings in wood consumption in lime and brick kilns. Other improvements in the design, construction and operation of wood burning ovens and kilns should be possible.

In the small industry area, ICAITI will concentrate on: kilns for the production of bricks, lime and ceramics kilns bakery ovens, and evaporators for salt and crude sugar (panela) production. This work will start early in the Project, allowing the laboratory testing of domestic stoves to be well underway before attention is turned to the small industry sector. ICAITI, assisted in each country by counterpart technical personnel, will conduct a technical investigation of existing operating parameters and efficiencies of

current designs. Through controlled testing, the dependence of efficiency on such parameters as temperature, time, type of wood and operating practices will be determined. These technical investigations will be made using both existing operational units properly instrumented and monitored and models constructed by ICAITI specifically for the studies. The specific case will determine which approach is needed. Design modifications resulting from these tests will be made by ICAITI and then field tested in the various countries.

Specific sites will be determined during project implementation by ICAITI with the collaboration of the national organizations. An effort will be made to distribute Project activities throughout the isthmus.

In each case, ICAITI will determine design characteristics of the equipment in use, process parameters and methods. ICAITI will observe the complete firing processes to determine the type, condition and weight of the fuelwood used and the volume of product obtained. Detailed information from owners of the industries concerning sales income, operating costs, investment, etc. will also be requested. Simultaneously with this investigation, ICAITI will obtain technical information concerning the design of appropriate kilns, ovens and/or related processing equipment in other parts of the world. This information will be reviewed to determine possible adaptations for use in the region. Short-term technical consultants will assist ICAITI in the adaptation and modification designs of existing processes to maximize fuelwood efficiency.

At least seven designs are expected to be developed or adapted over the life of the Project. Demonstration units are expected to be introduced in areas having a high density of particular industries. The following areas have been tentatively identified as appropriate for project demonstration sites. Final demonstration sites will be identified during project implementation.

One brick kiln	-	El Tejar, Guatemala
One lime kiln	-	Metapan, El Salvador
One small cottage industry ceramics kiln	-	Chinautla, Guatemala
One larger industrial ceramics kiln	-	Santa Ana, Costa Rica

One baking oven	-	Nicaragua/Honduras
One salt evaporator	-	Honduras
One crude sugar producer	-	Guatemala

As in the case with the domestic stoves, host country counterpart personnel will be responsible for construction and operation of each demonstration unit in the field, after receiving training by ICAITI. ICAITI will be responsible for overall supervision and will provide funds for local labor contracting and purchase of materials. The demonstration units will be tested and evaluated over an 18-month period.

Upon completion of evaluation and testing of the demonstration units, ICAITI will prepare a final report for distribution to national institutions, USAIDs and other interested groups and individuals to include designs, costs, operating manuals, adaptability and efficiency compared to existing methods. ICAITI and national counterparts will then hold seminars to disseminate the successful demonstration techniques to national extension agencies, private voluntary organizations, and industrial users throughout the region. ICAITI, along with national counterparts, will plan and follow-up on dissemination in critical areas (as applicable), and will prepare a final report of acceptability and effectiveness of these activities.

2) Alternative Renewable Energy Sources

The second area of effort will be the systematic investigation of a number of potentially attractive alternatives to direct combustion of fuelwood that use renewable energy resources. In particular, ICAITI is expected to conduct technical investigations, field tests and demonstrations of the following technologies:

- Small and medium - sized biogas generators
- Improved efficiency charcoal production techniques
- Pyrolytic conversion techniques
- Direct burning of non-wood biomass
- Solar wood dryers
- Solar evaporators
- Solar water heaters
- Direct burning of processed wood

The goal of these activities will be to introduce alternate energy sources and technologies which can reduce fuelwood use

and make use of available renewable natural resources to produce energy for the target group. ICAITI will conduct training sessions and seminars, publish reports and disseminate the results of their work throughout the region, including USAIDs, in order to systematically increase the awareness of potential users of these technologies and to make available to the region technical assistance in these technologies. The prime beneficiaries of these efforts are expected to be small and medium industries.

Three study teams will be formed: one in biomass combustion technology, another in biogas (fermentation) technology and a third in solar technology. Each team will consist of two engineers and one engineering aide. Project implementation will proceed in stages, beginning with work directly related to existing uses of fuelwood and, as progress is made in these areas, proceeding to wider uses of the technology.

For example, the combustion technology team will be initially involved with laboratory testing of domestic stoves. During the field testing phase, they will continue to monitor the activity closely but will place increasing emphasis on the laboratory work on improved efficiency of small kilns and ovens. As the improved kilns are being field tested, their attention will be increasingly given to experimental work on improved charcoal production and pyrolytic conversion techniques. In general, as the laboratory tests of a technology are completed and the technology enters, first, the field testing and then the demonstration stages, the technology team will need to give less attention to direct oversight of that activity and will, instead, give increasing attention to other laboratory work within the technological competence of the team and related to the project goals and purpose.

The evolving nature of the activities will require close supervision by the ROCAP project manager. Consequently, the six month review sessions are essential for proper project management.

2.a.) Biomass Combustion

The biomass combustion team is the group responsible for the fuelwood efficiency work described in the prior section. In addition to its laboratory work, field testing and field demonstrations in improved fuelwood efficiency, it will

also conduct other activities designed to increase the use made of non-wood biomass energy sources not now widely used in the region, to increase the efficiency of charcoal production, to demonstrate the feasibility of pyrolytic conversion and to investigate the use of wood chips and other processed wood forms in direct combustion.

Domestic Uses

On the domestic side, ICAITI will conduct a review of the literature on stoves burning non-wood fuels (such as sawdust, rice hulls and coffee pulp). A selected number of designs will be used to construct prototype models, which will be tested at ICAITI's facilities. The counterpart personnel to be involved in the field tests of the domestic fuelwood stoves will be trained also in the construction and operation of these non-wood stoves. As appropriate in the tests of the fuelwood stoves, these personnel will also introduce and test the non-wood stoves. The decision will be made on a case-by-case basis depending on local availability of the fuel and material resources. The results of these tests will be included in the various reports prepared by the counterpart personnel and ICAITI. A total of 60 units are expected to be demonstrated.

Industrial Uses

ICAITI's main focus in this technology will be on industrial uses of non-wood resources. It is felt that industrial users are more concerned with cost-effectiveness and are more willing to change if a positive gain is foreseen than domestic users would be.

Using the same sites as in the work on increased fuelwood efficiency (where possible) and additional sites if necessary, ICAITI personnel will determine the efficiency of using non-wood biomass as a supplement or replacement to wood-fueled combustion. As indicated by these tests, a review of literature and consultation with experts ICAITI will construct new combustion units to be field tested. Special attention will be given to bakery ovens and brick kilns . It is expected that at least two demonstrations will be undertaken in critical areas as applicable (a total of 1 units to be demonstrated).

The results of these studies will be made known through a final report on the cost-effectiveness, practicability, construction, social acceptance and utilization of the combustion techniques.

Although not anticipated at this time to be a test or demonstration activity of this Project, ICAITI will also be interested in processed wood as a biomass energy source and the use of direct burning of wood in electricity generation. Processed wood includes wood chips and densified wood pellets. The USAID/Panama Alternative Energy Sources project includes a major effort in fuelwood generated electricity, the results of which will be closely followed by ICAITI for dissemination in the rest of the region.

2.b.) Biogas Generation

Although not commonly known, biogas (primarily methane gas) generation has been used in Central America for perhaps 20 years, primarily on a limited number of medium large farms. In recent years, with the greater interest in appropriate technology, increasing enthusiasm has been shown by international agencies, national institutions and voluntary organizations in a wider use of biogas technology. Biogas is basically a fermentation process and ICAITI has had considerable experience, some of it with IDB funds, in such processes. Therefore, ICAITI is a natural candidate to become the leading regional source of technical expertise in this area.

Biogas generation is technically attractive because it produces both a combustible gas and an excellent fertilizer. Its disadvantages have been the high initial cost of small units so that single household units are frequently not cost-effective alternatives to fuelwood. However the economic situation improves significantly when the fertilizer value of the residue is properly considered and when other feedstocks besides animal manure are used. Recent AID reports have examined this technology and described its advantages and disadvantages. AID-funded work on community sized digesters is being undertaken by the Peace Corps in Nepal with a final report soon to be published. Other AID-funded Peace Corps work in biogas is expected to be included in the AID/W - Peace Corps Energy PASA which will train PCVs in small-scale energy technologies, some of whom may participate in this project.

The ICAITI biogas team will work on both small and medium-sized biogas digesters for use in both domestic and industrial applications. They will coordinate their work with that of existing work on small units in Guatemala by the ICADA Experimental Station and CEMAT. In addition, ICAITI will also coordinate all its work on biogas with the Hydraulic Resources and Electrification Institute of Panama (IRHE), which will conduct biogas feasibility studies under the USAID/Panama Alternative Energy Sources Project.

Extensive work in Asia has not yet led to the development of a single family-sized unit that is affordable by poor rural families. This is due to the initial cost of the unit itself and the requirement for more waste than that which the limited number of animals can produce, (A general rule is that one large animal per person is required to meet both cooking and domestic lighting needs.) Development efforts are underway to design units of cheaper construction and that use vegetable or agricultural wastes in addition to manure. However, larger sized units for community and industrial uses seem to be more promising.

The ICAITI biogas team will conduct a thorough review of available literature on biogas research, application and evaluation efforts. As necessary it will visit local installations and US facilities to assure that it is aware of the progress in this area. Short-term visits to the US and assistance of consultants from the US and other countries will be employed for this purpose.

Based on the information obtained from the above activities, the biogas team will select two designs for construction of prototype units - one domestic unit and one industrial unit. The units will be constructed at appropriate sites to be determined during project implementation. The domestic unit will be used to study the effects of different raw materials and be the baseline unit for design modifications as needed. The residual sludge or effluent will be examined to determine its fertilizer and/or animal nutrient value. The industrial units will probably be built at operating industrial sites where the cost-effectiveness of the designs can be evaluated. Access to a stable supply of feedstock will be an important criterion in site selection, for example, proximity to a slaughter house. Consideration will be given both to the use of biogas as the sole fuel source and to combinations with other fuel sources.

The prototypes will be studied to determine the operating parameters; such as the amount of gas produced, sludge produced and feedstock required; fermentation time required; value of the sludge as a fertilizer or other byproduct (such as animal feed); and cost of construction, operation and maintenance. Both animal manure and vegetable wastes will be examined as potential feedstocks.

This controlled testing phase is expected to take 18 months. A report will be prepared which will be a complete accounting of the investigations conducted. Based on the results of this phase, ICAITI will develop final designs for the construction of a domestic biogas unit and an industrial unit for field demonstration. ICAITI will develop and conduct a workshop for counterpart personnel in construction, operation and maintenance of these units. Along with participating country personnel, ICAITI will identify sites throughout the region and install ten domestic and three industrial units for field testing and demonstration. Final selection of industrial units will depend on industrial activity and availability of raw materials.

These field units will be monitored for two years and a final report prepared which will include the results of the field tests and demonstration, such as construction, operation and maintenance costs; technical problems encountered; social acceptability and cost effectiveness.

While the field tests are underway, ICAITI will provide technical assistance and training to interested outreach organizations and will work with national counterparts in identifying and assisting possible local manufacturers in construction and operation of biogas plants.

In the last year of the Project, ICAITI will organize a regional seminar that will present the state-of-the-art of methane research and application and future potential for the Central America region.

2.c.) Pyrolytic Conversion and Charcoal Production

Pyrolytic conversion is the destructive distillation of wood induced by burning the wood in an oxygen-depleted atmosphere, producing gas and oil and a residual char. All three products are combustible. The products obtained and the relative amounts depend upon the process used. In traditional charcoal production, the gasses and oils are not captured and only the char is produced.

Charcoal production and use is an important term of the energy equation for developing countries, In addition to its use in metal working and other industries, charcoal is frequently a preferred cooking fuel because of its steady and concentrated heat and its smokeless burning. Recent increases in the cost of kerosene and bottled gas have resulted in a shift (back) to charcoal in many urban areas of developing countries. Recent newspaper articles in Guatemala point out increasing use of charcoal in the urban areas and increasing illegal production, both due to the most recent rise in prices of petroleum and petroleum-based fuels.

The energy efficiency of charcoal use includes consideration of the efficiency of the conversion of wood to charcoal (energy is lost), the energy needed to transport the fuel (easier and cheaper to transport the lighter charcoal than the original heavier wood) and the efficiency of the final use (potentially higher for charcoal than for wood because of the greater controlability of a charcoal fire). Whether the overall efficiency of charcoal use is higher or lower than that of wood then depends upon local characteristics, in particular transportation distance.

The traditional process of charcoal production in Central America, as elsewhere, is the earthen kiln. Wood is stacked in a pit, ignited and covered with soil. It is then left to smolder for a few days in the oxygen-depleted atmosphere, producing charcoal. This process is inefficient, with a conversion efficiency of perhaps 30 percent. Modern charcoal kilns can achieve an efficiency of 65 percent. Less sophisticated techniques can nevertheless improve on the traditional approach and achieve a value of 50 percent. Other conversion techniques are even more efficient and can use a wider range of feedstock. Pyrolytic converters can produce a mixture of charcoal, combustible gas and combustible oil with up to 85 percent of the initial energy being converted into the final form. The relative weights of charcoal, gas and oil depend upon the operating characteristics of the device, such as temperature, pressure and time.

Although traditional charcoal production is very inefficient, it has the strong advantage of not requiring any capital investment for the kiln. Other approaches will require such investment to different degrees. Their acceptability will depend upon the perceived financial return of the investment and, perhaps, on the degree to which the small charcoal

producers will join together in cooperatives to finance the purchase of the needed capital equipment.

ICAITI will conduct a thorough review of the literature and, with the assistance of short-term technical experts, will select and construct a prototype improved charcoal kiln and a prototype pyrolytic conversion unit. ICAITI, along with national counterparts, will then test and demonstrate the units in appropriate areas. Particular consideration will be given to the introduction of the charcoal kiln in one of the critical areas. Preference will be given to established local cooperatives or small enterprises to operate the kiln, possibly purchasing its wood supplies from the fuelwood to be produced in the several demonstration production efforts in the area.

ICAITI will prepare a final report evaluating the operating experience, its construction and maintenance costs, acceptance results, and local manufacture possibilities. The results of their work will be disseminated to national cooperating agencies, USAIDs, private voluntary groups and interested individuals through this report and planned short courses and seminars.

2.d.) Solar Technology

The solar technology team will look at three primary applications of direct solar energy: solar wood dryers, and solar grain panela dryers, solar evaporators for salt production and solar water heaters.

Wet wood is very inefficient to burn because so much heat energy goes to vaporize the water in the wood rather than to other purposes. The team will examine the utility of simple solar dryers to dry wood for both domestic and small industry use. Both laboratory testing and field demonstrations will be included for two industrial and at least six domestic units. To the maxiumum extent possible the field activities will be incorporated into the activities of the other teams.

In panela production the liquid resulting from the cane pressing is boiled down until it forms a heavy syrup. In Central America this stage of the sugar production process is frequently done by small entrepreneurs. The boiling consumes large amounts of wood. Sometimes the crushed cane residue is added to the wood but its high moisture content

limits its utility. Because of this, the residue is sometimes left to rot away. The solar team will work with a selected panela producer and design and construct a solar dryer to dry the cane residue and use it as an efficient supplement to fuelwood. Measurements will be made of the moisture content of the crushed cane and the effectiveness of drying in open air for measured time periods or drying in a solar dryer. The cost effectiveness of the solar dryer will be determined. The work will be done in conjunction with the combustion technology work on improved efficiency in panela production

Salt is produced by evaporating sea water. The process usually is accomplished by heating the water by burning wood in tubs placed in shallow ponds. The rate of evaporation is thereby increased. The quantity of wood required for this has contributed significantly to deforestation in certain areas. The solar team will work with selected salt producers to design and construct solar evaporators. For example, one approach could be to use black plastic sheeting to line the bottom of the salt pond, absorbing sunlight and raising the temperature of the water. This would increase evaporation of the water. The approach may be used by itself or in conjunction with the wood burning technique. Another approach could be the use of a solar still, not to collect distilled water (though it is possible), but to produce the salt residue which remains. Tests will be made of these types of approaches to determine the cost-effectiveness of such innovations in this industry.

Solar water heating will be applied in critical areas in the region as appropriate. It is expected that two applications would be rural clinics (or schools) where the units would produce hot water for personal hygiene, food preparation, and cleanup and washing (not sterilizing) of instruments and linens. A third unit might be a supplement to a biogas generator to maintain the slurry at the proper temperature. The exact applications of the solar water heaters will be determined during project implementation.

ICAITI personnel will build several test units and determine the cost and performance of the designs. Only locally available components will be included in the units. Based on this initial work, the field test units will be constructed, installed and monitored. The results will be disseminated to the national counterpart institutions, USAIDs and other interested parties.

The USAID/Panama Alternative Energy Sources Project includes demonstrations in photovoltaics, solar air-conditioning, and solar hot water heating. ICAITI will not get involved in photovoltaics or solar air-conditioning, but its work in solar hot water heating will be closely coordinated with the Panama project.

As needed, ICAITI personnel will participate in training course, and conferences on the application of solar energy. Some of the training will be funded from project funds and other training opportunities will be explored. Particular consideration will be given to the attendance of ICAITI personnel in the DSB program of solar energy technology training.

3) Policy Study

During implementation, and prior to dissemination of results within the cooperating countries, the Project will finance a review of existing legislation and administrative regulations which might retard wide use of project results. For example, the study will review existing requirements or restrictions regarding:

- use of public lands for production of wood for sale
- fees for tree cutting
- credit on long-term investments such as tree production
- credit availability for purchase or production of non-traditional energy devices
- home use of gas generation devices
- licensing requirements for such devices

The results of this study will be made available to reqional and national policy makers with recommendations regarding where Project objectives could be encouraged with modifications to existing legislation, administrative regulations or practice.

The study will be conducted under contract with ICAITI, coordinating with CATIE and the COMENER secretariat at SIECA. The estimated cost is $25,000 to be obligated in FY 1981.

4) Training

In addition to training activities described in the previous sections, the Project includes a number of separate training activities for implementors of field tests and demonstrations and for the wider regional audience of persons interested in the results of the Project and in the general subject area of renewable energy resources.

Field Implementors

Counterpart personnel from various national agencies and volunteer organizations will receive specific instruction from ICAITI on the construction, operation and maintenance of the various energy devices to be field tested and demonstrated. Through workshops organized and conducted by ICAITI, these personnel will learn the technical details of the devices as well as the kind of information that ICAITI will need to evaluate properly the results of the several field activities. It is expected that there will be workshops in the domestic stove technology and biogas technology. Less formal training will be provided to the smaller number of people to be involved in the industrial application effort. A minimum of 75 people are expected to receive this specific training from ICAITI. Project funds are allotted for workshop costs and limited travel and maintenance costs of the participants. No participant salary costs are included in the Project.

Regional Audience

In addition to developing suitable technologies, a prime purpose of the Project is to increase regional awareness and dissemination of the efficacy of those technologies by making the results of the Project available throughout the region. The audience includes government planners, national outreach agencies, volunteer organizations and private sector individuals. Especially important is the need to heighten governmental awareness of the problems of rural energy use and the value of selected approaches to solve those problems. To achieve this broad public information goal, ICAITI will organize and conduct three regional seminars.

The first seminar will summarize the results of the field testing of the domestic stoves and the results to-date of the work in industrial applications. The second seminar will concentrate on solar energy uses, and the third seminar (during the last Project year) on all applicable alternative energy technologies that impact on the poor. In all seminars, the most up-to-date information on the activity in the critical areas will be presented. CATIE personnel will participate, as appropriate.

Project funds are allotted for the cost of organizir and conducting the seminars, as well as limited travel costs, and expenses for selected participants from the region and desired outside speakers.

The proceedings of each seminar will be prepared and published by ICAITI and distributed through appropriate channels in the region.

5) Financial Management Assistance to ICAITI

As discussed in the Financial Analysis Section of this paper, ICAITI requires the services of a financial/management consulting firm to review their accounting and management information systems and make recommendations to assure sound fiscal policies.

A highly qualified consulting firm experienced in evaluating systems of institutions comparable to ICAITI will be contracted at the beginning of the project to conduct the following:

a. Review ICAITI's financial accounting and reporting systems focussing principally on insuring that the systems:

   i. Provide accurate and timely information;

   ii. Allow the accurate accumulation and application of all direct costs;

   iii. Provide for accurate accumulation and proper allocation of indirect (overhead) costs to appropriate activities;

iv. Provide management with an accurate period by period comparison of operations as a measure of progress;

v. Provide information so that long term project progress can be realistically measured in financial terms at specific intervals during the project life; and

vi. Provide information to distinguish which operations generate financial losses, to identify the cause of losses and monitor and control such losses.

b. Provide recommendations for changes in the financial systems of ICAITI.

c. Review the management structure of ICAITI to evaluate:

i. The appropriateness of the current organization in light of new and projected expanded activities and

ii. Management information systems

iii. Personnel systems and policies

d. Provide recommendations for improved management procedures

The estimated cost for this activity is $50,000.

b. CATIE Element

Under the fuelwood component project resources will be utilized to carry out the following activities:

i. Identify the critical and potentially critical fuelwood availability areas in the region.

ii. Identify for testing as fuelwood, species of fast growing trees and provenances* that are already known and have been tested in Central America and Panama.

iii. Identify improved management practices (planting distances, pruning/thining systems and cultural practices) for selected fast growing trees identified in number two above.

iv. Conduct demonstrations of various methods produce increased supplies of fuelwood on small farms, village or community woodlots and fuelwood plantations.

v. Strengthen CATIE and national professional and institutional capacity to conduct research, carry out demonstrations, and provide training and technical assistance in improved fuelwood production systems.

It should be noted here that this portion of project is not directed toward the urban situation and should not be looked to as a strategy or action program to address urban fuelwood shortages.** The solution of the urban fuelwood problem may require very different approaches since land values near cities are high and increasing at a double digit figure annually, land availability for initiating fuelwood

* The area from which seeds of a speciesare collected.
**For purposes of this paper urban means the capital city and the two or three largest cities outside of the capital.

production is usually scarce, the income to be derived from fuelwood production versus alternative uses of land in a free market situation are as yet unknown as is the yield per area of alternate fuelwood species under known conditions. However, urban areas can be expected to benefit indirectly because, as the supply of fuelwood increases in the rural areas some of the increase will spill even into the cities.

CATIE will be primarily responsible for implementation of this project component. National counterparts will be involved in all activities.* (See Implementation Plan Part IV.B.2).

1. Critical and Potentially Critical Fuelwood Availability Areas

This activity will build upon and further refine the initial surveys of the fuelwood analysis carried out by ROCAP, the Peace Corps and short term contractors in preparation for this project paper. CATIE, ICAITI and counterpart agencies, with further Peace Corps and other assistance in the six countries, will prepare and conduct a survey to identify those areas in which fuelwood availability is presently a critical situation or is expected to become one within the next ten years. The survey will be carried out in the more itensely populated and cultivated areas of the region to identify those areas in which the fuelwood supply is or will soon become a major problem. A set of selection criteria will be developed for this purpose. Criteria that have been tentatively identified are:

(i.) Critical Areas

(a) Areas in which a majority of people are presently spending a minimum estimated level of fifteen percent of the principal householders time or financial resources to obtain fuelwood or charcoal for food prepa-

* The institutional analysis, Annex XVI, contains a list of CATIE's principal, national, counterpart institutions.

ration, home heating or other purposes;*

(b) Areas where no significant major forest resource exists within six kilometers** of the location or no significant commercial or village fuelwood plantations are presently planted or being planted; and

(c) Areas where changing farming systems have or are in the process of eliminating traditional sources of fuelwood, and alternative sources are not readily available or planned to be in productiion within the next five years.

2. Potentially Critical Areas

(a) Areas in which a majority of the people are presently spending a minimum estimated level of eight percent of the principal householder's time or financial resources to obtain fuelwood or charcoal for food preparation, home heating, or water heating.

(b) Forest resources have decreased significantly in availability within three kilometers of the location and no commercial or village fuelwood plantation or alternate sources are readily available or planned to be in production within the next ten years.

In order to be classified as a critical area a location would have to meet criterion (a) plus one of the other

* The fifteen percent figure is approximately equivalent to one person day of work assuming a seven day work week. In certain parts of Africa and on some Caribbean Islands a minimum figure of twenty-five percent is used. However, the ecological conditions and population pressures are not as severe in Central America; therefore, the fifteen percent figure was chosen. This figure is subject to readjust after the survey has yielded reliable statistical data.

**A distance of six kilometers was chosen as the maximum which an individual could walk, collect seven day's worth of fire wood and return home within one day.

criteria. In addition, both types of areas must meet a common criterion that fuelwood production be sufficiently profitable to induce farmers in the area to devote a portion of their productive resources to fuelwood.

The survey will be completed by March 1980 and the data analyzed by the end of May 1980. It is expected that this survey will identify at least ten critical or potentially critical areas. Annex XVIII shows those areas which CATIE judges to be likely critical areas amenable to project activities. Operations in critical areas will not only help maximize the impact from this project on areas of greatest need now but also aid national institutions mount programs later on.

To facilitate the transfer of research results on tree and shrub species between similar ecological areas, a life zone (Holdrige) characterization of each selected area will be completed.

A final report on the critical and potentially critical areas for fuelwood production availability will be completed in early 1981 based upon the above studies and distribution made to counterpart national institutions and USAIDs.

To the extent possible, the testing and development activities carried out by CATIE and ICAITI will be located in the identified critical areas. The Mission and the two institutions while working in those critical areas will attempt to monitor fuelwood use and supplies to gain an appreciation of the micro-level impact of the project. In doing this they would have to collect some basic data on the amount and source of energy consumed in those areas as well as the reasons for its use. Assistance with this data collection may come from A.I.D./W where the Development Support Bureau is currently designing a project to develop a methodology to collect information on energy use patterns in developing countries. After an international workshop is held this fall, the methodology will be developed and trial tested in selected countries. The Central American region is being considered as a possible test site.

ii. Known and Tested Species of Trees for Fuelwood Production

A significant number of field experiments, trials and plantings have been made in the region in the past (Annex XIX). Some of those plantings were for

timber while others have been planted for box wood*, fence-poles and transmission poles, a few plantings have also been made of fast growing species for banana plant props. CATIE intends to locate existing plantations and provenances of fast growing trees in CAP countries and collect basic data on plantation and management history, species and seed source, as well as characterization of soil and ecological conditions for each planting. It is anticipated that data will be obtained for a minimum of thirty plots planted before 1980 and will provide information on tree growth, and the physical and chemical characteristics of wood as they related to fuelwood and other potential uses. In addition, the potential impact of these species on the environment will be examined. The data will be obtained both in the field and in C.A. wood products laboratories (ICAITI as well as CATIE's cooperative forest products laboratory at the University of Costa Rica). Growth data and harvest characteristics will continue to be obtained for these plots during the remaining five years of the project using normal forestry procedures (tree count/area and diameter and height measurements) in order to refine the basis for estimating annual production for each species under study.

As part of this activity a preliminary social and acceptability survey will be undertaken in areas contigous to the pre-1980 plantings. The purpose of the survey is to determine the receptivity by potential consumers of those tree species identified under this activity. New species will be compared to fuelwood species presently used to determine such potential problems as drying and burning characteristics, existence of undesirable odors, existence of noxious oils or resins and smoke problems.

A preliminary report with recommendations for approximately fifteen of the most promising species having high social acceptability, produceable under selected ecological situations, and to the extent possible, multiple use potential will be published in 1981. Data collected from all of the plots under study in the region will be published at the end of the second year of the project. Data collection and further observations will be continued for the life of the project. In 1985 CATIE will further refine its recommendations based on these data and make appropriate adjustments to its preliminary recommendations in a final publication.

* Trees grown for box wood are usually soft woods such as pine.

iii. Improved Management Practices for Fuelwood Production

Experiments involving known species that received recommendations in activity two will be carried out under this activity. Previously similar silviculture research has resulted in major increases in roundwood production*. Similar results are believed possible in producing fuelwood using known species when grown under intensive silvicultural management conditions. Too, silvicultural changes if properly selected have the potential to increase production markedly without a major increase in the capital expenditure per area. Experiments will be planted on small farms, experiment stations and in other secure locations and will be designed to further refine silvicultural practices that maximize production of fuelwood.

The experiments will focus on such management practices as site preparation, initial fertilization, intensive weed control, planting distances, altering the land use configuration, pruning and thinning practices and pest control. Experiments using one to three of the most promising fuelwood species identified in activity two and testing one or two management practices alone and/or in combination will be carried out in at least one critical or potentially critical area in each country of the region. Each experiment will be evaluated both silviculturally and economically for a minimum of four years. Because the need to collect data under some experiments may extend beyond the life of the project, CATIE and the national agencies will agree to continue those experiments until all necessary information is gathered.

Data collected annually in each experiment will be processed at CATIE's data facility and conclusions resulting from the data available in 1985 will be published. Recommended practices based upon silvicultural as well as economic considerations for each tested species will be printed and made available to all CAP countries and USAIDs at the end of the initial research period covered by this project. Technical reports on each experiment will also be published annually.

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* Roundwood refers to wood used for poles, timber and pulp.

iv. Fuelwood Demonstration Units

The paucity of concrete data on fuelwood costs, labor requirements, social acceptability and comparative production levels for various types of planting patterns and ecological situations make it difficult to provide reliable data on which recommendations can be based. This output is primarily designed to develop such data for use by small farmers and communities and for fuelwood planning by national agencies. At the same time, it will serve as a set of demonstrations around which training courses and other awareness seminars will be developed by CATIE, national research and extension technicians and private organizations.

The proposed demonstration units will utilize the most promising, known, fast growing, consumer acceptable species of fuelwood trees that were selected in activity number two. Plantings will be made in at least one critical or potentially critical area per country.

The proposed demonstrations will focus on five types of plantings detailed below. The objective of this activity is to test each type of planting in each country. Depending on environmental and sociological conditions this may not be possible. Data collection from these plantings may go beyond the completion of the project; the national agencies and CATIE will agree to continue collecting necessary information.

(1) Natural Fuelwood Production Units

These units will be established in existing primary or secondary growth natural forest from which fuelwood is now being harvested. These units will be fenced and protected from fires and uncontrolled grazing. Silvicultural practices such as replanting presently unproductive areas, cleaning, pruning, thinning and selected harvesting will be demonstrated and data collected on costs and yields. Other upgrading and management improvement will be developed with the collaboration of the local farm owner, community council, national counterpart technicians or other public officials. Ten units are expected to be in operation by the end of the third year of this project. Annual progress reports will be sent to national agencies and USAIDs.

(2) Farm Level Fuelwood Production Units

These units will contain fast growing species planted in less than two hectare plots on small or medium sized farms. These will be developed in cooperation with Peace Corps or other voluntary field personnel, farmers, local extension agents and forestry research technicians.

At least twenty farm level fuelwood production units are expected to be planted. Nursery planting will start in at least three countries in the 1981 growing season and will be extended to at least five CAP countries by the 1984 growing season. Initial data collection on the socio-economic impact and the production of fuelwood will be completed for at least ten units and published at the completion of the project's sixth year for distribution to national institutions and USAIDs

(3) Village Woodlots

At least fifteen five to ten hectare village woodlot plantationswill be developed to meet the needs of small villages in critical as well as potentially critical fuelwood availability areas. Nursery planting will start in at least three countries in the 1981 growing season and will be extended to at least five countries by the 1984 planting season. The plantations will be undertaken by cooperative village action groups assisted where possible by the Peace Corps and national forestry or extension service staff under CATIE fuelwood specialist supervision. Plantings will be fenced and cared for by the village. Data will be collected by local and CATIE technicians to evaluate costs for land preparation, fencing, labor requirements and out-of-pocket costs as well as annual growth measurements, fuelwood yield, etc. Results will be published at the end of the project. Annual progress reports will also be issued.

(4) Fuelwood Plantations

These ten to twenty hectare plantations are intended to be commercial and supply in part fuelwood to small rural industries such as bakeries and lime kilns. It is expected that at least five plantations will be developed on private cooperating farms and municipal or national land during the project. The plantations may receive plant material from the project as well as technical assistance, through CATIE working with national counterparts. Appropriate data will be collected to measure economic, employment and produc-

tion costs and benefits and summarized annually in a similar manner to the above described trials. Three plantations will be developed in 1982 in three countries and the remaining plantations will be planted by 1983. Annual progress reports will be issued and final summation of experience and data will be presented as a part of the final project report.

(5) Agro-Forestry Demonstration Units

On small farms particularly, fuelwood largely comes from hedgerows, shade trees and prunings of commercial crops such as coffee and cacao. Most of these plantings utilize traditional shade tree species such as Poró (*Erythrina poeppigiana*), madre de cacao (*Gliricidia* sp.), Inga (*Inga* sp.) which are relatively slow growing species, or produce inferior fuelwood due to the succulent nature of new growth.

Under this output, the CATIE forestry group will work with the Small Farm Production Systems technicians and the Perennial Crops specialists of CATIE in collaboration with small farmers to design several systems which combine trees for fuel with other annual in renewal crops. They will also carry out research in fast growing species that could be utilized for fence rows, contoured erosion prevention or windbreak-type strip plantings at the farm level. In addition, they will work with CATIE animal husbandry specialists in the design of one or more systems combining potential fuelwood species with tropical animal production. These systems will be tested in appropriate ecological situations and supervised by national and CATIE technicians with Peace Corps collaboration. Data will be collected on the trials and made available to local extension and other agency personnel (including USAIDs) interested in this type of farming system. It is anticipated that during the life of the project a total of at least thirty trials and/or demonstration units will be planted in the six countries. Data resulting from these trials will be published annually and summarized at the completion of the project. As appropriate, depending upon the success of the trials from a fuelwood generation standpoint, one or more tech packs may result*.

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* For the purposes of this project a Tech Pack is defined as that set of ecological, economic, social, time-phased production and harvesting data and recommendations required to produce and harvest fuelwood plants alone or in combination with other plants or animals under given conditions.

v. Strengthen CATIE and National Professional and Institutional Capacity in the Field of Fuelwood

Throughout the region at the national level, the institutional capability, financial resources and technical personnel trained in the field of fuelwood are extremely limited. National forestry officials, because of their role of protecting the forests, are looked upon with disfavor by the small farmer and others who are dependant on fuelwood as an energy source. At the same time the forestry officials often view the small farmer as the enemy of the forests he is trying to protect. This project will provide training to the forestry officials, particularly at the lower levels where officials are in closest contact with the farmers, which will permit those officials to offer a more positive response to small farmer needs by providing assistance in growing fuelwood. In time it is hoped that the forestry officials will have positive effect on the farmer's use of natural renewable resources.

Currently in the public sector there are approximately 98 peritos agrónomos and ingenieros forestales, 28 ingenieros agrónomos, 13 master of science level personnel and one doctorate level person working in forestry activities throughout the region*. This is an insufficient number of personnel to carry out all necessary forestry activities in the region, and very few of them are working in activities directly related to increasing the supply of fuelwood.

This activity is directed toward improving the national institutions' capacity to design and care for research or production activities in the fuelwood area. It is also directed toward improving CATIE's capacity to provide support to the national institutions involved with fuelwood production.

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* Training for peritos agrónomos and ingenieros forestales is roughly equivalent to high school plus one year of college, and training for the ingeniero agrónomo is equivalent to a college bachelor of science degree.

Capability will be strengthened primarily through training but also through the provision of technical assistance for research and demonstrations. CATIE will improve the technical capacity of its present staff and increase its staff by one.* Governmental and private organizations will also be strongly encouraged to increase the number of people working in the area and augment budget allocations to cover essential counterpart needs. It is expected that as a result of this project, 5 percent of the national forestry agencies' budgets will be devoted to fuelwood activities.

Training will be provided by the CATIE forestry staff to national counterpart technicians at various levels in various ways. Short courses will be given at CATIE and in the countries. At least seventy-five students are expected to attend a total of five two-week intensive courses in various aspects of fuelwood production between 1981 and 1985 at CATIE. An additional minimum of one hundred persons will receive training on separate phases of fuelwood production, or general short courses in a minimum of five national training sessions. In addition, five traveling seminars for principal researchers will be held for approximately fifteen people in each session.

Training will also be given at the Master of Science level in fuelwood production. Nine Central Americans will be trained at CATIE and an additional nine will be trained in the United States. The U.S. training is expected to be funded under the Latin America Regional Training for Development Project (598-0528). If that is not possible contingency funds will be utilized if available. All M.Sc. level theses projects, whether coursework was carried out at CATIE or in the U.S., will be expected to be completed in the CAP countries under the field supervision of CATIE senior professionals. All Masters level students will agree to work for national counterpart institutions upon completion of their scholarships for a minimum of two years for each year of training. Each national institution will agree to employ students in a training-related position. A minimum total of two hundred Central American and Panamanian students are expected to benefit from the above training program.

Technical assistance will be provided by CATIE to counterpart national institutions in various ways. On-the-job training will be provided to national counterpart

*It is expected that the technical experts funded by the A.I.D. grant would become permanent employees of CATIE if the project is successful in generating a strong interest in fuelwood production among the CAP countries.

foresters while designing and conducting area characterizations, research, demonstrations and production trials on small farms, village woodlots, and commercial plantings as these are carried out under other phases of this project. Short consultation to small private woodfuel enterprises also will be given in critical or potentially critical availability areas by CATIE specialists accompanied by national counterparts.

Depending on availability of resources CATIE will provide assistance to national public sector institutions on various phases of national woodfuel activities in other than critical and potentially critical areas when formally requested. This can include short courses in forest upgrading techniques when undesired species are harvested for firewood or charcoal. CATIE will also provide advice on fuelwood program planning, state of the art as well as original research on planting, silvicultural practices, pest management and harvesting techniques for new or different situations as requested by the national institutions.

To improve CATIE's capacity to provide support to national institutions, technical assistance and training will be provided in the following areas:

(1) Technical assistance and research consultation to CATIE by at least eight of the leading experts in this field worldwide will be project financed. Outstanding researchers and extension specialists in silviculture, agroforestry, use of exotic tree species, laboratory methods and fuelwood evaluation, etc., from Asia, Africa and South America will review CATIE's program, present workshops for the CATIE staff and evaluations of their research progress.

(2) The CATIE library will have increased its capability to respond to requests for information. Over five hundred additional publications on all phases of research, extension and commercial production and use of fuelwoods worldwide will be available for consultation by CATIE staff and technicians regionwide. In addition, the library will prepare a comprehensive, annotated bibliography of articles on fuelwood research, extension, production and harvesting published worldwide. Copies of these articles will be provided as reprints to national institutions in order to further increase the availability of up-to-date knowledge to technicians throughout the region.

(3) The CATIE germplasm bank will have over fifty species and provenances of fast-growing trees in storage available to meet regional demands for research purposes. In addition, CATIE will have, as a result of this project, identified sources of seed and potential seed production as soon as the initial CATIE/national research results are available.

(4) CATIE will have developed its data base on all phases of fuelwood production to a point where it can provide information on a wide spectrum of fuelwood problems ranging from ecological and agronomic factors to plant growth, as well as small farm/community, social acceptance and economic considerations.

(5) CATIE will have also increased its knowledge of the area's fuelwood potential vs. alternate investment approaches and have developed a working relationship with national counterparts. This will permit CATIE, working with the region's public and private sector to further develop cooperative programs in research, extension, education and similar areas as these relate to national renewable resources.

In order to assess progress in improving the professional and institutional capacity as well as plan the most appropriate interventions to attain the objective of this activity, CATIE will during the first year of the project conduct a baseline survey of national capacity in this area. A similar assessment will be carried out in the sixth year of the project and a report prepared comparing progress made regionally, and at CATIE.

III. PROJECT ANALYSIS

A. Technical Analysis

1. ICAITI Element

a. Alternative Energy Technologies

The selection of alternative energy technologies to be evaluated, tested, and demonstrated by ICAITI was based on an evaluation conducted by a ROCAP consultant, Solar America, Inc. The consulting firm evaluated the potential of alternatives to present energy-use practices in the region, to select possible technologies that could be introduced in the region and directly impact on the poor. The criteria for selection included:

i. Availability of renewable resources

ii. Technological feasibility

iii. Cost and affordability by the rural and urban poor and small industries

iv. Potentially socially acceptable by the target group

v. Environmental considerations

vi. Replicability throughout the region

vii. In-country manufacturing potential and indigenous maintenance capability.

The analysis conducted by Solar America, Inc. resulted in the selection of the following technologies that will be investigated and demonstrated under the Project:

Biomass and Biogas Energy Sources

- Domestic biomass conversion
- Industry biomass conversion
- Domestic biogas use

- Industrial/Small Village biogas use

Direct Solar Energy

- Small industrial/domestic solar dryers
- Solar hot water systems
- Solar stills

Pyrolytic Conversion and Charcoal Production

- Pyrolytic conversion techniques
- Improved efficiency charcoal production techniques

Annex X describes the above technologies and possible applications, costs and savings. The proposed ICAITI activities under the Project are based on the recommendations contained therein.

b. Fuelwood Efficiency Techniques

The determining factor in the selection of the ICAITI activities to improve domestic and industrial use of direct combustion of fuelwood was the number of consumers. Available census data shows that approximately 80 percent of households in the region (excluding Panama) use fuelwood for cooking. The majority of cooking by rural low income groups is usually done over an open fire. Values of efficiency for this type of cooking are usually less than ten percent; that is, less than ten percent of the energy potential of the wood is productively used to cook the food. Many stove designs have been developed that promise a much greater cooking efficiency than the traditional open fire cooking. Such stoves can productively use 40-65 percent of the energy potential of the wood. Even relatively simple stoves for use in developing countries could double the efficiency of domestic

fuelwood use. For example, the Lorena stove (see Annex has been described as being up to 70 percent more efficient than current cooking practices. Under the Project, ICAITI will examine as many designs as practical in order to determine the most acceptable designs for the region. The criteria for selection of stoves to be control-tested, compared to existing cooking techniques in the region (including the two local improved stoves, the Lorena and the "Fogón"), and eventually demonstrated in the field include:

- Improved efficiency (at least 50 percent improved efficiency is expected)
- Low cost
- Use of local materials for construction
- Local manufacturing capability
- Low maintenance requirement
- Ease of construction
- Consumer convenience and probable social acceptance

The small industry users of direct combustion of fuelwood consist of a variety of industries whose numbers are almost impossible to quantify due to the lack of census data. A preliminary survey conducted by ICAITI to identify and list small industries by numbers and amount of fuelwood consumed showed that bakeries, brick and lime kilns, ceramic and pottery producers, and crude sugar and salt producers, are the major users of fuelwood. ICAITI estimated that these seven industries could number up to 53,700 in the region (excluding Panama), and possibly account for 88 percent of fuelwood use by small industries. Other small industrial activities include coffee grain drying, rubber and vegetable oil production, textile dying, blacksmith shops, confectioners, etc. (charcoal production, though quite significant, was excluded from the list of industries since it is not direct combustion of fuelwood, this activity is covered under alternative energy technologies).

The efficiency of fuelwood use of the above seven major industries varies from industry to industry. The crude sugar and salt producers, ceramic/pottery producers, and some of the coffee drying is generally done by the open-fire method which is obviously inefficient. The other industries use varying degrees of enclosed and more efficient heating methods; however, it is felt that opportunities exist for much improvement in these operations through simple modifications in construction and operation. Use of improved energy efficient techniques would conserve fuelwood, thereby reduce operational costs and improving overall production efficiency, and help protect the source of employment for many inhabitants of the region. A 20 percent increase in energy efficiency in these activities should be easily attainable, which would result in a substantial annual savings in wood consumption for these industries. For example, a recent VITA project in Honduras showed that inclined chimneys in lime and brick kilns can yield a 15 percent savings in firewood consumption. Other improvements in the design, construction and operation of wood burning ovens and kilns are considered to be technically and economically feasible. It is planned that ICAITI will only investigate possible industrial fuelwood efficiencies for the above seven industries.

2. CATIE Element

Relatively little research has as yet been undertaken in Central America on fuelwood production. Consequently, the approach taken in this project concentrates the total project focus on four key but basic questions. These are:

a. Where geographically, and under what conditions, is the fuelwood problem most serious in the region?

b. What plants offer the greatest potential for impacting on the problem in a short period of time?

c. What silvicultural practices will, under given conditions maximize the production and profitability of fuelwood cultivation in Central America?

Each of the above is at the center of the solution of this problem and will be addressed in this project. The approach taken and the procedures used are:

a. Where geographically is the fuelwood problem most serious in the region?

To answer this question sampling methods using established analytical procedures will identify the areas in which the fuelwood problem is "critical" or "potentially critical". To the extent possible, subsamples using the sample frame developed by the ROCAP/IICA Agricultural Research and Information Systems project (Project 596-0048) will be used for an evaluation. To measure project impact basic data will be gathered on present uses of fuelwood on farms, in small towns and in agro-industry, user preferences, amounts and sources of fuelwood as well as costs and/or time required to collect wood and haul it to the location where it is used.

b. <u>What plants offer the greatest potential for impacting on the problem in the shortest timeframe</u>.

A range of tree and shrub species have been used for fuelwood in the region and in other parts of the world (Annex XIX). Certain of these species are proven to be fast-growing, relatively widely adaptable types having good acceptability by users. A number of species have been grown at Turrialba, Costa Rica and the data base for them is well known. Their adaptability to other areas is less well documented. This Project will test these as well as collect data on a range of other species planted for various purposes in the CAP region. Normal silviculture data collection and analytical methods will be used to obtain such information as growth rate, dry weight and fuelwood extraction rates.

c. <u>What silvicultural practices will maximize fuelwood production and profitability of fuelwood cultivation in Central America</u>?

The more common procedures for affecting increases in per plant and/or per area yields will be followed in the project. Among these planting distance changes, use of fertilizers, plant pruning, weed and pest control offer the principal opportunities of increasing fuelwood production. Standard research procedures will be used in designing and implementing treatments comparing different planting distances, pruning procedures and pest control methods. Soil analyses and pot tests, using national or the CATIE Soil Laboratories, will in a prelim-

inary manner determine the nutrient levels required in order to design fertilizer experiments at test sites. Normal randomized complete block designs will be used for multi-level, single factor experiments. Normally five replications will be utilized per experiment. Multi-level multi-factor experiments testing, for example, fertilizer levels and planting distances will use split plots in randomized blocks designs. Evaluation of results will utilize standard analysis of variance, multiple correlation, regression, and other standard statistical procedures and tests of significance. Plant data measurements will follow accepted silvicultural norms in this as well as other elements of this research program.

Project Replicability - Plant Research

All agronomic research as conducted today is considered area specific. In this project we will describe the ecological situation in plant response terms using a recognized method (life zone characterization developed by Dr. Lester Holdridge) that is based on a species' favored ecological association. This zoning procedure permits the transfer of tree crop production methods to similarly characterized areas with a high degree of success. Using the Life Zone system, pruning methods, planting distances and similar silvicultural management practices on similar species of trees, should result in growth at similar speeds under similar nutritional conditions throughout the area for the same life zone. This will permit replication of project results throughout a significant portion of the region since research will be carried out under various ecological i.e.,life zone situations.

B. Economic Analysis

1. Macro Level Concerns

The cost of wood and charcoal, in terms of both time and money, is increasing rapidly in Central America in response to continued high demand and essentially stationary or shrinking supply. As stated elsewhere in this document, available evidence indicates that: (a) about 80 percent of all households in Central America rely on charcoal or wood for cooking (and, especially at higher elevations, for heating); (b) virtually all rural households use only wood or charcoal for fuel, as do a significant number of urban households; (c) industrial uses of wood and charcoal are a significant component of demand; (d) overall demand is basically a linear function of the size and growth of population; (e) available supplies of wood are becoming increasingly remote from the locus of demand; and (f) present and planned reforestation programs will not impact greatly on near-term fuelwood availability either because they are too small, work with slower growing species more appropriate to other applications, or will have major impacts in areas remote from fuelwood demand.

Given, then, that some special activities directed to the fuelwood problem are justified, project design becomes the first critical issue for economic analysis.

2. Project Design

The three elements of the project can be characterized as: (1) applied research on suitable fast-growing trees and shrubs; (2) applied research on increasing fuelwood efficiency in major uses; and (3) demonstrations of alternative energy sources. While the first element of this integrated project is directed to increasing the near-term supply of fuelwood, the second and third elements work toward decreasing demand.

All three elements are taken as far as possible for a regional project, but additional activities at the country level would magnify the returns to the investments to be made under this project. (See Section 6 below for a brief description of such follow-on efforts.) A careful review of all three elements confirms that project interventions are in fact cost-effective and, indeed, are least-cost ways of obtaining desired outputs and of achieving end of project status.

Alternative designs which could have been employed center on the use of national institutions in national programs, with or without support from regional institutions for some activities. National programs would have resulted either in significantly higher costs for the same outputs (because fewer economies of scale in advisory services could have been captured) or in a different set of outputs. National programs would have concentrated on what are known or thought to be special problems in supply or demand in their countries -- perhaps alternative energy sources in Costa Rica and El Salvador, and industrial fuelwood efficiency in Guatemala, for example -- and thus not obtained as much information on other generalized problems. In addition, it is not clear that the same range of institutions would have been involved as implementors or recipients of information as will be included in the present project. Because of such differences in comparability, the cost-effectiveness and cost-minimization review referred to in the above paragraph dealt only with possible input/output combinations under the proposed project.

3. Program Viability

Only a very limited portion of the Project's target group will receive benefits during the Project -- around 0.2 percent -- since the only impact will come about through demonstrations of improved fuelwood efficiency devices and processes, alternative energy applications, and research and demonstration fuelwood plantings. Nevertheless, the Project builds to larger investments and it is therefore important that systematic analysis be undertaken of the expected results of such programs, even though their scope and cost are only vaguely appreciated at this time.

The cost of the present project is somewhere around one dollar per potential beneficiary. Each potential beneficiary now spends an average of about $30 per year for the purchase of fuelwoods/charcoal. Assume the following hypothetical but not unrealistic variables:

(a) National programs would cost $20 per beneficiary;

(b) Such programs would reduce fuelwood expenses of each accepting beneficiary by 20 percent;

(c) Lead and lag times are as shown on the accompanying Table A; and

(d) Discount rate is 15 percent.

Under these assumptions, the benefit-cost ratio would be 1.43, indicating a good rate of return. The net present value is $29 million, with a positive net present value starting in the sixteenth year.

It should be understood here that the assumptions, although believed to be of the correct order of magnitude, could well be conservative. Several sensitivity tests were therefore performed to test the effect on the benefit-cost ratio of varying the assumptions.

Table B shows that the attractiveness of the program is enhanced dramatically when the relative price of fuelwood is increased by three percent per year. It also shows that the program would be worthwhile even if program costs increase by 25 percent or acceptance is limited to 75 percent of the target group. If program costs should turn out to be 25 percent lower than the $20 per capita, or fuelwood efficiency increased above 20 percent, as assumed for the basic case calculated in Table A, the program becomes very attractive.

These traditional tests confirm that program viability is not very sensitive to a wide range of changes in the values assumed for key variables. Table C shows the values of such variables that would still allow the program to be just acceptable as an investment. In all cases, the critical threshold values given in Table C are such that it is unlikely that the actual values encountered in national impact programs will be exceeded.

TABLE A

BENEFIT-COST CALCULATION
(20 PERCENT COST REDUCTION)

Year	Cost of Programs 1/ Regional	Cost of Programs 1/ National	Incremental Acceptance Rate % 2/	Benefit: Reduced Fuel Cost 3/	Present Values 4/ Cost	Present Values 4/ Benefit
0	2.0	.5	*		2.5	
1	2.0	.6	*		2.3	
2	2.0	.7	*		2.0	
3	2.0	.8	*		1.8	
4	1.8	.9	*	0.1	1.6	0.1
5		1.0	1	0.7	0.5	0.3
6		2.5	2	2.2	1.1	1.0
7		5.0	2	3.6	1.9	1.4
8		15.	5	7.2	4.9	2.4
9		50.0	10	14.4	14.2	4.1
10		50.0	20	28.8	12.4	7.1
11		50.0	20	43.2	10.7	9.3
12		50.0	20	57.6	9.3	10.8
13		13.0	15	68.4	2.1	11.1
14			5	72.0		10.2
15				72.0		8.8
16				72.0		7.7
17				72.0		6.7
18				72.0		5.8
19				72.0		5.1
20				72.0		4.4
TOTAL	9.8	240.0	100	730.2	67.3	96.3

* equals less than one percent

1/ In millions of dollars

2/ Percent of target population

3/ Assuming 20 percent per capita reduction in fuel cost at present (1979) relative prices; in millions of dollars.

4/ In millions of dollars, discounted at 15 percent.

TABLE B

		Benefit-Cost Ratio When Fuelwood Prices Are:	
		Stable	Incr. 3% p.a.
Original Assumptions		1.43	2.10
Program Costs	+25%	1.14	1.68
Program Costs	-25%	1.91	2.80
Acceptance Rate	-25%	1.14	1.58
Fuelwood Use Reduced	35%	2.50	3.68
Fuelwood Use Reduced	50%	3.58	5.25

TABLE C

	Threshold Values That Reduce Benefit-Cost Ratio to Unity, When Fuelwood Prices Are:	
	Stable	Incr. 3% p.a.
Program Costs per capita	$28.60	$42.00
Acceptance Rate	70%	48%
Fuelwood Use	- 14%	- 10%

4. Viability of Demonstration Activities

In general, it does not make much sense to demonstrate a technically feasible alternative energy source or efficient energy use device if it is not an economically or financially viable or culturally acceptable item. The exceptions to this rule are few, but they include situations in which: significant development costs are included in the cost of demonstrations, and the cost of production models is expected to be low enough to make the item viable in impact programs; pure experiments to get field data on operating costs or social acceptability, or both; applied experiments to see what design changes are needed and possible; and presently marginal items for which the rising cost of alternatives is expected to make the item viable in the near future. In this project, preliminary calculations indicate each alternative energy source or efficient energy use device proposed for demonstration will be financially viable either now or by the time national impact programs are mounted. (See the technical and economic analysis prepared by Solar America, Inc. and similar calculations prepared as part of AID's Caribbean and Panamanian alternative energy projects.)

5. Distribution of Benefits

The benefits expected to be generated under this Project are not conceptually different from those that national impact programs could produce. Benefits are seen to consist of those flowing directly to the target group and those accruing to society as a whole, including the target group. Despite the length of the description of expected benefits given below, we do not have a firm grasp on their relative or absolute importance. Experience with this Project will expand our understanding in this regard.

a. Direct Benefits

These are numerous, but their extent is difficult to predict. First, increased fuelwood availability and alternative energy sources will help insure that people will have sufficient caloric sources to cook food and heat their homes. The cost of changing life styles, in terms of human health and happiness, could be enormous if such sources were not available. Second, time now devoted to collecting firewood in distant places could be used in income producing

activities such as land improvement or cultivation work. Third, saving money now spent on energy (or money that would have to be spent in the future should energy have to be purchased) would increase real incomes by expanding target group ability to command real resources. Fourth, employment would be protected or expanded in industries becoming more efficient in transforming inputs, and employment opportunities would expand in the manufacture of energy devices and installation of tree plantings under all options (farm-level to agro-forestry).

b. Indirect Benefits

Society as a whole would see general government budgets and balance of payments have fewer demands placed on them to the extent that energy imports are lower than they would have been in the absence of efforts to increase domestic supply of and decrease local demand for energy. Measured GNP would increase because the same outputs could be achieved for fewer inputs and because trees now cut down for fuelwood but suited for higher valued uses could be used in those higher valued uses (such as timber). Although not designed primarily for this, widespread impact programs could also protect watersheds by decreasing erosion and silting and increasing year-round water availability.

6. Complementary Activities

Two additional kinds of complementary programs could extend the value of investments made through this Project. First, more investments in raising national institutional capacities would enable them to be in a better position to plan national strategies and carry out national impact programs. These investments would be in addition to the training and experience provided under this Project. Second, more work on other trees would enable national institutions to offer more extensive forestry and agro-forestry options as part of or alternatives to fuelwood activities.

C. Financial Analysis

1. ICAITI

a. Financial Viability

A more detailed review of ICAITI's financial statements and practices is contained in Annex XIV. In summary, ICAITI's past financial performance has been less than satisfactory. However, it must be remembered that ICAITI is a regional institution without a guaranteed annual budget from a central government. Rather it is dependent upon quotas established by the Central American republics, two of which are in arrears (Honduras $23,000 and Nicaragua $277,000).

Although the payment of these past due accounts will not affect income from current year operations, their non-payment has forced ICAITI to make long term borrowings in order to maintain its cash position.

Problems contributing to ICAITI's current situation and the actions that both the new administration has taken and those that we propose under the project are discussed below. In our opinion, these steps as well as the broader base which this project will give to ICAITI, will be sufficient not only to assure ICAITI a solid financial and managerial capability to implement this project, but will also place them on an overall sounder footing.

b. Summary Statement Analysis

Comparative Income Statements for the years 1975 through 1978 (Annex XIV, Exhibit C) reflect a worsening of ICAITI's financial situation. An actual year by year comparison of ICAITI income is made difficult by some of their accounting practices, which tend to distort an individual year's activity. The principal contributor to this distortion is ICAITI's practice of delaying the inclusion in income accounts of both revenues and related cost of projects until such time as the project is completed. The result is that long term projects extending over several fiscal years accumulate either a profit or loss of potentially significant magnitude to materially distort the Income Statement of any one given year in which it is recorded.

ICAITI has certain activities which are either non-revenue producing or are known to operate at a loss. In addition several of its older projects were at fixed overhead rates which could not be escalated as costs increased over the life of the project. (This project will have a provisional overhead rate). While some of these losses could be covered by the $400,000 annual contribution of the member governments, a careful financial and management review of all projects in process should be required so that at any given time management could determine remaining available funds from these sources, before proceeding with new contracts. Currently they do not have such a system, but they are taking steps to improve their oversight responsibilities. (See below). The Norms and Standards Division which provides services mandated under ICAITI's charter not easily chargeable to individual clients, had expenses of $70,000 in 1978 and received no offsetting income. Laboratory services that the Institute feel are a necessary part of their services, lost $77,000. Although the Central American governments contribute to the operations of the Institute, and in the past much of the funds went to offset the losses mentioned above, they have also been placing increased demand for services on the Institute, for which no charges are made.

c. Corrective Measures

Beginning in 1979 ICAITI has taken several steps to correct its financial problems.

1. A new Director and Deputy Director have taken over the management and have recognized the need for changes if ICAITI is to continue as a viable organization.

2. Effective in 1979 the Central American countries agreed to effectively increase their contribution to the Institute. This is done through a mechanism of guaranteed purchases of services from ICAITI at a level of $75,000 per year, per country. Services that ICAITI was performing free of charge for each country will now be allocated to this money. At the end of the year any unused funds revert to ICAITI. The end result is that some services which were being done for free will now be compensated for and a possibility exists that there will

be unutilized funds available for general purposes. It is too soon to predict the net effect of this new source of income on net income because it is conceivable that the presence of the fund will generate additional requests for services.

3. Some internal reorganization has taken place within the Institute with the resultant elimination of some positions to improve efficiency.

4. New management reporting systems have been instituted to enable management to determine the financial and implementation status of projects during their execution without having to wait until completion to see whether a profit or loss was made. This will allow them to minimize losses if possible, at the earliest possible moment.

5. A review of the costing system was planned to assure that to the extent possible costs, both direct and indirect, are covered by charges. The proposed Financial/Management Contract will assist in this.

The agreement by the Central American governments to the additional contribution to ICAITI demonstrates both the acceptance of the need for the services of ICAITI and their faith in the continued operations of the Institute, even if it means additional contributions. We feel that ICAITI has taken some meaningful steps in their attempt to get on sound financial footing. There are too many variables to assure that these steps are sufficient. We are proposing a major project with ICAITI which will represent a significant increase in their current level of operation over a five year period. We neither want to place the project with an institution which has serious financial problems, nor, through the burden of our project do we want to aggravate a precarious situation.

Therefore the project includes two actions. First, a provisional overhead rate has been included in the project. This will assure that if on review of their overhead practices by a competent auditor, costs have increased, ICAITI will have means of recovering those costs other than from country contributions.* Second, and most important, the new management has, as stated above, recognized their situation and therefore the services of

*Any increase in overhead costs will be covered by contingency funds or funds provided through reductions in the funding levels of other project activities.

a financial/management consulting firm to review their accounting and management information systems and make recommendations to assure sound fiscal policies is included in the project. It is in the interest of AID that this be done and it will have a beneficial effect not only on the management and implementation of the project but on the ultimate cost.

While institutional development of ICAITI is not a purpose of the project, ROCAP considers that this minimal technical assistance (estimated to be 4-5 months at a cost of $50,000) is essential to approving the project with ICAITI, given the latest financial report.

d. Replication - Continuation of Activities after End of Project

ICAITI is a non-profit research Institute. It relies upon contributions from Central American governments and from donations from the international community in general. Current quotas total $400,000 per year plus the service contracting totaling $375,000 yearly. Since quotas were just increased, there is reason to believe they will continue at least at the current level.

As a research project its replication will occur in the dissemination phase. This should be the responsibility of the host governments. Once technologies have been developed, up dating and reviewing new technologies will be small in comparison to the original research. We believe that ICAITI will have built up the residual capacity to continue these activities. In addition a result of this project will be an increased awareness and concern within Central American governments of the energy problem.* It is anticipated that by the end of the project the National Institutions will be devoting not less than 5% of their budgets to energy and fuelwood problems.

The result will likely be increased demand, on a reimbursement basis, for the experience and expertise established within ICAITI through this project. Such an increase will enable ICAITI to hire on a permanent basis those technicians that are funded under the A.I.D. grant.

e. Administrative Capability

As can be seen, this project represents a significant increase in ICAITI's activity. Using an

*During project implementation as the awareness level rises ICAITI will seek formal commitments in annual implementation plans and other operating documents from counterpart national institutions to work towards the long run objectives of the project.

average project income over the last four years of $800,000, the Project will double that figure. The administrative problem is addressed in three ways. First, ICAITI has the administrative capability to handle a higher level of activity (1975 activity was $1,200,000). Second, Project administrative staff is being funded within the Project. This is additional to their current staff. Third, the project is funding a financial/management consultant who will review and make suggestions for improvement of ICAITI's financial and management systems. A summary scope of work for this consultant follows:

1. Review ICAITI's financial accounting and reporting systems focusing principally on insuring that the systems:

   a. Provide accurate and timely information;

   b. Provide for the accurate accumulation and application of all direct costs;

   c. Provide for accurate accumulation and allocation of indirect (overhead) costs;

   d. Provide management with an accurate period by period comparison of operations as a measure of progress;

   e. Provide information so that long term project progress can be realistically measured in financial terms at specific intervals during the project life; and

   f. Provide information to determine which operations generate financial losses - the cause of the losses and how to control such losses.

2. Provide recommendations for changes in the financial systems of ICAITI.

3. Review the management structure of ICAITI to evaluate:

   a. The appropriateness of the current organization in light of new and projected activities.

b. Management information systems.

c. Personnel systems and policies.

4. Provide recommendations for improved management procedures.

In conclusion, with a combination of past experience and project inputs we feel ICAITI will have the necessary capability to carry out the project.

2. CATIE

a. Financial Viability

CATIE's detailed Financial Analysis is attached in Annex XIV.

In addition to the impressive physical plant, sound organizational structure, and long history (described in the Institutional Analysis, Annex XVI) CATIE's Financial Statement shows a solid, well-managed growing institution. It should be pointed out at the outset that CATIE has undergone a change in accounting systems as well as a change in fiscal year in late 1977 making a detailed comparison of financial statements for the past few years not only difficult but somewhat meaningless. The end of the fiscal year was changed from June 30 to December 31. Independent auditors arrived at CATIE in mid August to audit 1978 figures, therefore the figures we are using in this analysis are CATIE's own and unaudited.

CATIE is a non-profit organization and overall pricing and contracting policies are not established to show a profit. However, CATIE's Statement of Excess of Income Over Expenses showed an excess of $88,126 in 1978. Major portions of the income are from project related activities, commercial operations, and from donations. On the expense portion the major cost is for project activities.

CATIE segregates income and expenses which cannot be directly related to projects. In 1978 this showed a profit of $168,000.

The difference between the overall profit of $88,000 and the non project related profit of $168,000 is a project related loss of $80,000. It is our opinion that an institution which shows a cost overrun of only 6% has sound contracting policies and an overall solid administration.

b. Budgetary Analysis

CATIE is a non-profit research/training institution. It relies on contributions from member states and from the international community in general. It does not have a fixed annual budget. CATIE's membership presently

consists of Panama. Costa Rica, Honduras and Nicaragua. Each contributes $50,000 annually. El Salvador has the membership proposal pending and Guatemala is still negotiating membership. Additionally, under a ten year agreement signed in 1973, CATIE receives budget support from the Inter American Institute of Agricultural Sciences (IICA). This totals $540,000 in 1978 alone. The only income they have that is not donated is from a small commercial operation. This amounted to $557,200 in 1978.

c. Replicability

We cannot predict at what level CATIE will be able to continue project type activities after the AID inputs stop because untied financing is unpredictable. As a research project its continuation will be in the dissemination of the knowledge developed during the first phase. This will be the responsibility of host governments. Upon completion of the project, residual activities such as updating information banks and continued observation of on-going tests of fast growing species will be small in comparison to initial project activities involving the identification of fuelwood availability areas, the establishment of nurseries and test sites for fast growing species and the development of fuelwood cultivation technologies. CATIE will have the financial and technical capacity to continue such activities. In addition, as the project is implemented CATIE will seek formal commitments in annual implementation plans and other operating documents from counterpart national institutions to strive for long run objectives of the project and in particular to assist with the residual activities. Because of the project, the Central American countries will have a greater understanding of and concern for the fuelwood problem. They should be willing to make a firm commitment by devoting greater resources to disseminating the knowledge developed through the project. The result is expected to be an increase in demand on a reimbursement basis for the expertise developed within CATIE. Such an increase will permit CATIE to hire, on a permanent basis, those technical experts that are funded under the A.I.D. grant.

3. Financial Analysis and Plan

a. Summary Financial Plan - Total Project

The proposed project will total $10.8 million, $7.5 million provided as a Grant by AID, $.9 million by CATIE, $.7 million by ICAITI, $.9 million by host governments, and $.7 million by other donors. The project funding will be from January 1980 through December 1985. Table I, below, Financial Plan, contains summary figures by cost component, by year and by funding source. For detailed project costs refer to individual sections and Annex XIV for the two different components.

TABLE I

FINANCIAL PLAN

PROJECTED COSTS IN US $000'S

Project Element	AID	CATIE	ICAITI	HOST GOVT.	OTHER DONORS	TOTAL
Personnel Costs	3,048	656	265	692	457	5,118
Commodities	379	48	422	---	---	849
Travel & Per Diem	557	24	---	71	12	664
Training	403	90	---	85	144	722
Other Costs	493	99	---	79	129	800
Administrative Support	1,116	---	---	---	---	1,116
Sub Total	5,996	917	687	927	742	9,269
Contingency	196	---	---	---	---	196
Inflation	1,308	---	---	---	---	1,308
TOTAL	7,500	917	687	927	742	10,773

D. Social Analysis

Introduction

While deforestation in Central America is due in part to the evergrowing demand for firewood, it is also being pushed forward by the clearing of land for crop cultivation and cattle grazing, as well as lumbering for sale internally and abroad. It is a complex problem, and strategies that combat it will be difficult to formulate and translate into action. The present project does not attempt to tackle the intricate problem of deforestation head on. It instead tries to focus more tightly on a single yet very significant corner of the broader question. In this sense, it is not designed as a cure-all for the forest depletion that is menacing all of the countries of Central America. Given the weak condition of knowledge of the technical aspects of this tremendously complex issue -- not to mention the lack of trained personnel for implementation in this field -- it would be unwise to attempt launching a broad-scale reforestation project.

At the same time, however, the more modest goals of making more fuelwood available and increasing the efficiency with which fuelwood is utilized must be pursued with the wider issue of deforestation firmly in mind. The perceptions and attitudes of those living within the general context of rapidly shrinking forests will strongly bear upon the acceptability of the measures proposed in the project; and for this reason, they will receive treatment in the paragraphs that follow.[1/]

Deforestation and Forest Management

Deforestation -- resulting in the ever-increasing scarcity of wood for all purposes -- is amply documented throughout Central America. Travellers' accounts from the turn of

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1/ The social analysis is based largely on fieldwork in four areas of three Central American countries (Guatemala, Honduras, and Costa Rica) by AID Contractor Andrew Sisson (see Annex XI); 63 questionnaires filled out by Peace Corps volunteers from Guatemala, Honduras, and Costa Rica; a summary paper of fuelwood use in Central America by AID contractor Dr. Alfredo Méndez, anthropologist from the Universidad del Valle, Guatemala; and a number of reports and articles (cited in the text).

the century paint landscapes replete with forest growth -- which today are mere threadbare remnants. The pattern of forest depletion is, of course, uneven; some areas of Central America are still lush, but these are shrinking at an alarming rate. For example, in Guatemala it has been estimated that in 1950, 64.7% of the country was covered with forest; in 1975 -- just 25 years later -- only 36.2% remained in forest vegetation (UNDP/FAO Guatemala 1975). In Costa Rica the picture is similar: in 1950, 53% of the land was forested; in 1977 this had been reduced to a mere 31% (MAG Costa Rica 1977). All of the other countries in Central America are experiencing analogous deforestation, with El Salvador leading the pack. Once overrun with luxuriant vegetation -- making it the delight of tropical botanists -- today less than 15% of El Salvador's national territory is covered with forest, and commercial lumbering has come to a standstill.

Few of the campesinos of the region have perspective on the dimensions of what is happening and the speed with which it is taking place. At the same time, however, they are acutely aware of their own deteriorating lot. As the forests recede, agricultural land is cultivated more intensively, becomes more subject to erosion, and declines in fertility; and the campesinos are being forced to expend greater amounts of money and energy in gathering wood for fuel and timber. Throughout Central America the price of firewood has doubled or tripled over the past five years; people must walk farther and spend more time in their quest for wood; and they have become obliged to satisfy themselves with inferior woods simply because these are all they can lay hands on. The mere fact that they are now frequently forced to rely on strategies such as picking up fallen branches and trunks, pruning branches from live trees, gathering scraps from sawmills, and utilizing substitutes on the order of corn cobs and (for small industrial ovens) rubber tires, points to scarcity.

It is clear that the problem has been recognized on both the national and the local levels, yet to date efforts to resolve it have been sporadic and largely ineffective. In Costa Rica, for example, a good deal of propaganda about the need to protect forest lands and to reforest has been spread through the media, but the results thus far have been minimal. Although the Guatemalan and Salvadorean governments have launched "the year of the tree" amid exuberant fanfare, interest among rural peoples has been lukewarm at best. Scattered individuals and a few small groups in different Central American countries have taken it upon themselves to undertake

reforestation efforts on a minor scale; and there does exist a small number of quasi-trained forestry agents who are tending tree nurseries and distributing seedlings among the campesinos. But taken on as a whole the response has been weak, and deforestation continues largely unabated.

Why aren't existing forest reserves managed more competently, and why are so few people concerned with reforestation? There are several reasons:

1) It is an inescapable fact that the population of all of Central America has grown over the past 30-40 years at such a rate that undue pressure has been exerted on the existing resource base. Trees -- unlike annual crops -- need a minimum of six or seven years to grow to maturity (and the most highly prized species for firewood, such as oak, need more). Quite simply, the humans are winning the race. In the more densely populated areas of Central America - highland Guatemala, the Meseta Central of Costa Rica, and virtually all of El Salvador -- trees have simply been stripped from the land as if a plague of locusts had eaten them up. The overflow of population from these areas has spread into hitherto largely uninhabited and unexploited zones such as the Petén in Guatemala and Guanacaste and the Atlantic coast lowlands of Costa Rica, where the felling of trees and general laying of waste to vegetation have devastated previous plant life. In most countries of Central America the exploitation of these forest reserves has served to reduce some of the pressures and ease the scarcities in already heavily populated areas. But recent rises in the price of gasoline and diesel fuel have lifted transportation costs, and the reserves of forest themselves are rapidly dwindling. All of this is happening so fast that people have not had time to comprehend the effects of these trends.

2) Most of the government agencies concerned with forestry in all countries focus their attention on enforcing restrictions on wood cutting rather than on spreading technical information about conservation and reforestation. The agents are essentially policemen rather than specialists in forestry, land use, and forest ecology. Few of them have had adequate training in the intricacies of land use capabilities and forest management. The extent of their activities often revolves around demanding permits for timbering, passing out fines to those who fell trees illegally, and generally policing their territory. That this is the case is evident from the fact that campesinos in every country are well aware of the laws restricting their lumbering activities, but scant few have ever heard of the word reforestación.

There is also confusion among those who have heard mention of reforestation as to what it entails, leading many to see it in a negative light. Many believe that reforestation programs, if put into effect, will take their productive land and cover it with inedible trees. A number of government "showcase" reforestation plots reinforce this assumption, as they are located on highly visible terrain, like billboards announcing government concern, that is well suited for crop cultivation. Furthermore, poorly trained forestry agents frequently make well-intentioned yet misplaced judgments as to what land should be planted with which species of trees. For example, the efforts of a group of forestry agents near San José, Costa Rica, fell flat when they encouraged farmers to plant eucalyptus seedlings on their highland slopes; the seedlings were unsuited to that particular environment, and after two years only a few trees, deformed and stunted, remained alive.

In sum, most forestry efforts thus far have been negative (passing restrictions on wood cutting, levying fines, policing), and when they have been positive, they have more often than not been poorly grounded in knowledge of the technical aspects of forestry. It is clear that as long as the major thrust of government forestry action centers around restrictions on cutting wood, and what technical assistance there is, is of low quality, reforestation efforts will be received with mixed feelings.

3) Following directly from the point just discussed, it must be realized that campesinos are far from being irrational in their wood cutting behavior; nor are they unaware of the increasing depletion of the forest resources they must rely on for survival. They do not wantonly devastate forests, but rather their concern is with laying their hands on wood so they can cook their food and build their houses. Any long-term worries they may experience over fuelwood shortages are immediately overridden by concern for satisfying pressing basic needs. Where firewood has become scarce, campesinos tend to act pragmatically and with abundant "reason" -- which is demonstrated by their ingenuity in seeking out and utilizing practically everything that will burn. They fail to utilize petroleum-based substitutes simply because they cannot afford them, not because they are irrational. In this light. the imposition of restrictions on wood cutting is in itself an irrational solution unless it is accompanied by programs aimed at providing some alternative. Feeling themselves trapped, the response of the campesinos to wood cutting restrictions

has logically been to ignore the restrictions and to pillage wood from private and public land. Given the inescapable fact that dependence on wood for fuel will continue, strategies to produce more wood must be formulated and acted upon.

4) Running in partial contradiction to the point just discussed is the attitude among many Central Americans that forest reserves are unlimited, and, more importantly, that forests are not realizing their potential unless they are exploited. For example, in Costa Rica there has long persisted the belief that land is useless unless converted into farms. Beginning 30 to 40 years ago, the Costa Rican government began a massive campaign to colonize those regions of the country that were largely uninhabited. The reigning ethic of the time -- which has persisted largely intact to the present day -- was that the colonizing farmers were pioneers who were taming the wilderness and forging a base for the nation's economic progress. Non-productive land had to be exploited, and it was both the right and the obligation of the people to make it produce. The existence of land not in production was seen as a crime, and no one had moral qualms about laying into the natural vegetation with machete or axe. This attitude continues in Costa Rica to this day, and serves as the premise upon which heated arguments are constructed, with some frequency, in the nation's newspapers and over the radio. Although recent propaganda concerning the need to protect forests has made a slight dent in this attitude, it is still popularly held across the length of Central America that virgin land is of little or no use unless it has been "improved" (which generally means "cleared") by man.

5) In Central America, as well as in virtually every other part of the world, the concept of reforestation and everything it entails does not have a place within man's traditional view of how the universe functions. Man takes control of and manages his crops; he raises his pigs, chickens, and sheep; he builds villages and cities, irrigation canals and roads...But standing apart from man's domesticated corner of the world lies the world of nature, which is seen as being largely outside his responsibility. During the centuries that man has inhabited Central America, forests have been seen as wild places which are exploited for their resources -- food in the form of game and plants, building materials, medicines, and so forth; and man has never taken it upon himself to "manage" wild stretches of forest (much less reforest them)

in any systematic fashion.[1/] Man "mines" the forest by extracting resources, and God or the gods take care of the problem of regeneration -- and it must be admitted that the Powers-That-Be have been quite competent at their work until the last few decades. Jungles and forests are like the sea in that man's role is that of a predator; they were all created for man's benefit, and the question of giving God a hand by stocking the seas with fish and refurbishing forests with seedlings is simply not part of the Central American experience.

Conclusions:

The broad problem of forest depletion is a result of several interrelated factors: the biological reality of population growth and its consequent strain on the natural resource base; the lack of technically trained personnel in forestry management, land use capabilities, and reforestation; the absence of positive programs which aim at stopping or, at the very least, slowing the pace of deforestation; the belief that land is without value unless cleared of natural vegetation; and the firmly rooted attitude that forest management and replenishment are beyond man's sphere of responsibility.

Correction of the situation will be no easy matter, but with sustained effort all of these factors can conceivably be altered and the equation restored to balance. It will demand considerable strengthening of government agency capabilities, more intensive research and testing in the areas of appropriate technology and forestry, and above all a more thorough understanding of the problem and a stronger commitment to action. It hardly need be said that this will be a massive, multifaceted undertaking; and given the present threadbare state of technical expertise, it would be unwise to take on the whole animal at once and expect satisfactory results. In roping off a small portion of the deforestation issue, the present project is a good deal less ambitious. It attempts to place its foot in the door, as it were, of the broader

1/ As an interesting ethnographic note, among a few remaining tribal Indian groups in Guatemala, Mexico and Panama, certain forest areas are preserved out of respect for the spirits who claim them as their domain. However, the vast majority of Central Americans do not have their behavior guided by such considerations. And in any case, the idea of replanting forests is entirely alien throughout.

problem by concentrating its energy on a limited set of activities that are relatively easy to understand, manageable, and aimed at the satisfaction of a circumscribed range of basic needs.

The establishment of wood lots[1/] as "firewood plantations" (without excluding other potential uses) on community and/or privately owned land is seen as an excellent place to break ground, for certain of the elements involved in woodlot management are already present in the traditional experience of Central Americans. It has already been noted that in many regions, and especially in those with extreme wood shortages, campesinos follow the custom of pruning branches from living trees -- live fence posts, coffee shade trees, coffee bushes, and even wild trees. With the exception of trees found in their natural state, all of the trees and bushes harvested in this way have been consciously planted and are cared for. In short, they have been removed from the world of nature, domesticated, and brought under man's control.

Wood lot management is best seen as an extension and a systematization of this already existing tradition. In this light, it should not be a radical conceptual jump from pruning trees and bushes scattered about one's land to maintaining a more systematic wood lot; in fact, where land is scarce and there is no place for concentrations of trees, the woodlot will probably differ little from existing configurations. If handled with sensitivity and grounded in solid technical extension work -- and CATIE is considered to be adequately equipped on this score -- the barriers to acceptance should be minimal.

Community Participation

Critical areas in the region will be selected for testing and demonstrating different species of trees in woodlots. Whether or not the lots will be laid out and managed by entire communities, groups within communities, or individual families will depend upon the types of local organization found in the areas. Careful investigation of the social contours of each area will precede implementation. The project should only be

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1/ Here, and subsequently in this analysis, the term "wood lot" is used in its broadest sense, covering virtually every form of tree cultivation. It therefore includes such diverse arrangements as dense plots of cultivated trees (true wood lots in the most specific sense), living fence posts, coffee shade, and various forms of agroforestry.

promoted in communities which (1) are already well organized, and (2) demonstrate a willingness to invest time and energy in the planting and managing of the woodlots. It matters not whether local organization is comprised of entire communities or small segments of communities (associations of farmers, padres de familia, cooperative groups...). The only requirement is that it exists and is willing to work. After all, it will be difficult enough for those implementing the project to work closely with and adjust to the needs and peculiar arrangements of groups that are already formed; to try to weld fragmented communities into functioning groups before getting down to the business of wood lots would be simply adding an extra burden and diverting resources from the primary purpose of the project, which is to test and demonstrate wood lot farming.

The wood lot concept will be flexible enough to conform with local social and economic conditions and will therefore take varied forms in different regions. While more investigation into this aspect of the project still lies ahead, several examples of the types of differences that should be considered can be noted. In many regions of the Guatemala highlands there exist community forests which are used primarily (although not solely) as reserves in which firewood is gathered. These community forests are well established traditions, having existed in more or less the same form for centuries. Ideally, permission to fell trees and gather wood is secured for a small fee from municipality officials; but in actual fact, regulation of wood gathering activities is lax and "informal" collecting is common. In any case, a municipality in which one of these community forests is set, given it satisfies the other selection criteria, might be an ideal place to select as a "critical area." The land is available; a ready-made community structure already exists; and the forests are traditionally viewed as firewood reserves. Of course, municipalities will differ as to degree of community integration and interest in participating in demonstrations of wood lots, and this must be gauged. (In this context, one of the communities studied by Sisson (Annex XI), San Francisco El Alto, has both a community forest and a small but enthusiastic "reforestation committee" made up of villagers; thus far the committee has set up a seedling nursery and has been active in reforesting on the community forest.).

Municipality-owned forests are unique to Guatemala; organization at the local level in other Central American countries consists of a collection of cooperatives, associations and whatnot of varied strength. Few communities outside of Guatemala have community land, and in countries like El

Salvador very few rural campesinos own any land. Adjustments will have to be made for the different circumstances found in each area. Woodlots can be set up on individual farms where this would be the most viable arrangement; they can be composed of bunched lots of trees, or scattered about the farm. The important point is that the strategy concocted for each area must be derived from local needs, capabilities, and social organization.1/

Traditional cooking stove arrangements in Central America

There are several different stove types in use in rural Central America; the examples which follow are taken from highland Guatemala, Honduras, and two regions of Costa Rica (see appendix XI).

In rural highland Guatemala there are two common stove designs. One consists of a simple cooking fire set in the center of three stones situated on the floor of the house. Clay and metal pots are placed on the stones and the fire is allowed to climb up the sides of the pots for more effective cooking of certain foods, such as tamales. Virtually all of the cooking is done with firewood, and as there is no chimney the smoke in the room is often abundant. The second type of stove is called the plancha, which consists of a steel plate with two or three round openings for cooking pots set upon a clay and stone or block base. Smoke is usually conveyed out of the house by means of a chimney. In the larger towns of the highlands, relatively wealthier families often own more sophisticated stove models, and kerosine and propane gas are sometimes used. But the majority of families rely solely or largely on firewood for cooking. The most commonly used firewood is pine; oak is universally preferred because it burns longer, more evenly, and with less smoke than pine, but has become increasingly scarce in recent years.

Among the two basic types of rural stoves, the plancha is generally preferred because it is more convenient and

1/ Even if the woodlots are placed on individual, privately owned farms, the farmers worked with should belong to some sort of organization that holds regular meetings and has a regular schedule of activities. It will be easier for project agents to work with groups than a jumble of unassociated individuals.

expells smoke from the house. In a study done in the municipality of San Francisco El Alto (Appendix S), a few people mentioned that the plancha stove burns wood more efficiently than the three stone fire; but at the same time a number of people maintain a preference for the open three stone arrangement because it is more effective in heating the house during the winter months -- a consideration which is of some importance in highland Guatemala. However, it should also be noted that the plancha stove is a good deal more expensive than three ordinary stones, and would be welcomed by most if they could afford it. Kerosine and propane gas stoves are clearly beyond the means of most rural families; but even if they could be afforded, a number of families would still prefer wood because of the disagreeable taste imparted to the food by petroleum-based fuels.

All of the families interviewed in the region of Danlí, a rural municipality situated some 100 kilometers due west of Tegucigalpa, Honduras, use the stove type popularly called the fogón. Made of adobe and stone (or occasionally bricks), it comes in various sizes. The clay top is perforated by three or four open cooking holes which are sometimes covered by metal disks when not being used. Few of the families knew about other types of stoves, except for the same basic design with a metal sheet replacing the clay top. Some claimed that they did not particularly like this model, for the heating of the metal sheet would raise wood consumption. The fogón stove does not generally have a chimney, and smoke in the cooking area is often abundant.

Virtually all of the cooking is done with firewood. Compared to the Guatemalan highlands, wood is less scarce (although it is becoming more and more difficult to gather), and hardwoods such as oak and quebracho (ironwood; literally "axe breaker") are both preferred and most commonly used. Pine is a common supplement, along with a wide variety of substitutes of varying quality.

In two rural towns located in the Meseta Central of Costa Rica, only about 60% of the families visited rely solely or largely on firewood; given their relatively higher standard of living by Central American measures, Costa Ricans can often afford the luxury of kerosine or propane gas (and in some cases electric) stoves. In fact, many rural Costa Ricans consider it degrading to admit that they use firewood in a country where "nobody wants to be poor." (Close investigation

of households led to the discovery that many of those who said they used no firewood in fact did...).

Most of the stoves in the area are rather sophisticated models of metal, with ovens, several doors, and chimneys. There are a small number of stoves fashioned of cement and steel, but adobe and stone stoves are things of the past. Another measure of Costa Rica's relative affluence is the existence, here and there, of fancy stove models costing more than $200. The most commonly used firewood is coffee prunings taken from the extensive plantations in the area; a wide variety of other woods, made up largely of prunings from live trees of different species and scraps from saw mills is also utilized.

Most households on the Nicoya peninsula of Costa Rica, a more economically depressed region than the Meseta Central, burn firewood in an open fogón stove made of earth and stone. The fogón stove is usually not equipped with a chimney. A small number of households have a steel plate over the traditional fogón base, with a chimney carrying smoke out of the house. Iron stoves of the type found in the Meseta Central are rare, being too expensive for most families. However, there is a clear preference for iron stoves because they are easier to manage, burn wood more efficiently, and eliminate smoke. It should be added that while everybody would prefer a chimney-equipped stove, smoke does serve as an effective - if somewhat irritating - repellent for insects, which are abundant in Nicoya most of the year. The most popular firewoods are mangrove (the cutting of which is now prohibited by law) and quebracho ("axe breaker"), both of which are long burning and leave coals which can be used for other tasks, such as ironing clothes.

Testing the lorena stove: lessons and recommendations:

Over the past two or three years a number of institutions have been active in installing and testing lorena stoves in rural households. One such organization is the Estación Experimental Choquí near Quetzaltenango, Guatemala, where a group of promoters have installed more than 300 lorena stoves in neighboring areas since early 1977. They have also sponsored "short courses" of several days duration in stove construction, and estimate that a total of perhaps 400 or 500 stoves have come into being directly or indirectly because of their efforts.

It is extremely difficult to draw conclusions from the Choquí project. Assessments of campesino acceptance have been

sporadic and without rigor; estimates of wood burning efficiency have been subjective (example: "We visited 2 houses in Cantel where the stove was in use. The homes were selected at ramdon...Both families seemed very happy with the functioning of their stoves and said that they saved 25-50% in wood consumption."; from U.N. Petroleum and Energy Project report.) This sort of monitoring simply will not do.

One thing that is apparent from the project, however, is that few campesinos have taken it upon themselves to build their own stoves, and the numbers of people who have volunteered to take the Station's "short course" have been small. Why?

One reason is apparently that many of the stoves placed in rural households have been poorly built and do not function well. During an evaluation tour of 64 stoves installed by Station technicians, it was discovered that 73% of the stoves were cracked; 58% leaked smoke; and 9% had become inoperable (Evaluation Report, Estación Experimental Choquí 1979). It should be fairly obvious that faulty stoves do not make very good propaganda. While the Choquí agents claim that 95% of the families questioned said they were "very satisfied" with their stoves, as yet there has been no stampede on them by the general populace.

On the other hand, tepid acceptance of the lorena stove may be due to its inappropriate design; even if built correctly, there is something wrong with the basic model. Such a judgment will have to be predicated on a thorough understanding of the traditional types of stoves found in each area and the purposes to which they are put. The effectiveness of a new stove design is strongly dependent upon its ability to satisfy local needs. Is the lorena stove effective, given its present design, for cooking foods traditional to the area? (In the Guatemalan highlands,tamales are prepared in clay pots; flames up the sides of the pot are desired, and for this reason many people prefer the three rock arrangement to the lorena model. Could the lorena stove be somehow modified to take this technique into account? or would a very different style of stove be more relevant?)

A series of questions need to be asked, and the only people with the answers are the campesinos themselves. Is the lorena stove indeed more convenient -- as is often said -- than, say, the three rock arrangement or the plancha stove? If so, in what way and (roughly) how much? Granted that the lorena stove is more efficient than the three rock cooking fire, is it more efficient than the plancha or the fogón? If it is, how much

more efficient is it? (All evidence to date points to the conclusion that the figure "50%" more efficient, which appears over and over in evaluation reports, may be more on the order of a preconceived conclusion of evaluators rather than a fact derived from empirical measure.) What modifications in the present design of the lorena stove could be made to make it more relevant to local social, economic, and environmental conditions? (For example, is smoke in the house necessary on occasion to control insects...?) Few of these questions have been asked; or if they have been asked, little note has been taken of the answers.

Conclusions:

That the lorena stove has not been widely accepted by campesinos in Central America is clear. Whether or not this is due to faulty demonstration models or inappropriate basic design is not clear, and needs to be investigated. Three fundamental points are important in this context. First, evaluation of the lorena and any other type of stove must be carried out continuously, not as spot checks every six or eight months; those involved in stove demonstrations must be constantly on top of the project, monitoring not only the stoves and how they function but also the people who are using them, to elicit their reactions. Second, it must be realized that the campesinos themselves are the most highly qualified judges as to whether or not the stoves are any good, and they -- not the technicians -- are the best sources of opinions on modifications that would make the stoves better suited to their purposes. Evaluations to date have been little more than positive projections of the non-critical minds of stove promoters, and for this reason have been of limited value. Quite simply, questions beyond "Is this stove more efficient than your former stove?" and "Do you like this stove?" must be asked if anything important is to be learned. And third, great pains must be taken to ensure that demonstration stoves are well constructed and as efficient as they are supposed to be. A cracked, smokey showpiece stove with an obstructed chimney will hardly convince people that their house is incomplete without one. (In this context, "short courses" of a few days in the construction of stoves probably leaves a good deal of room for errors of this type; at least in the beginning, experienced stove builders should be employed.) It must be stressed that the above considerations are equally relevant for the testing and demonstration of all stove types, lorena or otherwise.

Small Industries

The project will test and demonstrate a variety of appropriate technologies for use in small industrial enterprises throughout Central America. At the present time, a large majority of these industries are entirely or largely dependent upon firewood; petroleum-based fuels are used to power a few small operations, but they are generally too expensive. Without going into descriptions of the numerous types of ovens, kilns, dryers, refiners and whatnot found in the hands of small-scale operators, several general observations relevant to the present project can be made.

Many managers of small industries are innovators by nature, and the most enterprising among them frequently journey about in search of new technologies which might improve their operations. They are more deeply concerned with turning a profit than is a household, being business enterprises, and are generally more receptive to ideas which might help them cut their operational costs and run their businesses more efficiently. While they are always concerned with avoiding risk, they are also quick to pick up new technologies once these have proven effective. For example, on the Nicoya peninsula of Costa Rica the technique of extending large plastic sheets on the ground to extract salt from sea water was introduced by a local man a few years back as an alternative to using tin pots; the benefits of this strategy were soon grasped by the other salt producers in the area, and the plastic sheet method has now become firmly rooted and widespread.

Even when the original technology is faulty, shrewd small entrepreneurs often salvage some of the basic principles and apply them to their own benefit. An instance of this occurred recently in Honduras, where the Volunteers in Technical Assistance (VITA) built a revolutionary new type of lime kiln that promptly collapsed. All was not lost, however, as

> ...the owner of a brick factory located a short distance from the lime kiln acquired a copy of VITA's report on the kiln's construction. He has proceeded to build six kilns, with some modification of the VITA design; and is using them successfully to make bricks rather than lime. (Perspectives on Appropriate Technology, Robert P. Morgan; 1977. Technology Transfer and World Development.)

If the testing of appropriate technology is competent, and takes into account local conditions and needs of small industry owners (that is, works closely with them on designing the ovens, kilns, dryers, and so forth), the success of the project need not rely entirely on the ingenuity of the operators. Given this minimum requirement, the introduction of appropriate technology among small industrial businessmen has the potential of producing very significant results.

Women:

Women handle virtually all of the cooking throughout Central America, and often participate in the collection of firewood (along with men and children, who carry the burden of firewood gathering in most regions). The project is designed to benefit entire households -- not men, women or children exclusively.

E. Summary Institutional Analysis

1. ICAITI

A review of ICAITI's organization, activities, and past experience shows that it is ideal for implementing the proposed Project activities. Being a regional organization, ICAITI has many established government and private contacts, and along with its technical expertise, provides a unique vehicle for this.

The Technical-Industrial Services Division of ICAITI will have primary Project management and implementation responsibility, and this Division has extensive experience in technical and economic feasibility study analysis and design of a variety of industrial and/or productive processes technically similar to the proposed activities. In addition, ICAITI is already involved in technology transfer and alternative energy research activities. The Project will make use of this experience and greatly expand ICAITI's activities and expertise to develop a cadre of experts who can provide the region with alternative solutions to the fuelwood problems.

A total of five professionals will be added to the Technical-Industrial Services Division staff to work directly on the Project, and this increase in professional staff, along with five present ICAITI staff professionals, will form the nucleus of the ICAITI project team. ICAITI will use and strengthen its contacts throughout the region under the Project, and with the ICAITI project team's leadership, it is expected that the regions technical knowledge base and use of alternative solutions to the energy needs of the poor will be greatly expanded. We believe that the ICAITI project team, along with the planned short-term technical assistance, backstopping from other ICAITI Divisions, and national counterpart cooperation, will be able to successfully implement the proposed Project activities. The additional five professionals are expected to remain permanently with ICAITI as a result of the increased demand generated by the project.

Annex XII provides a detailed discussion of ICAITI's history, organization, activities, and the proposed Project implementation organization.

2. CATIE

The Natural Renewable Resources Division of CATIE dates back to the founding of the Inter American Institute of Agricultural Sciences (IICA) at Turrialba, Costa Rica in 1942. The division has existed first as part of IICA, and since the 1973 creation of CATIE, as part of that institution. The division's early work was concentrated largely on broad leafed and other wet tropical lowland trees for timber production (teak, mahogany, and laurel among others). It also initiated work in the ecological characterization of the region and was the first M.Sc. forestry school in Latin America. It provides training in short courses and at the M.Sc. degree level in such areas as forestry management, silviculture, and resource conservation.

Since the creation of CATIE the division has expanded into agroforestry, wildlife conservation, watershed management, small farm silviculture, and small farm agroforestry. Its research on fast growing species for use as pulp and for poles provides a strong base for the expansion of efforts into woodfuel research.

As a result of the early recognition of a need for fast growing trees and their potential value on poorer hillside land and as a part of agroforestry, CATIE has identified and tested more than 20 species of promising trees. Staff research and 50 M.Sc. natural resource students' theses projects have been carried out largely at CATIE over the last ten years, testing nursery management practices, transplanting techniques, field planting, cultural practices, pest management, pruning and logging under the wet tropical ecological conditions prevalent at Turrialba. Based on this research, the city of Turrialba has developed a nursery of fast growing trees. To date reportedly over three million seedlings have been purchased and planted by farmers in the area. As a result, a new wood collection center is operating in the Turrialba region as a part of Costa Rica's growing national paper industry.

In addition, CATIE has begun to combine fast growing and legume trees with commercial crops of coffee, cacao, bananas, corn, beans, assorted vegetables, etc. This work has combined the technical resources of the Natural Renewable Resources Department with the Multiple Cropping and Perennial Crops staffs of CATIE in order to begin the study of the interrelationships of fast growing species, fruit crops, basic food crops and vegetables under wet tropical conditions. Over 100 hectares of field trials with fast growing trees alone and in combination with other crops have been planted at CATIE. This work establishes a very valuable basis for expanding the work of the divisions professional staff into other ecological situations of Central America and particularly into the fuelwood production field.

Although CATIE has a sound base to work from, expansion of their scope into six countries with concurrent increase in species, provenances and cultivation practices to be tested calls for expansion of CATIE's capacity in several major ways. During the project, staff will be increased by at least six full-time senior researchers specialized in fuelwood production, economic and social analysis, and fuelwood characterization. They and the ten existing staff members will emerge at the end of this activity as the senior fuelwood production specialists in Central America. Their in-depth understanding of intensive forestry research, their knowledge of production and consumption problems, linkage to public and private agencies throughout the region and knowledge of plant material available from other parts of the world for meeting the fuelwood needs in this region will place CATIE in a unique position to respond to the area's fuelwood problems. It is expected that a majority of the newly hired experts will stay on as permanent employees of CATIE due to an increase in demand for their services generated by the project.

In addition, the CATIE germ plasm bank will collect over two hundred new species and provenances from the region or elsewhere that hold promise for fuelwood production. The CATIE/IICA library, already one of the foremost tropical agricultural libraries of the hemisphere, will obtain over five hundred new entries related to fuelwood production, processing, marketing and use worldwide. This literature will be available to the CATIE staff and students and the region's national researchers, extensionists and others.

Probably one of the most important contributions of this project will be the linkage developed between national public and private forestry agencies and CATIE. The return of M.Sc. forestry graduates from CATIE and the U.S. to their own countries as well as the short course participants will further permit CATIE to assist the region to more fully utilize its agronomic and rural sector potential.

Based upon our review of the institutional capacity of CATIE we have concluded that with the increase in staff size and inputs of training and technical assistance envisioned, CATIE will be able to successfully implement its portion of the project.

Annex XVI provides a detailed discussion of CATIE's history, physical plant and organizational structure.

IV IMPLEMENTATION ARRANGEMENTS

A. AID's Role and Responsibilities

1. Monitoring

AID monitoring responsibilities for this project will be divided between the Rural Development Office (CATIE element) and the Engineering Office (ICAITI element). These offices will rely on other Mission offices including Program and Controller to assist with such activities as disbursement and procurement.

2. Disbursement Procedures

A five-year disbursement period is anticipated for the ICAITI element while a six-year period is anticipated for the CATIE element. The additional year for CATIE is due to the length of time required to carry out some of the planned experiments. Part III.C contains a detailed disbursement schedule. Disbursements will follow standard AID procedures. Because of the nature of the project no element is suitable for use of the Fixed Amount Reimbursement (FAR) method.

3. Procurement Procedures

Standard AID procurement procedures will be followed. It is anticipated that except for the financial/management consultant all goods and services for the project will be procured directly by the Grantees. The Mission will review all contracts for the provision of services and the procurement of commodities prior to their execution. The Mission will also review all long-term training.

B. Implementation Plan

1. ICAITI Element

The following is an agenda and project implementation events for this element of the Project:

September 30, 1979	- Sign Project Agreement.
October 1, 1979	- Commence Project. Commence recruitment of F/M consultant and staff. Commence preliminary work on domestic stoves, domestic biogas, and solar dryers, with existing personnel.
November 1, 1979	- Meet conditions precedent. Hire financial/management consultant Issue RFP for short-term technical consultants.
December 1, 1979	- Hire required project technical and administrative staff.
January 1, 1980	- Sign technical short-term services contract.
	- Determine and arrange ICAITI technical staff short-term training courses and technical visits.
February 1, 1980	- Sign letters of agreement with counterpart institutions.
	- Issue IFB on equipment and instruments.
March 1, 1980	- Biannual ROCAP/ICAITI detailed project review.
	- RFP financial/management consultant report completed.

April 1, 1980	- Finalize preliminary stove designs.
	- Commence firewood burning kilns and oven project element.
June 1, 1980	- Financial/management consultant's recommendations implemented
September 30, 1980	- Review of first year activities.
	- Workshop for stove component held.
	- Develop plan for second year with ROCAP and national counterparts.
October 1, 1980	- Commence solar hot water element.
	- Major project review and evaluation.
June 1, 1981	- Combustion team ovens/kilns workshop held.
October 1, 1981	- Biannual review and evaluation.
	- Commence industry biomass element.
January 1, 1982	- Combustion team commences industrial evaporation element.
	- Commence solar stills and charcoal pyrolysis elements.
	- Regional seminar on combustion team work (including biogas) held.
March 1, 1982	- Biannual project review.

April 1, 1982	- Combustion team industrial evaporators started.
	- Stove work field testing and demonstration completed and evaluated.
October 1, 1982	- Major project review and evaluation.
March 1, 1983	- Regional seminar on solar technologies.
	- Biannual project review.
October 1, 1983	- Regional seminar on all project elements.
	- Biannual project review.
	- Meeting with all national counterparts, national governments representatives and funding sources to plan program continuance after year five.
February 1, 1984	- Final seminar held on all ICAITI work.
	- Post demonstrations monitoring and ICAITI assistance to governments and private groups.
September 30, 1984	- Final reports.
	- Final project evaluation.

ICAITI ELEMENT
IMPLEMENTATION PLAN

		1st YEAR				2nd YEAR				3rd YEAR				4th YEAR				5th YEAR				
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
COMBUSTION TEAM	Wood Burning & Biomass Domestic Stoves	Evaluation Design & laboratory Testing		Site Selection Workshop		Fabrication Installation Field Testing Demonstration				Post Demonstration Counterpart Dissemination Program ICAITI Follow up Technical Assistance												FINAL REPORT
	Wood Burning Kilns & Ovens			Site selection Plans Designs Materials Identification & Purchase		Field investigation Adaptations	Report Workshop	Fabrication Installation Demonstration Field Testing Evaluation						Counterpart Dissemination Program Post Demonstration ICAITI Follow-up Technical Assistance								FINAL REPORT
	Small Industry Biomass									Field Investigation Plans Designs Heat & Batch		Fabrication Installation Field Testing						Post Demonstration Counterpart Data				FINAL REPORT
	Pirolysis Charcoal										ICAITI Training (U.S.) Plans Design Site Selection Field Investigation Material Identification & Purchase			Fabrication Installation Field Testing Demonstration				Post Demonstration Counterpart Dissemination				FINAL REPORT
	Industrial Evaporators											Field Investigation Plans Design Materials Identification and Purchase		Fabrication Installation Field Testing Demonstration				Post Demonstration Counterpart Dissemination Program				FINAL REPORT
Domestic Team	Domestic & Small Industry Units	ICAITI Training (U.S.) Review research literature		Site selection Materials Purchase Construction of one domestic and one Industrial Prototypes					Plans Designs Site Selection Materials Purchase	Workshop	Post Demonstration Counterpart Dissemination Program											FINAL REPORT
SOLAR TEAM	Dryers	ICAITI Training (U.S.) Plans Designs Fabrication Field Investigation Materials Purchase				Fabrication Installation Field Testing Demonstration						Counterpart Dissemination Program Report		Post Demonstration								FINAL REPORT
	Hot Water System					Plans Designs Site Selection Field Investigation Material Identification and Purchase		Fabrication Installation Field Testing Demonstration								Post Demonstration Counterpart Report	Dissemination Program					FINAL REPORT
	Stills										Plans Designs Materials Purchase	Fabrication Installation Field Testing Demonstration						Preliminary Post Demonstration Report Counterpart Dissemination Program				FINAL REPORT
	Regional Seminars									N° 1				N° 2				N° 3				

2. CATIE Element

Under the Small Farm Production Systems Project (596-0083) CATIE has Memoranda of Understanding with all six CAP countries for the conduct of research and information transfer in collaboration with agencies of the Ministries of Agriculture. CATIE also has signed membership agreements with Nicaragua, Honduras, Panama and Costa Rica. Under these agreements the four countries provide funds to the core budget of CATIE and serve as members of CATIE's Advisory Committee.

During the first three months of the Fuelwood Project, CATIE and its counterpart national institutions will amend the Memoranda of Understanding, as necessary, to properly reflect the implementation requirements of this Project. CATIE will organize national and regional coordinating committees and develop specific first year and general life of project work plans with supporting budgetary information.

National and regional coordinating committees will be organized to support the objectives and operations of this Project. A national committee will be formed in each country to support the program, review project operations and solve problems that might delay project progress in that country. National committees will be headed by a senior Ministry official or the director or deputy director of the national forestry agency in the country. Other members of the committee will include senior national government forestry technicians and others as advisable. A Peace Corps representative (if available) and a CATIE member will serve as advisors to the National Committee.

National committees will meet quarterly. One member of each national committee will represent that country on the regional committee as will the CATIE senior Natural Resources officer appointed by the Director of CATIE. The regional committee will meet annually at CATIE or in one of the member countries. It will review overall project operations and progress, suggest modifications in plans and program activities which further achievement of overall project goals, establish essential policy, and develop follow-up activities of a regional nature which utilize and further the application of the project's research results.

In the fall of each year CATIE and the national institutions will review project progress and, based on

their findings, prepare an annual implementation plan and budget for the coming year. The plan will be completed by November 15 of each uear so that funding requirements can be included in each country's national budget.

The following is a list of early implementation target dates for this component of the project:

Project Authorization signed:	September 14, 1979
Project Agreement signed:	September 30, 1979
Memoranda of Understanding modified:	December 31, 1979
First annual implementation plans approved by ROCAP:	December 31, 1979
All Conditions Precedent to disbursement met:	December 31, 1979

C. Request and Justification for Source and Origin Waiver

Waivers permitting procurement of: (1) services of a general nature from countries included in A.I.D. Geographic Code 941 and certain specialized services for short-term technical assistance in silvicultural technologies from countries included in A.I.D. Geographic Code 935; and (2) commodities from countries included in Code 941 are proposed in the draft project authorization.

The Regional Office of Central American Programs' goal is to strengthen Central American Institutions. This requires the recruitment, hiring, and training of qualified Central Americans and personnel from other Code 941 countries, as appropriate, and supporting their activities in the field. U.S. technical assistance will be utilized to supplement this expertise. In addition, due to the specialized nature of some of the silvicultural activities proposed under the project it is anticipated that short-term consultants will be required from Code 935 countries. The consultants desired are experts in fuelwood plantations. However, the vast majority of these experts are of European or Japanese nationality. The total cost of these short-term consultants is not expected to exceed $90,000. Finally, it is anticipated that procurement of samples of such commodities as seeds and wood fueled stoves from other Latin American or African countries with similar socio-economic environments as Central America will be necessary in order to carry out projected testing activities.

Accordingly a waiver of the authorized geographic code is recommended to permit procurement of goods and services from countries included in A.I.D. Geographic Code 941 except for technical assistance in fuelwood plantations, the procurement of which will be permitted in Code 935.

D. Evaluation Plans

The Project proposed herein is complex in its implementation and ambitious in its objectives. Two regional institutions will conduct innovative research and demonstrations with national counterparts on small farms, in communities and in the home. Peace Corps and other PVO assistance will be solicited.

Evaluation has an important and constructive role in this implementation process. Six evaluations are proposed during the life of project, alternating annually between the CATIE and ICAITI elements. In each evaluation, as the activity continues, increasing stress will be placed on acceptance by target populations of new cultivation and fuel efficient technologies, the kinds of constraints encountered and remedies proposed. In addition, the annual evaluations will allow for examination of linkages between ICAITI and CATIE and between them and their counterpart national institutions. The evaluations will be flexible in approach to permit special areas of the Project to be stressed as necessary regardless of which element is scheduled for evaluation during the particular year. Finally, in year three and in year four of the project, an indepth review of the viability of the institution then under evaluation will be completed.

1. CATIE: Fuelwood Production

The first evaluation will occur at the end of the second year of project implementation and will consider appropriateness of selection of species and provenances; the quality of experiments including trial management, site selection and design, data collection and processing; and preliminary conclusions and recommendations. The adequacy of CATIE personnel, management and coordination with national counterparts, and the level and suitability of national support will also be a part of this evaluation. A second evaluation at the end of year four and a final evaluation, at the end of the sixth year, will also consider these issues.

2. ICAITI: Technology Demonstrations

Evaluations of this Project segment will occur at the ends of the first, third, and fifth project years. The evaluations will review institutional support and linkages with national cooperating institutions, technology selection, management of demonstrations and data collection. As the Project continues, the second and final evaluations will place greater attention on dissemination of results.

3. Coordination

The link between the parts of this project is more than conceptual. In site selection for technology demonstrations and for cultivation of fast growing trees, as well as in application of criteria for critical area selections, CATIE and ICAITI must carefully coordinate their efforts. The results of this coordination will be part of each evaluation.

4. Proposed Evaluation Schedule

End First Year - First ICAITI evaluation
End Second Year - First CATIE evaluation
End Third Year - Second ICAITI evaluation
End Fourth Year - Second CATIE evaluation
End Fifth Year - Final ICAITI evaluation
End Sixth Year - Final CATIE evaluation

E. Conditions, Covenants and Negotiating Status

The draft authorization contains all of the conditions and covenants that the Missions considers are necessary for successful implementation of the Project. Both grantee institutions contributed heavily to the development of their respective elements of the Project. As a result all major issues were resolved prior to submission of the Project Paper to AID/W.

INSTITUTO CENTROAMERICANO DE
INVESTIGACION Y TECNOLOGIA INDUSTRIAL
(ICAITI)

CENTRAL AMERICAN RESEARCH INSTITUTE FOR INDUSTRY
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COSTA RICA
EL SALVADOR
GUATEMALA
HONDURAS
NICARAGUA

Apartado Postal 1552
Telex: 5312 ICAITI-GU
Teléfono: 310631/5
Cables: ICAITI

ACTION. HECHTMAN
INFO. SUNDERMANN

Mr. Harry Ackermann
Director, ROCAP
c/o American Embassy
Guatemala, Guatemala

Su referencia	Fecha de su carta	Nuestra referencia	Fecha
		SD	1979.08.14

Asunto:

Dear Harry:

During the last few years, and especially the last few months, we have shared our views with regard to technology adaptation and transfer. Our ongoing Transfer of Technology Program, which ROCAP is supporting, is concrete evidence of the interest of our two organizations in this material. For some years ICAITI has attempted to broaden its scope from the more sophisticated capital intensive, to the not always less sophisticated but no less important, energy and labor intensive appropriate technologies.

Most recently, a series of stimulating and most useful visits by personnel of Solar America Inc., and rural industry and village fuel technology surveys which ICAITI conducted with AID assistance, has helped us design a proposal which, in cooperation with CATIE, offers a unique and timely program of applied research designed to offer energy efficient and woodfuel alternative technologies for use in the home as well as in the rural community.

These studies, as well as information from other sources, provide dramatic evidence of the degradation of the Central American environment. This is also apparent to anyone who takes the time to travel throughout Central America and Panama. Erosion, floods, and deforestation, coupled with rising petroleum-based fuel costs, are placing the poor (and the not so poor) in an increasingly difficult situation. We believe that a joint effort between on the one hand CATIE, dealing with production of fast growing trees and plants, and on the other ICAITI, helping national counterparts test on-site fuel efficient stoves for home use, wood efficient kilns and charcoal makers, coffee or other agricultural dryers, as well as biogas and pyrolitic devices, can begin to offer practical alternatives.

Accordingly, I wish to request AID's support for a five year program of approximately US$ 4 000 000 primarily supporting skilled technical manpower, construction costs as well as a technology training program for cooperating institutions. ICAITI is prepared to contribute approximately US$ 500 000. It is estimated that the national counterparts contribution to this project will amount to some US$ 800 000 for a total cost over the five year period of US$ 5 300 000. Included in ICAITI's contribution, in addition to staff time, will be use of any and all our research, testing, reference and data research facilities and manpower. As you know, this includes our experience with pyrolisis development, gasohol, use of regional products for energy and will benefit from our proven country contacts in Central America developed under the Technology Transfer Project as well as under numerous other activities carried out in the area. We have reviewed our charter and may operate in Panama without any further authorization.

The fuelwood alternatives program confronts us with a challenging problem; the time is overdue for Central America and Panama to begin to provide a way out of the squeeze that increasing energy costs and decreasing fuelwood supplies place on the poorer elements of our society. I look forward to a favorable response to foster our continuing close cooperation with ROCAP and, in this case, with CATIE in facing the challenge and in carrying out this activity.

Sincerely yours,

Francisco Aguirre B.
Director

ACTION COPY
THIS COPY MUST BE RETURNED TO CENTRAL FILE INDICATING THE ACTION TAKEN AND DATE.
ACTION TAKEN _____

DATE	INITIALS:

AUG 16 8 16 AM '79
FILE ROOM
ROCAP/GUATEMALA

CATIE
TURRIALBA

CENTRO AGRONOMICO TROPICAL DE INVESTIGACION Y ENSEÑANZA
TURRIALBA, COSTA RICA

Cable: CATIE
Teléfonos:
56-01-22 56-01-69

August 14, 1979

Mr. Harry Ackerman
Director, ROCAP
c/o American Embassy
Guatemala, Guatemala

Dear Mr. Ackerman:

I am writing in regard to the proposed fuelwood production activity involving CATIE's Natural Renewable Resources Division.

For many years, indeed almost since its founding as a research institution, CATIE has supported activities designed to help the tropics cope with the distressing depletion of forest lands. Over 100 hectares of our land are devoted to trials involving a variety of species and provenances. In these activities we have been able to support the research in forestry of 136 graduate students of which 25 are presently conducting advanced research here and special students.

Somewhat proudly, I can say that CATIE had the foresight to begin these research programs years before the impact of deforestation on the region's ecology, national economies and on the poor, was more generally realized. We have been supported in these efforts by Great Britain, Holland, the FAO, and the Rockefeller Brother's Fund among others.

As we have discussed, the time appears opportune to expand our program and begin to apply what we - and other researchers - are learning. From our discussions I am heartened by AID's encouragement, through ROCAP, to expand our activities in this important endeavor. Recently my staff has spent considerable effort with your personnel in designing a proposal which not only will provide significant impetus to our ability to support the isthmus in growing appropriate fast growing trees and other plants employing a number of cultivation practices, but will match our efforts with those of ICAITI with regard to analysis of BTU yield of fast growing species and the introduction of fuel-efficient technologies for use in the rural home, on the farm and in the community. In combination

El CATIE es un Centro Internacional, establecido como una Asociación Civil de Carácter científico y educacional, constituida entre el Instituto Interamericano de Ciencias Agrícolas de la OEA y el Gobierno de Costa Rica. Su objetivo es realizar, promover y estimular la investigación y la

these two institutions can jointly provide a program unique in scope, simultaneously dealing with woodfuel production and use. For CATIE, too, close cooperation with another regional institution will help enhance and broaden our programs with new technical considerations. It is for these reasons that I am hereby requesting AID support for the following proposal.

We foresee a six year effort, with an estimated total cost of US$8.0 million for the fuelwood portion of the project. CATIE will make available a full time liaison officer which will be a new position. In addition, CATIE will make available other professional research and supporting staff as well as necessary office space, laboratory facilities, land for research trials, use of the germplasm bank, library, and some supporting transportation, communications, managerial and related services. The value of CATIE's contribution over six years is estimated to be US$1.8 million.

AID, through ROCAP, is requested to contribute about $5.5 million to fund additional personnel, travel and transportation, vehicles, an expanded program of training for Central Americans and some of the costs of doing research in the participating countries.

CATIE will establish the necessary working agreements with the six participating countries in the same manner as under the Small Farm Production Systems Project. The expected contribution by these countries during the project, representing professional staff and shared research costs, is valued at about US$700,000 over the six years of project life.

I share your perception that we are dealing in an area still largely untouched where great interest exists in the region to do something, but that we are still woefully without enough knowledge of what to do. I look forward to a favorable response to yet another opportunity for a collaborative effort in another important aspect of rural Central American development.

Sincerely,

Santiago Fonseca Martínez
Director, CATIE

c.c. Dr. Edwin J. Wellhausen - President, CATIE's Board of Dir.

5C(1) - COUNTRY CHECKLIST

Listed below are, first, statutory criteria applicable generally to FAA funds, and then criteria applicable to individual fund sources: Development Asistance and Economic Support Fund.

A. GENERAL CRITERIA FOR COUNTRY ELIGIBILITY

1. FAA Sec. 116. Can it be demonstrated that contemplated assistance will directly benefit the needy? If not, has the Department of State determined that this government has engaged in a consistent pattern of gross violations of internationally recognized human rights?	Yes. Project will benefit the poor.
2. FAA Sec. 481. Has it been determined that the government of recipient country has failed to take adequate steps to prevent narcotics drugs and other controlled substances (as defined by the Comprehensive Drug Abuse Prevention and Control Act of 1970) produced or processed, in whole or in part, in such country, or transported through such country, from being sold illegally within the jurisdiction of such country to U.S. Government personnel or their dependents, or from entering the United States unlawfully?	N/A - Assistance is to regional organizations
3. FAA Sec. 620(b). If assistance is to a government, has the Secretary of State determined that it is not controlled by the international Communist movement?	Ibid.
4. FAA Sec. 620(c). If assistance is to government, is the government liable as debtor or unconditional guarantor on any debt to a U.S. citizen for goods or services furnished or ordered where (a) such citizen has exhausted available legal remedies and (b) debt is not denied or contested by such government?	Ibid.
5. FAA Sec. 620(e)(1). If assistance is to a government, has it (including government agencies or subdivisions) taken any action which has the effect of nationalizing, expropriating, or otherwise seizing ownership or control of property of U.S. citizens or entities beneficially owned by them without taking steps to discharge its obligations toward such citizens or entities?	Ibid

A.

6. FAA Sec. 620(a), 620(f); FY 79 App. Act, Sec. 108, 114 and 606. Is recipient country a Communist country? Will assistance be provided to the Socialist Republic of Vietnam, Cambodia, Laos, Cuba, Uganda, Mozambique, or Angola?	Ibid.
7. FAA Sec. 620(i). Is recipient country in any way involved in (a) subversion of, or military aggression against, the United States or any country receiving U.S. assistance, or (b) the planning of such subversion or aggression?	Ibid.
8. FAA Sec. 620 (j). Has the country permitted, or failed to take adequate measures to prevent, the damage or destruction, by mob action, of U.S. property?	Ibid.
9. FAA Sec. 620(l). If the country has failed to institute the investment guaranty program for the specific risks of expropriation, inconvertibility or confiscation, has the AID Administrator within the past year considered denying assistance to such government for this reason?	Ibid.
10. FAA Sec. 620(o); Fishermen's Protective Act of 1967, as amended, Sec. 5. If country has seized, or imposed any penalty or sanction against, any U.S. fishing activities in international waters: a. has any deduction required by the Fishermen's Protective Act been made? b. has complete denial of assistance been considered by AID Administrator?	Ibid.
11. FAA Sec. 620; FY 79 App. Act, Sec. 603. (a) Is the government of the recipient country in default for more than 6 months on interest or principal of any AID loan to the country? (b) Is country in default exceeding one year on interest or principal on U.S. loan under program for which App. Act appropriates funds?	Ibid.
12. FAA Sec. 620(s). If contemplated assistance is development loan or from Economic Support Fund, has the Administrator taken into account the percentage of the country's budget which is for military expenditures, the amount of foreign exchange spent on military equipment and the	N/A

A.12.

amount spent for the purchase of sophisticated weapons systems? (An affirmative answer may refer to the record of the annual "Taking Into Consideration" memo: "Yes, as reported in annual report on implementation of Sec. 620(s)." This report is prepared at time of approval by the Administrator of the Operational Year Budget and can be the basis for an affirmative answer during the fiscal year unless significant changes in circumstances occur.)

13. FAA Sec. 620(t). Has the country severed diplomatic relations with the United States? If so, have they been resumed and have new bilateral assistance agreements been negotiated and entered into since such resumption? — **N/A - Assistance is to regional organizations**

14. FAA Sec. 620(u). What is the payment status of the country's U.N. obligations? If the country is in arrears, were such arrearages taken into account by the AID Administrator in determining the current AID Operational Year Budget? — **Ibid.**

15. FAA Sec. 620A, FY 79 App. Act, Sec. 607. Has the country granted sanctuary from prosecution to any individual or group which has committed an act of international terrorism? — **Ibid.**

16. FAA Sec. 666. Does the country object, on basis of race, religion, national origin or sex, to the presence of any officer or employee of the U.S. there to carry out economic development program under FAA? — **Ibid.**

17. FAA Sec. 669, 670. Has the country, after August 3, 1977, delivered or received nuclear enrichment or reprocessing equipment, materials, or technology, without specified arrangements or safeguards? Has it detonated a nuclear device after August 3, 1977, although not a "nuclear-weapon State" under the nonproliferation treaty? — **Ibid.**

B. FUNDING CRITERIA FOR COUNTRY ELIGIBILITY

1. Development Assistance Country Criteria

a. FAA Sec. 102(b)(4). Have criteria been established and taken into account to assess commitment progress of country in effectively involving the poor in development, on such indexes as: (1) increase in agricultural productivity through small-farm labor intensive agriculture, (2) reduced infant mortality, (3) control of population growth, (4) equality of income distribution, (5) reduction of unemployment, and (6) increased literacy? — **Ibid.**

B.1.

b. FAA Sec. 104(d)(1). If appropriate, is this development (including Sahel) activity designed to build motivation for smaller families through modification of economic and social conditions supportive of the desire for large families in programs such as education in and out of school, nutrition, disease control, maternal and child health services, agricultural production, rural development, and assistance to urban poor? Ibid.

2. Economic Support Fund Country Criteria N/A

a. FAA Sec. 502B. Has the country engaged in a consistent pattern of gross violations of internationally recognized human rights?

b. FAA Sec. 533(b). Will assistance under the Southern Africa program be provided to Mozambique, Angola, Tanzania, or Zambia? If so, has President determined (and reported to the Congress) that such assistance will further U.S. foreign policy interests?

c. FAA Sec. 609. If commodities are to be granted so that sale proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made?

d. FY 79 App. Act, Sec. 113. Will assistance be provided for the purpose of aiding directly the efforts of the government of such country to repress the legitimate rights of the population of such country contrary to the Universal Declaration of Human Rights?

e. FAA Sec. 620B. Will security supporting assistance be furnished to Argentina after September 30, 1978?

5C(2) - PROJECT CHECKLIST

Listed below are statutory criteria applicable generally to projects with FAA funds and project criteria applicable to individual fund sources: Development Assistance (with a subcategory for criteria applicable only to loans); and Economic Support Fund.

CROSS REFERENCES: IS COUNTRY CHECKLIST UP TO DATE?
HAS STANDARD ITEM CHECKLIST BEEN REVIEWED FOR THIS PRODUCT?

A. GENERAL CRITERIA FOR PROJECT

1. FY 79 App. Act Unnumbered; FAA Sec. 653 (b); Sec. 634A. (a) Describe how Committees on Appropriations of Senate and House have been or will be notified concerning the project; (b) is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than $1 million over that figure)?	This project was not included in the FY 1980 CP. The program will require Congressional Notification before obligation of funds.
2. FAA Sec. 611(a)(1). Prior to obligation in excess of $100,000, will there be (a) engineering, financial, and other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?	Yes.
3. FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?	N/A
4. FAA Sec. 611(b); FY 79 App. Act Sec. 101. If for water or water-related land resource construction, has project met the standards and criteria as per the Principles and Standards for Planning Water and Related Land Resources dated October 25, 1973?	N/A
5. FAA Sec. 611(e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed $1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability effectively to maintain and utilize the project?	N/A
6. FAA Sec. 209. Is project susceptible of execution as part of regional or multilateral project? If so why is project not so executed? Information and conclusion whether assistance will encourage regional development programs.	Program is a regional effort.

A.

7. FAA Sec. 601(a). Information and conclusions whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.	The program will concentrate on improved efficiency of small farm and small industry use of fuelwood and alternative renewable energy resources.
8. FAA Sec. 601(b). Information and conclusion on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).	N/A
9. FAA Sec. 612(b); Sec. 636(h). Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized to meet the cost of contractual and other services.	Countries are not contributing local currencies but cooperating countries will be required to support in-country project activities.
10. FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?	No.
11. FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?	Yes.
12. FY 79 App. Act Sec. 608. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar, or competing commodity?	N/A

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

a. FAA Sec. 102(b); 111; 113; 281a. Extent to which activity will (a) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production and the use of appropriate technology, spreading investment out from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained	Project will provide, test and demonstrate energy efficient appropriate technologies as well as alternate fuelwood cultivation practices to benefit rural poor. Project is a regional effort involving six countries.

B.1.a.

basis, using the appropriate U.S. institutions; (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions; (c) support the self-help efforts of developing countries; (d) promote the participation o women in the national economies of developing countri and the improvement of women's status; and (e) utiliz and encourage regional cooperation by developing countries?

b. FAA Sec. 103, 103A, 104, 105, 106, 107. Is assistance being made available: (include only applicable paragraph which corresponds to source of funds used. If more than one fund source is used for project, include relevant paragraph for each fund source.)

(1) [103] for agriculture, rural development or nutrition; if so, extent to which activity is specifically designed to increase productivity and income of rural poor; [103A] if for agricultural research, is full account taken of needs of small farmers;

Project will provide and test alternate cultivation practices for small farm fuelwood production and consumption requirements and provide efficient low cost technologies for use in farm production, storage and in the home.

(2) [104] for population planning under sec. 104(b) or health under sec. 104(c); if so, extent to which activity emphasizes low-cost, integrated delivery systems for health, nutrition and family planning for the poorest people, with particular attention to the needs of mothers and young children, using paramedical and auxiliary medical personnel, clinics and health posts, commercial distribution systems and other modes of community research.

(3) [105] for education, public administration, or human resources development; if so, extent to which activity strengthens nonformal education, makes formal education more relevant, especially for rural families and urban poor, or strengthens management capability of institutions enabling the poor to participate in development;

(4) [106] for technical assistance, energy, research, reconstruction, and selected development problems; if so, extent activity is:

(i) technical cooperation and development, especially with U.S. private and voluntary, or regional and international development, organizations;

(ii) to help alleviate energy problems;

(iii) research into, and evaluation of, economic development processes and techniques;

(iv) reconstruction after natural or manmade disaster;

B.1.b.(4).

(v) for special development problem, and to enable proper utilization of earlier U.S. infrastructure, etc., assistance;

(vi) for programs of urban development, especially small labor-intensive enterprises, marketing systems, and financial or other institutions to help urban poor participate in economic and social development.

c. [107] Is appropriate effort placed on use of appropriate technology?

Project will focus on appropriate low cost and energy efficient technologies.

d. FAA Sec. 110(a). Will the recipient country provide at least 25% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or has the latter cost-sharing requirement been waived for a "relatively least-developed" country)?

N/A - Assistance is to regional organizations. However, substantial resources will be committed by each participating country to support in-country activities.

e. FAA Sec. 110(b). Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to the Congress been made, and efforts for other financing, or is the recipient country "relatively least developed"?

N/A

f. FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civil education and training in skills required for effective participation in governmental and political processes essential to self-government.

Regional program involves cooperating national technical institutions. Training of national technicians in new cultivation and technologies is a major project element.

g. FAA Sec. 122(b). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase or productive capacities and self-sustaining economic growth?

Project will help develop increased reliance on national renewable energy resources instead of on imported energy.

2. Development Assistance Project Criteria (Loans Only)

a. FAA Sec. 122(b). Information and conclusion on capacity of the country to repay the loan, including reasonableness of repayment prospects.

N/A

b. FAA Sec. 620(d). If assistance is for any productive enterprise which will compete in the U.S. with U.S. enterprise, is there an agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan?

N/A

B.

3. Project Criteria Solely for Economic Support Fund

a. FAA Sec. 531(a). Will this assistance support promote economic or political stability? To the extent possible, does it reflect the policy directions of section 102?

b. FAA Sec. 533. Will assistance under this chapter be used for military, or paramilitary activities?

PROJECT AUTHORIZATION

Name of Entities: Tropical Agricultural Research and Training Center (CATIE)

Central American Research Institute for Industry (ICAITI)

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, I hereby authorize the Fuelwood-Alternative Energy Sources Project for the Tropical Agricultural Research and Training Center (CATIE) and the Central American Research Institute for Industry (ICAITI) (the "Grantees"), involving planned obligations of not to exceed $7,500,000 in grant funds over a six year period from date of authorization, subject to the availability of funds in accordance with the AID OYB/allotment process, to help in financing certain foreign exchange and local currency costs for the project.

2. The Project consists of supporting a regional effort within Central America and Panama (1) to test and provide new energy-efficient technologies for use in rural homes and communities, and (2) to test alternate species and alternate patterns of production of fast-growing trees and shrubs.

3. The Project Agreements which may be negotiated and executed by the officers to whom such authority is delegated in accordance with AID regulations and Delegations of Authority shall be subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as AID may deem appropriate.

4. <u>Source and Origin of Goods and Nationality of Services</u>

Goods financed by AID under the project shall have their source and origin in the Central American Common Market or in the countries included in AID Geographic Code

000, except as AID may otherwise agree in writing and except as set out in subparagraph d below. Suppliers of services, except for ocean shipping, financed by AID under the Project shall have their nationality in the Central American Common Market or in the countries included in AID Geographic Code 000, except as AID may otherwise agree in writing and except as set out in subparagraph d below. Ocean shipping financed by AID under the project shall, except as AID may otherwise agree in writing, be financed only on flag vessels of the United States.

b. Conditions Precedent to Disbursement

(1) Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreements, ICAITI and CATIE shall furnish, in form and substance satisfactory to AID, a coordinating agreement between ICAITI and CATIE.

(2) Prior to any disbursement, or the issuance of any commitment documents under the Project Agreement with CATIE, to finance the procurement or use of pesticides, CATIE shall (a) furnish, in form and substance satisfactory to AID, a plan ensuring that proper safeguards, consistent with the nature and purposes of the Project, are established and followed in the procurement and use of pesticides; and (b) obtain the written approval of AID prior to the procurement or use of any pesticide.

(3) Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreement with ICAITI to finance ICAITI-related activities, except for contracting of a financial/management consultant and for expenditures incurred for travel and per diem costs incurred in Cooperating Countries by ICAITI related to the preparation of time-phased implementation plans for the Project for each Cooperating Country, ICAITI shall furnish in form and substance satisfactory to AID a time-phased implementation plan, including budgets, for its portion of the Project which details actions to be taken and procurement arrangements to be made during the first year of the Project.

(4) Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreement with ICAITI to finance the contracting of engineering staff not already on the ICAITI staff, ICAITI shall furnish evidence to AID, in form and substance satisfactory to AID, that it has contracted for the services of a financial/management consultant.

(5) Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreement with ICAITI for operations in Panama, ICAITI shall furnish, in form and substance satisfactory to AID, evidence that the Government of Panama will permit it to implement project-related activities within its territories.

(6) Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreement with CATIE for anything other than expenditures incurred (1) at Turrialba, Costa Rica by CATIE for hiring staff, or (2) for travel and per diem costs incurred in Cooperating Countries by CATIE related to the preparation of time-phased implementation plans for the Project for each Cooperating Country, CATIE shall furnish, in form and substance satisfactory to AID, a time-phased implementation plan, including budgets, which details actions to be taken and procurement arrangements to be made for its portion of the Project during the first year of the Project.

(7) Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreement with CATIE, for expenditures incurred in initiating field experiments in a Cooperating Country, CATIE shall obtain from such country's counterpart national agency or agencies and furnish, in form and substance satisfactory to AID, time-phased implementation plans, including a budget, for activities to be carried out in such country, detailing actions to be taken and procurement arrangements to be made during the first year of the Project.

(8) Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreement with ICAITI for expenditures incurred in initiating field experiments in a Cooperating Country, ICAITI shall obtain from such country's counterpart national institution(s) and furnish, in form and substance satisfactory to AID, a time-phased implementation plan, including a budget, for activities to be carried out in such country, detailing actions to be taken and procurement arrangements to be made during the first year of the Project.

c. Covenants

(1) CATIE shall covenant to continue to collect data and distribute results on those experiments or portions thereof which require monitoring beyond the life of the Project.

(2) CATIE shall covenant to use its best efforts to ensure that its counterpart national agencies will continue to collaborate with it in the collection of data and distribution of results on those experiments or portions thereof which require monitoring beyond the life of the Project.

(3) ICAITI shall covenant to use its best efforts to implement the recommendations of the financial/management consultant to be hired under the Project and to submit, within 90 days of receipt of such consultant's final report, an implementation plan for the consultant's recommendations.

(4) CATIE shall covenant to submit to AID, in form and substance satisfactory to AID, annual implementation plans for its own activities under the Project prior to November 15 of the year preceeding the year in which each plan is to take effect for every year of the Project except the first. CATIE shall also covenant to use its best efforts to obtain and to submit to AID annual implementation plans from its counterpart national agencies for their activities under the Project prior to November 15 of the year preceeding the year in which each is to take effect for every year of the Project except the first.

(5) ICAITI shall covenant to submit to AID in form and substance satisfactory to AID annual implementation plans for its own activities under the Project prior to November 15 of the year preceeding the year in which each plan is to take effect for every year of the Project except the first. ICAITI shall also covenant to use its best efforts to obtain and to submit to AID annual implementation plans from its counterpart national institutions for their activities under the Project prior to November 15 of the year preceeding the year in which each plan is to take effect for every year of the Project except the first.

d. Waivers

The following waivers to AID regulations are hereby approved:

Waiver of source, origin and nationality requirements for goods and services is approved to permit procurement of goods from AID Geographic Code 941 and of services from suppliers whose nationality is in AID Geographic Code 941 countries. In addition, short-term technical assistance services in silviculture techniques to be provided to CATIE may be procured from suppliers whose nationality is in AID Geographic Code 935 countries.

_____
Assistant Administrator

_____
Date

INITIAL ENVIRONMENTAL EXAMINATION

PROJECT LOCATION:	Selected locales in Central America
PROJECT TITLE:	Fuelwood and Alternative Energy Sources
PROJECT NUMBER:	596-0089
LIFE OF PROJECT:	Six Years (FY 79-84)
IEE PREPARED BY:	R. J. Maushammer, Chief, LAC/DR/EEA
DATE:	August 16, 1979
ACTION RECOMMENDED:	Negative Determination

CONCURRENCE: Harry Ackerman

Harry Ackerman, Director, ROCAP

DATE: Aug 16, 1979

I. PROJECT DESCRIPTION

The project supports a regional effort within Central America and Panama to (1) test and provide new energy efficient technologies for use in rural homes and communities and by small and medium industry, and (2) to test alternate species of fast growing trees and shrubs and alternate patterns for their production for use as fuel. A survey will be conducted to identify areas within the region where the supply of fuelwood is critically short. Three of the critical areas will be selected for detailed area energy balance surveys and for testing a methodology to assess and offer means of increasing fuelwood production, improving the efficient use of fuelwood or substitution with other renewable energy sources. Alternate production trials and technology demonstrations will be conducted in critical areas throughout the isthmus. The results will help determine the actual and potential impact large scale introduction of new technologies may have on accessibility of fuelwood, reduced fuelwood cost to consumers, and more efficient use of fuelwood or other renewable energy resources in individual households and small or medium industries, and in the community as a whole.

CATIE's Division of Natural Renewable Resources, cooperating through national coordinating agencies with small farmers, community leaders, national forestry and agricultural research institutions, will collect available experiences within the region and worldwide and provide assistance in the conduct of production trials with selected fast-growing species, including species heretofore unknown in the region. These trials will be conducted in critical, potentially critical or in other appropriate areas, including farms, communities as well as protected government or private research stations. Experiments will be conducted in all participating countries. Long and short-term training in new production methods will be offered to over 200 cooperating national agency technicians.

ICAITI's Technical and Industrial Services Division, in cooperation with national energy and technology institutes, private manufacturers and home owners, will procure, evaluate, where necessary produce, and provide for testing and demonstration in homes, public buildings and small or medium industries, technologies which either increase the efficiency with which wood is used as a fuel or use renewable substitutes for wood as a fuel, e.g. biomass, solar

radiation, etc. These technologies will be provided in the three selected critical areas; some will be demonstrated in all six participating countries.

Both institutions will establish or strengthen relationships with public and private national and international organizations having the potential to act as disseminating agents for either fuelwood production or energy efficient technologies. These include such organizations as national extension services, agricultural production and marketing cooperatives, electric institutes, VITA, the Peace Corps, etc.

The AID contribution to this activity, over six years, is proposed to be $9.5 million. For the fuelwood production and community fuelwood balance survey portion, AID will contribute $5.5 million over six years; for the energy efficient technology portion, AID will contribute $4.0 million over five years.

II. IMPACT IDENTIFICATION AND EVALUATION FORM

Impact Areas and Sub-Areas	Impact Identification and Evaluation 1/
A. LAND USE	
1. Changing the character of the land through:	
a. Increasing the population	N
b. Extracting natural resources	N
c. Land clearing	N
d. Changing soil character	N
2. Altering natural defenses	M +
3. Foreclosing important uses	M+
4. Jeopardizing man or his works	N
5. Other factors	
B. WATER QUALITY	
1. Physical state of water	N
2. Chemical and biological states	N
3. Ecological balance	N
4. Other factors	

1/ We use the following symbols:

N = No environmental impact
L = Little environmental impact
M = Moderate environmental impact
H = High environmental impact
U = Unknown environmental impact
+ = Beneficial impact
- = Negative impact

IMPACT IDENTIFICATION AND EVALUATION FORM

C. ATMOSPHERIC

1.	Air additives	L +
2.	Air pollution	L +
3.	Noise pollution	N
4.	Other factors	

D. NATURAL RESOURCES

1.	Diversion, altered use of water	N
2.	Irreversible, inefficient commitments	N
3.	Other factors	

E. CULTURAL

1.	Altering physical symbols	N
2.	Dilution of cultural traditions	N
3.	Other factors	

F. SOCIOECONOMIC

1.	Changes in economic/employment patterns	L +
2.	Changes in population	N
3.	Changes in cultural patterns	N
4.	Other factors	

IMPACT IDENTIFICATION AND EVALUATION FORM

G. HEALTH

1. Changing a natural environment _____ N
2. Eliminating an ecosystem element _____ N
3. Other factors

_____ _____

_____ _____

H. GENERAL

1. International impacts _____ N
2. Controversial impacts _____ N
3. Larger program impacts _____ N
4. Other factors

_____ _____

_____ _____

I. OTHER POSSIBLE IMPACTS (not listed above)

1. Introduction of new plant species _____ L -
2. Agricultural chemicals _____ L -
3. Other factors

_____ _____

_____

III. DISCUSSION OF IMPACTS

The cutting of trees for fuelwood and charcoal production for domestic and industrial uses has contributed to deforestation and resulting erosion, siltation, flooding, loss of natural habitat and lower water infiltration. The Project will, in limited geographic areas, contribute to decreased demand for fuelwood and charcoal through the introduction of both alternative energy sources and more efficient energy conversion devices and processes. It will also increase the supply of wood for use as fuel through the introduction, in test-size experimental plantings, of fast-growing trees and shrubs and thus reduce pressure on other forests and woody vegetation. All interventions will be carefully monitored by professional personnel who have, as one purpose of conducting trials, the objective of collecting and analyzing data on the environmental and ecological impacts of the items on which they are working. In the following discussion, which is keyed to Part II above, the limited geographic area involved in each test or demonstration should be kept in mind. At the same time, however, the fact that applied research under the Project is expected to guide the development of national impact programs should also be remembered.

A. Land Quality

The environmental effects of this Project on land quality will be to improve vegetative cover on selected plots of land and eventually regenerate natural defenses against erosion and flooding. We also hope that these interventions will foreclose inappropriate uses of land in the future by stimulating tree production on land that is not suitable for more intensive uses in the long run and that should revert to less intensive uses. Both impacts will be highly beneficial.

B. Water Quality

To the extent that siltation is decreased and infiltration increased, water quality should improve both in project areas and at lower elevations that now are subject to flooding and other wide swings in water availability and quality.

C. Air Quality

Increased vegetative cover will lead to corresponding

increases in oxygen production and carbon dioxide utilization, both beneficial to the human and animal environment. More efficient use of woodfuels and wider use of alternative energy sources will lead to lower levels of carbon monoxide, carbon dioxide, methane and particulates being released into the air in homes, industries and other places than otherwise would have been the case.

F. Socioeconomic Changes

In addition to negligible changes in cultural patterns (see the social analysis), some small changes in employment patterns will emerge in the medium term as productive efficiency is increased on farms and in woodfuel-using small and medium industries.

I. Other Possible Impacts

1. Introduction of New Plant Species

The Project will introduce seeds of species of fast-growing plants not native to the area in order to test their adaptability to and suitability for Central American growing conditions for comparison with native species. As no live stock will be imported, the possibility of importing funguses and other plant disease pathogens will be minimized. Phytosanitary certificates are obligatory for all CATIE seedbank accessions. Past transfers of species from native to new areas have usually resulted in vigorous growth of plants, resistance to local natural enemies and escape from natural enemies in native areas that restricted vigorous growth. (Commonly cited examples are the transfer of coffee to Africa and rubber to Indonesia.) This involves the danger of newly-introduced species crowding out native plants, however, the effects of new species on local flora and fauna will be carefully monitored. Such effects will be one of the principal criteria for judging a species overall acceptability for wider promotion in follow-on programs. CATIE will follow its standard environmental safeguard procedures which include measures to control inadvertant propagation during nursery and post-transplant stages.

2. Agricultural Chemicals

The Project, since it is structured to gain information on practical, relatively labor intensive silvicultural and arboricultural production styles, will not use

herbicides. Various types of fertilizer may be used to test if fertilizer applications at planting would be cost effective in such production styles. On the other hand, at least one of the shrubs that are expected to be tested is known to be a leguminous, nitrogen-fixing species. Pesticides may be used, however, to control minor outbreaks of plant diseases or plagues, but major applications, even within the small test areas, are not expected. Again, all such applications will be carefully monitored to assure that pesticide applications will be restricted to the number and level of intensity absolutely essential for research or limited field evaluation purposes. ROCAP will work with CATIE to ensure that the only pesticides used will be those for which the manufacturers provide the toxicological and environmental data necessary to safeguard the health of research personnel and the quality of the local environment in which the pesticides will be used.

IV. RECOMMENDATION

In light of the nature of this Project and of the programs which could follow it, a negative threshold decision is recommended. The Project is not believed to be a major action which will have a significant effect on the general human environment, except perhaps on a very localized scale. At the local level, only controlled experimentation exclusively for the purpose of research which is confined to small areas and carefully monitored will have any environmental impact.

LOGICAL FRAMEWORK

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

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
SECTOR GOAL	MEANS OF GOAL ACHIEVEMENT		
Improve welfare and productivity of low income groups and increase supply of low cost energy for rural and urban poor.	Increased supply and increased use of energy efficient technologies by the poor and reduced energy costs.	National statistics Project evaluation	No decrease in real cost of commercial energy.
PROJECT PURPOSE	END OF PROJECT STATUS		ASSUMPTIONS FOR ACHIEVING PURPOSE
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 fuelwork and non-conventional energy technologies.	Improved non-conventional energy and fuelwood production technologies tested and accepted. National institutions using them in extension programs. National and regional institutions continuing research in these areas.	National documents and plans. Project evaluation.	Improved techniques in fuelwood production exist, or can be developed. Increasing government interest in resource management.
OUTPUTS: CATIE Element	MAGNITUDE OF OUTPUTS: CATIE Element		
1. Critical and potential critical areas. 2. CAP identified and tested species for fuelwood production.	1. Critical and potential critical areas for fuelwood supply identified. 2. a) Listing of properties and production potential of approx. 15 promising species for different ecological zones in CAP.		

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
OUTPUTS: CATIE Element (Cont.)	MAGNITUDE OF OUTPUTS: CATIE Element (Cont.) b) Social acceptability of these species verified. c) Data on approx. 30-pre-1980 plot.		
3. Management practices for fuelwood production.	3. Data on 3 management practices under trial in approx. 6 critical areas.		
4. Fuelwood demonstration units	4. Not less than: 10 national fuelwood production units; 20 small farm fuelwood production units (planted woodlots, or existing vegetation); 15 village woodlots; 5 fuelwood plantations minimum; 30 small farm agroforestry systems (living fences, shade trees, mixed production systems)		
5. Strengthened CATIE and national professionals and institutional capacities in these areas.	5. CATIE continuing capacity to assist national institutions in the area. National institutions financing research and transfer in this area in at least 3 countries. Personnel trained.		

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
OUTPUTS: ICAITI Element	MAGNITUDE OF OUTPUTS: ICAITI Element		ASSUMPTIONS FOR ACHIEVING OUTPUTS:
1. Test and demonstrate low-cost domestic and small community fuelwood and non-conventional energy efficient technologies.	1. a) 460 domestic fuelwood stove units tested and demonstrated in each C.A. country and Panama. b) 65 different domestic biomass stove units tested and demonstrated in C.A. and Panama. c) 10 biogas domestic stoves tested and demonstrated.	Project reports, publications, and evaluations	National funding available Fuelwood production, use efficiencies and alternative energy techniques economically viable and sociologically acceptable. Timely input of land, manpower, and capital.
2. Test and demonstrate small industry non-conventional energy and fuelwood efficient technologies throughout CAP.	2.a) 7 improved small industry fuelwood kilns and ovens tested and demonstrated. b) 16 biogas, biomass, pyrolitic, and solar small industry energy systems tested and demonstrated.		
3. Strengthened ICAITI and national institution capacities in non-conventional energy sources.	3.a) ICAITI continuing an expanded capacity to assist national institutions in non-conventional development. b) National energy development plans include non-conventional energy applications. c) 7 seminars/workshops in demonstrated fuelwood efficiencies and renewable energy applications held throughout CAP (300 participants).		

DEPARTMENT OF STATE

TELEGRAM

AMERICAN EMBASSY GUATEMALA

UNCLASSIFIED

ACTION: HECHTMAN
INFO: ACKERMAN
VENEZIA
SUNDERMANN

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NNNNVV- ESB037BRA849
PP RJESGT
DE RUEHC #2747/01 1851532
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TO AMEMBASSY GUATEMALA PRIORITY 6630
BT
UNCLAS STATE 172747

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E.O. 12065 N/A

TAGS:

SUBJECT: DAEC REVIEW OF FUELWOOD AND ALTERNATIVE ENERGY SOURCES PID

THE DAEC REVIEWED AND APPROVED THE SUBJECT PID ONN JUNE 8, 1979. THE FOLLOWING SPECIFIC GUIDANCE IS PROVIDED TO ASSIST THE MISSION IN PREPARRING THE PROJECT PAPER.

1. PROJECT STRATEGY.

A. FUELWOOD VS. ALTERNATIVE ENERGY SOURCES. QUESTIONS WERE RAISED AT THE DAEC OVER THE MISSION'S DECISION TO CONCENTRATE ITS EFFORTS ONN THE PROBLEM OF DEFORESTAATION AND THE RELATED AREA OF FOREST DEPLETION DUUE TO THE DEMMANDS FOR FFUELWOOD. TTHE DAEC ALSO QUESTIONED THE EXTENT TO WHICH FUELWOOD IS A PRIORITY CONCERRN TO CENTRALL AMERICANS AND TO THE BILATERAL MISSSIONS, AND THE DEGREE OF RELATIONSHIP BETWEEN DEFORESTATIONN AND FUELWOOD USE. THERE WAS DIS--AGREEMENT IN THE MEETING OVER WHETHER THE BASIIC CAUSE OF DEFORESTATION IN CENTRAL AMERICA WAS THE NEED FORR FUELWOOD OR WHETHER OTHER FACTORS, SUCH AS TH" NEED FORR MORE LAND IN CULTIVATION OR FOR COMMERCIAL WOOD, WERE EQUALLY OR MORE IMPORTANT CAUSES OF THE PROBLEM. AT THE SAME TIME, THERE WAS ALSO DISCUSSION OVER THE APPRROPRIATE RELATTIVE WEIGHT

GIVEN THE THREE PROJECT COMPONENTS IN THE PID - MORE SPECIFICALLY WHETHER THE PROJECT SHOULD BE ADDRESSING THE PROBLEM OF DEFORESTATION BY IMPROVING THE EFFICIENCY OF FUELWOOD USE AND/OR PROMOTING FAST GROWING TREES FOR USE AS FUELWOOD OR WHETHER THE PROJECT SHOULD BE CONCENTRATING RESOURCES ON TH DEVELOPMENT OF ALTERNATIVE ENERGY SOURCES, WHICH MIGHT HAVE A MORE SIGNIFICANT IMPACT ON THE A.I.D. TARGET GROUP. THE MISSION IS, THEREFORE, REQUESTED TO RECONSIDER THE LIKELY IMPACT OF THIS PROJECT ON THE SERIOUS PROBLEM OF DEFORESTATION IN CENTRAL AMERICA, AND WHETHER THIS PROJECT SHOULD BE DESIGNED TO CONCENTRATE ITS EFFORTS MORE HEAVILLY ON DEVELOPMENT OF ALTERNATIVE ENERGY SOURCES AND IMPROVING FUELWOOD EFFICIENCIES. THE MISSION MAY, IN THE FUTURE, WANT TO EXPLORE OTHER PROJECT DESIGNS WHICH MIGHT HAVE A MORE DIRECT IMPACT ON THE REVERSAL OF DEFORESTATION AND NATURAL ...

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RESOURCES DEGRADATION. TO THE EXTENT THAT GROWING WOOD FOR FUEL IS IDENTIFIED AS PART OF THE PROJECT'S FOCUS, THE PP SHOULD BE ABLE TO DEMONSTRATE THE RELLATIONSHIP BETWEEN THE DEFORESTATION PROBLEM AND FUELWOOD AND THE APPROPRIATENESS OF THE MISSION'S APPROACH, AS OPPOSED TO ALTTERNATIVE RESPONSES, SUCH AS SUPPORTING AGRO-FORESTRY RESEARCH AND EXTENSION. THE PP SHOULD ALSO DEMONSTRATE THAT THERE IS SUFFICIENT TIME WITHIN THE PROJECT FRAMEWORK TO TEST VARIOUS TREE VARIETIES FOR A MEANINGFUL ANALYSIS OF RESULTS.

ITWAS NOTED AT THE DAEC THAT THERE HAS BEEN NO CENTRAL AMERICAN REGIONAL ENERGY ASSESSMENT, EXCEPT IN THE AREEA OF HYDROELECTRIC POWER GENERATION. TO REMEDY THIS GAP, THE MITRE CORPORATION IS CURRENTLY BEING CONTRACTED TO UNDERTAKE AN INITIAL ASSESSMENT OF CENTRAL AMERICAN ENERGY PROBLEMS (SEE STATE 136666). THIS ASSESSMENT SHOULD LAY OUT THE CAUSES AND INTERRELATIONSHIPS OF SOME OF THE PROBLEMS IN THE ENERGY AREA AND FORM THE BASIS FOR THE DEVELOPMENT OF A FRAMEWORK FOR A MAJOR REGIONAL AND BILATERAL ACTION PROGRAMS IN ENERGY. EVEN THOUGH IT IS CONTEMPLATED THAT THIS ASSESSMENT WILL NOT BE COMPLETED BEFORE NOVEMBER 1979, THE MISSION SHOULD ENSURE ITS PROPOSED PROGRAM IS COORDINATED WITH THE ASSESSMENT TEAM AND FITS INTO AN OVERALL REGIONAL STRATEGY. IIN THIS REGARD, THE MISSION MAY WISH TO INCLUDE A SMALL TRAINING COMPONENT IN THIS PROJECT TO PROVIDE SHORT-TERM TRAINING COURSES OR SEMINARS FOR CENTRAL AMERICANS THAT COULD INCREASE REGIONAL AWARENESS OF ENERGY PROBLEMS AND ASSIST IN DEVELOPING A REGIONAL RESPONSE.

B. SMALL INDUSTRY V. HOME FUELWOOD USE.

CONCERN WAS EXPRESSED AT THE DAEC THAT PROJECT FINANCED RESEARCH WOULD CONCENTRATE ON S;ALL INDUSTRY FUELWOOD USEN AS OPPOSED TO HOME FUELWOOD USE. IN ACCORDANCE WITH THE DAEC'SS UNDERSTANDING THAT THE PROJECT'S THRUST WOULD BE DIRECTED TOWARD HOME USERS, IT IS SUGGESTED THAT THE PROJECT MIGHT CONCENTRATE ITS EFFORTS ON WAYS OF DISSEMINATING RESEARCH RESULTS TO THESE HOME USERS.

C. RESEARCH VS. APPLICATION AND DISSEMINATION.

IT WAS NOTED AT THE DAEC THAT CONSIDERABLE RESEARC HAS ALREADY BEEN DONE IN AREAS OF PROJECT CONCERN, SUCH AS FAST GROWING FUELWOOD SPECIES, ENERGY SAVING DEVICES AND ALTERNATIVE ENERGY TECHNOLOGIES. THEREFORE, CONCERN WAS EXPRESSED AT THE DEGREE TO WHICH THIS PROJECT WAS ESSENTIALLY RESEARCH ORIENTED AS OPPOSED TO CONCENTRATING ON OUTREACH AND APPLICATION, AND THE ROLE OF THE REGIONAL INSTITUTIONS IN DISSEMINATION TO NATIONAL ENTITIES. THE PP SHOULD CLEARLY INDICATE THE DEGREE OF BASIC RESEARCH CONTEMPLATED BY THE PROJECT, THE RATIONALE FOR SUC; RESEARCH, AND THE MEANS THROUGH WHICH RESEARCH TESTED BY THE REGIONAL

INSTITUTIONS WILL BE DISSEMINATED TO APPROPRIATE NATIONAL AND OTHER INTERESTED ORGANIZATIONS. FOR EXAMPLE, IT WAS

P-3

SUGGESTED THAT THE PP MIGHT REFLECT THE EXPERIENCES ON DISSEMINATION OF THE LORENA STOVE AND THE RELATIONSHIP CATIE AND ICAITI HAVE ALREADY DEVELOPED WITH NATIONAL INSTITUTIONS. FURTHERMORE, IT WAS SUGGESTED THAT ROCAP EXPLORE POSSIBLE ROLES FOR PVO'S AND THE PEACE CORPS IN THE DISSEMINATION PROCESS.

2. COORDINATIONN.

KEY TO THIS PROJECT IS THE NEED FOR COORDINATION OF RESEARCH AND DEVELOPMENT BOTH AT THE REGIONAL LEVEL BUT ALSO AT THE LEVEL OF THE NATIONAL RESEARCH ORGANIZATIONS. THE PP SHOULD CCLEARLY LAY OUT THE LINKAGES BETWEEN THESE VARIOUS ORGANIZATIONS AND DESCRIBE THE PROCESS THROUGH WHICH A PILLOT RESEARCH EEFFORT WILL BE TESTED, DDEMONSTRATED AND DISSEMINATED. THUS, THE CAAPACITY OF THEE NATIONAL INSTITUTIONS TO CONDUCT ADDITIONAL ADAAPTIVE RESEARCH AND DISSEMINATE RESULTS SHOULD BE DEMONSTRATEED IN THE PROOJECT. THE PP SHOULD ALSO INDICATE HOW THIS PROJECT WILL BE COORDINATED WITH THE RECENTLY APPROVED PANAMA ALTERNATIVE ENERGY PROJECT.

3. SOCIAL ANALYSIS.

THE PID INDICATED THAT THE SOCIAL ANALYSSIS WOULD BE BASED

UPON CENSUS DATA, SUPPLEMENTED BY DESCRIPTIONS OF TYPICAL AREAS OR COMMUNITIES WHERE DEMONSTRATIONS WOULD BE CONDUCTED, WITH AN ASSESSMENT OF THE EXPECTED ACCEPTANCE OF OR REACTION TO NEW TECHNOLOGIES. GIVEN THE IMPORTANCE OF THE ACCEPTANCE/UTILIZATION FACTOR TO PROJECT SUCCESS, IT IS SUGGESTED THAT THE SURVEYS MIGHT BE UNDERTAKEN TO ANALYZE THE POTENTIAL MAGNITUDE AND COMPLEXITY OF THESE PROBLEMS AND LAY OUT RESEARCCH TECHNIQUES TO BE USED IN THE PROJECCT DESIGN. FURTHERMORE, THE PROJECT SHOULD PROVIDE SUFFICIENT RESOURCES TO ENSURRE THAT SOCIAL ACCEPTANCEE FACTORS BE INCLUDED IN THE TESTING AND DISSEMINATION PROCESS.

44. INSTITUTIONAL CAPABILITIES.

THE AMOUNT OF TECHNICAL ASSISTANCE PROPOSED IN THE PID FOR CATIE AND ICAITI WAS CONNSIDERED INSUFFICIENT TO INSTITUTIONALIZE THE PROPOSED RESEARCH AND DISSEMINATION PROGRAAM. DURING PROJECT DEVELOPMENT, THE AMOUNT AND TYPE OF TECHNICAL ASSISTANCE SHOULD BE REEXAMINED TO DETERMINE THE ADEQUACY OF THE PROPOSED INPUTS. AT THE SAME TIME, THE APPROPRIATENESS OF THE PROPOSED CRITERIA TO BE USED BY ICAITI TO SELECT INTERVENTIONS TO BE RESEARCHED AND TESTD SHOULD BE CAREFULLY REVIEWED AND ANALYZED.

5. LANDSAT COMPONENT.

THE MISSION SHOULD CAREFULLY REVIEW TTHE USEFULNESS OF LANDSAT IMAGERY IN PROVIDING INFORMATION ON THE RATE ANDD INCIDENCE OF DEFORESTAION, GIVEN THE CLOUD CCOVER PROBLEMS IN CENTRAL AMERICA. IT IS SUGGESTED THAT ALTERNATIVE INFORMATION GATHERING AND PROCESSING MEANS SHOULD BE CONSIDERED AND MIGHTT PROVIDE BETTTER DATA THAN LANDSAT IMAGERY FOR USE IN THE PROJECT. CHRISTOPHER
BT
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INCOMING
DEPARTMENT OF STATE
TELEGRAM
AMERICAN EMBASSY GUATEMALA

UNCLASSIFIED

ACTION: ACKERMAN
INFO: VENEZIA
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VV ESB072BRA760
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TO RUESAS/AMEMBASSY ASUNCION 0410
RUESBG/AMEMBASSY BOGOTA 2173
RUEHWN/AMEMBASSY BRIDGETOWN 6017
RUESON/AMEMBASSY GEORGETOWN 5796
RUESGT/AMEMBASSY GUATEMALA 7097
RUESKN/AMEMBASSY KINGSTON 9148
RUESLZ/AMEMBASSY LA PAZ 2360
RUESLM/AMEMBASSY LIMA 0721
RUESMG/AMEMBASSY MANAGUA 5782
RUEHZP/AMEMBASSY PANAMA 7108
RUESPR/AMEMBASSY PORT AU PRINCE 8133
RUESQI/AMEMBASSY QUITO 3534
RUESJO/AMEMBASSY SAN JOSE 8147
RUESAL/AMEMBASSY SAN SALVADOR 6282
RUESNA/AMEMBASSY SANTIAGO 6483
RUESSD/AMEMBASSY SANTO DOMINGO 9550
RUESTE/AMEMBASSY TEGUCIGALPA 7071
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ACTION TAKEN: Cable
DATE: 8/13
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AIDAC, FOR MISSION DIRECTORS; GUATEMALA FOR USAID & ROCAP

E.O. 12065: N/A

TAGS:

SUBJECT: WHITE HOUSE PERSPECTIVE ON DEFORESTATION

REF: STATE 183721

1. THE FOLLOWING MEMORANDUM WAS RECEIVED BY THE A/AID. IT IS BEING FORWARDED TO YOU IN FULL TEXT IN ORDER THAT YOU MAY HAVE A BETTER UNDERSTANDING OF THE PRESIDENT'S VIEW ON INTERNATIONAL ENVIRONMENTAL, NATURAL RESOURCE AND RELATED ENERGY MATTERS.

2. QUOTE:
THE WHITE HOUSE
WASHINGTON
AUGUST 2, 1979

MEMORANDUM FOR
THE ADMINISTRATOR OF THE AGENCY FOR INTERNATIONAL
--DEVELOPMENT
THE DIRECTOR OF ACTION

IN MY ENVIRONMENTAL MESSAGE OF AUGUST 2, 1979, I EXPRESSED CONCERN ABOUT THE RAPID DISAPPEARANCE OF THE EARTH'S FORESTS, ESPECIALLY IN THE TROPICS AND SUBTROPICS.

QUOTE I BELIEVE THERE IS MUCH THAT THE UNITED STATES CAN DO IN OUR DEVELOPMENT ASSISTANCE TO OTHER NATIONS TO CONTRIBUTE TO ENVIRONMENTALLY SOUND CARE AND MANAGEMENT OF THE EARTH'S FORESTS AND TO THE WELL-BEING OF PEOPLE AFFECTED BY THEM.

I AM DIRECTING YOU TO EVALUATE YOUR DEVELOPMENT ASSISTANCE PROGRAMS IN LIGHT OF THE FOLLOWING OBJECTIVES AND TO GIVE HIGH PRIORITY TO PROGRAMS WHICH WOULD ADVANCE THESE OBJECTIVES:

--NECESSARY PRESERVATION OF NATURAL FOREST ECOSYSTEMS AND THEIR RICH COMPLEX OF PLANT AND ANIMAL LIFE;

--MULTIPLE USES OF HIGHLY DIVERSE TROPICAL FORESTS, INCLUDING MANAGEMENT OF NATURAL STANDS, DEVELOPMENT OF ECOLOGICALLY SOUND FOREST PLANTATIONS, AND COMBINED AGRICULTURE AND FORESTRY;

--INCREASING YIELDS IN FAMILY-SCALE TROPICAL AGRICULTURE TO RELIEVE PRESSURES ON FOREST LANDS THAT ARE NOT SUITABLE FOR CULTIVATION;

--DEVELOPING INTEGRATED PROJECTS FOR REFORESTATION, MORE EFFICIENT FUELWOOD USE, AND ALTERNATIVE ENERGY SOURCES.

PLEASE GIVE THIS ASSIGNMENT YOUR IMMEDIATE ATTENTION.

);63&,-4) JIMMY CARTER UNQUOTE COOPER
BT
#9967

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INCOMING
DEPARTMENT OF STATE

TELEGRAM

AMERICAN EMBASSY GUATEMALA

ROCAP

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RUESBZ/AMEMBASSY BRASILIA 0369
RUEHWN/AMEMBASSY BRIDGETOWN 5775
RUESDN/AMEMBASSY GEORGETOWN 5613
RUESGT/AMEMBASSY GUATEMALA 6773
RUESKN/AMEMBASSY KINGSTON 0727
RUESLZ/AMEMBASSY LA PAZ 2234
RUESLM/AMEMBASSY LIMA 0352
RUESMG/AMEMBASSY MANAGUA 5532
RUEHME/AMEMBASSY MEXICO 2365
RUESDO/AMEMBASSY MONTEVIDEO 0229
RUEHZP/AMEMBASSY PANAMA 6527
RUESPR/AMEMBASSY PORT AU PRINCE 7987
RUESQI/AMEMBASSY QUITO 3192
RUESJO/AMEMBASSY SAN JOSE 7954
RUESAL/AMEMBASSY SAN SALVADOR 5773
RUESNA/AMEMBASSY SANTIAGO 5276
RUESSD/AMEMBASSY SANTO DOMINGO 9249
RUESTE/AMEMBASSY TEGUCIGALPA 6771
BT
UNCLAS STATE 183721

15 JUL 79 15 00Z

ACTION DIRECTOR
INFO FIESTER
PROGRAM

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AIDAC, FOR MISSION DIRECTORS

E.O. 12065 N/A

TAGS:

SUBJECT: CONGRESSIONAL PERSPECTIVE ON DEFORESTATION
GUATEMALA FOR USAID AND ROCAP
REG: H.R. REPORT NO. 96-273

1. THE HOUSE COMMITTEE ON APPROPRIATIONS SUBMITTED TO THE CONGRESS A REPORT TO ACCOMPANY H.R. 4473 (FOREIGN ASSISTANCE AND RELATED PROGRAMS APPROPRIATION, 1980). THE FOLLOWING IS EXTRACTED FROM THAT REPORT IN ORDER THAT YOU MAY HAVE A BETTER UNDERSTANDING OF THE CONGRESS' VIEW ON ENVIRONMENTAL, NATURAL RESOURCE AND RELATED ENERGY MATTERS.

QUOTE: DEFORESTATION - THE COMMITTEE FINDS THAT IN RECENT YEARS THE GROWING DEPENDENCE ON WOOD FOR HEATING AND COOKING BY THE WORLD'S POOR HAS LED TO OVERCUTTING, DEFORESTATION, EROSION AND LOSS OF AVAILABLE AGRICULTURAL LAND IN MANY PARTS OF THE DEVELOPING WORLD. MAN HAS DEFORESTED ONE THIRD OF SOUTH AMERICA'S NATIVE FORESTS, ONE HALF OF AFRICA'S AND TWO THIRDS OF SOUTHEAST ASIA'S. WITHOUT ADEQUATE ENERGY AVAILABLE AT AFFORDABLE PRICES, THE BASIC NEEDS OF THE WORLD'S POOR FOR FOOD, WATER, SHELTER, CLOTHING AND JOBS WILL REMAIN UNSATISFIED AND POLITICAL STABILITY WILL BE JEOPARDIZED. THE COMMITTEE HAS FOUND

THAT LARGE CENTRAL GENERATION AND LONG DISTANCE TRANSMISSION AND DISTRIBUTION SYSTEMS ARE TOO COSTLY TO MEET RURAL ENERGY NEEDS BY MEANS OF A NATIONAL GRID. ONLY ONE OUT OF EIGHT RURAL INHABITANTS WOULD BE ABLE TO AFFORD ELECTRICITY BY THE END OF THIS CENTURY. IN FACT NON-

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COMMERCIAL FUELS STILL SUPPLY ABOUT HALF THE TOTAL ENERGY IN DEVELOPING COUNTRIES AND ALL BUT A SEVENTH IN RURAL SECTORS.

ALTHOUGH A LARGE POTENTIAL EXISTS FOR THE CONTRIBUTION OF RENEWABLE ENERGY RESOURCES TOWARD ECONOMIC DEVELOPMENT AND MEETING BASIC NEEDS OF THE WORLD'S POOR, THE COMMITTEE BELIEVES THAT RECENT INITIATIVES BY THE AGENCY FOR INTERNATIONAL DEVELOPMENT AND THE INTERNATIONAL FINANCIAL INSTITUTIONS SEEM IN NO WAY COMMENSURATE WITH THE SCALE OF THE PROBLEM FOR A COMPREHENSIVE PROGRAM IS NEEDED TO OBTAIN LONG-RUN INDEPENDENCE OF FOSSIL FUEL.

p.2

AS PART OF AN OVERALL PROGRAM TO PROMOTE THE WIDESPREAD INTRODUCTION OF RENEWABLE ENERGY TECHNOLOGIES IN RURAL AREAS, THE COMMITTEE URGES A COMPREHENSIVE STRATEGY ON TROPICAL FORESTRY, JOINTLY DEVELOPED BY THE DEPARTMENT OF STATE, AID, THE DEPARTMENT OF AGRICULTURE, THE DEPARTMENT OF INTERIOR, PEACE CORPS, THE NATIONAL SCIENCE FOUNDATION, AND THE COUNCIL ON ENVIRONMENTAL QUALITY. IT SHOULD IDENTIFY PRIORITY PROGRAMS AND ACTIVITIES FOR U.S. BILATERAL AND MULTILATERAL SUPPORT, OUTLINE FIELDS IN WHICH THE UNITED STATES HAS SPECIAL COMPETENCE, DEFINE THE TYPES OF POTENTIAL DESTRUCTIVE ACTIONS WHICH SHOULD BE AVOIDED OR MODIFIED IN TROPICAL FORESTS ECOSYSTEMS, ADDRESS THE MATTER OF RESPONSIBILITIES OF U.S. FIRMS, AGENCIES, AND INSTITUTIONS OPERATING ABROAD, ENUNCIATE RESEARCH, DEVELOPMENT AND DEMONSTRATION AND TRAINING NEEDS.

THE COMMITTEE IS PARTICULARLY CONCERNED THAT AID HAS NOT SET PRIORITIES IN ITS FORESTRY PROJECTS. IT IS NOT CLEAR WHAT EITHER AID OR THE STATE DEPARTMENT PLAN TO DO IN COUNTRIES WHICH MIGHT LOSE THEIR REMAINING FORESTS WITHIN THE NEXT 5 OR 10 YEARS AS COMPARED WITH THOSE COUNTRIES WHICH MIGHT STILL HAVE CONSIDERABLE AREAS OF FOREST BY THE END OF THE CENTURY. THE RAIN FORESTS OF THE PHILIPPINES AND PENINSULA MALAYSIA MAY WELL BE LOGGED OVER AND GROSSLY DISRUPTED AS EARLY AS 1985. IN HAITI, OVER THREE QUARTERS OF THE COUNTRY'S FORESTS HAVE BEEN LEVELED OVER THE PAST 15 YEARS, PRIMARILY TO MAKE CHARCOAL FOR COOKING AND HEATING. A RAPID RATE OF DEFORESTATION IS OCCURRING IN GHANA, NIGERIA AND THE IVORY COAST. SUCH COUNTRIES SHOULD BE ASSISTED IN DEVELOPING FAR REACHING RURAL ENERGY-REFORESTATION PROGRAMS INCLUDING VILLAGE WOODLOTS, IMPROVED STOVES, THE CONTINUED DEVELOPMENT OF FOSSIL FUEL RESOURCES AND RENEWABLE ENERGY RESOURCES AND EVEN RENEWABLE ENERGY

PLANTATIONS.

THE COMMITTEE ALSO URGES AID TO INCREASE ITS STAFF CAPABILITIES IN FORESTRY, TO PLAN FOR AND INCLUDE REFORESTATION ACTIVITIES IN ALL FUTURE RURAL DEVELOPMENT PROGRAMS, TO ADDRESS FOREST MANAGEMENT CONSIDERATIONS WITHIN THE FRAMEWORK OF THEIR ENVIRONMENTAL ASSESSMENT POLICIES, PROCEDURES AND REVIEWS AND EXAMINE ALL OF ITS CURRENT RURAL DEVELOPMENT PROJECTS TO INSURE THAT, WHENEVER APPROPRIATE, THEY INCORPORATE A FORESTRY/FIREWOOD COMPONENT.

P.3

THE COMMITTEE CAUTIONS AID THAT A WIDE RANGE OF WELL-INTENTIONED DEVELOPMENT PROGRAMS INCLUDING BEEF EXPORT PROMOTION, POPULATION RESETTLEMENT AND THE EXTENSION AND UPGRADING OF RURAL ROADS HAS ACCELERATED DEFORESTATION IN MANY PARTS OF THE DEVELOPING WORLD.

SINCE MANY OF THE SOLUTIONS TO DEFORESTATION INVOLVE SMALL SCALE BUT WIDESPREAD EFFORTS, THE COMMITTEE IS OF THE OPINION THAT THE PEACE CORPS COULD ALSO FORM A VERY IMPORTANT COMPONENT OF ANY U.S. INITIATIVE.

AS FAR AS THE MULTILATERAL AID ORGANIZATIONS ARE CONCERNED THE DEPARTMENT OF TREASURY AND THE DEPARTMENT OF STATE SHOULD USE THEIR INFLUENCE IN THE DEVELOPMENT BANKS, IN REGIONAL DEVELOPMENT BANKS AND WITH OTHER BILATERAL DONORS TO CALL ATTENTION TO THE FIREWOOD PROBLEM AND URGE ITS SOLUTION BY THESE ORGANIZATIONS. END OF QUOTE.
CHRISTOPHER
BT
#3721

THE LORENA STOVE

The Lorena Stove offers great potential for helping many of Central America's poor to cope with the increasingly serious problem of firewood scarcity. It is a prominent example of new technology designed for more efficient firewood consumption in the home.

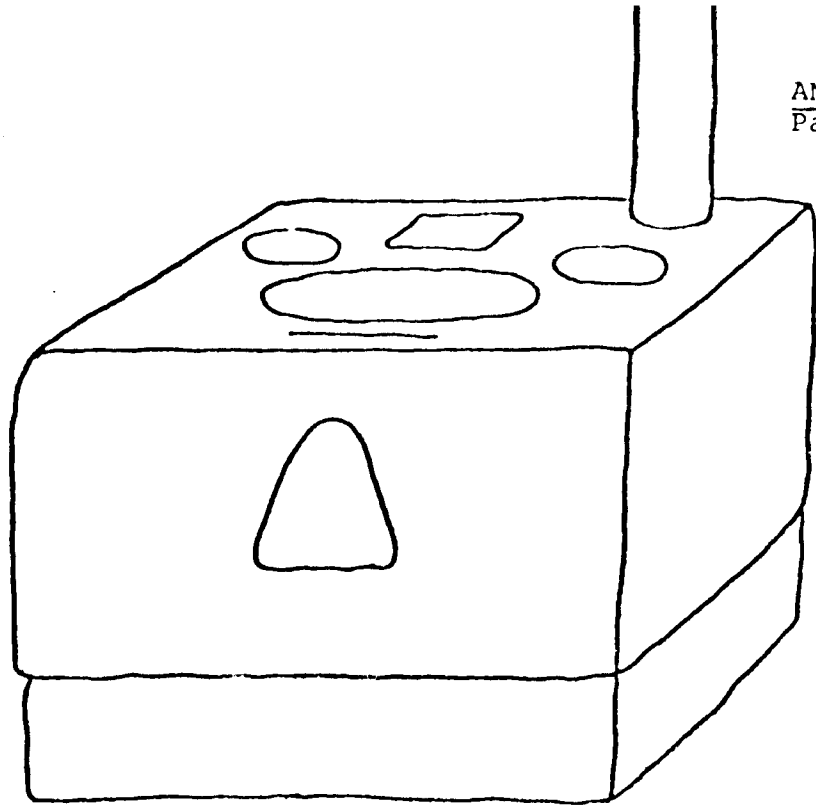
The Problem Addressed

Most of Central America's urban and rural poor are heavily dependent on firewood for cooking - an energy source that has become increasingly difficult to collect and has doubled in price in the past five years in many areas of Central America owing to widespread deforestation. While hard hit by firewood's scarcity, most users cook with it inefficiently. Many homes use three stones for their stove and lose at least 90 percent of the heat produced. Promoters of the Lorena claim that their stove saves at least half the wood used by most traditional cooking methods.

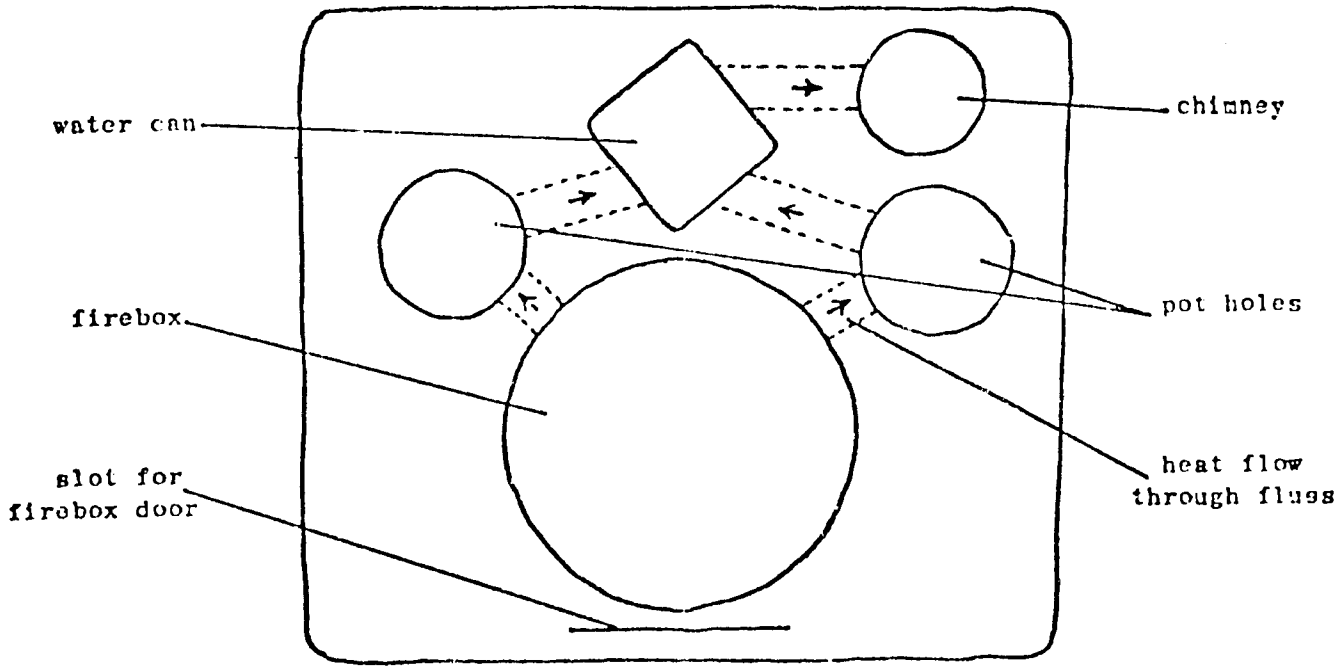
What the Lorena Stove is

The Lorena Stove ("Lodo y Arena" - Mud and Sand) was designed and introduced in 1976 by Ianto Evans, of the ICADA Experimental Station in Guatemala. Made from a mixture of water, sand, and clay without reinforcement, it is a waist-high cube with tunnels carved inside for connecting the pot holes. It includes a chimney and burners for disposing of smoke and fumes (see figure 1). The stove requires about 30 man-hours to construct, and it can be put into service within one week. If labor for construction is not hired out, the only required expenditures are for the metal chimney, dampers and hot water container - altogether costing from four to eight dollars. The clay and sand can be obtained locally at no cost.

Two modifications to the Lorena stove that have been made in some places concern the exterior shape and interior design. Some Lorenas have been built rectangular or even round in shape. The "Ghana" and "Chulah" stoves are similar in appearance to the Lorena but do not have its complicated circular duct system for heat flow.



Frontal view of Lorena stove.



Top view of Lorena stove.

Figure 1.

Source: Dale V. Shaller. March 79

Promoters

So many groups are promoting the Lorena Stove in Central America that it is impossible to keep track of them all. In Guatemala, its principal promoters are two PVOs: The ICADA Experimental Station and CEMAT (Centro Mesoamericano de Tecnología Apropiada).

The ICADA Experimental Station was established six years ago by Donald Hibbits. This research station works in the development of low cost, energy-consuming appropriate technology for Guatemala, and its limited resources come from CARE, OXFAM, WORLD NEIGHBORS, and WORLD VISION.

CEMAT has been working nearly three years on the Lorena Stove. Its promotion of the stove has been primarily concentrated in the Department of Sololá, in the western part of Guatemala.

Both the ICADA Experimental Station and CEMAT have trained people from many PVOs and other organization to disseminate the stove. These groups now known to be promoting the stove in Guatemala include: CARE, Peace Corps, the Medical Assistance Program (MAP, of Chicago, Illinois), INAFOR (Instituto Nacional Forestal - the Guatemalan Government forestry agency), and several community development organizations.

Also in Guatemala, the UNDP is studying the Lorena and other wood stoves as a very small part (less than $30 thousand) of its energy assistance program with the Guatemalan Planning Office.

After learning in Guatemala how to build the Lorena Stove, Save the Children of Honduras promoted it in the town of Pespire. Under the program, which trained the residents to build the stove, nearly 300 have reportedly been constructed. Also promoting the stove in Honduras are COHDEFOR (Corporación Hondureña Forestal - the Honduran Government forestry agency), the Peace Corps, CARE, and community development organizations. Peace Corps Volunteers throughout Central America are also receiving training on constructing the Lorena Stove for dissemination.

Problems with Lorena Stoves

While the Lorena stove has shown promise in several areas, many problems have to be solved before it can be generally accepted. These are in addition to an important problem on the institutional side - insufficient financial resources of PVOs and other organizations to promote the stove on a large scale.

One difficulty is that the Lorena stove is often built incorrectly, where an improper mixture of sand and mud later results in cracks. Sometimes the cracks impair proper functioning of the stoves. In its "Preliminary Program Report" of February 1979, the ICADA Experimental Station claims that over two thirds of the stoves checked in Guatemala had cracks.

In San Francisco El Alto, a town in the Guatemalan altiplano (visited in June 1979 by ROCAP Contractor Andrew Sisson), the Lorena has had limited popularity because it provides less household heating than the more traditional three stones. Also, it appears to be no more fuelwood efficient than three stones for cooking tamales, a staple in the Altiplano diet, because cooking is generally done with round bottomed clay pots and the Lorena does not permit flames to surround the pots' sides. In addition, there seem to be maintenance problems. One family had not been using its Lorena for over a week because the chimney was clogged. The promoter who built the stove had never been back to check and was unaware of the problem. But the family had decided it would always cook tamales on three stones even if the Lorena did work.

Peace Corps volunteers claim that the Lorena stove has had very limited success in the Jalapa Region of Guatemala. In addition to problems with improper mixtures and cracks, the stove is often used incorrectly. For example, when only one pothole is used, the other three are frequently left uncovered permitting heat to escape. Also limiting the Lorena's popularity is its reduction of smoke. Many families want smoke from their cooking fires in order to keep bugs out of their thatched roofs. An Appropriate Technology

Incorporated (ATI) officer recently reported many failures of CEMAT installed stoves in Chimaltenango, Guatemala.

Owing to certain environmental factors, it appears that the Lorena stove has more potential in some areas than others. In order to improve its acceptability, further research is needed to reduce the cracking problem. More intensive promotion is also required, including follow-up visits and education about proper use.

COPIES OF ANNEXES X AND XI CAN BE FOUND

IN THE LAC/DR OFFICIAL FILES

ICAITI: INSTITUTIONAL ANALYSIS

i. Background and Functions

The Instituto Centro Americano de Investigación y Tecnología Industrial (ICAITI), officially known in English as the Central American Research Institute for Industry, is a non-profit regional organization founded in July 1955 by the five Central American republics to advise and provide technical services to the region's industrial sector and to conduct appropriate technical research on products and processes utilizing raw materials and natural resources. It has been in its present Guatemala facilities, donated and maintained by the Government of Guatemala, since March 1957.

ICAITI's fundamental objectives are:

- to advise the private sector in all phases of industrial feasibility studies and their execution;
- to advise and assist private firms in solving any production problems that they might encounter;
- to undertake technical experiments using regional raw materials, develop production methods, design new projects and adapt modern production techniques;
- to promote the adaptation and adoption of modern technology to improve Central American industrial productivity;
- to advise public and private industrial development institutes and investment institutions;
- to develop Central American standards for raw materials, intermediate and finished goods;
- to conduct quality control analyses, tests and trials for raw materials and products;
- to cooperate with the various offices of the governments of the Central American Isthmus, universities, technical organizations and other entities.

ii. Organization

ICAITI's management is headed by a Board of Directors composed of the five Central American Ministers of Economy. The Institution's director is nominated by the Board of Directors and is responsible for, among other things, the direction, organization and administration of the Institute.

The Executive Committee consists of the Director, Assistant Technical Director, Financial and Administrative Manager and the Assistant Director for Planning and Institutional Development. It is responsible for providing advisory services to the Director and assisting in policy making.

ICAITI's facilities cover 6,485 square meters where the staff of 148 employees, including 55 professionals, are employed as of 6-30-79. Professional personnel cover such fields as chemical, industrial and mechanical engineering, chemistry, bio-chemistry, microbiology, geology and various other technical fields. For details of personnel by Division, type, and profession, see Exhibit A.

ICAITI's facilities include:

- an organic chemistry laboratory;
- an inorganic chemistry laboratory;
- a leather technology laboratory;
- a laboratory and pulp and paper pilot plant;
- a laboratory and textile pilot plant;
- a food technology laboratory;
- an industrial microbiology laboratory;
- a special analysis laboratory equipped with an atomic absorption spectrophotometer, an ultra-violet and visible spectrophotometer, an infra red spectrophotometer, a mass spectrophotometer and various gas chromascopes.
- an up-to-date reference center and research service

ICAITI is organized into the following divisions. For additional detail see ICAITI's Organizational Chart in Exhibit B.

Applied Investigation. This division conducts food technology work and studies processes designed to exploit regional, especially agricultural, natural resources.

Technical and Industrial Services. Marketing, technical and economic feasibility studies, cost control, process expansion, raw material availability, productivity and other economic and industrial engineering activities are conducted by this division. Use of alcohol produced from sugar as a partial gasoline substitute is under current investigation here.

Norms. ICAITI has developed regionwide standards for a variety of manufactured industrial products. It also acts as a reference laboratory to help maintain standards for a variety of exports which have to meet foreign standards.

Applied Geology. This division assists and advises on geological resources and potential for mineral exploitation in the region.

Analysis, Testing and Trials. A variety of work in food, textiles, leather, paper and cartons, synthetic industrial resins, use and control of insecticides and pesticides and environmental contamination tests are carried out by this division.

Scientific Policy. This division conducts applied studies and special training programs using resources of other divisions in applied science and technology.

Documentation and Information. Information storage, research and retrieval are provided by this division using ICAITI's own library and a variety of other information resources.

Technical Publications. This division publishes popular, technical and research studies for the general public, industrial sectors and specific industries or other clients.

iii. Technical Activities

As of August 9, 1979, ICAITI had a total of 75 projects contracted, ranging from a few hundred dollars to about $600,000

for a total cost of $1.9 million. The types of activities ICAITI is involved in are listed in Exhibit C.

ICAITI is presently involved in research activities related to the proposed Project, including: 1) the development of solar grain dryers, and 2) the production of biogas from coffee and agricultural wastes. This research experience in alternative energy technologies, as well as ICAITI's research in Gasohol, is the foundation on which the Project will build upon. ICAITI's existing Technical-Industrial Services Division staff will be greatly increased under the Project to widen its scope in a variety of applications and technical solutions of rural energy problems. Basic research will not be conducted by ICAITI; rather, ICAITI will apply existing knowledge, adopt technology as necessary and develop new approaches to meet immediate and short-term energy needs of fuelwood users. In addition, ICAITI staff will conduct studies in small hydro development and assist the region in beginning to standardize solar data collection systems.

ICAITI personnel will attend short-term training courses, visit appropriate technical institutions and receive technical assistance from short-term technical experts and consultants in order to increase their technical knowledge base in the variety of technologies to be introduced and demonstrated under the Project. This will insure a cadre of experts at ICAITI which will be better able to provide the leadership in the region to focus on solutions to the energy problems of the poor. ICAITI's contacts with government and private groups will be used to increase attention given to and skills employed in this problem area in the region. ICAITI will employ local training, seminars, workshops and information services to disseminate the results of its work under the Project in order to develop regional competence in the proven technologies.

iv. Project Organizational Structure

The organization for the ICAITI element of the Project will be as follows (see organizational chart, Exhibit D):

ICAITI Director: The top managerial responsibility for all ICAITI projects is at the director level. About 5% of his time will be devoted to this project. The present Director is Lic. Francisco Aguirre.

ICAITI Deputy Director and Technical-Industrial Services Division Head: The major managerial decisions and direct project operations will be coordinated between this position and the Assistant Technical Industrial Services Division Head. About 20% of the Deputy Director's time will be devoted to this project. The present Deputy Director and Division Head is Ing. Ludwig Ingram.

Project Manager - ICAITI Assistant Technical-Industrial Services Division Head: The Technical-Industrial Services Assistant Head will be the overall project manager. Program planning, implementation, operation and administration will be at this level. He will have line responsibility over the three project teams and all staff assigned to the project. He will also be the principal communication link with the CATIE project element Manager and the ROCAP Project Manager, and will be responsible for coordinating outside technical assistance. About 60% of his time is expected to be devoted to this project. The present Technical-Industrial Services Division Assistant Head is Ing. Justin Whipple, Mechanical Engineer.

Project Operations Manager: The project operations manager will report to the project manager but will be responsible for the day to day operation of the project, and coordination with the national counterparts and volunteer groups involved in the project in the specific countries. This is a newly created full-time ICAITI position for Project Implementation. This position will require an engineer with strong management experience.

Field Operations Coordination Advisor: The Field Operations Coordination Advisor will be responsible for field coordination and evaluation of the demonstrations to be carried out in the different countries. This person will provide the sociological input and will work closely with the technical teams from design and selection of the equipment to be demonstrated and tested, through evaluation of acceptability in the field and dissemination coordination specifically in the critical areas. This position will require a person with a strong background in rural sociology.

Technical Teams: Each technical team will consist of a chief engineer, one or two additional engineers and an engineering assistant. Each team will be assigned a specific

technical area and will conduct investigations, develop/design, construct, test, and demonstrate their technology as programmed. The teams will provide continued technical assistance to counterparts in the expected counterpart dissemination.

The teams and their principal activities are:

(a) Combustion Team - 2 Combustion Engineers and 1 Assistant. This team will work on technical aspects of domestic and industrial efficiencies testing, adaptation, demonstrations, and evaluation.

(b) Appropriate Technology Team - 2 Engineers and 1 Assistant. This team will work on the technical aspects of biomass, biogas, and pyrolysis (and charcoal making) including adaptation of designs, testing, demonstrations, and evaluation.

(c) Solar Team - 2 Engineers and 1 Assistant. This team will work on the technical aspects of solar plans, designs, demonstrations, and evaluation, and development.

ICAITI Advisory Committee: ICAITI has organized an internal Advisory Committee. This committee is chaired by the project manager and has as members the heads of each of the major ICAITI divisions. Their function is to review progress and advise on program management and project implementation.

COMENER: This is a regional energy program development organization. It is being organized at the ministerial level and will become the Central America energy policy coordinators for the region. At present, the organization is in the organizational stage and is not expected to have a major input in the program. However, ICAITI will maintain contact with COMENER as this organization plans energy development strategies and policies.

National Cooperators and In-Country Organizations;

Throughout the five year project period, various national and international counterpart organizations will collaborate with ICAITI in carrying out the project tasks. Their effort is expected to cover the following:

- Continuous liaison for information and planning
- Work directly with ICAITI line personnel in field investigations
- Provide assistance in the selection of specific sites for demonstration units and obtain official permits as required
- Take direct responsibility, with ICAITI's technical supervision, for the construction and operation of all demonstration units
- Joint sponsoring with ICAITI of regional seminars
- Provide personnel and pay all costs for their participation in regional seminars and in ICAITI workshop sessions
- Undertake wide-scale dissemination of proven new technologies after completing the demonstration projects

The following institutions capable of participating in some or all of the above tasks, are being considered for this collaboration:

Guatemala — University of San Carlos, Peace Corps, VITA, United Nations Central American Energy Program, Mesoamerican Center of Appropriate Technology Studies (CEMAT), Choquí Experimental Station, Solar Energy Association of Guatemala, Instituto de Fomento Municipal (INFOM), Fundación del Centavo, Desarrollo de la Comunidad, INAFOR, Oficina de Planificación Económica.

El Salvador	University of El Salvador, Catholic University, Río Lempa Energy Commission (CEL), United Nations Central American Energy Program, CENAP, Peace Corps, VITA, Solar Energy Association of El Salvador, Banco de Fomento Agropecuario, CENTA
Honduras	Corporación Hondureña de Desarrollo Forestal (COHDEFOR), National University, United Nations Central American Energy Program, Peace Corps, VITA, Centro de Desarrollo Industrial (CDI)
Nicaragua	National University, INVIERNO, Fundación Nacional de Desarrollo (FUNDE), United Nations Central American Energy Program, Peace Corps, VITA
Costa Rica	National University of Costa Rica, University of Costa Rica, National Board of Scientific and Technological Investigation (CONOCIT), Centro de Investigación de Tecnología de Alimentos (CITA), Instituto Costarricense de Electrificación (ICRE), United Nations Central American Energy Program, Peace Corps, VITA
Panama	Hydraulic Resource and Electrification Institute (IRHE), Panamanian Institute for Agricultural Research (IDIAP)

Although ICAITI will contact directly all of the above organizations, their assistance for each specific application will be requested through the offices of the national coordinators of the United Nations Central American Energy Program, who are thoroughly familiar with regional energy problems and with the relative capabilities of the local organizations presently active in this field. The criteria for selection of the field counterparts will be that they are extension oriented, are able to provide personnel to receive training in the technologies or systems to be introduced, assist in construction of the demonstrations, and follow-up in monitoring the demonstrations.

The coordinators in four countries who already have expressed their willingness to cooperate with ICAITI in this Project, are the following:

Guatemala	-	Ing. José Luis Terrón C., Jefe del Area de Energía of GOG Planning Office
El Salvador	-	Ing. Eric Casamiquela, Executive Deputy Director of the GOES Electric Institute (CEL)
Honduras	-	Ing. José Angel Bobadilla, Consejo Superior de Planificaicón Económica
Costa Rica	-	Ing. Mario Barboza S., Infrastructure Dept., National Planning and Coordination Division

Depending upon the political situation in Nicaragua, the coordinator in that country may be Ing. Alejandro Guerrero, manager of Planning Systems of National Electric Co. (ENALUF).

ICAITI, through SIECA, will also maintain continuous contact with the COMENER organization which is expected to participate more directly in the project in the later years, possibly substituting the National Coordinators of the United Nations program.

Since Panama will have an AID financed Renewable Energy Sources Project, ICAITI will maintain contact with that program, through IPHE, or possibly using the services of the Panamanian collaborator for the United Nations Energy Program, Lic. Beatriz Ordaz de Rodríguez, to arrange a continuous interchange of technological information. It is expected that at least domestic stove demonstrations will be carried out in Panama with counterpart assistance. Other technological demonstrations and solar data collection will be coordinated with the USAID/Panama Alternative Energy Sources Project. Also, Panamanian organizations are expected to participate in the Regional Seminars under the Project.

Peace Corps: At least three peace corps volunteers will participate in each country to work with national counterparts in selection of the demonstration sites, construction of the demonstrations, and evaluation and dissemination of the technologies to be introduced. See Annex XV for a complete description of Peace Corps participation.

Outside Consultants: Because of the program's wide range and diverse technologies and their application, funds have been allocated for short-term technical assistance to ICAITI over the life of the project.

Project Staffing

The present staffing of the ICAITI Technical-Industrial Services Division and the Applied Research Division are as follows:

Technical-Industrial Services Division

Justin H. Whipple	Deputy Head, Mechanical Engineer
Oscar Gil Girón	Chemical Engineer
Orlando Posadas V.	Chemical Engineer
Raúl Pingarrón B.	Electro-Mechanical Engr.
José Manuel Recinos	Economist
Luis F. Cifuentes	Economist
Bertha E. Barrios	Economist
Heinz Walter	Textile Engineer/Industrial Economist
Marco Antonio Castañeda	Technician - Draftsman
Estela González	Secretary
María del Carmen Parada	Secretary
Lidia Hrstka de Valladares	Secretary

Applied Research Division

Carlos Rolz	Chemical Engineer
Juan Francisco Menchú	Chemical Engineer
Sheryl de Cabrera	Microbiologist
Roberto de León	Bio-Chemist
Elizabeth de Porres	Food Technologist
Edna Isabel Morales	Bio-Chemist
Ricardo García	Chemical Engineer
Francisco Calzada	Chemical Engineer
Jaime Valladares	Industrial Chemist, PHD
Carlos Porres	Chemical Engineer
María del Carmen de Arriola	Bio-Chemist
Fabiola Micheo	Pharmaceutical Chemist
Oscar Maldonado	Chemical Engineer
Carlos Segura	Technician
Guillermo Pérez	"
Federico Chavarría	"
Carlos Iván Arriola	"

Williams Guillermo Alvarez	Technician
Gustavo Adolfo Herrera	"
Juan Francisco Alonzo	"
Jesús de María Silva	Laboratory Technician
Rafael Ramírez	" "
Norberto González	" "
Roberto Castañaza	" "
Carlos Eduardo Rodríguez	" "
Carlos Humberto Arias	" "
Edgar Rolando Pineda	" "
Germán Cecilio López	" "
Cecilio Antonio Coronado	" "
María Eugenia Ayala	Secretary
Patricia de León	Secretary

For the proposed Project, five existing ICAITI personnel are to be assigned directly to the Project (under the Technical Services Division) and will be AID financed. This includes two full-time Chemical Engineers from the Applied Research Division, one mechanical engineer, an economist, and a draftsman. The mechanical engineer and the two Chemical Engineers will be available for the Project since their present activities end in October. The Technical-Services Division economist and the draftsman will be partially funded by AID based on the time they spend on the project.

In addition to the above, the ICAITI proposed project staff will be increased by the following AID financed staff:

Project Operations Manager
Field Operations Coordination Advisor
Two Chemical Engineers
Mechanical Engineer
Industrial Engineer
Three Engineering Aides
Secretary

EXHIBIT A

I C A I T I
LABOR FORCE AS OF 6-30-79

Description	Profes-sional Pers.	Tech-nical Pers.	Admin. Pers.	General Services Person.	Secreat. Person.	2/ Other	Total
Director's Office 1/	17	2	1	---	1	---	21
Scientific & Technological Development	2	---	1	---	1	---	4
Technical Editor	1	---	---	---	1	---	2
Documentation & Information	2	1	3	---	2	---	8
Tech. Asst.-Deputy Director	1	---	---	---	---	---	1
Tech. & Industr. Serv. Div.	8	2	---	---	2	---	12
Applied Geology Division	1	---	---	---	---	---	1
Analysis & Testing Division	6	2	6	---	1	1	16
Applied Research Division	13	7	9	---	2	7	38
Norms & Standards Div.	2	---	---	---	1	---	3
Financial & Admin. Mgt. Div.	1	3	6	20	2	---	32
Cost & Budget Control Div.	1	---	7	---	2	---	10
TOTAL	55 3/	17	33	20	15	8	140

3/ Professional Personnel

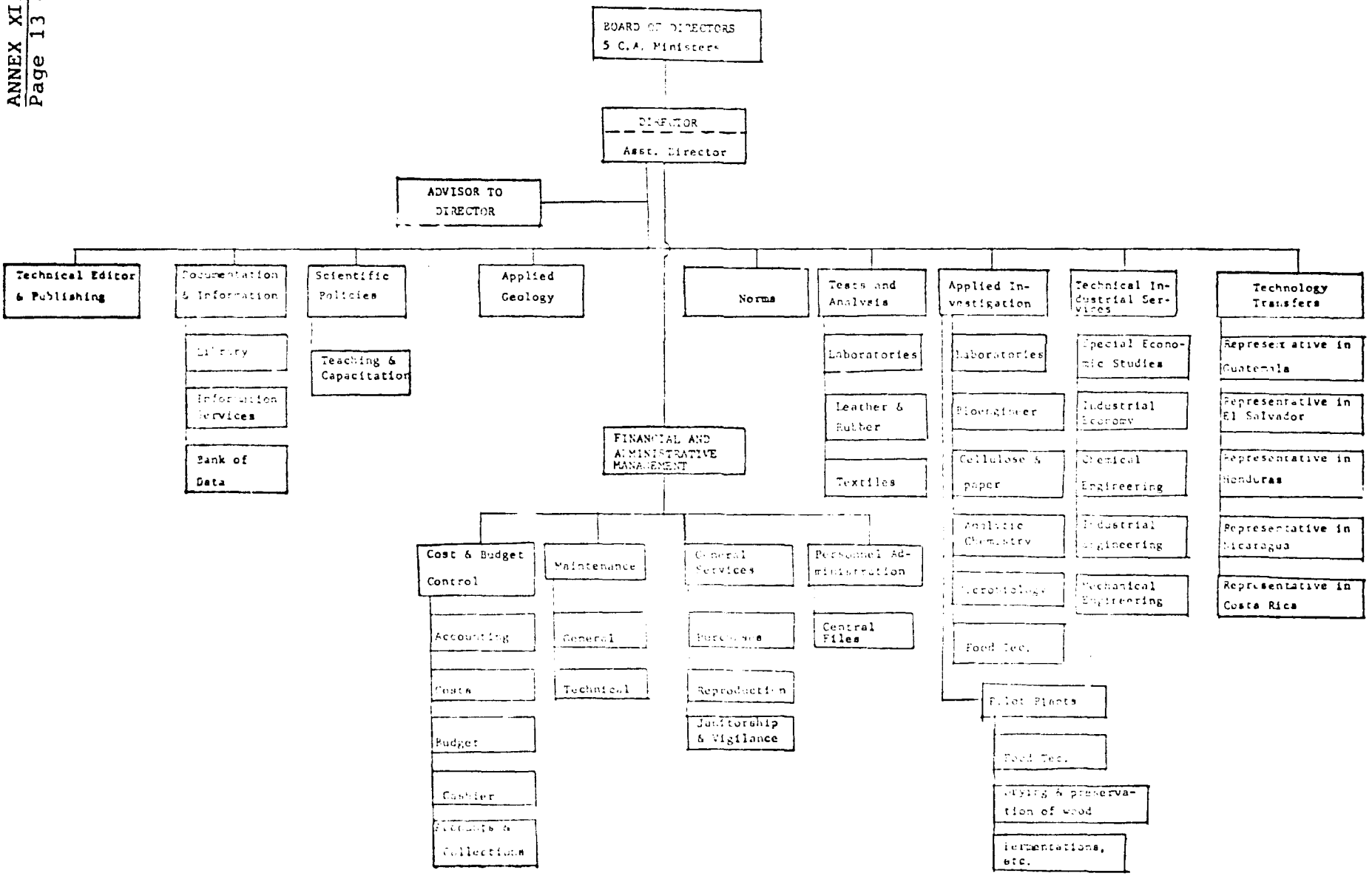
A.	Engineers	31
	Agricultural	3
	Civil	1
	Geologist	1
	Electrical	1
	Mechanical	1
	Electromech.	1
	Ind. Mechanic	2
	Industrial	4
	Chemical	14
	Textil	1
	Bio-Chemist	1
	Business Adm.	1
B.	Licenciados (BA)	24
	Pharmaceutical	6
	Biologists	6
	Microbiologist	1
	Nutrition	2
	Lawyer	1
	Economists	5
	Auditors CPAs	3

NOTE: This chart does not include some temporary consultants from Georgia Tech., Denver Research Inst., CODOT, etc.

1/ Includes consultants for Special Projects, i.e. PTT, ITECAP/IDB, etc.
2/ Includes University of San Carlos participants and Other.

EXHIBIT B

ICAITI - ORGANIZATIONAL CHART



ICAITI Activities

Producción combustibles a partir de desechos agrícolas

Utilización de secadores solares para preservación de granos

Aprovechamiento pulpa de café para forraje y/o abono químico

Purificación de agua para consumo humano, utilizando pequeños filtros

Miniplanta de cemento de horno vertical

Ladrillos, techos y otros elementos de construcción en base de desperdicios vegetales

Producción de carburo de calcio para uso en pequeños talleres del area rural

Miniplanta de pasta celulósica en base de desperdicios agrícolas

Segunda Fase de los Proyectos Anteriores

Programa de capacitación servicios de información a la industria (II)

Asesoría en normalización, control de calidad y metrología

Evaluación de yacimientos de mármol

Adiestramiento y capacitación personal

Estudio mercado varios productos

Curso sobre principios de control de procesos términos y evaluación cierres de envases

Seminario sobre uso y manejo plaguicidas

Asistencia en Ingeniería Mecánica

Reparación de emergencia-planta

Programa de capacitación, clasificación, almacenamiento y recuperación de información

Asistencia en el sistema regional de laboratorios aduaneros

Capacitación análisis microbiológicos

Utilización energía solar para secado cosechas

Seminario para Directores de Institutos Latinoamericanos de Investigación Tecnológica

Servicios de consultoría en sistemas de información financiera y procedimientos administrativos

Capacitación análisis microbiológicos

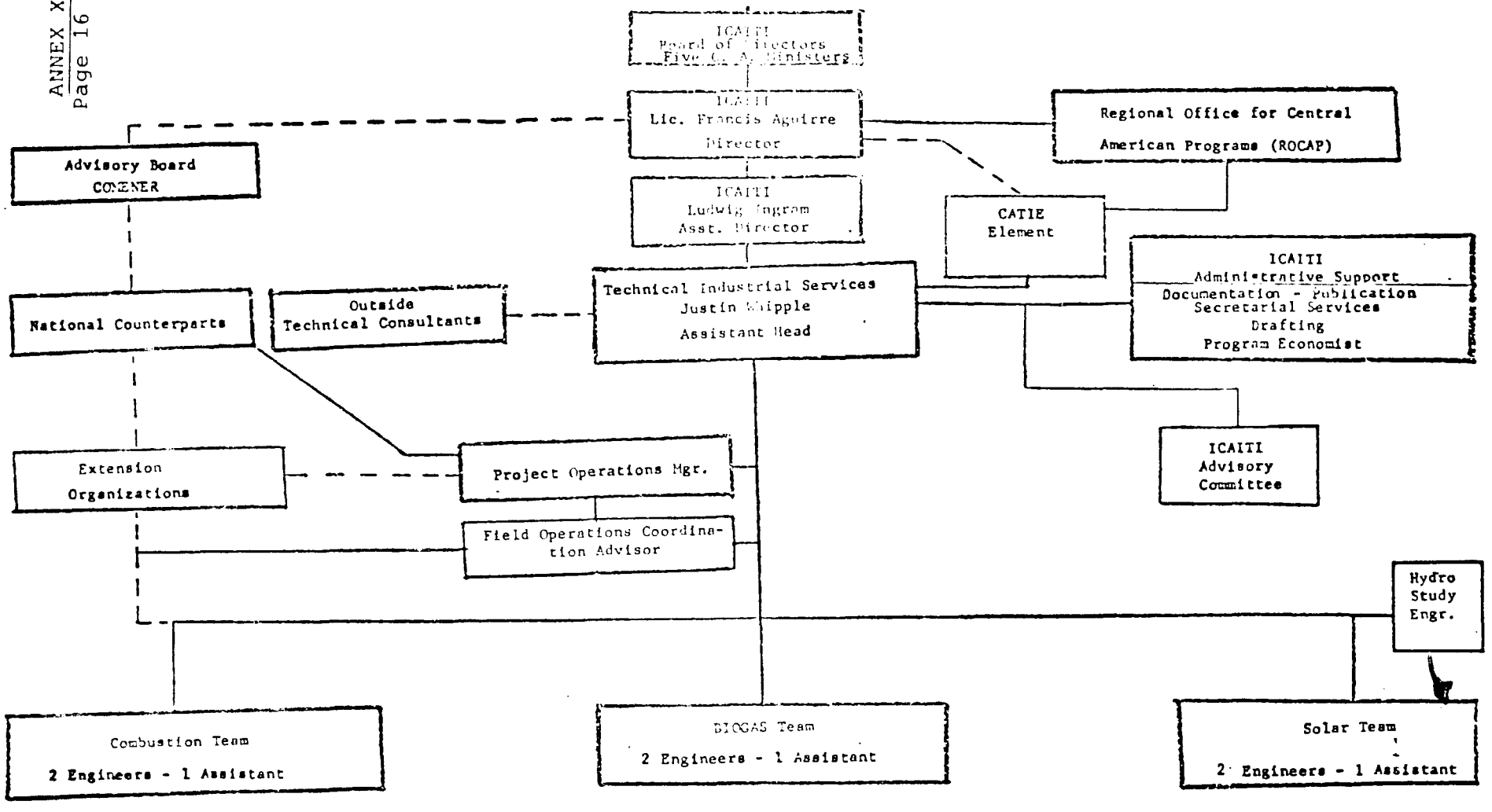
Seminario sobre preparación y promoción proyectos de pequeña empresa

Estudio de factibilidad para la producción de alcohol como carburante (planta para Guatemala)

Preparación de seminario interamericano sobre alcohol como carburante

ICAITI PROJECT ORGANIZATIONAL CHART

EXHIBIT D



NATURAL ENERGY SOURCES FOR OIL SUBSTITUTION IMPORTANT AGREEMENTS OF THE CENTRAL AMERICAN COMMITTEE ON ENERGY (COMENER)

(Informal Translation)

The first meeting of the Central American Energy Commission (COMENER) was held in San Salvador on June 19th and 20th, at which time the Committee was officially constituted as an institutional advisory mechanism for the coordination of regional efforts for the solution of energy problems.

Present at the meeting were COMENER members appointed by the five countries of the area and their advisors, and delegates of the Central American Bank for Economic Integration (CABEI), CEPAL, ICAP and the Executive Secretariat of the Central American Monetary Council (CAMC).

SIECA, as Secretariat of COMENER, was represented by the Assistant Secretary General, Lic. Rodolfo Trejos D., and other technicians.

ENERGY SITUATION

On this matter COMENER recommended:

1) The desirability of promoting the use of natural energy sources, mainly those which are renewable, to diminish dependence on imported energy and the utilization of non-renewable resources.

2) The need to obtain international cooperation in transfer of technology and experiences on tapping new energy sources within the reach of the majority of the population of the Central American countries.

It was agreed that little use is made of hydroelectric and geothermal energy, that there is great consumption of oil for thermoelectric production, and the certainty that there will be a deficit in the oil supply required by the region in the medium term.

RECOMMENDATIONS FOR GOVERNMENT ACTIONS ON THE ENERGY CRISIS

The Committee recommended that the governments take the following actions:

In this regard, it was agreed that as the energy crisis becomes more severe the Central American governments will have to carefully establish precise energy policies. It will be essential that the different responsible entities coordinate their decisions at the national and regional level, on production and commercialization of energy as well as on orientation on consumption, in order to diminish the continuous unfavorable impact of the energy crisis. The objectives of the energy policy should be based on the premise that it is an essential requisite for the development of Central America to increase the energy consumption per capita and to try to:

- Accelerate the utilization of renewable natural resources, especially hydraulic and geothermal, as well as biomass, solar energy and fuel alcohol.

- Immediately increase the efficiency of the energy systems, replacing low production units.

- Orient the consumption of oil fuels, so that they can be utilized in accordance with the needs of society.

- Promote the utilization and improvement of mass transportation.

- Provide to the national and regional organizations the resources which allow them to increase their technical capacity in the energy field.

Bearing the above objectives in mind, it is recommended that the Meeting of Ministers of Economy of Central America take the following steps and actions:

A. Short-term Effects

1. Support international negotiations to integrate an oil consumers front.

2. Negotiate with Venezuela an extension of the original five-year term and the improvement of financial conditions of the system for payment of oil imports.

3. Further insure the fuel supply, negotiating jointly purchases and supplies with different suppliers.

Based on the resolutions of the Ministers of Economy, it was agreed to recommend the establishment of a High Level Committee, which would have among its functions to carry out direct government to government negotiations with pertinent entities of oil production countries and other entities or enterprises involved in its commercialization, transportation and refining, taking into consideration Central American refining conditions and capacity, so that supplies obtained can be utilized more efficiently in the regional context of such facilities.

This negotiating committee should have the technical support of SIECA, CABEI, CAMC, ICAITI and CEPAL.

COMENER also recommended:

The establishment of national oil commercialization companies.

Other recommendations were:

To promote as soon as possible the agreements to interconnect the electric systems of the countries of the area.

To initiate as soon as possible the interconnection lines so that they will be completed when interconnection agreements are finalized or improved. There is nothing against investments made for building such lines, as they are a development factor in the zones where they are built.

To establish a regional coordinated policy on oil products prices, which is in accord with final prices as well as with taxes and profit margins.

To promote the utilization and improvement of mass transportation to substitute individual transportation in

high fuel consumption vehicles and to initiate a campaign to increase voluntary energy savings.

To study the feasibility of substituting oil imports for imports of other energy resources such as coal and natural gas.

B. Medium-Term Effects

1. To assign to COMENER the study of energy development programs for proposal to the governments.

2. To establish an accelerated program for utilization of sugar cane alcohol as a hydrocarbon mixed with gasoline, and fuel alcohol.

3. Accelerate the development of large projects for utilization of hydroelectric and geothermal resources.

4. Establish a program for biogas production at the rural and small community level.

5. Promote the development of industries which manufacture solar energy collectors for utilization as water heaters in homes, as seed dryers and in industrial processes.

6. Promote the development of small hydraulic plants which can complement the use of mechanical or electric energy; the latter whether isolated or interconnected to the national systems.

7. Promote the utilization and adaptation of new technologies for utilization of other renewable energy resources in the region.

C. Long-Term Effects

1. Promote the exploration and exploitation of any oil sources which might exist in the country under the best conditions for the Central American countries which have this resource and for the region as a whole.

2. Promote the study, research and utilization of the coal resources of the region.

3. Promote rational utilization of existing forests, as well as development of fast growth forests for utilization as fuel, especially at the rural level and for small isolated communities.

4. Promote utilization and adaptation of new world technology for utilization of solar energy.

DETAILED FINANCIAL ANALYSIS

1. ICAITI

a. Comparative Balance Sheet

Exhibit A is ICAITI's Condensed Balance Sheet for the years ended December 31, 1975 through 1978. The Balance Sheet total has had a very modest 11% increase in Total Assets from 1975 - 1978. The relatively minor increase is a result of ICAITI's losses over the last two years. Exhibit B shows the Paid-in-Capital Account movement for 1978.

b. Comparative Income Statements

Exhibit C, Comparative Income Statements for the years 1975 through 1978, reflects a constant increase in project related costs in relation to project income. A detail of actual income generated through contracts, projects and programs and costs related thereto for 1975 through 1978 follows:

(US $000)

Year	Project Related Income	COST: Project Related	COST: Non-Project Related	COST: Total	NET COST TO ICAITI Amount
1975	1,139	1,015	428	1,443	304
1976	940	1,053	280	1,333	393
1977	411	555	318	868	457
1978	745	1,211	283	1,494	749

An analysis of 1978 Loss is found as Exhibit D, and shows that it can be attributed 98 percent to the fact that project related revenues do not cover project costs. Furthermore, Laboratory Services cost the Institute $77,000 in 1978 representing 164 percent of revenues collected. This trend is also found for the Norms and Standards Division which does not receive any revenues and cost the Institute $69,000 in 1978. Total services not chargeable to projects has amounted to $282,000 in 1978. The major revenue sources

are the reimbursement of project-related costs which do not cover the rate of expenditures and government contributions which will be discussed separately, but that are not sufficient to cover the Institute's costs.

c. Central American Governments Contributions

Exhibit E shows Central American Governments Contributions assigned from 1975 through 1979. This Exhibit reveals that the latest increase was pledged in 1976 from $288,000 total all countries in 1975 to $400,000 total in 1976 or a 72 percent increase. All Central American Governments pledge the same amount, $75,000 per country, except Guatemala ($100,000) which has always contributed more. The additional amount for Guatemala is considered an extraordinary contribution. ICAITI's budget has increased 65 percent between 1976 and 1979 while government contributions have been maintained at the same 1976 level. To alleviate this situation ICAITI's Board of Directors 1978 meeting approved an increase in country quotas of $75,000 each. This initiative was supposed to be included by each Minister of Economy in their countries respective budgets. The requested increase represents an estimated amount of services to be rendered by ICAITI for each country, with the promise that if the country does not request services equal to the amount pledged, the remaining funds remain in ICAITI as governments extraordinary contributions.

The Central American contributions can be considered current except for Honduras which owes $23,000 representing the increase of 1976 over 1975 quota which was not included in the GOH budget, and Nicaragua whose outstanding contributions cover the period 1975 to 1979. See Exhibit F for additional detail.

In order to alleviate cash flow problems caused in part by the non-payment of the Nicaraguan quota, CABEI's Board of Governors authorized ICAITI an 18-month loan in the amount of $202,000 at six per cent. The loan expiration date was May 7, 1979 and was extended for one additional year. In addition, in 1978 $75,000 more were obtained from CABEI pledging the Nicaraguan outstanding quotas as collateral as again authorized by the Bank's Governors.

e. Conclusion

The serious or potentially serious financial situation reflected in these Financial Statements will be addressed in the Financial/Management Study undertaken as part of AID input to the project. In this study ICAITI's financial accounting and reporting systems will be reviewd with emphasis on:

1) Establishing a system to provide accurate and timely information to administration and to department and project heads. This will enable them to see potential problems before they affect the cash flow situation.

2) Establishing or revising the appropriate direct cost accounting system for the proper allocations of project costs in a timely manner.

3) Establishing or revising modified indirect cost accounting system for application to projects and activities and to establish a system with capability to revise overhead rate in a timely manner.

4) Establish a system that would provide management with an accurate year by year comparison of operations to measure project progress as measured against predetermined time table.

I C A I T I
CONDENSED COMPARATIVE BALANCE SHEET (AUDITED)
As of December 31, 1975 Through 1978

(US $000)

ASSETS	As of 12/31/75		12/31/76		12/31/77		12/31/78	
Current Assets								
Cash in Bank	220		214		267		135	
Accounts Receivable								
C.A. Governments	325		339		334		322	
Accounts Receivable Other	213		126		103		158	
Projects in Process	553		251		458		361	
Inventory	104		104		88		97	
Other	43	1,458	50	1,084	55	1,305	171	1,244
Employee Benefit Fund		---		436		515		558
Fixed Assets (Net)		678		647		626		559
Total Assets		2,136		2,167		2,446		2,361
LIABILITIES AND EQUITY								
Current Liabilities								
Accounts Payable	17		40		67		168	
Accumulated Leave	63	80	55	95	60	127	64	232
Long Term Loans Payable		---		---		202		277
Employee Benefit Fund		---		504		630		744
Deferred Credits								
Loans Payable	66		50		13		30	
Project Advances	512	578	108	158	225	238	240	270
EQUITY								
Paid in Capital	923		1,071		915		516	
C.A. Govt. Quotas	325		339		334		322	
General Reserve	230	1,478	---	1,410	---	1,249	---	838
Total Liabilities and Equity		2,136		2,167		2,446		2,361

I C A I T I

ANALYSIS OF PAID IN CAPITAL ACCOUNT

AS OF 12-31-78

(US $000)

	Balance 12-31-77	1 9 7 8 Increases	1 9 7 8 Decreases	Balance 12-31-78
Previous Balance	915	---	---	915
Vacation and Fringe Benefits	---	13	20	(7)
Application Cost/Revenue from Operation	---	1,224	1,564	(340)
Pension Plan	---	---	1	(1)
Patent	---	---	4	(4)
Previous Years Adjustment	---	13	9	4
Cost Changes	---	---	51	(51)
TOTAL	915	1,250	1,649	516

I C A I T I

COMPARATIVE INCOME STATEMENTS (AUDITED)

For the Years Ending December 31, 1975 Through 1978

(US $000)

	Fiscal Years Ended			
	12/31/75	12/31/76	12/31/77	12/31/78
INCOME				
Government Contributions	208	366	385	392
Contracts, Projects and Programs	1,139	940	411	745
Donations and Subsidies	28	42	25	4
Other	108	315	55	82
TOTAL INCOME	1,483	1,663	876	1,223
EXPENSES				
Cost of Contracts, Projects and Programs	1,443	1,333	868	1,494
Own Activities	33	51	63	70
Other	---	131	100	59
TOTAL EXPENSES	1,476	1,515	1,031	1,623
NET INCOME (LOSS)	7	148	(155)	(400)

I C A I T I

ANALYSIS OF 1978 LOSS

(US $000)

	Revenues	Expend-itures	Income (Loss)
Projects	697	1,088	(391)
Laboratory Services	47	124	(77)
Government Contributions	412	---	412
Norms and Standard Division	---	69	(69)
Services not Chargeable to Projects	---	282	(282)
Other Income or Expenditures	89	82	7
TOTAL	1,245	1,645	(400)

I C A I T I

CENTRAL AMERICAN GOVERNMENTS CONTRIBUTIONS

AMOUNTS ASSIGNED BY COUNTRY FOR YEARS 75/80

(US DOLLARS)

	1975	1976	1977	1978	1979	(Projected) 1980
Costa Rica	52,000	75,000	75,000	75,000	75,000	75,000
El Salvador	52,000	75,000	75,000	75,000	75,000	75,000
Guatemala 1/	80,000	100,000	100,000	100,000	100,000	100,000
Honduras	52,000	75,000	75,000	75,000	75,000	75,000
Nicaragua	52,000	75,000	75,000	75,000	75,000	75,000
Total	288,000	400,000	400,000	400,000	400,000	400,000

1/ Includes $28,000 in 1975 and $20,000 thereafter considered extraordinary quotas.

I C A I T I

STATUS OF CENTRAL AMERICAN GOVERNMENT

CONTRIBUTIONS AS OF 6-30-79

	OUTSTAND BALANCE 12-31-78	1979 QUOTAS	TOTAL	PAYMENTS RECEIVED 1979	OUTSTANDING BALANCE AMOUNT	OUTSTANDING BALANCE PERIOD	LAST PAYMENT MADE
Costa Rica	22,000	75,000	97,000	40,750	56,250	Balance 1979	1979
El Salvador	---	75,000	75,000	37,500	37,500	Balance 1979	1979
Guatemala	---	100,000 1/	100,000	100,000	---	---	1979
Honduras	23,000	75,000	98,000	50,000	48,000	1976 & 1979 2/	1979
Nicaragua	277,000	75,000	352,000	---	352,000	1975/1979	1978 3/
TOTALS	322,000	400,000	722,000	228,250	493,750		

1/ Includes $20,000 considered extraordinary quota.

2/ Represents 50% of 1979 quota and $23,000 increased quota for 1976 over 1975.

3/ Payment made in 1978 for $52,000 corresponding to 1974 quota.

2. CATIE

CATIE changed their accounting system in late 1977 and at the same time changed their fiscal year from July 1 through June 30 to coincide with the calendar year. These two factors have made a detailed comparative analysis of CATIE's financial statements difficult and not all that meaningful.

a. General Working Fund

CATIE's General Working Fund, Comparative Consolidated Income and Expense Statements, Exhibit G, shows that for the period ended December 31, 1978 Excess of Income Over Expenses was $168,000. This statement does not include either project related income or project related expenses, only core budget expenditures and non-project related income.

b. Core Budget

Attached, Exhibit H, Core Budget 1978, gives a breakdown of expenses incurred without direct relation to a specific project activity. These costs are paid for mainly by profit from commercial operations, contributions and overhead charged to projects.

c. Excess of Income Over Expenses 1978

CATIE's overall Excess of Income Over Expenses for 1978 is shown in Exhibit I. This shows their total income was $3,539,000. Of this $690,600, or 20% was represented by direct contributions. Costa Rica, Panama and Nicaragua, each, contributed $50,000 and the balance, $540,000, was contributed by the Inter American Institute of Agricultural Sciences (IICA) under a ten-year agreement with CATIE, signed July 1, 1973. Agreements with three other Central American countries are being negotiated, and if signed could increase annual contributions by $150,000.

Another large portion of total income is represented by Commercial Operations. The CATIE facilities encompass a coffee plantation, a cattle and milk operation and a small cocoa plantation. For details of what these operations have contributed to the overall CATIE financial situation for the

last three and one half years, see Exhibit J, Income and Expenses by Commercial Operation.

The largest portion of total income is represented by Contributions for Execution of Projects. This is the value of agreements and contracts which member countries and other organizations have signed with CATIE for work on specific projects.

On the expense portion of the Statement of Excess of Income Over Expenses, Exhibit I, the largest item is the cost of Technical Programs ($2,315,000). This line item can be broken down into two parts: one, the core budget for the research division which was $971,000 in 1978 (see Exhibit H) and two, the cost directly attributed to research projects undertaken under contracts. This amounted to $1,344,000 in 1978. Another notable expense item is the cost of the commercial operation $393,000. This was offset by the income earned from these operations.

d. Conclusion

General Working Fund Statement, Exhibit G, shows that activities not directly related to project income or project expenses had a net profit of $168,000 in 1978. On the other hand, the General Statement of Income Over Expenses, Exhibit I, shows the total net excess of income over expenses to be $88,000. The difference between the two Statements represents project related activities and shows a net loss of $80,000. This is a 6% cost overrun and can easily be absorbed by the $690,000 annual contributions.

We believe that a research institution which has overruns of only 6% of project related costs has sound contracting policies and good overall administration.

Administrative Capability

This project will be focused on CATIE's Natural Renewable Resources Division. This division had a budget of $153,000 in 1978. This project will be adding a yearly average of approximately $900,000 to the budget. We have considered this in the project preparation and are including as project inputs administrative and support items which will be necessary to achieve project purpose.

Additionally, included in the budget is an overhead line item. This is at CATIE's standard rate. It is provisional pending an audit to determine the exact rate which we will apply.*

With these items included we believe that CATIE will have the administrative capability to carry out the project.

*Any increase in overhead costs will be covered by contingency funds or funds provided through reductions in the funding levels of the other project activities.

C A T I E

GENERAL WORKING FUND

COMPARATIVE CONSOLIDATED INCOME & EXPENSE STATEMENTS

AS OF JUNE 30, 1975, 1976, 1977; DEC. 31, 1977 AND DEC. 31, 1978

(US $000)

	1975	1976	1977	12-31 1977	12-31 1978
Basic Budget Income	870	985	1,336	603	2,260
Other Income	83	22	5	269	15
Total Income	953	1,007	1,341	872	2,275
Basic Budget Expenses	724	910	910	604	2,050
Other Expenses	163	30	193	4	57
Total Expenses	887	940	1,103	608	2,107
Excess of Income Over Exp.	66	67	238	264	168

C A T I E

1978 BUDGET EXPENDITURES

Board of Directors/Executive Committee	22.2	
Office of the Director	97.7	
Public Relations and Information Office	32.7	
		152.6
Sub Direct/Research	59.1	
Sub Direct/Training & Tech. Coop	59.2	
Annual Crops Program	286.7	
Perennial Plants Program	70.9	
Animal Production Program	223.6	
Natural Renewable Resources Prog.	153.0	
Library, Documentation	10.1	
Laboratory Services	37.8	
Post Graduate Program	53.7	
Other Levels Training Program	16.8	
		970.9
Sub Direct/Administration	39.4	
Finance Sector	65.3	
Human Resources Sector	16.3	
Communications Sector	27.5	
Transport. and Agric. Machinery Sector	129.8	
Maintenance and General Services	255.4	
		533.7
Coffee and Sugar Cane Production	224.4	
Cocoa Seeds and Plansts Production	68.2	
Milk and Subproducts	100.0	
		392.6
Electricity	50.6	
Housing Repairs	6.6	
		57.2
SUB TOTAL CORE BUDGET		2,107.0

1978 - CATIE
Excess Of Income Over Expenses

Income:		
Government Quotas	690,600	
Products and Services	440,726	
Commercial Operations	949,926	
Administration of Projects	177,862	
Contributions for execution of Projects	1,264,173	
Other	15,908	
Total		3,539,195
Expenses:		
Direction	152,587	
Technical Programs	2,314,944	
Administrative Services	533,667	
Commercial Operations	392,644	
Other	57,227	
Total		3,451,069
Excess Income Over Expenses		88,126

C A T I E

INCOME AND EXPENSES BY COMMERCIAL OPERATION

FISCAL YEAR ENDING JUNE 30, 1975, 1976, 1977 12/31/1977, 1978

(US $000)

	INCOME	EXPENSES	NET INCOME
Cattle & Milk Operations	157	131	26
Turrialba Farm	207	135	72
La Lola Farm	48	29	19
Total 1975	412	295	117
Cattle & Milk Operations	118	95	23
Turrialba Farm	275	161	114
La Lola Farm	56	42	14
Total 1976	449	298	151
Cattle & Milk Operations	106	100	6
Turrialba Farm	623	198	425
La Lola Farm	124	42	82
Total 1977	853	340	513
Cattle & Milk Operations	39	41	(2)
Turrialba Farm	342	113	229
La Lola Farm	69	30	39
Total July/Dec. 1977	450	184	266
Cattle & Milk Operations	924	100.1	(7.7)
Turrialba Farm	652	224.4	427.6
La Lola Farm	205.5	68.2	137.3
Total 1978	949.9	392.7	557.2

I C A I T I

DETAILED PROJECT BUDGET

JANUARY 1, 1980 TO DECEMBER 31, 1985

BUDGET LINE ITEMS	TOTAL P.M.	TOTAL Amount	YEAR 1 P.M.	YEAR 1 Amount	YEAR 2 P.M.	YEAR 2 Amount	YEAR 3 P.M.	YEAR 3 Amount	YEAR 4 P.M.	YEAR 4 Amount	YEAR 5 P.M.	YEAR 5 Amount
Project Economist	14	23,330	7	11,200	7	12,130	---	---	---	---	---	---
Project Operations Manager	57	108,588	9	14,400	12	20,800	12	22,533	12	24,411	12	26,444
Coordination Advisor	54	103,738	6	9,600	12	20,800	12	22,533	12	24,411	12	26,444
Combustion Enginner 1	60	113,388	12	19,200	12	20,800	12	22,533	12	24,411	12	26,444
Combustion Engineer 2	45	82,144	9	14,400	12	20,800	12	22,533	12	24,411	--	---
Engineer (Biogas #2)	32	56,133	8	12,800	12	20,800	12	22,533	---	---	---	---
Engineer (Biogas #1)	58	108,981	12	19,200	12	20,800	12	22,533	12	24,411	10	22,037
Engineer (Solar #1)	58	108,981	12	19,200	12	20,800	12	22,533	12	24,411	10	22,037
Engineer (Solar #2)	24	41,667	6	9,600	12	20,800	6	11,267			---	---
Total Professional	402	747,000	81	129,600	103	178,530	90	168,998	72	146,466	56	123,406
Draftsman	46	27,523	6	3,000	10	5,417	10	5,867	10	6,356	10	6,883
Engineer Aide #1	46	26,167	10	5,000	12	6,500	12	7,039	12	7,628	–	---
Engineer Aide #2	45	25,667	9	4,500	12	6,500	12	7,039	12	7,628	–	---
Engineer Aide #3	44	25,167	8	4,000	12	6,500	12	7,039	12	7,628	–	---
Secretary	60	35,428	12	6,000	12	6,500	12	7,039	12	7,628	12	8,261
Total Non-Professional	241	139,952	45	22,500	58	31,417	58	34,023	58	36,868	22	15,144
Total Long Term Personnel	643	886,952	126	152,100	161	209,947	148	203,021	130	183,334	78	138,550
Consultants	34	182,350	10	38,600	9	46,000	7.5	44,300	5.5	42,950	2	10,500
Management Study	4	50,000	4	50,000	---	---	---	---	---	---	---	---
Total Short Term Professionals	38	232,350	14	88,600	9	46,000	7.5	44,300	5.5	42,950	2	10,500
TOTAL PERSONNEL	681	1,119,302	140	240,700	170	255,947	155.5	247,321	135.5	226,284	80	149,050

BUDGET LINE ITEMS	TOTAL P.M.	TOTAL Amount	YEAR 1 P.M.	YEAR 1 Amount	YEAR 2 P.M.	YEAR 2 Amount	YEAR 3 P.M.	YEAR 3 Amount	YEAR 4 P.M.	YEAR 4 Amount	YEAR 5 P.M.	YEAR 5 Amount
Total Travel and Per Diem		273,487		55,012		68,925		62,100		52,630		34,800
Training - Short Term		60,000		12,000		12,000		12,000		12,000		12,000
Workshops		28,125		9,375		18,750		---		---		---
Seminars		56,250		---		---		18,750		18,750		18,750
Total Training Costs		144,375		21,375		30,750		30,750		30,750		30,750
Equipment & Materials		289,500		106,000		45,500		60,000		78,000		---
Telecommunications		20,000		4,000		4,000		4,000		4,000		4,000
Reports and Publications		25,000		5,000		5,000		5,000		5,000		5,000
Policy Study		25,000		---		25,000		---		---		---
Evaluation		90,000		30,000		---		30,000		---		30,000
Total Other Costs		160,000		39,000		34,000		39,000		9,000		39,000
Overhead (80% of Long Term Personnel)		709,562		121,680		167,958		162,417		146,667		110,840
Sub Total		2,696,226		583,767		603,080		601,588		543,351		364,440
Contingency 5%		87,510		18,947		19,573		19,525		17,635		11,830
Sub Total		2,783,736		602,714		622,653		621,113		560,986		376,270
Inflation (5% of Long Term Personnel 10% all other - compounded)		455,914		---		51,927		108,941		154,386		140,660
TOTAL		3,239,650		602,714		674,580		730,054		715,372		516,930

A. ROCAP CONTRIBUTION - ICAITI

1. Professional Staff

Professionals are to be recruited locally for long term service in the project. Pay and administration for these people will be in accordance with ICAITI current personnel policy. Salary in the first year of the project was estimated based on current salary scale at ICAITI. Following the policy of giving employees a step increase, equal to 8.33% of base salary per annum for longevity, the personnel costs over the life of the project have been increased accordingly.

2. Non-Professional Staff

The non-professional staff is paid and administered the same as the professionals except the starting salary is much lower.

3. Consultants

The cost of short term consultants is estimated to be $250 per working day. Per diem, however, is computed on calendar days. The rate of per diem is $50. It is estimated that the average cost per trip will be $800. Further, it is estimated that the length of a trip will be 12 days. Computation is as follows:

Year	Work Days		Rate			Calendar Days		Rate			Total
1	97.5	x	250	= 24,375	+	(154.5	x 50)	= 7,725	=		32,100
2	119	x	250	= 29,750	+	(165	x 50)	= 8,250	=		38,000
3	114	x	250	= 28,500	+	(164	x 50)	= 8,200	=		36,700
4	110	x	250	= 27,500	+	(165	x 50)	= 8,250	=		35,750
5	24	x	250	= 6,000	+	(58	x 50)	= 2,900	=		8,900
								Total			151,450

Trips to average 12 working days each:

Year	Salary & Per Diem	Airfare		Total
1	32,100 + (97.5 ÷ 12 x 800)	=	6,500 + =	38,600
2	38,000 + (120 ÷ 12 x 800)	=	8,000 + =	46,000
3	36,700 + (114 ÷ 12 x 800)	=	7,600 + =	44,300
4	35,750 + (110 ÷ 12 x 800)	=	7,200 + =	42,950
5	8,900 + (24 ÷ 12 x 800)	=	1,600 + =	10,500
		Total		182,350

Computation of person months: Based on 20 working days per month:

Year	Workdays				
1	97.5	÷	20	=	5
2	120	÷	20	=	6
3	114	÷	20	=	6
4	110	÷	20	=	5.5
5	24	÷	20	=	1

4. Financial/Management Study

Included as part of the project is a Financial/Management Study to review ICAITI's accounting and management information systems to make recommendations for sound fiscal policy. It is estimated this will cost $50,000.

5. Travel and Per Diem

All full-time professional personnel are expected to travel 90 days per year (7.5 per person month). Trips are to be 10 days in length; round trip is estimated at $200/trip. Per diem is $35 (ICAITI Rate) plus average $15 per day travel costs - total $50.

Year	PM	Days Travel		Rate		Total
1	81	x 7.5 = 607.5	x	$50	=	$ 30,375
2	103	x 7.5 = 772.5	x	50	=	38,625
3	90	x 7.5 = 675	x	50	=	33,750
4	72	x 7.5 = 540	x	50	=	27,000
5	56	x 7.5 = 420	x	50	=	21,000
				Total		150,750

INSTITUTO INTERAMERICANO DE CIENCIAS AGRICOLAS

Escala de Sueldos para el Personal

de Categoría Profesional Internacional

Efectiva al 1° de enero de 1979

Clase		PASOS 1	2	3	4	5	6	7	8	9	10	11	12	13
SD	N-D	$ 36.031	$ 36.691											
	N-S	34.031	34.706											
	B	57.542	58.596											
D-2	N-D	33.150	33.875	$ 34.600	$ 35.340									
	N-S	31.310	31.995	32.680	33.365									
	B	51.813	53.323	54.833	56.435									
D-1	N-D	28.845	29.562	30.279	30.996	$ 31.713	$ 32.395	$ 33.055						
	N-S	27.180	27.867	28.554	29.241	29.928	30.580	31.210						
	B	43.090	44.524	45.958	47.392	48.826	50.240	51.615						
P-5	N-D	25.899	26.496	27.079	27.633	28.186	28.740	29.293	$ 29.847	$ 30.400	$ 30.954			
	N-S	24.374	24.946	25.504	26.033	26.561	27.090	27.618	28.147	28.675	29.204			
	B	37.443	38.569	39.690	40.756	41.819	42.885	43.986	45.094	46.200	47.308			
P-4	N-D	21.357	21.909	22.461	23.013	23.565	24.102	24.639	25.176	25.728	26.280	$ 26.832	$ 27.350	
	N-S	20.082	20.604	21.126	21.648	22.170	22.682	23.194	23.706	24.228	24.780	25.272	25.760	
	B	29.240	30.209	31.177	32.146	33.120	34.115	35.109	36.104	37.126	38.154	39.215	40.212	
P-3	N-D	17.796	18.308	18.821	19.318	19.831	20.343	20.856	21.357	21.822	22.287	22.752	23.217	$ 23.682
	N-S	16.726	17.208	17.691	18.163	18.646	19.128	19.611	20.082	20.522	20.962	21.402	21.842	22.282
	B	23.279	24.097	24.952	25.780	26.635	27.488	28.361	29.240	30.056	30.872	31.688	32.504	33.337
P-2	N-D	14.695	15.140	15.573	16.005	16.438	16.870	17.303	17.735	18.168	18.600	19.033		
	N-S	13.805	14.225	14.633	15.040	15.448	15.855	16.263	16.670	17.078	17.485	17.893		
	B	18.432	19.106	19.762	20.437	21.124	21.810	22.497	23.183	23.870	24.583	25.305		
P-1	N-D	11.514	11.932	12.350	12.768	13.186	13.604	14.022	14.425	14.843	15.240			
	N-S	10.814	11.207	11.600	11.993	12.386	12.779	13.172	13.555	13.948	14.320			
	B	13.728	14.322	14.928	15.533	16.145	16.779	17.412	18.023	18.656	19.258			

N-D = Sueldo neto aplicable a los funcionarios con dependientes.

N-S = Sueldo neto aplicable a los funcionarios sin dependientes.

B = Sueldo bruto que se utiliza exclusivamente para el cálculo de los aportes al Fondo de Retiro.

INSTITUTO INTERAMERICANO DE CIENCIAS AGRICOLAS

Escala Vigente para Ajuste por Lugar de Destino

Efectiva al 1° de enero de 1979

Factores de Ajuste por Lugar de Destino POSITIVOS

para Lugares Asignados

Clase		PASOS												
		1	2	3	4	5	6	7	8	9	10	11	12	13
SD	D	$ 1.503	$ 1.533											
	S	1.375	1.403											
D-2	D	1.384	1.414	$ 1.444	$ 1.474									
	S	1.269	1.295	1.322	1.348									
D-1	D	1.249	1.272	1.294	1.317	$ 1.339	$ 1.362	$ 1.384						
	S	1.150	1.171	1.190	1.210	1.229	1.249	1.269						
P-5	D	1.144	1.163	1.181	1.199	1.219	1.236	1.256	$ 1.275	$ 1.294	$ 1.312			
	S	1.057	1.074	1.090	1.106	1.124	1.130	1.156	1.173	1.189	1.206			
P-4	D	957	979	1.001	1.022	1.046	1.065	1.084	1.103	1.123	1.147	$ 1.170	$ 1.192	
	S	889	909	929	948	969	986	1.003	1.020	1.038	1.059	1.080	1.100	
P-3	D	803	826	847	867	889	911	934	956	975	993	1.012	1.030	$ 1.050
	S	749	770	789	807	827	847	868	888	905	921	939	955	973
P-2	D	667	687	705	724	743	762	781	799	818	837	855		
	S	626	643	660	677	695	712	729	746	763	780	797		
P-1	D	531	549	567	585	603	621	640	656	673	690			
	S	499	516	533	550	567	583	600	615	631	646			

D = Ajuste aplicable al funcionario con dependientes.

S = Ajuste aplicable al funcionario sin dependientes.

NOTA: Las sumas aquí mostradas se multiplican por el número de factores positivos asignados al lugar donde trabaja el funcionario y el resultado se agrega al sueldo básico.

INSTITUTO INTERAMERICANO DE CIENCIAS AGRICOLAS

Escala Vigente para Ajuste por Lugar de Destino

Efectiva al 1° de enero de 1979

Factores de Ajuste por Lugar de Destino NEGATIVOS

para Lugares Asignados

Clase		PASOS												
		1	2	3	4	5	6	7	8	9	10	11	12	13
SD	D	$ 1.458	$ 1.487											
	S	1.333	1.360											
D-2	D	1.342	1.371	$ 1.400	$ 1.430									
	S	1.230	1.256	1.282	1.307									
D-1	D	1.170	1.198	1.227	1.256	$ 1.284	$ 1.312	$ 1.338						
	S	1.077	1.103	1.128	1.154	1.179	1.203	1.227						
P-5	D	1.052	1.076	1.099	1.121	1.144	1.166	1.188	$ 1.210	$ 1.232	$ 1.254			
	S	972	993	1.014	1.034	1.054	1.074	1.093	1.113	1.133	1.152			
P-4	D	870	892	914	937	959	980	1.022	1.023	1.045	1.067	$ 1.089	$ 1.110	
	S	808	828	848	860	888	907	927	946	966	986	1.005	1.024	
P-3	D	728	748	769	789	809	830	850	870	889	908	926	945	$ 963
	S	679	698	717	735	753	772	790	808	825	842	859	876	892
P-2	D	604	622	639	656	674	691	708	725	743	760	777		
	S	566	582	598	614	630	645	661	677	693	708	724		
P-1	D	477	493	510	527	543	560	577	593	610	626			
	S	449	464	480	495	511	526	541	556	571	586			

D = Ajuste aplicable al funcionario con dependientes.

S = Ajuste aplicable al funcionario sin dependientes.

NOTA: Las sumas aquí mostradas se multiplican por el número de factores negativos asignados al lugar donde trabaja el funcionario y el resultado se deduce del sueldo básico.

CATIE
(U.S.$)

PhD's	1	2	3	4	5	6	Total
Recruitment & Repatriation	750					750	1500
Transportation of Personal Effects	6250					6250	12500
Installation Allowance	1650						1650
Family Allowance	1750	1750	1750	1750	1750	1750	10500
Education Allowance	1260	1260	1260	1260	1260	1260	7560
Insurance Coverage	500	500	500	500	500	500	3000
Home Leave		3000		3000			6000
Housing Allowances	4200	4200	4200	4200	4200	4200	25200
Pension Fund Retirement	1559	1607	1656	1706	1755	1805	10088
Basic Salary & P.S.I.	22460	23013	23565	24102	24639	25176	142955
Post Differential	3000	3000	3000	3000	3000	3000	18000
	43379	38330	35931	39518	37104	44691	238953

CATIE
(U.S.$)

MS's	1	2	3	4	5	6	Total
Recruitment & Repatriation	750					750	1500
Transportation of Personal Effects	6250					6250	12500
Installation Allowances	1650						1650
Family Allowance	1750	1750	1750	1750	1750	1750	10500
Education Allowance	1260	1260	1260	1260	1260	1260	7560
Insurance Coverage	500	500	500	500	500	50	3000
Home Leave		3000		3000			6000
Housing Allowances	4200	4200	4200	4200	4200	4200	25200
Pension Fund-Retirement	1248	1289	1332	1374	1418	1462	8123
Basic Salary & P.S.I.	18821	19318	19831	20343	20856	21357	120526
Post Differential	2550	2550	2550	2550	2550	2550	15300
	38979	33867	31423	34977	32534	40079	211859

FUELWOOD PROJECT - CATIE

ESTIMATED CATIE CONTRIBUTION & OTHER CONTRIBUTIONS TO THE PROJECT

(US $000)

		TOTAL		CATIE DIRECT		CATIE INDIRECT		HOST COUNTRY	
		P.M.	Amount	P.M.	Amount	P.M.	Amount	P.M.	Amount
	Principal Forester (Fuelwood)	72	252	72	252				
PhD	C. MacFarland	15	45	15	45	---	---	---	---
PhD	G. Budowsky	20	71	20	71	---	---	---	---
	Watershed Mgt.	24	72	24	72	---	---	---	---
PhD	G. de las Salas	24	72	24	72	---	---	---	---
MS	H. Jiménez	22	66	---	---	22	66	---	---
MS	F. Rosero G.	20	60	20	60	---	---	---	---
Agr.	J. Combe	22	66	---	---	22	66	---	---
PhD	W. Dyson	29	102	---	---	29	102	---	---
MS	N. J. Gewald	36	108	---	---	36	108	---	---
BUD	B. Palmer	18	63	---	---	18	63	---	---
BS	S. Hudson	7	21	---	---	7	21	---	---
	International Professionals	309	998	175	572	134	426	---	---
CHEM	M. San Román	7	7	---	---	7	7	---	---
MS	G. González	14	17	---	---	14	17	---	---
ENG	D. Rivera	7	7	---	---	7	7	---	---
	Host Country Manager	384	288	---	---	---	---	384	288
	National Professionals	412	319	---	---	28	31	384	288
	Secretaries 1 Full Time	72	54	72	54	---	---	---	---
	Field Assistants 1 Full Time	72	30	72	30	---	---	---	---
	Laborers	2138	214	---	---	---	---	2138	214
	Non-Professional Staff	2282	298	144	84	---	---	2138	214
	TOTAL PERSONNEL (100)	3003	1615	319	656	162	457	2522	502
	Post Graduate Stud.		144	---	---	---	144	---	---
	Short Courses		30	---	30	---	---	---	---
	Seminars/Workshops		60	---	60	---	---	---	---
	Training Costs (200)		234	---	90	---	144	---	---
	Regional Travel		18	---	6	---	12	---	---
	Local Travel		18	---	18	---	---	---	---
	Total Travel		36	---	24	---	12	---	---
	Office Equipment/Space		4	---	4	---	---	---	---
	Vehicles		30	---	30	---	---	---	---
	Agric. Equipment/Lab.		6	---	6	---	---	---	---
	Tools		6	---	6	---	---	---	---
	Audio Visual Equipment		2	---	2	---	---	---	---
	Equipment Costs (400)		48	---	48	---	---	---	---
	Communications (500)		111	---	36	---	75	---	---
	Maint. of Op. Equip. (600)		42	---	21	---	21	---	---
	Research Inputs (700)		27	---	12	---	15	---	---
	General Expenses (900)		48	---	30	---	18	---	---
	GRAND TOTAL	3,003	2,161	319	917	162	742	2,522	502

PEACE CORPS COOPERATION

The presence of Peace Corps Volunteers throughout the region (except Panama and, presently, Nicaragua) offers numerous benefits during Project implementation. During Project preparation Peace Corps Volunteers:

- participated in a survey of community fuelwood practices, and

- consulted with ROCAP officers on numerous occasions regarding technologies in use, tree farming practices and the relative merits of technology and fast growing tree development programs.

Central American Peace Corps Directors gave ROCAP their current projections for future volunteer assignments and provided helpful guidance on the project design.

Project implementation will benefit from the participation of some 46 Peace Corps Volunteers to support essential field work of CATIE and ICAITI with cooperating national institutions.

CATIE

With regard to the fuelwood production and area fuelwood balance methodology portions of the Project, volunteers may:

- participate in survey and field data collection on fuelwood species, cultural practices, critical area determination and demonstration areas or trials,

- assist national technicians to plant nurseries and field experiments, apply cultural practices and plot treatments and harvest experimental plots,

- supervise in the planting, culture and harvesting of demonstration plots,

- assist in organizing surveys and studies of rural and urban attitudes, preferences, costs and uses of fuelwood in the home, in business and in industrial enterprises, and

- participate in training courses on fuelwood research and demonstrations.

Trained volunteers in forestry, anthropology, rural sociology or agricultural economics will be needed during the six years of project life starting as early as possible. Leadership will be provided by the national project leaders with appropriate CATIE technicians.

Projected requirements for this segment of the Project are:

Post	Number PCVs	Person Years per PCV
CATIE	six (increase of two)	six
Costa Rica	four	six
El Salvador	four	six
Guatemala	four	six
Honduras	six	six
Nicaragua	six	six

ICAITI

With regard to the technology segment of the Project volunteers may:

- assist in selection of demonstration sites,

- participate in technology training and seminars,

- assist national counterparts and participating agency personnel in technology trials, supervision and evaluation,

- assist in planning dissemination programs for subsequent implementation by national cooperators, Peace Corps and other voluntary organizations.

Volunteers trained or experienced in appropriate technology, dissemination or training are preferred. Also included is one trained volunteer holding a BS or more advanced degree in mechanical or chemical engineering for assignment to ICAITI to support the work of the combustion engineering group.

	Number PCVs	Person Years
ICAITI	one	five
Costa Rica	three	five
El Salvador	three	five
Guatemala	three	five
Honduras	three	five
Nicaragua	three	five

The Peace Corps will assume total normal volunteer support costs except for modest project support for specific rural transport costs for access to project areas and to attend seminars or participate in research planning and experiment analysis at the two cooperating institutions (international travel and per diem).

CATIE DETAILED INSTITUTIONAL ANALYSIS

A. Organization

1. Summary History

CATIE is situated near the city of Turrialba, 70 kilometers southeast of San Jose, Costa Rica. The valley of Turrialba was selected in 1942 as the site for the headquarters of the Inter-American Institute of Agricultural Sciences (IICA) of the O.A.S. When the General Directorate of IICA was transferred to San Jose in 1960, it maintained at Turrialba those activities initiated in 1942: training and research in agriculture, animal husbandry, and forestry.

To carry out these functions IICA created the Centro de Enseñanza e Investigación (CEI) at Turrialba. From 1960 to 1969 the training of Latin American personnel in Turrialba was strengthened and that decade saw the steady growth of IICA's Postgraduate Training Program. In 1970 CEI became the Centro Tropical de Enseñanza e Investigación (CTEI), still a part of IICA and maintained the emphasis on postgraduate training; research continued as a back-stopping activity for training.

2. Creation of CATIE

On January 12, 1973, IICA and the Government of Costa Rica executed an agreement to create the Centro Agronómico Tropical de Investigación y Enseñanza (CATIE). This agreement was approved by Costa Rica's Legislative Assembly in June, 1973, and Turrialba was designated the headquarters of CATIE.

This non-profit autonomous organization, scientific and educational in nature, was created to promote and carry out research at different levels in the areas of agriculture, forestry, and animal husbandry, with the purpose of responding to the needs of the American tropics, particularly the countries of Central America and the Caribbean.

Upon establishing CATIE, its founders gave it a clear mandate to shift emphasis from teaching to research

with a sharp focus toward solving problems of the small farmer. Research was no longer to simply complement the Postgraduate Study Program but was to assume a more active role corresponding to the work carried out by national institutions in order to better respond to the perceived needs of the region's countries.

3. Current Organizational Structure

As of January 1978, CATIE's activities in the fields of research, training, and technical cooperation were reorganized into three functions (research, training and technical cooperation, and administration) thereby eliminating the previous departmental structure in order to give CATIE more flexibility in its new interdisciplinary research approach to solving the problems of small producers and to meeting its obligations in training and technical cooperation.

There are now three Sub-Directors immediately responsible to the Director of CATIE -- the Sub-Director for Research (Dr. Hector Muñoz), the Sub-Director for Training and Technical Cooperation (Dr. Eduardo Locatelli), and the associate Sub-Director for Administration (Mr. Gustavo Delfino).

The research activities under Dr. Muñoz include four programs: Annual Crops (headed by Dr. Pedro Oñoro), Perennial Plants (Dr. Gustavo Enríquez), Cattle and Small Farm Animals (Dr. Gustavo Cubillos), and Natural Renewable Resources (Dr. Gerardo Budowski). Dr. Locatelli is responsible for three programs: Postgraduate and Other Training and Technical Cooperation. Mr. Delfino is responsible for five CATIE administrative functions: finance, personnel management, communications, transportation, and agricultural machinery, maintenance and general services.

4. Organizational Relationships

a) Formal Agreements

CATIE's membership presently consists of Panama, Costa Rica, Nicaragua and Honduras. Each pay $50,000 annually. El Salvador has the membership proposal before their Congress at the present time; Guatemala is negotiating membership.

While CATIE's basic core budget has remained relatively stable since the Center's inception as an autonomous unit, the financial resources from external sources to carry out specific tasks have steadily grown. Collaboration with AID and the international community has increased significantly in recent years as discussed below.

Under a Project Agreement signed with ROCAP on February 13, 1979, CATIE is undertaking the Small Farm Production Systems Project (596-0083). In this effort, CATIE, in cooperation with national research institutions in Central America and Panama, is developing a regional program in agricultural research which: (a) places priority on the special needs of small farmers; (b) focuses on the whole farming system of the small farmer and the interrelationships among technology, services institutions, and economic, social, and cultural factors affecting small farm agriculture; (c) makes extensive use of field testing on small farmer plots to adapt basic research to local conditions; and (d) places special emphasis on developing methodology for developing farm level crop and animal systems, dissemination methods of research results, and recommendations to other small farms in other similar areas of Central America and Panama.

In the past ROCAP has assisted CATIE in conducting the Soil Fertility Project (596-0063), and Small Farm Cropping Systems (596-0064), the latter completed in March, 1979. These projects enabled CATIE to extend its activities to all the Central American countries, conducting research on small farms with the cooperation and participation of national research agencies. AID/W, in connection with the International Plant Protection Center (IPPC), is funding a regional project on weeds and their control. Other U.S. assistance includes that of a group of young professionals from the Peace Corps who assist in various projects.

Through its Technical Cooperation Organization (GTZ), the Federal Republic of Germany is assisting a Genetic Resources Project to preserve species of high genetic value that otherwise would be lost. The project will make materials available to interested countries as alternatives to the farming system components presently in use.

The International Development Research Center (IDRC) of Canada is financing a study of the importance of agricultural bi-products in animal nutrition and is supporting counterpart research personnel to work on farming systems for annual crops in Honduras and Nicaragua. Additionally, the IDRC is underwriting a cattle research project which CATIE developed for IDIAP (Panama). Two more projects being developed for IDRC financing will undertake research on systems for semi-arid zones and research on combined agriculture and forestry systems (agroforestry). The Canadian Government, through the Canadian International Development Agency (CIDA), grants fellowships to graduate students from Latin American countries to CATIE.

CATIE and the Inter-American Institute of Agricultural Sciences (IICA), are collaborating with the French Government in the translation and adaptation of the "Tropical Agriculture Handbook". The Government of the Netherlands has assigned resident scientists to CATIE and is the main sponsor for the Postgraduate Study Program which finances fellowships for professionals from all the countries of the American Continent.

Work in forestry documentation was initiated in 1977 by a technician assigned to CATIE by the Government of Switzerland in connection with its Technical Cooperation Office (CTS). This collaboration includes financing for publications, equipment, and operational expenses in addition to technical assistance.

Preliminary negotiations are underway with the Governments of Japan and Israel to obtain their cooperation in soils and training respectively.

Besides the project support from the governments of the more developed countries, CATIE receives support from several international organizations. With assistance from the World Bank (through the Central Bank of Honduras), CATIE is providing technical assistance to dairy cattle production in San Pedro Sula, Honduras, and a similar project with the Central Bank of Panama is being developed.

For many years the Organization of American States (OAS) has been granting fellowships for the Postgraduate

Study Program and has sponsored short courses in specific subjects. At present the OAS contracts CATIE to do research for the rural development of western Honduras, and a similar activity is under consideration for the Atlantic Zone of Costa Rica.

In support of management and conservation of natural resources in the Central American Isthmus, agencies such as the World Wildlife Fund (WWF), the International Union for the Conservation of Nature (IUCN), the Food and Agriculture Organization of the United Nations Educational, Scientific and Cultural Organization (UNESCO), have contributed to specific projects.

In joining the international network of institutions associated with the United Nations University (UNU), CATIE became the first member organization to carry out work in the area of natural resources conservation. CATIE and the Institute of Nutrition for Central America and Panama (INCAP) are the two Central American regional centers which are members of the UNU network.

CATIE has received assistance from both the Rockefeller Foundation and the Rockefeller Brothers Fund (RBF). The latter is currently supporting a project on Management and Conservation of Wild Lands in the region. Discussions have been initiated with the Ford Foundation and with the Kellogg Foundation for assistance in socio-economic studies and technology transfer training, respectively. In the private sector, the American Cocoa Research Institute (ACRI), has supported CATIE activities in the production of hybrid seed necessary for the expansion of cacao plantations in this hemisphere.

b) Formal and Informal Working Relationships

CATIE now has close ties with the International Potato Center (CIP), one of whose scientists has been assigned to CATIE since 1976 on a research project aimed at the production of potato varieties for the low humid tropics. These varieties could be of importance as alternative crops in the farming systems of the area. In April 1978, CATIE signed an agreement with CIP to establish the latter's regional office for Central America and the Caribbean with CATIE at

Turrialba. CATIE's farming system research has led to a regular exchange of related information with other international centers doing related research. Among these are the International Rice Research Institute (IRRI), the International Institute of Tropical Agriculture (IITA), and the International Crops Research Institute for the Semi-Arid Tropics (INCRISAT). Contact is also maintained with the Asian Vegetable Research and Development Center (AVRDC), the International Board of Plant Genetic Resources (IBPGR), and the International Fertilizer Development Center (IFDC). CATIE also maintains professional contacts with Oregon State University, and the Universities of Florida, Iowa, and Kentucky.

Within the region there are several organizations with which CATIE coordinates its programming and project development and implementation. The Secretariat for Central American Economic Integration (SIECA) plays a fundamental role in the formulation, coordination, and promulgation of regional agrarian policies. CATIE maintains special coordinating relationships, including mutual support for shared project objectives with ICAITI, INCAP, the Regional Organization for Plant and Animal Sanitation (OIRSA), and the Central American Bank for Economic Integration (CABEI).

Because of its historical association with IICA, CATIE continues to work closely with that organization. The work in research, training, agricultural information generation and transfer as well as technical assistance that both institutions carry out in the Isthmus, requires effective coordination to maximize results.

B. Infrastructure

1. Lands

CATIE's central facility covers 1,069 hectares of the Turrialba Valley, bordering the western side of the City of Turrialba. Most of this land is relatively flat. The soil lends itself to such crops as coffee, sugar cane, cacao, improved pasture, citrus and other fruit trees, vegetables, and forest trees as well as livestock. There are seven major soil series found at CATIE: Reventazón,

Turay, Institute Clay, La Margot, Cervantes, Colorado, and Birrisito (as well as other miscellaneous soils). Of the total land area some 266 hectares are devoted to crop research programs, 287 to animal research production, and 100 to the natural renewable resources program (including forests). 396 hectares are used for residential areas, buildings, and landscaped areas (the remainder is in commercial production or a reserve).

Some 60 kilometers from Turrialba, between Siquirres and Port Limón on the Atlantic slope of Costa Rica, CATIE has another farm, "La Lola", 102 hectares in size. The climate there is warm and humid with an annual average rainfall of 3500 millimeters. The original vegetation of the area was wet tropical forest. Presently it is dedicated principally to production research development and multiplication of cacao hybrid seed and the commercial production of cacao. Some combined agriculture and forestry studies also are being undertaken at this facility.

2. Buildings and Facilities

CATIE's main facilities include four office buildings, a conference hall and other meeting rooms, classrooms, and teaching laboratories. There are also laboratories and facilities for soils, plant pathology, wood technology, computer technology, entomology, plant physiology, animal nutrition and physiology and languages. The Center has 13 greenhouses, a herbarium, two cold chambers for genetic materials, an arboretum, nurseries, and a meteorological station. Presently under construction is a new 24 room dormitory and a warehouse/workshop.

Added since the creation of CATIE have been a building for the Cattle and Small Animals Program and one for the Soils Laboratory, a cold chamber for genetic resources, an apartment building to house visiting scientists, an enlarged potable water supply with an internal purification system, and facilities for drying and processing cacao seeds. Most of these facilities have been built with funds derived from the sale of lands.

The Orton Memorial Library was retained by IICA upon the creation of CATIE but is still located in Turrialba, serving the region's countries as well as technicians and

students at CATIE. This library, reputedly the finest agricultural library in Latin America, houses over 80,000 volumes, 2300 titles of periodicals, and 110 titles of bibliographical indexes and abstracts.

Other CATIE facilities include three dormitories for bachelor students, 11 apartments for married students, one guesthouse, one apartment building for visiting scientists, 48 residences for technicians, a cafeteria, a recreation center with swimming pool and sports areas, and two school buildings, one for an elementary school and the other for a kindergarten.

3. Equipment

All laboratories are adequately equipped for requisite research and teaching (the modern soil laboratory has a capacity for analyzing 200 samples daily).

CATIE maintains a motor pool of some 60 vehicles (buses, utility vehicles, carryalls, microbuses, sedans, trucks) and a fueling station. It also is equipped with agricultural machinery including tractors, bulldozer, loader, and spray equipment for the commercial farm operation (coffee and sugar cane). The dairy farm has a mechanical milking facility and operates a creamery.

Center equipment also includes Hewlitt-Packard and IBM Computers for processing experimental data. The conference room is equipped with slide film projectors as well as an opaque projector.

4. Professional Staff

Attached is the professional staff list of CATIE personnel in the Natural Renewable Resources Division (Exhibit I), as well as the job descriptions of the senior and junior professional staff to be employed under the proposed project (Exhibit II).

CATIE PERSONNEL AS OF 8-31-79
NATURAL RENEWABLE RESOURCES DIVISION

Degree	Name	Professional Description	Country of Citizenship	Financing Source	Allocation of Time to Fuelwood Proj.
	Professional Personnel (13)				
PhD	Gerardo Budowsky	Dasyonomist-Program Head	Venezuela	CATIE	50%
PhD	Gonzalo de las Salas	Forester, Specialist in Forest Soils	Colombia	CATIE	50%
MS	Pablo Rosero G.	Dasyonomist - Forestry Management	Ecuador	CATIE	50%
MS	Frank Zadroga	Specialist in Hydrographic Basin Management	USA	CATIE	
AGR. ENG.	Jean Combe	Forester	Swiss	B	50%
PhD	William Dyson	Geneticist, Specialist in Fast Growing Species	England	A	50%
MS	Nico Jan Gewald	Tropical Forester	Holland	D	50%
BS	John M. Hudson	Forestry Engineer-Specialist in Forest Fires	England	A	
MS	Craig Macfarland	Wild Area Management	USA	E	
MS	Humberto Jimenez S	Specialist in Agro-Communication	Colombia	CATIE	
	Stationed at University of Costa Rica Laboratory				
Chem. Eng.	Manuel de San Roman	Wood Processing Assistant	Costa Rica	C	33%

CATIE PERSONNEL AS OF 8-31-79
NATURAL RENEWABLE RESOURCES DIVISION

Degree	Name	Professional Description	Country of Citizenship	Financing Source	Allocation of Time to Fuelwood Proj.
MS	Guillermo Gonzalez	Chief of Laboratory of Forestry Products	Costa Rica	C	33%
Eng.	Daisy Rivera G.	Wood Anatomy Specialist	Costa Rica	C	33%
	Support Personnel (13)				
	Flor de Celia Pacheco de R.	Executive Secretary	Costa Rica	CATIE	
	Zaritza Chaves M.	Secretary	Costa Rica	CATIE	
	Ana Lorena Calvo	Secretary	Costa Rica	B	
	Ana Grace Hidalgo de M.	Secretary	Costa Rica	E	
	Amalia Vega A.	Secretary	Costa Rica	C	
	Oscar Ramirez	Laboratory Assistant	Costa Rica	C	
	Manuel Sequeira	Laboratory Assistant	Costa Rica	C	
	Rafael Aguero A.	Field and Laboratory Asst.	Costa Rica	CATIE	
	Oscar Ovares	Field and Laboratory Asst.	Costa Rica	CATIE	
	Alexis Ramírez	Field and Laboratory Asst.	Costa Rica	CATIE	
	Roger Morales	Investigation Assistant	Costa Rica	E	
	Francisco Solano	Janitor	Costa Rica	C	
	Victor Aguilar	Carpenter Assistant	Costa Rica	C	

Notes: Source of Financing

A. Overseas Development Ministry (ODM) Great Britain
B. Directorate of Development Corporation and Human Assistance - Swiss
C. University of Costa Rica/Ministry of Agriculture - Costa Rica
D. Netherland Kingdom
E. Rockefeller Brother Fund (RBF)

JOB DESCRIPTIONS - CATIE

General

Senior Professional Staff should hold the degree of either Ph.D. or M.S. or have other equivalent qualification plus experience and exceptional capability in his field work in LDCs, and should have an appreciation of and a commitment to interdisciplinary planning, execution and analysis of forestry research, not only within the CATIE project group, but also in collaboration with the technical personnel of cooperating institutions. A major part of the activities of the Senior Professional Staff will be in critical and potentially critical areas for fuelwood availability in the cooperating countries.

1. Energy Specialist

The energy specialist will have the overall responsibility for the development of an area fuelwood balance methodology. He will participate in the selection of critical and potentially critical areas. He will develop guidelines for the gathering of reliable statistical data on fuelwood consumption in CAP on a national basis. He will participate in the interpretation of data generated throughout the project period.

2. Silviculturist of Fast-Growing Species (Senior Forester, Ph.D. Level)

The Silviculturist will have the responsibility for the analysis of the existing trial plots and for the planning, design, execution, management and analysis of new experiments He will plan an important role in the determination of critical and potentially critical areas for fuelwood availability and participate in the development of the area fuelwood balance methodology. He will participate in the study of tree-environment interactions and the identification of traditional agroforestry techniques important for fuelwood production. He will design new agroforestry experiments.

He will select fuelwood species to be introduced in selected areas, design experiments to test these and design management trials for existing vegetation as well as for plantations.

3. Fuelwood Project Representatives for the Six Countries (Junior Silviculturists, M.Sc. Level)

Three forest research project representatives will provide CATIE leadership for the fuelwood related activities, at the national level, in the six CAP countries.

These professionals, resident in CAP countries, will cooperate with other project personnel resident at CATIE in all activities, including the conduct of baseline surveys and field trials, and experiments of mutual concerns. In addition, they will serve in the same capacity as the CATIE resident professionals to develop close collaboration with relevant national institutions and their technical personnel. They will be the points of contact between national personnel and CATIE project staff in the planning and analysis of project results at the national level, and in the management of the field work and training.

4. Land Use Specialist in the Field of Natural Resources (M.Sc. Geography)

This specialist will, in close collaboration with the rural anthropologist/sociologist, plan, design and implement a field survey in CAP in order to determine critical and potentially critical fuelwood availability areas. He will prepare current land use maps of these areas using aerial photography and draw new detailed maps of the demonstration areas. He will participate in training at different levels and organize a course on aerial photointerpretation for forestry and land use, principally as these relate to fuelwood production.

5. Rural Anthropologist/Sociologist

The rural anthropologist/sociologist will, in collaboration with the land use specialist, plan, design and implement a survey in CAP in order to determine the critical and potentially critical areas for fuelwood availability. He will analyze the questionnaires especially prepared for this project and indicate limiting socio-economic factors for the establishment of fuelwood production units. He will give the outline for the project's sociological approach to make the project activities readily acceptable to the rural communities.

The anthropologist/sociologist will participate in training at different levels and prepare information on which technology transfer can be based.

6. Economist (Natural Resources Use)

In collaboration with the rural anthropologist/sociologist

and the silviculturist, this economist will put the survey results in an economic context. Furthermore, he will design and implement accounting methods necessary for the analysis of costs and benefits of the activities carried out in the fuelwood demonstration units. In this analysis he will determine the economic soundness of the different techniques under trial, evaluating tangible as well as non-tangible benefits and drawbacks. He will study transport and marketing processes for fuelwood and indicate the limiting factors requiring special attention. He will design methods to achieve higher efficiency of fuelwood production with a low-cost input. He will be involved in teaching at different levels.

7. Information Transfer and Use Specialist

This specialist will be active during the last years of the project when trials and fuelwood demonstration units start to yield results of sufficient reliability. The extensionist will be required to organize information transfer activities such as short courses, slide/film shows, field days, extension informative publications, radio transmissions, and other audio-visual techniques on fuelwood production and use.

Short Term Consultants

During the Project, specialists working in fuelwood and charcoal production and utilization will be called upon to visit Project activities in the countries to assist in conduct of the various field trials.

These consultants will be hired from Latin America, Africa or Asia. They will be experienced in selection of species, charcoal production, and/or utilization of fuelwood by rural communities. Broad experience on plantation techniques, management procedures and problems faced, particularly acceptance by rural populations, will be an important aspect of their consultations. They will also assist the Project regarding alternate land use practices and be knowledgeable on various socioeconomic aspects.

One consultant should be a charcoal specialist, who shall determine the efficiency of traditional charcoal techniques and design and put into practice alternative more efficient production methods. Total estimated services are 32 person months over the six year life of project.

CATIE's Linkage to National Institutions

Under this Project, CATIE will have the opportunity to build upon existing links to several national and regional institutions. All of the region's Ministries of Agriculture or agencies therein have memoranda of understanding with CATIE. In addition the governments of Panama, Costa Rica, Nicaragua and Honduras are now members of CATIE and contribute to its core budget support. Other institutions, both public and private have indicated an interest in working with CATIE in the area of fuelwood production and will be encouraged to take part in the Project effort. The following discussion identifies some of the key institutions in each country that are already working with or are expected to work with CATIE.

Panama

The Ministry of Agriculture (MIDA) and its Dirección de Recursos Naturales Renovables (RENARE) will be the primary public sector collaborators in that country. RENARE and MIDA are extremely interested in natural resource conservation and have planted tree trials themselves and in collaboration with the FAO, which will be used as a source of data for this project. RENARE will be the primary counterpart institution to CATIE in Panama. It will have overall responsibility for implementation of project activities in that country. In addition, RENARE will coordinate this project's fuelwood production activities with the more general forestry and conservation related activities of the Panama Watershed Management project approved earlier this year.

The Summit Botanical Gardens, soon to become a part of Panama, will be a potential source of seed and technical experience because it has tree species from various parts of the world. These could be useful to both Panama and other countries of the region. In addition, the Universidad de Panama and its Escuela Técnica Forestal have data, expertise and interest in the fuelwood production area and can serve as valuable advisors to or collaborators in this Project.

The Instituto de Recursos Hidráulicos y de Electrificación (IHRE) is working on watershed and forest resource conservation. They will be encouraged to collaborate with this project and utilize data and plant material developed for watershed conservation, erosion control and fuelwood production.

In the private sector, the banana companies, natural resource conservation associations and numerous private farmers have plots of trees that can yield valuable growth, consumer wood acceptability and economic data useful to Panama, the Project and to other CAP countries.

Costa Rica

Various institutions in this extremely resource conservation conscientious country will collaborate with CATIE to carry out the activities of this Project. CATIE and the Ministerio de Agricultura's (MAG) Dirección Forestal are expected to collaborate in the reexamination of the 1967-1968 FAO field plots in various parts of the country, review new MAG (FAO) and AID/MAG upper Reventazón Watershed tree plots, collaborate in the critical area survey, and develop new fuelwood species experiments and fuelwood demonstrations with fast-growing species. The Dirección will be CATIE's principal counterpart institution in Costa Rica and will have overall responsibility for project implementation.

In addition, CATIE will seek out the collaboration of the USAID MAG group working on the new AID Natural Resources Conservation Project. They plan to also contact the Instituto Costarricense de Electricidad (ICE), the Junta Administrativa de Desarrollo de la Vertiente Atlántica (JAPDEVA), the Instituto de Tierras y Colonización (ITCO), the MAG's Extension service, banana companies, the Universidad de Costa Rica, the Instituto Tecnológico de Costa Rica and the Peace Corps for collaboration in carrying out the critical area survey and planting trials and demonstration plots.

Nicaragua

The new Nicaraguan government has indicated to CATIE its interest in participating in this program. The

Ministry of Agriculture's (MAG) Dirección de Recursos Naturales Renovables (DRNR) is expected to take the lead role in the execution of this project in Nicaragua. DRNR and MAG technicians and the extension services as well as the Instituto de Fomento Nacional are expected to collaborate in conducting surveys for the identification of the most serious fuelwood availability (critical and potentially critical) areas of that country. They will also collaborate in planting and collecting data on existing and new plant species potentially useful for fuelwood, conducting social acceptability studies of wood species for home and industrial use and other elements of this Project.

As the project progresses it is expected that land reform recipients, private sector social organizations, and the University will collaborate in one or more phases of this Project.

The Instituto Nacional de Tecnología Agropecuaria (INTA) and the Overseas Development Ministry of Great Britain had a tree production project, which ended in 1978 and which can provide valuable data on tree growth and seed material to this Project.

Honduras

Various institutions in Honduras have extremely valuable data for the Project. They can be expected to collaborate in one or more phases of the program. The Corporación Hondureña de Desarrollo Forestal (COHDEFOR) has worked with CATIE previously as has the Dirección General de Recursos Naturales (DGRN). COHDEFOR will be CATIE's principal counterpart in Honduras. Both COHDEFOR and the DGRN will be valuable sources of data for a range of plant species in Honduras that are growing under different ecological conditions. Also, the Escuela Nacional de Ciencias Forestales (ESNACIFOR) which trains most of the country's practical foresters has plant data. It will be invited to collaborate in training courses and to carry out demonstrations of existing and new tree species for fuelwood production.

The Lancetilla Botanical Gardens, formely operated by the United Brands Corporation and now by the GOH, has various exotic tree plantings and is an extremely

important seed source. Data from these plots, and from the FAO/MRN/COHDEFOR projects at Lake Yojoa and Choloma as well as the CATIE/OAS project at Santa Rosa de Copán will be valuable to the Project. Also, the plantings, seed propagation, the most complete collection of Central American botanical samples and the forestry nursery activities of the Excuela Agrícola Panamericana, as well as the Holdridge Life Zone survey soon to be carried out in Honduras, will provide extremely valuable inputs to a range of activities planned under the Project.

The Peace Corps' past and ongoing activities in resource conservation and tree production will be reviewed and their active collaboration in this CATIE project will be solicited.

El Salvador

No other country in the CAP region has as serious a fuelwood availability situation as does El Salvador. The Ministerio de Agricultura's (MAG) Dirección de Recursos Naturales Renovables, Servicio Forestal (DRNRSF), the Centro Nacional de Tecnología Agropecuaria (CENTA), the Instituto Salvadoreño de Tierras Agrícolas (ISTA), and the Electricity Institute are all extremely concerned with deforestation and production of fuelwood. Research work on leucaena for fuel and animal feed is being carried out by the public sector as is the planting of a number of tree species for forest products, fuel, erosion control, agro-forestry, and windbreaks. These and private plantings in various parts of the country are expected to yield valuable data on trees, their ecological adaptability (especially to drier-short rainfall situations) and potential for fast-growing fuelwood production.

Collaboration by the MAG and its dependencies in forestry and CENTA will be the linchpin for Project activities in El Salvador. The DRNRSF will be CATIE's primary counterpart institution in El Salvador. However, all of the aforementioned are expected to collaborate actively in the critical area surveys, developing data on existing and new fast-growing socially acceptable species, cultural practices experiments, and other activities programmed under this Project. Due to the extreme seriousness of the fuelwood problem in El Salvador there

is little doubt that one of the community energy balance methodology test areas will be located in that country.

The Peace Corps in that country is extremely interested in the fuelwood situation and its solution. CATIE will request a number of Peace Corps volunteers to work with national technicians, communities and small farmers on various elements of this effort.

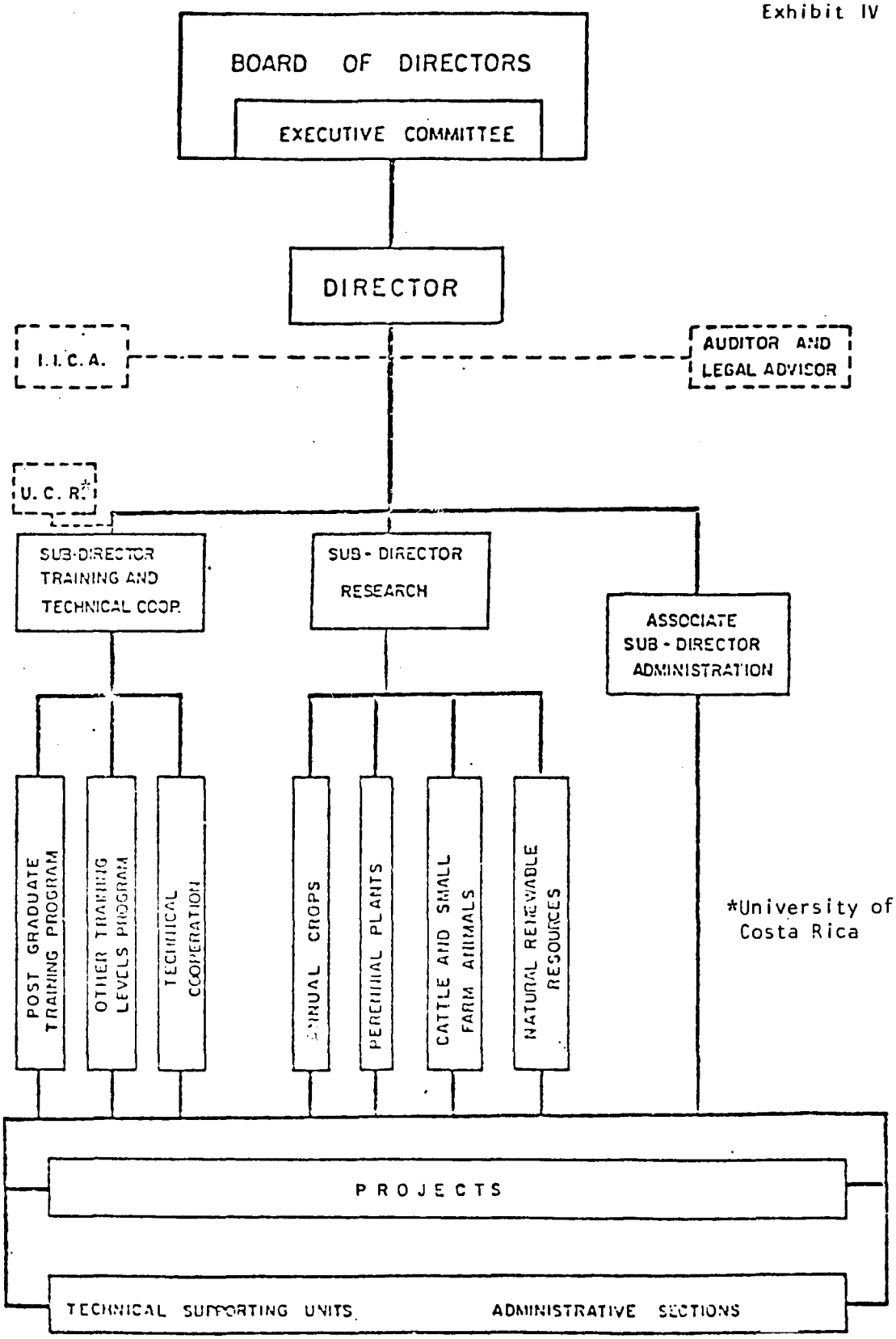
Guatemala

In Guatemala, there is growing interest in non-conventional and fuelwood energy production and use. ROCAP has had formal expressions of interest in this project from the National Planning Council and the Minister of Economy. CATIE's Director has been informed by a Vice-Minister of Agriculture that the Ministry of Agriculture is extremely interested in this project and as a result will push for full paying membership in CATIE. It will also actively support research and training on fuelwood production through its forestry agency, the Instituto Nacional Forestal (INAFOR), and extension service. INAFOR will be CATIE's primary counterpart agency in Guatemala. CATIE also expects to work with the Instituto de Ciencia y Tecnología Agropecuaria (ICTA), the Electric Institute (INDE), the Fomento y Desarrollo del Petén (FYDEP), and the banana companies.

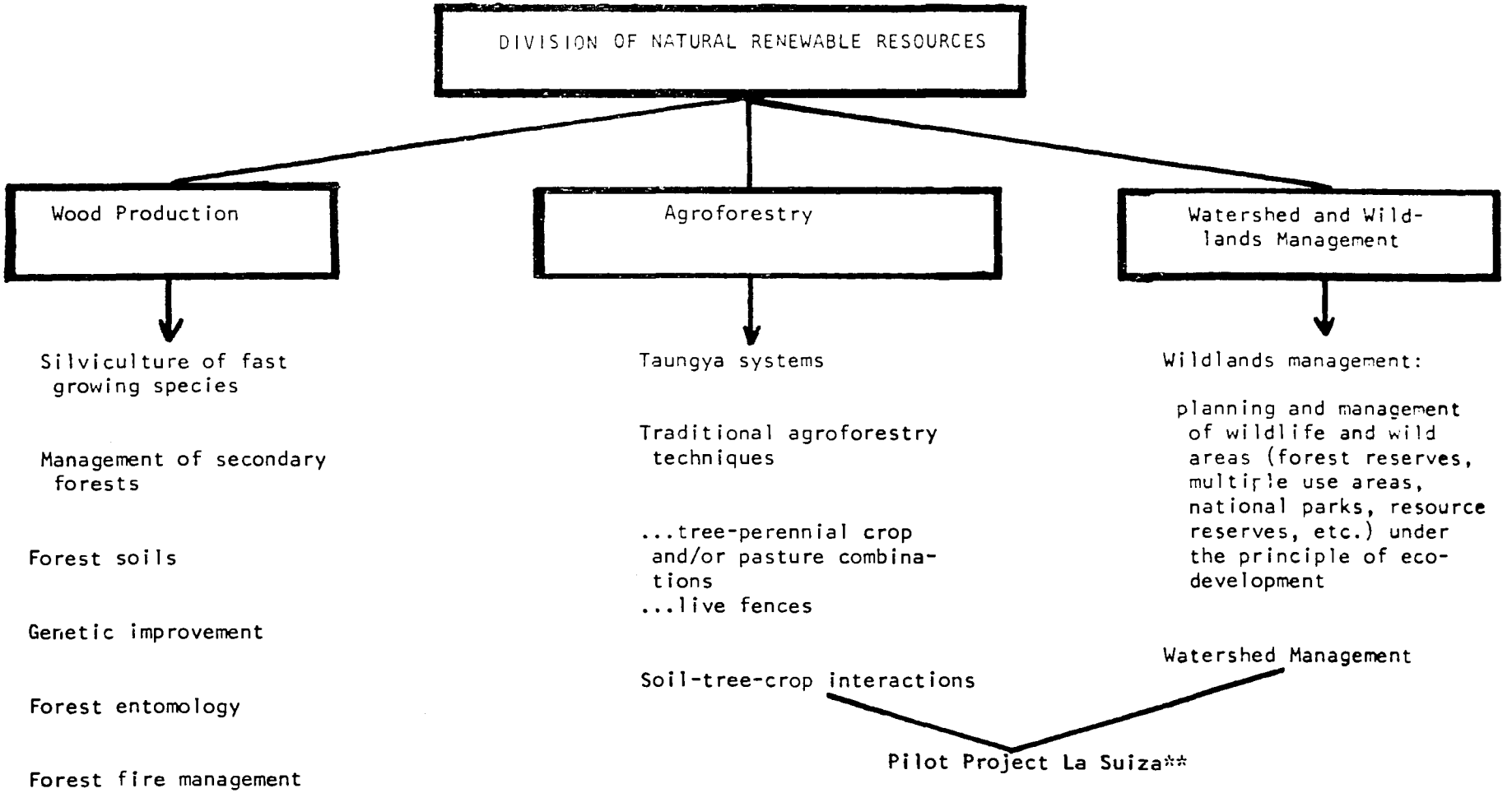
INAFOR, INDE and the banana companies have established trials and collected growth and adaptability data for a range of trees having fuel production potential in Guatemala. CATIE also expects to work with INAFOR, ICTA, and INDECA on surveys to determine critical and potentially critical areas and on agroforestry experiments and demonstrations.

CATIE ORGANIZATIONAL STRUCTURE

ANNEX XVI
Exhibit IV



CATIE DIVISION OF NATURAL RENEWABLE RESOURCES



ANNEX XVI
Exhibit V

SECRETARIA DEL CONSEJO NACIONAL DE PLANIFICACION ECONOMICA

GUATEMALA, C. A.

AUG 6 3 00 PM '79
FILE COPY
ROCAP/GUATEMALA

NUMERO 2179
CLASIFICACION SSG-P-302-79

Sírvase referirse al número y clasificación de esta nota

6 de agosto de 1979

ACTION Asesores
INFO Hector Estrada
Desarrollo Regional

Sr. Harry Ackerman, Director
Oficina Regional de Programas
para Centroamérica - ROCAP -
Ciudad

Señor Director:

El Instituto Centroamericano de Investigación y Tecnología Industrial - ICAITI -, ha informado a esta Secretaría General de las conversaciones que actualmente se están realizando con ROCAP sobre un "Programa de Energía de Fuentes no Convencionales en la Región Centroamericana".

Al respecto, deseamos manifestarle que por razones obvias el Gobierno de la República ve con profunda simpatía el desarrollo del referido Programa, por lo que apreciaríamos que ROCAP considere el financiamiento requerido, a fin de que pueda comenzar a ejecutarse a la mayor brevedad posible.

No está demás indicar al Señor Director que esta Secretaría General desde ya ofrece todo su apoyo al Programa.

Al agradecer al Señor Director la atención a la presente, aprovecho la oportunidad para reiterarle las muestras de mi más alta consideración.

Julio César Segura Trujillo
Secretario General

RVR/sdea

ACTION COPY
THIS COPY MUST BE RETURNED TO CENTRAL FILE INDICATING THE ACTION TAKEN AND DATE.
ACTION TAKEN Leído

DATE	INITIALS
8/9/79	K.H.

MINISTERIO DE ECONOMIA

GUATEMALA, C. A.

AUG 10 8 40 AM '79

FILE - ROM
ROCAP/GUATEMALA

1193

8 de agosto de 1,979.-

ACTION Ackermann
INFO Hechtman
Sundermann

Señor
Harry Ackermann
Director de ROCAP
GUATEMALA

Estimado señor Ackermann:

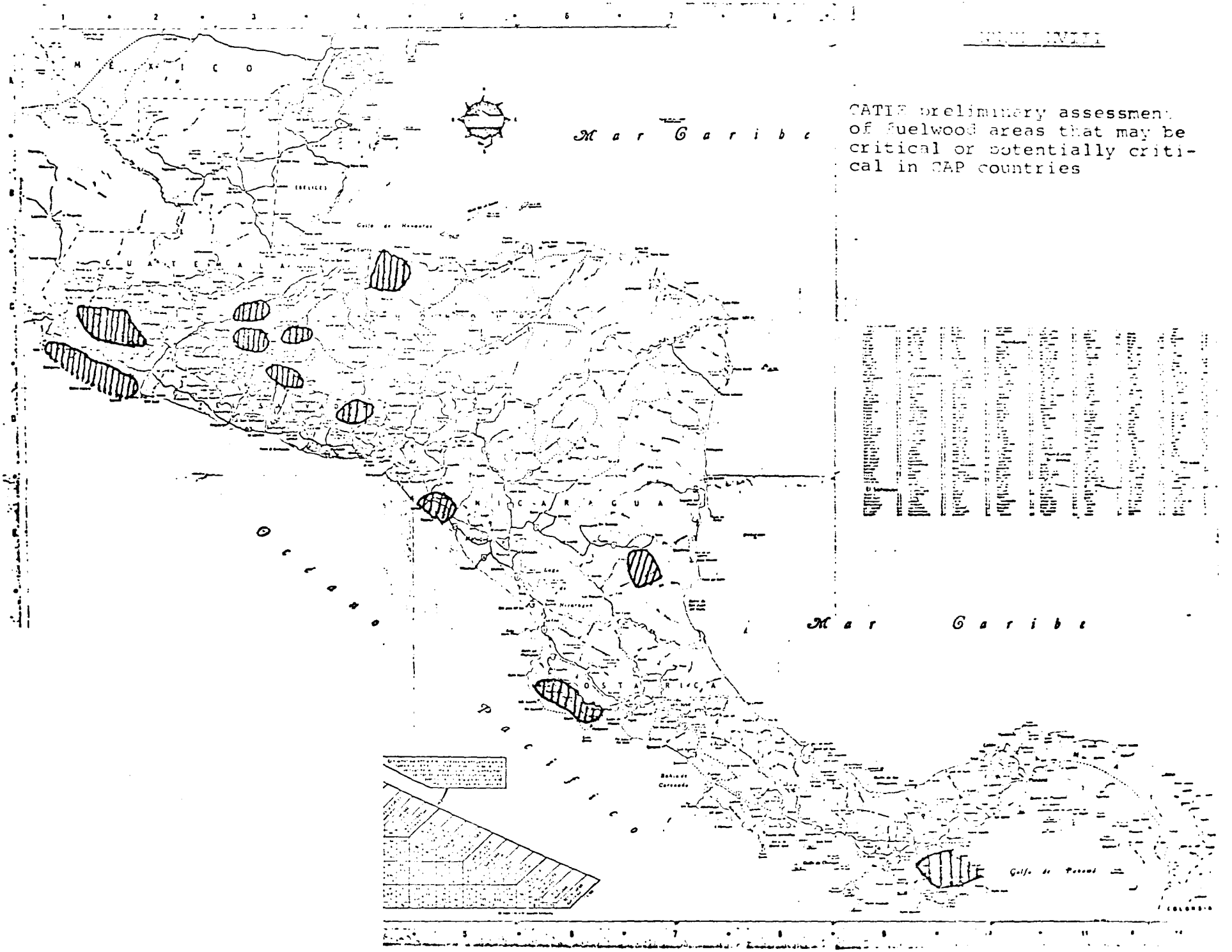
El ICAITI ha puesto en mi conocimiento las gestiones que está realizando ante ROCAP, tendientes a obtener financiamiento para un programa de energía de fuentes no convencionales en la región centroamericana.

Como considero que el programa antes mencionado redundaría en beneficio de los países del área centroamericana, de la manera más atenta ruego a usted se considere favorablemente la gestión del ICAITI, la cual, en mi carácter de Presidente del Comité Directivo del ICAITI y de Ministro de Economía de Guatemala, me es grato apoyar en su totalidad.

Agradeciéndole la atención que se sirva dispensar a la presente, hago propicia la oportunidad para saludarlo con muestras de consideración y alta estima,

Lic. Valentín Solórzano Fernández
MINISTRO DE ECONOMIA

VSF'GICI'bemmdeh



CATIE preliminary assessment of fuelwood areas that may be critical or potentially critical in CAP countries

SHRUB AND TREE SPECIES FOR ENERGY PRODUCTION

This Annex discusses presently known species and provenances which will be considered, among others, for test plantings under this project. It also discusses considerations on the introduction of new species into the region.

Managed Natural Forest vs. Plantations

Managed natural forests may be a valuable source of fuelwood in some fortunate locations of Central America. In the critical fuelwood scarcity areas, with which this project is mainly concerned, accessible forests will already have been heavily exploited and seriously depleted. In such circumstances, various types of fuelwood plantings will be necessary to provide accessible and socially, as well as economically, acceptable sources of fuelwood.

Natural forests produce much of their woody biomass in forms not readily utilizable by small farmers or by small rural industries. Much of the lowgrown undergrowth is in the form of small twigs, lianas and tree ferns. The material produced in acceptable sizes for burning usually comprises many species of trees and shrubs, which dry and burn at different rates and require sorting before use. In contrast, fencerows, agroforests and plantations can produce larger amounts of more uniform material, in preferred sizes of types having greater consumer acceptability. Too, plantations are normally more productive of a particular type of material than natural forests because all plants are in a more active growth stage than in natural forests, and biomass production can be concentrated in a few selected species harvested at the correct stage of growth.

Against these advantages of uniformity, accessibility and productivity, solid stands in a given area with a single or a very few species in the tropics may lead to undesirable changes in the site or build-up of disease and pest organisms. This phenomenon is not unique to trees, but also takes place in such diverse situations as cotton (bole worm) and bananas (late blight). Examples of such problems in

Central American forests already exist in the pine borer, which is attacking natural pine forests, and a borer of mahogany which decimates solid plantings. These risks are accepted in agriculture, where solid stand plantations of most cereals and other crops are the norm, but they do imply the necessity for vigilance in management and access to alternatives.

Exotic Species vs. Indigenous Species for Plantations

Objection is often raised to the use of exotic or imported species for forestry plantations, and the principal reasons for their use should be stated. First, an exotic species may have unique properties not available in any indigenous species. Teak, native to the Philippines and the Malay Archipelago, for example, is a remarkable wood for ship decking and furniture woodworking. Second, provided they are reasonably well adapted to local site and climatic conditions, imported species usually are more productive than indigenous species because they have a smaller parasite load; i.e., they escape most of their home parasites and only a part of the local parasites in their new country can attack them. By contrast, indigenous species always carry their full load of parasites (which may intensify by growing them in plantations) which they are well adapted to withstand, but only at cost in productivity. This in part is the reason that coffee, which is native to Ethiopia, produces best in the Americas, cacao, native to Mexico and Central America, produces best in West Africa, and rubber, native to tropical Brazil, grows best in Malasia and Indonesia.

Third, an exotic may be easier and cheaper to manage than any indigenous alternative for a specific end product. Moreover, while an indigenous species may apparently perform well in its natural environment, it is often found that it does not grow well in artificial plantations.

Generally speaking, all species must be tested individually for the purpose intended on the site(s) available, regardless of whether they are native or exotic. Against their advantages, however, must be set the risk of disastrous disease or pest attack on single species, and requirements

for some up-grading of the environment for imported species to achieve maximum yield. Such up-grading may be quite simple and inexpensive, e.g., improved early weeding of the crop, or simple fire control measures.

Type of Material Required for Firewood

On a dry weight basis most species of wood yield about 4.7 k cals/g. on total combustion. Coniferous woods, and some hardwoods, have slightly higher values because they contain resins or gums which have higher heats of combustion than basic wood substance. This does not mean that all kinds of wood are equally acceptable and useful for firewood. Preferred firewood species have dense, hard wood, which gives a steady hot burn; should have a grain whose conformation permits easy splitting to facilitate drying and cutting to the required size; should have straight stems and branches, which permits stacking and transport; and should dry relatively rapidly when stacked under cover. The genera *Acacia*, *Albizia*, *Platanus* (Sycamore), *Alnus* (alders) are remarkable in each having a number of species which combine most of these properties with fast growth. Traditional favorites, such as fruitwood in temperate Europe, olive in the Mediterranean and indigenous acacias in Africa and Asia, are often crooked and slow-growing but meet the other criteria. In tropical coastal areas some mangrove species produce preferred firewood. Unfortunately, it is the slower growing species which produce the best firewood and mangrove forests are easily over-exploited and damaged by intensive firewood extraction. Indeed, in Central America the value of mangroves for fishery conservation probably far exceeds their value as a source of fuel.

List of Species Worthy of Trial in the Present Project

Species are grouped by broadly defined altitudinal and climatic zones.

(a) High altitudes, above 1750 m, with reliable rainfall, temperate mean annual temperatures and soils usually moderately fertile but often shallow locally:

Alnus jorullensis. (Indigenous to Central America)	Colonizing species established easily on moist bare soil

	surfaces; sprouts easily from root suckers; known to enrich the soil by nutrifying root nodules; wood is soft, pinkish, stable, in demand for shoe soles, dairy utensils and turning; bark can produce withies (strips of wood) suitable for basket work; produces fuel and charcoal of moderate quality. Familiar species in Central America. Already in use.
Acacia mearnsii A. Decurrens (Australia)	Very easily established on bare soil surfaces by direct seeding; regenerates from self-sown seed after felling and burning. Fast growing; produces dense, gummy timber which gives excellent fuel and charcoal; heartwood makes durable posts and sapwood is easily impregnated with preservatives. Bark formerly used for tanning and is easily stripped to accelerate wood drying. Produces dense crops of withies. Silvicultural techniques very well known in many parts of the world.
Acacia melanoxylon (Australia)	Similar to A. mearnsii but grows to larger sizes and usually is straighter. Requires moister sites in the initial juvenile stages. Later growth stages finds this species highly adaptable to a variety of sites (moist to harsh).
Eucalyptus globulus (Australia)	Very fast growing, easily established by planting, and regenerates well by coppice after felling; resistant to mild frosts. Wood pale colored, dense, somewhat gummy and yielding excellent firewood and charcoal, and also is widely used

	for pulpwood chips. Bark fragments when hammered, making for easy debarking which is necessary for rapid drying. A world famous exotic plantation species for which silviculture and management are very well known. In India, used as a source of Eucalyptus oil. Now grown in Central America.
E. maidenii and E. bosistoana	Are very similar but suited to rather lower altitudes and clayey soils.
E. regnans E. gigantea E. fastigata E. cloezinnia (Tasmania and Australia)	Produce very large trees, usually of superlatively straight stem form and on good sites have the fastest growth of any Eucalyptus. Bark tough and fibrous, difficult to remove. Wood from old trees is sought after for timber, but smaller sizes make superlative poles and excellent firewood, easily established by planting; often regenerate well from self sown seed after felling; usually does not coppice well.

(Some Cypresses and Pines grow well at these altitudes but would normally be planted for timber rather than for fuel for which they can also be used).

(b) Medium altitudes 600-1800 m. Moist climate with over 1000 mm annual rainfall in two seasons, or greater than 1400 mm if there is a long dry season.

Eucalyptus grandis Eucalyptus saligna	Easily established from seedling transplants; regenerates very well from coppice. Very fast growth and straight stem form (when grown from selected seed); produces pinkish, gummy timber, excellent for fuel and charcoal. Straight

	growth, yields high quality poles of which sapwood is easily impregnated with preservative; bark fragments on hammering and hence easily removed for drying. A popular exotic for which silviculture and management practices are well known. Now grown in Central America.
Eucalyptus aurophylla also known as (Brazil "alba") The species is native to Australia; a Brazilian landrace merits special comparison with native Australian material)	Similar to above but yields paler colored timber, more suitable for pulp chips. Prefers a slightly cooler, more seasonal climate than E. grandis. Techniques extremely well developed in Brazil. Brazil landrace under test in many other areas.
E. delegatensis	Similar to above, with excellent straightness and high production potential. Less well known and merits further investigation.
E. maidenii E. bosistoana	See above under E. globulus, but these species suited to heavy soils at lower elevations.
E. paniculata E. marginata	Easily established from transplants and coppices well. Slower growing than E. grandis but usually very straight and produces brownish, dense, heavy, durable wood. Excellent for fuel, fence posts and tool handles and, in larger sizes, for heavy construction (bridge building, dock works, railway ties, etc.). Bark hard, fibrous and difficult to remove but confers fire resistance in crops over 5 mts. tall.

E. viminalis	Suitable for higher parts of this zone. Easily established, coppices well, rapid growth. Form often rather crooked but some straighter cultivars now being developed. A popular exotic species in plantations wherever it is not defoliated by the Eucalyptus weevil and hence techniques well known. An important source of Eucalyptus oil.
Acacia decurrens Acacia mearnsii	See above but also suitable for upper part of this zone.
Albizia gummifera Albizia procera Albizia coriaria Albizia zygia	A group of fast-growing forest edge trees widely distributed in tropical Africa and India. Produce pale-colored easily dried timbers; potentially valuable fuel species as yet insufficiently tested.
Acrocarpus fraxinifolius (India)	Easily raised from seed, extremely fast growing usually with excellent straight form; produces near-white easily dried wood; bark easily stripped. Grows remarkably well on very poor stony soils and in East and Central Africa has turned out to be one of the most productive fuel species.
Gliricidia sepium Tropical America (an adaptable species also suitable for lower altitudes)	A well-known shade and fence line tree in tropical America, already in use for fuel. To be included as a local reference standard.

(c) Medium altitudes 600-1800 m. Moist climate with less than 1000 mm annual rainfall, but with harsh dry season. Natural vegetation usually deciduous woodland.

Acacia albida Acacia senegal Acacia abyssinica	These hardy African flat-topped Acacias are very resistant to grass fires and coppice well. Produce ideal, dark reddish firewood but their bark is difficult to remove and wood difficult to split and dry. Growth rates are very variable depending on soil fertility and dryness of the site.
E. tertericornis (Australia)	An extremely hardy fast-growing Eucalyptus which produces reddish fuel wood of good quality. There is a very wide range of natural variation which is being tested in internationally replicated provenance trials. It is an extremely popular exotic and local cultivar and is already available e.g., "Mysore Hybrid" (India) and "Soroti Strain" (Uganda). A range of provenances of this species should be tested.
E. Camaldulensis (Australia)	Another very popular exotic firewood species suitable for this zone, with a wide range of natural variation. Internationally replicated provenance trials have identified the Petford provenance as good in many tropical areas, and Lake Albacuta for the Mediterranean and North Africa. Some local cultivars have also been developed of which Zanzibar 'C' is a well known one, suited to heavy soils. A range of provenances of this species should be tested.
Gmelina arborea (India)	Very fast growing deciduous species producing pale colored, light, tough wood. It can be planted from intact seedlings or from stumps and striplings; coppices

	well. In savannah climates, it sheds its leaves to survive the dry season. Very widely planted for fuel plantations in Africa, Asia and Tropical America and techniques well known.
Cassia siamea (India)	A hardy species easily established from seed and which coppices moderately well. Produces dark colored, dense firewood. Growth rates vary greatly with the fertility of the site, but capable of growing on very poor stony soils.

(d) Low altitude tropics 0-600 m. with rainfall usually in excess of 2000 mm/year; rainfall well distributed, natural vegetation - evergreen and tropical rain forests.

Fast growing species in this climatic zone usually produce soft light timbers, which are burnable, but not of preferred firewood quality. In these circumstances, high growth rate and ease of management in plantation are probably the most important criteria.

Eucalyptus deglupta (New Guinea)	One of the few Eucalyptus species which grows well in wet tropical forest. Timber rather softer and lighter than is usual in the genus.
Acacia maguim (Australia)	Has produced excellent results in Sabah Queensland, not yet tested in Central America.
Acacia Koa	Native to Hawaii where it is used as a fast growing fuel and timber species.
Albizia lebbek Albizia falcataria	Asian species of Albizia which have given excellent results and very rapid growth in Malaysia: silviculture well known.
Leucaena leucocephala (Central and South America)	A widely used very fast growing shrubby species suitable for calcareous soil. A Nicaraguan selection grows to tree size, and

	some varieties are suitable for cattle fodder (used with care because the leaves contain a toxic alkaloid). Provenance trials of this species necessary; silviculture well known.
Calliandra calothyrsus (Central America)	A very fast-growing shrubby species native to Central America, which has produced outstanding yield in Indonesia; silviculture well known.

(e) Low altitude tropics 0-1000 m; rainfall usually 1600 mm annually with marked dry season. Natural vegetation deciduous woodland.

The species listed under (d) above should be tested plus some from (c). In addition, the following may be suitable.

Tectona grandis (India and Burma)	Teak is usually grown for timber, but is also used in Central America for fence lines, posts and poles and firewood. Requires good soils.
Enterolobium cyclocarpum (Central America)	Very fast-growing with broad crown, useful for shade in pastures. Wood from large trees in demand for timber. Fruits edible by livestock but suspected of being toxic if fed in excess.
Samanean saman (Hawaii)	Similar to above.
Dalbergia sissoo	A preferred species in northern India, which produces a valuable timber when large enough. Very hardy. Silviculture well known.
Casuarina equisetifolia (certain other Casuarina ssp. merit trial in this zone)	A hardy fast-growing species that produces dense, easily dried timber, favored for poles and firewood. Silviculture well known.

(f) Arid areas. It is not expected that this project will encounter many truly arid areas. Should any appear locally, a list of well tried *Acacia*, *Prosopis* and *Eucalyptus* species is available and FAO and the International Board for Plant Genetic Resources are developing seed sources for such arid area species.

CATIE
Fuelwood Production
Implementation Plan

Action	1979	1980	1981	1982	1983	1984	1985
A. Administration and Coordination Activities							
1. Draft CATIE/ROCAP Project Agreement	—						
2. Modify Memoranda of Understanding with CAP countries	—						
3. Sign initial Project Agreement CATIE/ROCAP	X						
4. CATIE identify and employ or renew long-term staff contracts	—	—	—	—	—	—	—
5. CATIE/National Government develop or update admin/staff level	—	—	—	—	—	—	—
6. Annual work plans and budgets completed and sent to ROCAP for approval	—	—	—	—	—	—	—
7. Construct administrative framework to implement technical plans	—	—					
8. Coordination of Technical activities and Financial Admin.	—	—	—	—	—	—	—
9. Organize national and regional Committees	—	—					
10. CATIE core project staff on board (initially)	—	—					
11. Peace Corps on board		—		—		—	
12. Purchase equipment and vehicles		—	—	—	—	—	—

Action	1979	1980	1981	1982	1983	1984	1985
13. Progress reports		• • • •	• • • •	• • • •	• • • •	• • • •	• • • •
14. Annual obligation of Funds	—	—	—	—	—	—	
15. Annual Regional Committee Meetings		—	—	—	—	—	— —
16. Annual Report (March)			•	•	•	•	•
17. Final Report (Technical)							•
18. Final Report (Admin.)							
19. Project Monitoring	—	—	—	—	—	—	—
20. Short term Consultants		—	—	—	—	—	
21. Project evaluation			—		—		—
22. Invite USAIDs and Peace Corps to review project progress in country			•	•	•	•	• •
B. Activity # 1 - Critical Area Identification (6 countries)							
1. Develop survey procedures and complete identification of selection criteria	—	—					
2. Train surveyors in six countries		—					
3. Conduct survey		—	—				
4. Process Data		—	—				
5. Analyze Data		—	—				
6. Identify critical and potentially critical areas		—	—				

Action	1979	1980	1981	1982	1983	1984	1985
Activity # 2 - Identify Known Fast-growing Species							
1. Identify all previous research and demonstration plots having fast-growing tree types in CAP countries							
2. Visit locations and mark trees, secure data collection areas							
3. Develop data collection format and analytical procedure							
4. Collect growth-ecological and economic data on each plot (at least 30 plots)							
5. Collect wood characteristics							
6. Conduct social acceptability studies of species							
7. Collect and process seed samples							
8. Place seed samples in storage							
9. Plant in nurseries (6 countries) for activities 4, 5 and 6							
10. Prepare preliminary analysis of data							
11. Identify 15 promising species							
12. Continue collecting field data on most promising species							
13. Summarize all data on best species							

Action	1979	1980	1981	1982	1983	1984	1985
14. Publish all data and make recommendations on best species found (in final report) and distribute							—
D. Activity # 3 - Improved Management Practices							
1. Design field trials on management practices		—	—	—			
2. Select location for field trials		—	—	—			
3. Plant field trials (6 countries) using seedlings in nurseries developed under C-8			—	—	—		
4. Apply management treatments		—	—	—	—	—	—
5. Collect data from field trials		—	—	—	—	—	—
6. Analyze field data from each experiment			—	—	—	—	—
7. Prepare technical reports on each experiment as part of annual report			—	—	—	—	—
8. Prepare final project recommendations on management practices							—
9. Publish as part of final technical report and distribute							—
E. Activity # 4 - Fuelwood Demonstration Units							
1. Natural fuelwood production units							
a. select demonstration sites and secure local agreement on management of area		—	—	—			

Action	1979	1980	1981	1982	1983	1984	1985
b. design management practices to be used							
c. prepare sites for project use (fence, clean, replant)							
d. take initial baseline data							
e. collect fuelwood yield employment, economic and social data							
f. ten units in operation (6 countries)							
g. annual analysis of data collected in each demonstration summarized in annual report							
2. Farm Level Fuelwood Production Units							
a. select farms in critical areas of each country on which demonstrations will be placed							
b. develop time level plans of work for each location							
c. plant fuelwood species from nursery in action C-8 (6 countries)							
d. provide silvicultural practices and maintenance in accordance with the unit plans							
e. collect data on economic, agronomic, social and production aspects of each plot							

Action	1979	1980	1981	1982	1983	1984	1985
f. analyze data for annual technical reports			—	—	—	—	—
g. analyze data for final report, publish and distribute							—
3. Village Woodlots							
a. select villages in critical areas in 6 countries having a community organization		—	—				
b. select areas with community leadership for village woodlot development			—	—			
c. make appropriate arrangements for safeguarding the demonstration area			—	—			
d. design and secure concurrence of village on demonstration activity			—	—			
e. determine contributions by village, national government and CATIE			—	—			
f. design data format for economic labor inputs and growth and harvest data		—	—				
g. plant village woodlot using plant material from action C-8			—	—	—	—	—
h. collect data on plots		—	—	—	—	—	—
i. analyze data			—	—	—	—	—

Action	1979	1980	1981	1982	1983	1984	1985
j. prepare annual summary of technical data			—	—	—	—	—
k. prepare final analysis of data							—
l. publish final results on village woodlots							—
4. Fuelwood Plantations							
a. develop fuelwood plantation plans			—	—			
b. select at least five sites in at least five countries			—	—			
c. plant fuelwood plantations using plant material developed in C-8 above			—	—	—		
d. collect economic, social, agronomic and growth data on each plantation according to plan			—	—	—	—	—
e. analyze data for annual technical report				—	—	—	—
f. publish in annual report				—	—	—	—
g. analyze all data, develop final result analysis and publish in final report and distribute							—
5. Agro-Forestry Demonstration Units							
a. in critical areas select small farms on which one or more of the agro-forestry demonstrations can be carried out			—	—	—		

Action	1979	1980	1981	1982	1983	1984	1985
b. with the crops and animal technicians of CATIE prepare demonstration unit action plans							
c. plant agro-forestry demonstration units in 6 countries							
d. maintain demonstrations and provide technical assistance as necessary							
e. collect economic, social, agronomic and production data on each unit as scheduled							
f. analyze data and prepare annual report inputs							
g. analyze all plot data and prepare recommendations for final report							
h. publish results in final report and distribute							
i. develop tech packs							

Action	1979	1980	1981	1982	1983	1984	1985
. Activity # 5 - Strengthen CATIE and National Professional Capacity							
1. Collect copies of available research extension articles on fuelwood							
2. Develop bibliography on fuelwood research							
3. Publish bibliography and send copies to principal project counterpart technicians							
4. Prepare and distribute reprints on fuelwood to national counterpart fuelwood groups or libraries in CAP countries							
5. Hold seminars or workshops for CATIE and counterpart senior project managers from CAP countries with international experts							
6. Review project design and operations with international experts - Receive critique							
7. Organize CATIE team for research and demonstrations on fuelwood							
8. Conduct short courses at CATIE for national technicians							
9. Conduct short courses in country for national technicians							

Action	1979	1980	1981	1982	1983	1984	1985
10. Hold seminars and traveling workshops on elements of fuelwood program				—	—	—	
11. Develop computerized analytical procedures at CATIE for analysis of research		—	—				
12. Develop tree crop and tree/pasture research procedures and technical linkages in CATIE			—	—			
13. Select graduate students and train at CATIE			—	—	—		
14. Graduate students return to home institution and initiate work on fuelwood program					—	—	—
15. Develop bulletins and production guides on fuelwood at CATIE and in countries				—	—	—	—
16. Develop filmstrips on production of fuelwood from several methods				—	—	—	—
17. Conduct initial and final assessment of national technical personnel and funds spent on fuelwood research and extension to assess change	—	—					—
18. Provision of CATIE short term technical assistance on fuelwood planning (national level) and technical aspects of production and harvesting			—	—	—	—	—
19. CATIE germplasm bank has in storage seed of fast-growing species available to national agencies		—	—	—	—	—	—