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UNCLASSIFIED

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

ROCAP

PROJECT PAPER

CENTRAL AMERICA ENERGY RESOURCES

Amendment No. 2

AID/LAC/P-399

CR P-263

Project Number: 596-0134

UNCLASSIFIED

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT DATA SHEET

1. TRANSACTION CODE: A (A = Add, C = Change, D = Delete)

Amendment Number: 2

DOCUMENT CODE: 3

2. COUNTRY/ENTITY: ROCAP - CENTRAL AMERICAN REGIONAL

3. PROJECT NUMBER: 596-0134

4. BUREAU/OFFICE: LAC 05

5. PROJECT TITLE (maximum 40 characters): Central America Energy Resources

6. PROJECT ASSISTANCE COMPLETION DATE (PACD): MM 06 DD 30 YY 89

7. ESTIMATED DATE OF OBLIGATION (Under 'B.' below, enter 1, 2, 3, or 4)

A. Initial FY 87 B. Quarter 3 C. Final FY 89

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

A. FUNDING SOURCE	FIRST FY 87 B. FX	C. L/C	D. Total	LIFE OF PROJECT E. FX	F. L/C	G. Total
AID Appropriated Total						
(Grant)	($ 5,000)	( )	(5,000)	($21,200)	( )	($21,200
(Loan)	( )	( )	( )	( )	( )	( )
Other U.S. 1.						
Other U.S. 2.						
Host Country		2,797	2,797		5,595	5,595
Other Donor(s)						
TOTALS	$ 5,000	$ 2,797	$ 7,797	$21,200	5,595	$26,795

9. SCHEDULE OF AID FUNDING ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE 1. Grant	2. Loan	D. OBLIGATIONS TO DATE 1. Grant	2. Loan	E. AMOUNT APPROVED THIS ACTION 1. Grant	2. Loan	F. LIFE OF PROJECT 1. Grant	2. Loan
(1) ESF	740	960		11,200		10,000		$21,200	
(2)									
(3)									
(4)									
TOTALS				11,200		$10,000		$21,200	

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each): 741 742 750 751 752

11. SECONDARY PURPOSE CODE: 970, 870, 820, 710

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

A. Code

B. Amount

13. PROJECT PURPOSE (maximum 480 characters)

The purpose of the project is to introduce new technologies and assessment methodologies into the region that will allow each of the participating countries to better analyze their current and future energy needs, to develop non-traditional sources of energy such as geothermal and low grade coal and peat, and to more efficiently utilize the energy and mineral resources found in the region.

14. SCHEDULED EVALUATIONS

Interim MM YY MM YY Final MM 05 YY 89

15. SOURCE/ORIGIN OF GOODS AND SERVICES

☒ 000 ☐ 941 ☒ Local ☐ Other (Specify)

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

The purpose of the project amendment is to provide resources to increase the growth and efficiency of energy investments, and improve the policies and planning mechanisms of energy sectors in each country of the region in order to achieve a more economical and efficient allocation of energy resources.

17. APPROVED BY

Signature: Nadine M. Plaster

Title: Director

Richard Coughnour, Act. Controller

Date Signed: MM 04 DD 14 YY 87

18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION

MM 07 DD 27 YY 88

ACTION MEMORANDUM FOR THE DIRECTOR

FROM: Michael Deal, PPD

SUBJECT: ROCAP Central America Energy Resources Project (596-0134) Authorization Amendment No. 2

Action Requested: Your approval is required to authorize an increase of $10.0 million in the life-of-project grant funds from the Economic Support Fund Account for the subject project and extend the Project Assistance Completion Date (PACD) from December 31, 1987 to June 30, 1989.

Background: The project was approved on March 21, 1985, at a level of $10.2 million. On September 26, 1986, the project was amended to include an additional $1 million in funding. The project purpose is to provide resources needed to increase the growth and efficiency of energy investments, and improve the policies and planning mechanisms of energy sectors in the countries of Central America. It responds directly to the recommendation of the National Bipartisan Commission on Central America to assist countries of the region to diversify exports and utilize local energy resources. Of particular interest is the development of the region's geothermal energy resources for electricity generation and for industrial process heat applications. Through these efforts, the project will contribute to the development of substitutes for costly imported fuels and increase industrial development in the region. The project includes Panama and all of the countries of Central America with the exception of Nicaragua.

The project is being implemented by the Los Alamos National Laboratory (LANL) through a Participating Agency Services Agreement (PASA) with the Department of Energy.

Discussion: An evaluation carried out in August, 1986, pointed to the accomplishment of many of the project's short-term objectives. After two years of developing working relationships with host country counterpart Ministries of Energy, other international donor organizations, USAID energy staff members and Central American project beneficiaries, these relationships have now jelled. At this time, stronger continuity of project activities is necessary to accomplish other important project objectives having a greater impact on the economies and energy investments of the region. Moreover, the current economic condition of each country in the region does not allow for sufficient resources to fully develop the potential of ongoing activities initiated under the Energy Resources project.

The proposed $10 million amendment is a two year project effort designed to incorporate a modified project management strategy based on a cost effective implementation approach. A new project component will include actual well logging explorations and testing in each country. Project amendment activities will also explore and develop the geothermal direct heat commercial applications initially started under the project. By developing investment banking and promotional capabilities both at Los Alamos and in the region, the project's research, feasibility and other analytical data can be converted into bankable project proposals.

The foregoing activities will require the current PACD of December 31, 1987 be extended to June 30, 1989, and an amendment to the PASA with the Department of Energy increasing funding under the contract for LANL to a new total of $21.2 million.

Congressional Notification: An Advice of Program Change notifying Congress of A.I.D.'s planned FY 1986 obligation for this project will be forwarded to Congress on April 20, 1987. The waiting period will expire on May 4, 1987.

Recommendation:

1. That you sign this Authorization Amendment which will permit the obligation of an additional $10.0 million in ESF grant funds for the subject project and establish a new PACD of June 30, 1989; and

2. That you sign the attached PIO/T authorizing AAM to negotiate an amendment to the PASA for the subject project with the Department of Energy.

Approved: Adline M Baster

Disapproved: _____

Date: April 14, 1987

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

SEP 26 1986

ACTION MEMORANDUM FOR THE ASSISTANT ADMINISTRATOR (LAC)

FROM : LAC/DR, ~~Terrence J. Brown~~ TB

SUBJECT: ROCAP - Central America Energy Resources Project (596-0134) Authorization Amendment No. 1

Action Requested: Your approval is required to authorize an increase of $1.0 million in the life-of-project grant funds from the Economic Support Fund Account for the subject project and extend the Project Assistance Completion Date (PACD) from December 31, 1986 to December 31, 1987.

Background: The project was approved at a level of $10.2 million on March 21, 1985. The project purpose is to assist the countries of Central America to identify and to utilize more efficiently their energy resources. It responds directly to the recommendation of the National Bipartisan Commission on Central America to assist countries of the region to diversify exports and utilize local energy resources. Of particular interest is development of the region's geothermal resources for the generation of electricity and for industrial process heat. Through these efforts, the project will contribute to the development of substitutes for expensive imported fuels and industrial development in the region. The project includes Panama and all of the countries of Central America with the exception of Nicaragua.

The project is being implemented by the Los Alamos National Laboratory (LANL) through a Participating Agency Services Agreement (PASA) with the Department of Energy. The project consists of two complementary phases. Phase I involves development of a regional energy situation analysis and resource data base to assist in the formulation of long-term planning models and energy and resource policy. Also under Phase I, an alternative energy resource development component has been initiated through technical assistance in the use of geothermal resources to generate electricity and demonstrate the use of geothermal heat in commercial and industrial applications. Geothermal research and development activities have continued under Phase II. Country-specific mineral resource assessments are being conducted along with a study of energy conservation potential in the industrial and transportation sectors of participating countries. Both phases involve the training of local technicians and scientists and the purchase of equipment.

Discussion: The increase in project funding is necessary to augment geothermal exploration activities in Honduras under Phase II of the project, and to demonstrate the application of geothermal energy for industrial use in the region. The development of Central American institutional capabilities in energy planning, policy, and management will be another important focus of this amendment. Specific activities to be funded with amendment funds include a variety of studies aimed at providing energy planning assistance to participating countries, limited training assistance, a pair of geothermal well tests to be carried out in Honduras, and experiments in commercial applications of geothermal heat in Guatemala, all of which are expected to be completed by December 31, 1987.

The foregoing activities will require the current PACD of December 31, 1986 be extended to the end of next year, and an amendment to the PASA with the Department of Energy increasing funding under that contract for LANL to a new total of $11.2 million.

Congressional Notification: An Advice of Program Change notifying Congress of A.I.D.'s planned FY 1986 obligation for this project was forwarded to the Hill on August 13, 1986. The waiting period expired on August 27, 1986.

Recommendation:

(1) That you sign this Authorization Amendment which will permit the obligation of an additional $1.0 million in ESF grant funds for the subject project and establish a new PACD of December 31, 1987; and

(2) That you sign the attached PIO/T authorizing AAM to negotiate an amendment to the PASA for the subject project with the Department of Energy.

Approved: Dwight Ink

Disapproved: _____

Date: Sept 26, 1986

-2

ACTION MEMORANDUM FOR THE ASSISTANT ADMINISTRATOR (LAC)

FROM : LAC/DR, Dwight B. Johnson

SUBJECT: Project Authorization, LAC/Bureau, Central America Energy Resources Project (596-0134)

Action: Your authorization is required for the Central America Energy Resources Project. A DAEC reviewed and approved the PP for this project on Friday, March 8, 1985.

Background and Description: The goal of this new $10.2 million ESF Grant Project is to improve the economic situation in Central America and help create employment through increased and more efficient utilization of the region's energy and natural resource endowment. The purpose of the project is to introduce new technologies and assessment methodologies into the region that will allow each of the participating countries to analyze better their current and future energy needs, to develop non-traditional sources of energy such as geothermal and low grade fossil fuel resources, and to utilize more efficiently the energy and mineral resources found throughout the region.

The Project will be implemented by the Los Alamos National Laboratory through a Participating Agency Service Agreement (PASA) with the Department of Energy.

Project Components: The project will be implemented in two phases. The initial phase ($5.2 million) will have two major components: 1) A regional energy situation analysis that will involve the collection and analysis of regional energy and resource data, construction of a standardized regional data base, and the development of long term planning models to assist in the formulation of energy and resource policy; 2) An alternative energy resource development component which will: a) provide assistance in the identification and use of geothermal resources to generate electricity; b) assess potential industrial and domestic uses for peat and low grade coal; and c) assess the feasibility of and demonstrate the use of low temperature geothermal heat for commercial and agro-industrial uses. Both components will involve the training of local technicians and scientists and the purchase of equipment which will make the participating countries self-sufficient in these areas over the long term.

Activities in Phase II ($5.0 million) of the project will derive primarily from the results of activities begun in Phase I. In general, these additional monies will be used to fund the expansion of geothermal and peat development activities, to conduct country specific mineral resource assessments, provide mineral sector profiles, and fund a study of energy conservation potential in the transportation sector in Central America. Before these Phase II funds are committed to any specific activity, Los Alamos and A.I.D. must reach agreement that a specific activity is appropriate and Los Alamos must submit an approved addendum/workplan/budget for inclusion in the amended Project Paper.

The DAEC approved this Project subject to minor modifications in the Project Paper (Statement of Work for Los Alamos) as developed jointly by Bureau staff and the Los Alamos project team. These modifications are as follows:

1. Reference to specific Universities, individuals, and private sector companies are not permitted under A.I.D. procurement regulations. All references to specific firms or institutions will be deleted.

2. Reference to the Costa Rica mineral reconnaissance component as a possible Phase II activity will include the caveat that future work will depend on the outcome of the planned April 1985 USGS meeting in Antigua, Guatemala and other preliminary work done during Phase I.

3. Before shipment of the well logging truck to Central America, a detailed management plan will be developed which specifies the provisions for maintenance, movement from one country to another, insurance and liability, and other factors pertinent to the efficient utilization of this equipment. Reference to the truck title being held by Los Alamos will be deleted. Title to the truck will remain with A.I.D. during the life of the project and a determination as to which Central American institution will receive final title to the equipment will be made during the course of the project.

4. Reference to the Advisory Committee will be followed by the statement that a final determination regarding the function and membership of this committee will be determined in future discussions between A.I.D. and Los Alamos.

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5. Procedures will need to be developed to define the relationship between the various participating organizations. A Memorandum of Understanding (MOU) or other similar document as may be prescribed by GC/LAC will be signed with all of the major participating Central American agencies and organizations with the Bureau, the appropriate Mission, and Los Alamos as signatories. These documents will be designed to clarify the expected tasks and responsibilities of each of the participating parties. Wording to this effect will be included in Section IX, Overall Project Implementation.

6. Funding for Phases I and II of this project is currently $10.2 million with a PACD of 31 December 1986. The addition of other project activities and new funding will depend on the results of the first two project phases and will require an amendment to the Project Paper. Reference to activities beyond the first two phases will be deleted from the paper.

7. In addition to the periodic internal review and evaluation outlined in the Project Paper, there will be interim evaluations in November 1985 and again in June 1986. These evaluations will be conducted by a private, outside firm selected by AID.

8. The DAEC judged the "Energy Situation Analysis" component and the "Peat End Use" subcomponent to be over funded. The Bureau has suggested that Los Alamos submit revised, more detailed budgets justifying these expenses or reduce the budgets for these activities until it is clear that the proposed levels of effort are really needed. If Los Alamos elects the second alternative, the "contingency" line item will be increased accordingly and Los Alamos, with A.I.D. concurrence, will be able to draw on these monies to support any of the project activities as needs determine.

Also, the Costa Rican peat end use assessment subcomponent will be modified to include the condition that the "Feasibility Studies" will await the findings of the "Parametric Study of Economically Feasible End Uses", the "Peat Characterization", and the "Selection of Most Promising End Uses". It is important this component include an analysis of non-extractive peat uses, i.e., the long term economic and social benefits of leaving the peat in site and using it for agriculture, forestry, watershed management, and parks.

Waivers:

OMB Circular A-76 Exemption: When submitting a PIO/T for the initiation of a PASA, the submitting Bureau is required to include with the submission a statement signed by the cognizant Assistant Administrator that the proposed agreement is exempt from the provisions of Circular A-76 because 1) it is for the provision of technical assistance and; 2) the facilities and resources of the other Federal agency (Department of Energy/Los Alamos in this case) are particularly suitable for the technical assistance being provided and are not competitive with private enterprise.

In this case, Los Alamos possesses the only well logging equipment of its kind. It is capable of conducting measurements in extremely high temperture geothermal wells. This makes Los Alamos unique in the geothermal research and development field. In addition, their expertise in the mineral research and peat research fields make them particularly suitable for implementing the other proposed project activities.

Payment of International Travel - Payment of international travel costs by participating governments, as required under Handbook 10, is not feasible for the subject Project given the severe shortages of foreign exchange occurring in each of the Host countries. For this reason, we propose approval of payment of international travel costs with Project funds.

Handbook 10, Section 15B.b. allows for A.I.D. payment of international travel in the case of centrally funded programs if a waiver request by the initiating Office or Bureau has been approved by both the appropriate Geographic Bureau Assistant Administrator and the Mission Director (the Bureau is requesting a general waiver for this purpose from each of the participating Mission Directors).

Congressional Notification: A Congressional Notification was sent to the Hill on March 6, 1985 and expires on March 21, 1985.

Recommendation:

That you approve the waivers and authorize the Project and that you sign the attached PIO/T.

Approved: [signature]

Disapproved: _____

Date: 3/21/85

WAIVERS

OMB Circular A-76: The proposed agreement is exempt from the provisions of Circular A-76 because it is for the provision of technical assistance and the facilities and resources of the other Federal agency (Department of Energy/Los Alamos) are particularly suitable for the technical assistance being provided and are not competitive with private enterprise.

Payment of International Travel: Payment of international travel costs by participating governments or other sponsoring agencies, as required under Handbook 10, is not feasible for subject project given the severe shortages of foreign exchange in each of the participating countries. For this reason, the Bureau proposes approval of payment of international travel costs with project funds.

Approved Date: 5/21/85

Disapproved Date:

CENTRAL AMERICA ENERGY RESOURCES
PROJECT AMENDMENT
No. 596-0134

Table of Contents

		Page
I.	SUMMARY RECOMMENDATIONS AND BUDGET	1
II.	PROJECT BACKGROUND AND RATIONALE	4
	A. The Problem	4
	B. Project Amendment Strategy	6
	C. Relationship of Project to AID Strategy	7
	- USAID and Other Donor Energy Assistance	7
III.	PROJECT DESCRIPTION	10
	A. Goal and Purpose	10
	B. Project Components	10
	1. Energy Planning Assistance	12
	2. Geothermal Development	23
	a. Geothermal Field	23
	b. Geothermal Resource	35
	c. Geothermal Direct Heat	41
	3. Costa Rica Mineral Reconnaissance	47
	4. Evaluation of Peat Deposits of Central America	52
	5. Investment Analysis, Promotion and Monitoring	59
IV.	COST ESTIMATES AND FINANCIAL PLAN	63
	A. Summary Description	63
	B. Detailed Amendment Budget	64
	C. Methods of Implementation and Financing	73
	D. Projection of Expenditures by Fiscal Year	73
	E. Fiscal Management and Reporting Requirements	73
	F. Contributions by Participating Countries	74
	G. Procurement Plan	77
	H. Accounting Control	77
	I. Audit	78
V.	SUMMARY PROJECT ANALYSES	80
	A. Economic/Investment Analysis Guidelines	80
	B. Institutional Analysis	84

		Page
VI.	IMPLEMENTATION AND MONITORING PLAN	92
	A. Implementation Schedule	92
	B. ROCAP Management and Monitoring	94
	1. Host Country Counterpart	95
	2. Implementation Procedures	95
	3. Project Amendment Evaluation	97
VII.	ANNEXES	
	A. Logical Framework	
	B. Model Scope of Work for Investment Analysis	
	C. IEE and Environmental Threshold Decision	
	D. Job Descriptions for Los Alamos Key Project Staff	
	E. Evaluation Recommendations and Resultant Actions	
	F. Project Development Committee	

LIST OF ACRONYMS

REGIONAL INSTITUTIONS:

ICAITI	Instituto Centroamericano de Investigaciones y Tecnología Industrial
SIECA	Secretaría Permanente del Tratado de Integración Económica Centroamericana
CABEI	Central American Bank for Economic Integration
OLADE	Organización Latinoamericana de Energía
INCAE	Instituto Centroamericano de Administración de Empresas
SICAPE	Sistema de Información Centroamericana para Planificación Energética
ECLA	Economic Commission of Latin America
FAO	Food and Agriculture Organization

GUATEMALA

MEM	Ministerio de Energía y Minas
INDE	Instituto Nacional de Electrificación
GREMIAL	Gremial de Exportadores del Occidente
DGMH	Dirección General de Minas e Hidrocarburos
DIGESA	Dirección Sectorial de Agricultural
INACOP	Instituto Nacional de Cooperativas

EL SALVADOR

CEL	Comisión Ejecutiva Hidroeléctrica del Río Lempa

HONDURAS

ENEE	Empresa Nacional de Energía Eléctrica

PANAMA

IRHE	Instituto de Recursos Hidráulicos y Electrificación
CONADE	Comisión Nacional de Energía

COSTA RICA

ICE	Instituto Costarricense de Electricidad
RECOPE	Costa Rican Oil Refinery
MIEM	Ministerio de Industria, Energía y Minas
PMRA	Preliminary Mineral Resource Assessment

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I. SUMMARY RECOMMENDATIONS AND BUDGET

The proposed PP Amendment is a critical follow-on effort to the original two year Central American Energy Resources project agreement, signed between A.I.D. and the Department of Energy and carried out by the Los Alamos National Laboratory. The original project was designed for the purpose of increasing energy productivity in the Central America and Panama (CA/P) region, and to help reduce each country's balance of payments deficit attributed to costly petroleum imports. The proposed project amendment will strive to achieve energy- and mineral-based industrial growth, and improve the policies and planning mechanisms of energy sectors in each country of the region for a more efficient allocation of energy resources.

The Central American Energy Resources project was authorized on March 4, 1985 for a total of $10.2 million. In September, 1986, the project was amended for an additional $1.0 million to be used in the completion of definitive tasks in keeping with the original project objectives.

The primary focus of the project is to assist the governments of the region in the development of their respective geothermal energy reservoirs. The project explored the feasibility of mineral resource development in Costa Rica, and assisted in research and analyses involving large peat deposits in both Costa Rica and Panama. A sub-component of the original project also focused on the development and application of direct geothermal heat for commercial/agribusiness purposes.

A major project evaluation carried out in August, 1986, pointed to the accomplishment of many of the project's short-term objectives. After two years of working in the region and developing relationships with host country counterpart Ministries of Energy, other international donor organizations, USAID energy staff and project beneficiaries, project linkages and working relationships with Los Alamos have now jelled. Stronger continuity of project activities is necessary at this time to accomplish longer-term objectives which have the potential for greater impact on the Central American economies. Moreover, assistance is needed by each country in the region to provide sufficient resources to fully develop the immediate potential of energy and investment activities initiated under the project.

The proposed amendment is a two year project with total funding of $10 million. Based on the recommendations of the evaluation team, the project amendment will incorporate a modified design strategy, employing a cost effective management and implementation approach to carrying out the objectives of each project component. As the project continues to progress, the Los Alamos full time management unit will gain the necessary experience, and utilize its new decision-making authority, to act quickly in meeting technical needs and supplying critical administrative and logistical assistance. The project amendment will include a new project component designed to provide actual well logging explorations and testing in each country. This will be performed with the use of a well logging truck procured under the original project. Training and maintenance programs will be provided for the eventual operation of the well logging truck by host country counterparts. The amendment will also fully explore and develop the geothermal direct heat commercial applications initiated during the past year.

Project evaluation recommendations also focused on the development of investment banking and promotional capabilities needed to turn the project's research, feasibility and other analytical data into bankable energy proposals. It is expected the proposals can be marketed to both public and private sector investment groups. In support of this activity, the amendment will establish a short-term technical assistance contracting mechanism, to be managed centrally by Los Alamos and utilized as needed on each new geothermal, mineral, peat and direct heat investment opportunity.

Summary Budget (U.S. $)

1.	Energy Planning Assistance	
	Personnel	450,480
	Contracts	184,000
	Materials, Equipment and Other Costs	34,000
	Overhead and Administration	131,520
	Sub-Total	800,000
2.	a. Geothermal Field	
	Personnel	1,997,830
	Contracts	540,000
	Materials, Equipment and Other Costs	355,000
	Overhead and Administration	472,170
	Sub-Total	3,365,000

	b. Geothermal Resource	
	Personnel	1,009,190
	Contracts	178,000
	Materials, Equipment and Other Costs	5,000
	Overhead and Administration	157,810
	Sub-Total	1,350,000
	c. Geothermal Direct Heat	
	Personnel	434,360
	Contracts	160,000
	Materials, Equipment and Other Costs	173,000
	Overhead and Administration	142,640
	Sub-Total	910,000
3.	Costa Rica Mineral Reconnaissance	
	Personnel	204,150
	Contracts	70,000
	Materials, Equipment and Other Costs	8,000
	Overhead and Administration	42,850
	Sub-Total	325,000
4.	Evaluation of Peat Deposits of Central America	
	Personnel	176,550
	Contracts	0
	Materials, Equipment and Other Costs	2,000
	Overhead and Administration	46,450
	Sub-Total	225,000
5.	Management, Investment and Promotion	
	Personnel	742,060
	Contracts	853,000
	Materials, Equipment and Other Costs	5,000
	Sub-Total	1,600,060
	Contingency and Inflation	1,425,000
	TOTAL	$10,000,000

II. PROJECT BACKGROUND AND RATIONALE

A. The Problem

The late 1970's world energy crisis clearly demonstrated how high oil import bills could adversely effect the economies of the CA/P region. As a result of the energy crisis, new emphasis was placed on energy planning and the development of alternative sources of energy to substitute for petroleum imports and help alleviate balance of payments deficits, generate new employment opportunities and establish the foundation for future energy independence.

The potential for geothermal energy development in Central America and Panama has always been strong. During the late 70's, some geothermal explorations and analyses were being conducted in the CA/P region, yet these activities were carried out on a relatively small scale with limited host government resources. Hydro-electric energy alternatives have also been developed over the last decade in the CA/P region. The primary drawback to this source of energy, however, is the large initial capital investment required before any power generation can be achieved. This is in sharp contrast to geothermal energy development, in which capital outlays can be invested gradually as the demand and financial resources increase and in relation to the needs and economic conditions of each country.

The involvement of the Los Alamos National Laboratory in Caribbean Basin development activities dates back to 1980-81, when the Laboratory provided consulting services in hydro-electric energy and energy conservation programs for USAID/Costa Rica. In addition, in 1983, at the request of the Prime Minister of the Eastern Caribbean island state of St. Lucia, Los Alamos undertook several development projects to explore and test for geothermal and mineral resources. Shortly thereafter Los Alamos participated in the Kissinger Commission's assessment (NBCCA) of energy problems in the Central American region, and helped make key recommendations for alleviating these problems and other obstacles to natural resource development.

The Los Alamos geothermal energy development program in Central America is based primarily on its experience and successful track record achieved in the United States. As such, Los Alamos is in an excellent position to transfer this and other energy technologies to the CA/P region.

The original project covered a two year period, with a funding level of $10.2 million needed to assist with Energy planning in the CA/P region, update the Mitre energy situation economic and statistical report on Central America, aid the governments of the region in exploring and developing geothermal reservoirs in their respective countries, undertake a mineral reconnaissance project in Costa Rica, and assist with peat development in both Costa Rica and Panama.

The project amendment will focus on those objectives deemed to have a much longer-term impact on, and benefit to, the economies of the region than was originally anticipated: i.e.,

1. Energy and fuel savings, and improved energy planning systems for countries of the CA/P region;

2. Both direct and indirect employment generation for new industries in energy development;

3. The reduction of oil import requirements through the development of more economic alternative sources of energy, improved balance of payments and trade, and enhanced possibilities for foreign and domestic energy-related investments both in the public and private sectors; and

4. The combined effect of these project objectives is expected to contribute to the stabilization of economies in the CA/P region, improve the standard of living and create energy independence over the longer-term.

The project evaluation pointed out several implementation difficulties and inefficiencies with respect to the transfer of technology, the Los Alamos management approach, and the lack of sound investment procedures and promotional activities which must be utilized in the development of end products and benefits. In part, these problems have been attributable to Los Alamos's relatively recent experience in working on a full time project in the CA/P region -- an area quite diverse in geography and political and cultural affairs. Taking this into account, some of the current project implementation difficulties could be expected. Now, with two

full years of experience, there is a much better awareness on the part of Los Alamos of potential problems. Many of these problems have already been addressed and resolved by the Laboratory with assistance from host country counterparts and AID.

The project amendment is designed to correct past implementation difficulties and to fully address the recommendations made in the project evaluation. (See Annex E for project evaluation recommendations).

B. Project Amendment Strategy

The following summary recommendations will be incorporated into the overall project amendment design, and within each individual project component:

1. A new approach to project management will serve to meld together the advanced technologies and scientific orientation of the Alamos National Laboratory, with that of a cost/benefit analytical approach to developing new and existing project components. This approach is needed to objectively measure the potential energy gains and feasible developmental impact of each project component. Given a scarce amount of host country resources and the lack of longer term guarantees of project funding by AID and other international donors, it is imperative that Los Alamos develop decision-making capabilities based on invest/discard analyses and realistic projected returns on energy investments.

2. The project's regional focus and implementation capabilities will be strengthened under the project amendment. This can be accomplished by having more decentralized decision-making and administrative procedures in the Central American region and, more importantly, by having a regional "presence of professional expertise" on a par with the full time Los Alamos personnel located at the Lab's headquarters in New Mexico. To accomplish this, Los Alamos will establish an IQC-type contract mechanism that will allow for the short-term contracting of highly qualified professionals to work on specific project development activities. Emphasis will be given to financial personnel experienced in energy investment analyses and development, who can carry out short- and medium-term in-country assignments.

3. Los Alamos Management must employ a more cost effective approach to carrying out the objectives of the project. In the areas of mineral and peat development, it is only justifiable at this time to proceed with explorations which have demonstrated project feasibility and solid returns on investment.

4. Lastly, the follow-on two year amendment will be designed to address the existing project implementation difficulties, improve the efficiencies and economies of a regional project, and most importantly, to strive to continue to benefit the economies and, in turn, the standard of living for the countries of Central America and Panama.

C. Relationship of Project to AID Strategy

AID's energy policy encourages projects that focus on energy conservation, institution building, pricing reforms, private sector and other donor involvement and on developing indigenous energy supplies to reduce pressure on foreign exchange earnings for costly oil imports. Strategically, now is a wise time to invest in energy programs in Central America given the temporary depression in world oil prices. Decisions can be made by these countries without the pressure of high prices which are expected to return within the next 3 to 5 years.

The Central America Energy Resources project addresses all of the above policy directions through support for geothermal feasibility programs, continuing the building of energy ministries and their capabilities to make decisions based on facts, and with emphasis placed on creating bankable activities.

- USAID and Other Donor Energy Assistance.

The Central American countries receive assistance from several multilateral and bilateral donors. The assistance provided under this amendment will complement this work and help shape its overall direction.

The majority of recent assistance has been in the form of loans to national utilities for large hydroelectric facilities, with the IDB as the principal lender. Debts

incurred by these investments are large and in some cases have resulted in countries having excess production capacity.

The IDB, Japan and Italy are financing development of geothermal energy in Costa Rica, El Salvador, Guatemala and Honduras, but in all cases this amendment is complementing rather than duplicating efforts through highly specialized expertise and equipment not available to these other donors.

The IDB, IBRD, UNDP, ECLA and France are funding energy planning in El Salvador, Costa Rica, Guatemala and Honduras which are complementary to and feed into this amendment's energy planning and assessment component.

AID is currently supporting three energy projects through ROCAP. ICAITI and SIECA are jointly implementing industrial energy audits and will construct an industry energy use database. CATIE is assessing the region's fuelwood problems and researching solutions, and INCAE is educating business leaders in energy efficiency. All three of these ROCAP funded programs address critical energy issues not covered under this amendment.

The IDB and the World Bank co-financed the construction of El Cajón, a large hydroelectric project that began operation in 1985. One estimate is that the final cost of El Cajón will be $775 million. It is further estimated that 1/3 of the accumulated public debt in Honduras will be due to the El Cajón project. The national utility is also receiving assistance from the IDB for improvement of its electricity distribution system.

DGMH is presently involved with a petroleum exploration promotion project funded at $300,000 by the United Nations. The object is to attract exploration firms to do comprehensive petroleum studies. Honduras has one refinery, which has a capacity of 14,000 barrels per day.

ENEE is also doing a feasibility study for the electric interconnection to El Salvador, and the IDB is providing funding for the Central American Interconnection through the Central American Bank for Economic Integration (CABEI). Thus far, $45 million have been committed for the interconnection. The U.S. Trade and Development Program provided $530,000 for the Naranjito hydroelectric development feasibility study performed by ENEE. The extension service in

the Natural Resources Secretariat is working with OLADE and FAO on biodigesters, and the total cost is estimated at $875,000.

Panama has received loans from the IDB for the recent completion of Fortuna, a 300 MW installed hydroelectric project in the northern part of the country. Currently, power generation in Panama is three-quarters hydroelectric with the balance supplied by bunker and diesel fuels.

The national energy planning organization has received a small amount of assistance from ECLA to begin the construction of a national energy plan. Like Costa Rica and Honduras, Panama also has a $6 million loan from the World Bank for oil exploration. An IDB Organization of Latin American Energy Development national utility panel exists to advise the country on development of its geothermal resources.

III. PROJECT DESCRIPTION

A. Goal and Purpose

The Project Paper Amendment will continue to focus on the achievement of the original project goal of stabilizing the CA/P economies and their respective energy balances.

The sub-goal of the Amendment is to achieve energy- and mineral-based industrial growth and efficiency in the CA/P region.

To accomplish these goals, the project amendment will provide the resources to increase the growth and efficiency of energy investments and improve the policies and planning mechanisms of energy sectors in each country of the region. 1/

B. Project Components

All of the components of this project amendment are logical extensions of work initiated under the original project, and reflect the modifications recommended by the project evaluation completed in September 1986 and subsequent analyses. The project has been divided into the five major components discussed below. It is anticipated that the work described below will be completed within the two year life of project.

End of Project Status and Conditions Indicating Purpose Was Achieved:

Eight (8) energy investment opportunities identified, feasibility determined and government, investor, and/or other donor presentations made.

National energy planning and policy matrices enhanced, thus permitting a more efficient allocation of energy resources.

1/ i.e. Guatemala, Honduras, El Salvador, Costa Rica, Panamá.

Data generated and shared with Central American governments and agencies and other donors will permit informed invest/discard decisions on proposed geothermal projects.

ENEE will possess a sound technical and economic basis for determining appropriate investments in geothermal resource development in Honduras.

A successful demonstration of the application of geothermal direct heat for industrial use established to serve as a model for similar facilities throughout the region.

The viability of a peat-fired power plant in northwestern Panama will be determined.

The feasibility of peat as a substitute for fuel oil in a combined process heat/electrical plant at the RECOPE refinery near Limón, Costa Rica will be determined.

Completed mineral reconnaissance data for Costa Rica will have been disseminated, in coordination with the GOCR, LANL, USGS and AID, in order to stimulate exploration and attract investors.

1. Energy Planning Assistance

Introduction

The energy situation in Central America and Panama is similar to that of other developing countries which do not export oil. This energy situation is marked by the following characteristics: a reliance on non-commercial fuels, such as firewood; growing use of oil and electricity commensurate with the level of per capita income and the rate of urbanization; high levels of national indebtedness; and government control over much of the energy sector.

Many of the large hydroelectric projects constructed during the past twelve years in Central America have contributed substantially to the foreign debt problem. Low commodity prices for the region's exports have led to scarce foreign exchange with which to finance oil imports, debt payments and new investment. In addition, most countries have rigid energy pricing policies which further exacerbate problems with inefficient allocation of energy.

Rigid energy pricing refers to government policies which establish energy prices based on non-economic criteria; that is, without regard to the actual cost of energy or demand for it within the country itself or the world marketplace. For example, highly subsidized fuel oil prices in the region limit the substitution of other less costly energy sources that could provide more equitable energy diversification and increased efficiency in energy usage. Each country in the region is expected to improve its energy policies as a result of the following project activities:

a. Energy planning and policies in general will be helped by the ready availability of accurate, up-to-date energy data accessed by SICAPE, the regional database managed by SIECA;

b. As energy planning models are developed, pricing policies will improve given the model's emphasis on price and demand fluctuations. Computer models can rapidly update energy situations and allow planners and government policy-makers to visualize and analyze the costs associated with using economic as opposed to social criteria for establishing energy prices;

c. The development of new energy projects in the region will be greatly facilitated by improved energy planning. The timing of new projects will correspond to realistic objectives of satisfying each year; the selection of individual be based on project evaluations and pr methodologies; and

d. Institutional strengthening will help counterparts better influence the poli the implementation of optional energy policies.

Deforestation is causing severe Central America, which in the longer term will si affect the well-being of the poor people of the r Deforestation also negatively affects the watersh hydroelectric plants by reducing the soil's water capacity and changing weather patterns.

There are various ways to help a energy problems of the region, such as conservation, substitution of more costly supply sources with less costly ones, as well as price changes. Several of the other components of this project help the countries evaluate the feasibility of using indigenous geothermal and peat resources, which are possible substitutes for diesel, fuel oil, fuelwood and large expensive hydroelectric projects. For example, the debt problem of the national utilities can be partially addressed through development of peat and geothermal energy, which can be economically exploited on a far smaller scale than hydroelectric energy.

Improved national planning is another means of overcoming energy problems through more efficient energy use, investment and pricing. Thus, the objective of this project component is to enable the countries of Central America to allocate energy resources more efficiently, and thereby

contribute to economic growth. The continued timely implementation of this project activity will help government energy planners in the region institute energy policies that effectively deal with current problems and lead to optimal use of energy in their countries. The large amount of governmental control over the energy sector in the Central American countries, and the importance of energy use to economic growth, combine to make energy policy a governmental priority.

Most of the governments that consolidated their energy planning activities in the late 1970's or early 1980's now have established organizations that can benefit from the ongoing and proposed project assistance. The countries of the region will benefit from improved energy policies, primarily in the form of rational energy investments and pricing mechanisms.

The most significant accomplishments, documents and positive interactions resulting from the activities completed to date under this component are:

- The current energy situation in the CA/P region has been analyzed and a final report will be published shortly. It contains recommendations for specific energy-assistance projects that could benefit each country and the region as a whole.
- As a means of improving energy data storage and analysis capabilities within the host governments, an energy/economic database was constructed and transferred to each country along with IBM personal computers. The database is called Sistema de Informacion Centroamericano Para Planificación Energética (SICAPE). Members of each counterpart organization were trained in the use of SICAPE through visits to each country by Los Alamos personnel and a contractor, and by a regional seminar held at Instituto Centroamericano de Administración de Empresas (INCAE) in April, 1986. As a result, the countries of the region are all using similar information systems and are incurring mutual benefits from the experiences of each country. For example, the Ministerio de Energía y Minas (MEM) in Guatemala has offered to provide further database training to members of the economic planning secretariat of Honduras. Working relationships among energy planners in the region have been strengthened significantly, and a newsletter has been established to foster communication between planners involving common problems.

- A draft of an energy atlas financed under the original project paper has been completed. It contains maps and graphs portraying energy resources, supply and demand in the region, as well as socioeconomic data relevant to energy use in Central America. The atlas is intended as an educational tool and means of information dissemination, with the computerized maps easily updated to reflect current situations.

- All countries of the region have now received energy planning assistance designed to meet their specific needs. Examples of this assistance included a mission to Belize which outlined a program to institute national energy planning in the country; and a macroeconometric model constructed jointly with counterparts in Costa Rica for use in energy modeling. In El Salvador, the status of energy planning was evaluated at the request of the Comisión Ejecutiva Hidroeléctrica del Río Lempa (CEL) and a verbal report delivered, while Guatemala has also received assistance on energy planning and energy information systems. In Honduras, planners have benefited from the computer hardware, software, and training provided under the project. Activities under the project component were coordinated with the Economic Commission of Latin America's (ECLA) program to assist Panama with formulation of their first national energy plan. Several requests from each country for more assistance have been received and are discussed later in the Component Technical Description section.

- To date, agreements for work to be performed under the original project have been signed with planning organizations in each of the five Central American countries.

- Two training seminars were held at INCAE under the original project, with the first in April 1986 completing the transfer of the SICAPE energy database. As part of a regional training effort on energy-demand modeling, a second training seminar was sponsored at INCAE in September, 1986. Many of the same people who attended the April seminar on databases were present, and the training continuity provided a favorable environment for communication and cooperation.

The proposed work involves counterparts from energy planning organizations and national utilities of five countries (Costa Rica, El Salvador, Guatemala, Honduras, and Panama) and four regional organizations (ECLA, ICAITI, INCAE, and SIECA). Planners from Belize will be included if their government decides to support a national energy planning effort in that country.

The nature of the work involves activities in the region and at Los Alamos that include energy data collection, computerization, modeling, energy planning and project evaluation. A large training subcomponent is inherent in all of these activities. The cooperation already fostered through this component among the energy planners in the region is expected to be reinforced and strengthened in the project's future activities.

Component Description

National energy planning is an integrated process that requires a clear understanding of energy supply, demand and alternatives in each country and the entire region. Such an understanding in turn requires definition of national energy resources, cost of development of these resources, the expected cost of imported energy, energy use in the country and the economic benefits to be derived from rational energy consumption. Energy planning also determines how present energy-use patterns can be altered and what the effects of these alterations will be. Other project components described in this document will help define the energy resources of the region and the cost of development and use of those resources, e.g., geothermal energy and peat. Subcomponents described below are aimed at improving knowledge and understanding of particular aspects of energy planning. An additional subcomponent is devoted specifically to assisting the countries in the region with integration of all of the aspects of energy planning. All of the subcomponents described below will be carried out at the regional level, and are intended to address general planning needs in all countries on an equal basis. An exception is the last subcomponent, which will provide individualized assistance to each country as needed.

i. Update and Expansion of Database.

The existing SICAPE database containing annual energy balances and economic data will be updated as the appropriate information becomes available. Assistance with expansion of the database will be provided to country counterparts and organizations as it is requested. For example, the planning organizations of Honduras, Guatemala, SIECA and ECLA have all requested such assistance. It is anticipated that

each country will possess an individualized version of the database, as information needs and availability differ among the countries. However, in order to complete the transfer of technology to the region and to ensure that the database is maintained, a regional version of the database will be established at SIECA.

SIECA will also be responsible for training and troubleshooting, functioning as a regional technical assistance resource on information systems. The proposed subcomponent will support SIECA in this endeavor throughout the project's duration, thus strengthening a regional organization and helping the region to become self-sufficient in one aspect of energy planning. Guatemala, Honduras and Panama have higher priority database needs than other countries since these countries did not have an adequate information system when the project started. Therefore, more assistance and training will be provided to these countries to strengthen their information systems and integrate them into the energy planning process.

ii. Enhancement of Computing Capabilities.

Counterparts in the region have benefited significantly from the personal computers and software transferred under this project subcomponent. A strong reliance on computer equipment warrants either purchase of additional computers or enhancement of the existing equipment. Energy planning and data analysis could be considerably improved in all countries by relatively small expenditures on more computer hardware and software--even for countries such as El Salvador and Costa Rica, which had IBM personal computers before the project component started. Computer productivity transferred under this project subcomponent has been especially high in Honduras and Panama, which previously did not have any personal computers for use in their energy planning.

iii. Energy Demand Modeling.

The use of mathematics for defining energy consumption as a function of price and other variables helps planners to predict what the consumer price response will be given a change in energy prices (e.g., whether a price increase will decrease household consumption of electricity below acceptable levels, or whether an increase in fuel oil prices will be especially harmful to certain industries.)

Understanding price sensitivity is especially critical to energy planners due to price movements which can control or influence energy consumption. All countries in the region have requested assistance in energy-demand modeling, and, with incorporation of prices in their demand models in particular.

The Central American energy-demand models are being reviewed, and a literature survey of appropriate methodologies will be undertaken to select one that can be easily incorporated into existing models. Adaptation and specification of the methodology will be undertaken under this amended project component using the data collected from the Central American countries. The methodology will then be transferred to host country counterparts and other appropriate personnel who will be trained in its use through workshops to be held at INCAE with the participation of SIECA and Ministries of Energy personnel. Training will be done on an individual country basis as well as at regional seminars for the purpose of disseminating the results of these efforts.

iv. Evaluation of Energy Alternatives.

Energy-supply investments and the evaluation of available alternatives are important components of national energy planning in Central America. Most public utilities in the CA/P region use the Wien Automatic System Planning Package (WASP) for evaluation of energy expansion investments. This package is recommended by the Inter-American Development Bank (IDB), and the corresponding software is being adapted by Argonne National Laboratory for use on an IBM personal computer, thus making it available to planning ministries in the region that lack large computing facilities. However, neither Argonne nor the IDB plans to transfer this package individually to the countries in the region. When this new version does become available, however, Los Alamos will transfer it to counterparts under this project subcomponent.

Training of planners outside of utilities will also be carried out so that the national energy planners can become knowledgeable in the electric capacity expansion evaluation activities. In addition, another piece of project-evaluation software developed by the IDB to calculate net present value of public-works projects, will also be transferred with appropriate training programs. This latter model, SIMOP, is easier to use and more versatile than WASP for evaluating the social benefits of a variety of energy development alternatives. SIMOP will serve to complement WASP, which focuses more on electricity-expansion decisions.

v. Integrated Energy Planning.

This subcomponent is included to meet the recognized need for integrating all aspects of energy planning in the countries of the region. Many of the other tasks being undertaken in this project subcomponent are designed to strengthen specific parts of national energy planning. This task will focus on providing training and support for integration of all aspects of planning and for identification of areas where improvement is needed. For example, most countries have focused on definition of energy consumption and may in the future need to devote more attention to evaluation of alternatives, including energy conservation and substitution. The integration of the national energy-planning effort will be the topic of a regional seminar where participants from all countries examine and describe their strengths and weaknesses in all areas of planning, and establish priorities for areas where improvement is needed. A meeting will be held with high-level officials of planning organizations to discuss the importance of national energy planning.

vi. Assistance to Individual Countries.

Energy planning capabilities are at different stages among all of the countries, and each country has need for assistance with specific projects or problems. All of the above activities will be carried out at a regional level either by INCAE, SIECA, ICAITI or ECLA, with resources generally devoted equally to all countries. While some of the activities in this subcomponent overlap with the tasks that have been described above, such as energy-demand modeling or database expansion, this sub-task is included to assign a budget and level of effort to requests for special assistance required in each country. Examples of requests for assistance that may be addressed under these subcomponent activities include:

- Costa Rica. Incorporate prices in their energy demand model; work with ECLA to carry out the survey of the transport sector; expand their macroeconomic model; incorporate the effects of conservation and substitution in their energy-demand model; and enhance their personal computers.

- El Salvador. Provide assistance for estimating fuelwood consumption, particularly in areas that are not easily accessible for surveys; assist with surveys of energy consumption in the residential and commercial sectors; help analyze the potential for energy conservation in the industrial sector through more energy audits than are being performed by ICAITI; and network CEL's personal computers.

- Guatemala. Computerize their vast amount of data on oil exploration and production; enhance their personal computers; train several additional people in the use of SICAPE; assist with expansion of their information system; assist with construction of a macroeconomic model to obtain consistent forecasts of growth in key variables; and help them better utilize the HP-3000 mainframe computer with additional hardware and software.

- Honduras. Carry out surveys of energy consumption in all sectors for all fuels; implement an information system for the new planning ministry; help to construct a national energy-planning model; and enhance their computing capabilities.

- Panama. Assist with construction of their national energy plan; help construct a macroeconomic model to use with their energy-planning model; incorporate prices in their energy- demand model; provide assistance with surveys of energy consumption in the residential, commercial and transport sectors; and provide another personal computer, preferably a model with more storage capability, a tape back-up unit and a modem.

ENERGY PLANNING ASSISTANCE

Proposed Deliverables 5/87 - 6/89

Deliverables	Est. Date Complete
. Econometrics software selected for counterpart use in modeling efforts.	June 1987
. Econometrics software transferred to counterparts with instructions in its use.	July 1987
. Regional computer hardware enhancement completed.	August 1987
. Regional SICAPE database containing annual energy balances and economic data established at SIECA.	August 1987
. Contract signed with INCAE to provide 4 workshops organize, host and assist in carrying out.	September 1987
. Contract signed with SIECA regarding regional assistance such as maintenance of the database.	September 1987
. Prices incorporated into the energy demand models of two or three countries (Costa Rica, Panama and/or Guatemala). A demand model suitable for the countries of the region developed.	September 1987
. Report prepared on energy demand modeling literature survey and methodology selection.	September 1987
. Regional seminar on energy demand modeling.	September 1987
. Planning assistance provided to El Salvador, complementing IDB-sponsored planning project.	January 1988

. Assistance provided to Guatemala in construction of information system and adaptation of Costa Rican energy planning model to Guatemala.	January 1988
. Planning assistance provided to Honduras in energy consumption survey techniques.	January 1988
. Consultation completed with Panama on their national energy plan.	January 1988
. Regional seminar on methodologies of energy project evaluation and energy planning. Transfer of evaluation methodology developed at Los Alamos and of SIMOP and WASP if available.	July 1988
. Two regional seminars held on topics to be determined based upon results of work in 1988.	1989
. Specific assistance to be provided to each country, based upon the requests and needs of each country.	1989

2. Geothermal Development

a. Geothermal Field

Introduction

A chain of volcanic activity that exists along the eastern boundary of the Pacific Ocean manifests itself in demonstrated geothermal reservoirs that stretch across the western United States, Mexico, Guatemala, El Salvador, Nicaragua, and Costa Rica. Where exploited by deep production wells, the geothermal reservoirs of Central America can be characterized as high quality resources with very favorable properties for the generation of electricity. These favorable properties include:

- High reservoir temperatures
- Shallow reservoir depths
- High permeability reservoir formations resulting in high production flow rates
- Relatively clean reservoir brines with low total dissolved solids content
- High reservoir pressures

The first geothermal electric power plant to come on line in Central America was in 1975 in El Salvador. With an initial installed capacity of 30 MW, the field at Ahuachapán grew over a six year period to an installed capacity of 95 MW. Over 40 wells have now been drilled in the Ahuachapan field. A total of eight production wells have now been drilled in the Miravalles geothermal field in Costa Rica and a 55 MW power plant is scheduled to begin operation in the early 1990s. In Guatemala, the Zunil geothermal field has five production wells and construction of a 15 MW power plant is planned. Completion of these power plants will bring the combined total investment in Central America geothermal energy development to over $200,000,000.

The power plant at Ahuachapán, El Salvador, is a clean and efficient power station operating from a localized, high-quality hydrothermal geothermal resource. Current power production is approximately 42 MW although the installed electrical capacity of the plant is 95 MW. During the early 1980s, Ahuachapán generated approximately 42% of the electric power required in El Salvador. However, because of increasing demand and declining well productivities, it now provides only 20% of El Salvador's electric power.

The El Salvador geothermal field development subcomponent responds to direct requests from the bilateral USAID Mission office and the Comisión Ejecutiva Hidroeléctrica del Río Lempa (CEL), for assistance at the Ahuachapán and Chipilapa geothermal fields. Production at Ahuachapán has been steadily declining, and a well logging program is desired to investigate the characteristics of the reservoir and wells responsible for this decline.

CEL's short-term plans during 1987 include a very aggressive drilling program for Ahuachapán and Chipilapa to further exploit the region's geothermal energy potential. Three new wells are scheduled to be drilled to the south and east of the existing Ahuacnapán field. One of these wells, with a target depth of 3 km, will be drilled to investigate a deep regional anomaly that was indicated by a previous study of the area. The site for this well is under investigation and CEL has requested Los Alamos to perform deep DC electrical resistivity tests and other geophysical surveys to support this investigation. In addition, five exploratory wells will be drilled at a depth of 1-1.5 km in the Chipilapa area approximately 5 km east of Ahuachapán. CEL has requested that Los Alamos extend the DC resistivity coverage to the east to provide data for understanding the relationship between these two geothermal fields.

The El Salvador geothermal field development subcomponent is designed to assist CEL in stabilizing the power production from the Ahuachapán geothermal plant, preparing a reservoir and field development plan that will ultimately increase the power production from Ahuachapan, and in evaluating the Chipilapa geothermal field as a potential future site for a power plant.

In Guatemala, a 15 MW power plant is planned for the Zunil geothermal field. This localized, high-temperature hydrothermal resource has been exploited with six deep production wells, five of which can be classified as successful producers. Since the completion of the last well in 1980, however, drilling activities have been terminated.

In addition, INDE has been investigating the geothermal potential of the Amatitlán site. Although to date only three holes have been drilled to shallow depths, the temperature gradients have been very high and a maximum temperature in excess of 170°C has been reported. Preliminary geochemical and geophysical investigations indicate the

possibility for a high-temperature reservoir with significant geothermal energy potential. Although development activities at Amatitlán are still in the prefeasibility stage, this region could be one of the most promising geothermal sites in Guatemala.

A 55 MW power plant is planned for the Miravalles geothermal field in Costa Rica with funding from IDB. This high-quality hydrothermal resource is being actively developed and boundaries of the field are still undetermined at the present time. Eight deep production wells have been drilled and all can be classified as successful energy producers. A new phase of drilling activities is scheduled to begin at Miravalles during 1987 with the objective of completing the required wells for the 55 MW power plant. The combination of high-temperature, high formation permeability, and relatively shallow reservoir depth, make this resource an extremely desirable candidate for extensive development as a source of electrical power.

The Costa Rica geothermal field development component is designed to assist the Instituto Costarricense de Electricidad (ICE) in evaluating the characteristics of the Miravalles geothermal reservoir, finding solutions for abating or controlling calcite deposits in production wells and in performing additional brine chemistry investigations related to potential long-term environmental concerns.

Geothermal exploration and production activities are escalating at a rapid rate in Central America and a need currently exists for scientific equipment and instrumentation to support these efforts. Since the early days of petroleum production, it is a proven fact that the use of modern geophysical exploration equipment and sophisticated downhole logging tools can substantially reduce the cost and increase the production from oil fields. This lesson is being proven again for the development of geothermal fields.

Because limited geophysical equipment and high-temperature logging capabilities had existed in Central America prior to the original project, the project financed the provision of a modern logging truck, high-temperature downhole logging tools, and a high output DC resistivity system in FY85 and FY86. This equipment will be used to bolster geothermal project activities in Costa Rica, El Salvador, Guatemala and Honduras during planned FY87 and FY88 field operations. Some pieces of equipment, such as the downhole logging tools, require frequent service and repair after exposure to the high-temperature corrosive brines encountered in geothermal

wells. Thus, it is essential that this equipment be maintained to field operational standards in order to meet the milestones imposed by the aggressive field testing programs planned during FY87 and FY88.

As exploration activities for new geothermal sites in Central America continue to increase, more small-diameter thermal gradient wells are being drilled. Information from these slim holes is vital for evaluating the geothermal potential of the site being investigated. However, these wells cannot be logged with conventional logging tools because their small-diameter requires specialized slim hole implements to be procured under the project amendment.

Costa Rica, El Salvador and Guatemala have each requested assistance from Los Alamos in performing high-temperature cement bond logs in their production wells to determine the integrity of the cement bonding between the well casing and the reservoir rock. To perform these logs, a cement bond logging tool upgraded for higher temperatures will be procured.

The equipment support subcomponent of the geothermal field development activity is designed to assist the Empresa Nacional de Energía Eléctrica (ENEE) of Honduras, CEL, ICE and INDE, by providing the necessary spare parts, specialized tools, updated software developments, logging tool improvements and support maintenance to keep all Central American logging and geophysical equipment field operational and equipped with the necessary capabilities to satisfy all project component requirements.

The most significant accomplishments, documents and interactions as a result of activities completed to date are:

- A surplus well logging rig was overhauled, equipped with a modern data acquisition system and a high-temperature armored 7-conductor geothermal logging cable was shipped to the Miravalles field in Costa Rica. Working in cooperation with ICE scientists and engineers, a Miravalles well logging plan and logging agreement were developed. In addition, a selection of high-temperature geothermal well logging tools, consistent with the requirements of the well logging plan, were tested and shipped to Miravalles.

ICE participation during previous phases of the Miravalles logging operation has been excellent. ICE personnel were present in the logging van during all logging operations, participating in all decisions and discussions, comparing the new logging data with the information previously available for each well. ICE personnel also performed all wellhead work required for the logging operations, moved the Los Alamos equipment to each well as required, and participated in the sampling of numerous hot springs in the Miravalles area.

- The technical specifications for a state-of-the-art geothermal logging truck for use in Central America were developed under the original project. A competitive procurement contract was awarded to Mathey Engineering and the logging truck has now been fabricated and delivered to Los Alamos. Installed on the logging truck cable drum is a high-temperature 7-conductor geothermal logging cable fitted with a Los Alamos designed cablehead. The components for a modern data acquisition system, including a data processing computer, were ordered and are currently being installed on the logging truck.

One of the advantages of the logging truck is that it is a totally self-contained unit that includes its own logging cable, winch, logging accessories, electrical power supplies and data acquisition system. This allows the unit to operate at essentially any geothermal field without the need for appreciable support equipment from the counterpart organizations. Consistent with the requirements for logging geothermal wells in Central America, four different specialized high-temperature downhole logging tools were designed at Los Alamos, fabricated and tested for geothermal service.

Because of the high flow rates and pressures observed in many geothermal wells in Central America, special equipment and procedures are required for inserting a logging tool into a flowing well. To reduce insertion operations, Los Alamos combined the functions of two separate logging tools into a single fluid velocity, temperature and pressure tool. This tool was used successfully to log the Miravalles wells at temperatures of up to 255°C.

Technical specifications for a high-power DC resistivity system for use in exploration geophysics were developed. The system has now been fabricated and delivered to Los Alamos, field tested in an area where the structural geology is well understood, and is being prepared for shipment to El Salvador.

- Production well locations and casing profiles were reviewed with CEL personnel in El Salvador to identify the highest priority wells at Ahuachapan for upcoming logging operations. As a result of these meetings, a logging plan was developed and approved by CEL and Los Alamos and a memorandum of understanding for logging operations at Ahuachapán was signed. A preliminary proposal for conducting reservoir engineering investigations of the Ahuachapán geothermal field has been prepared by the Lawrence Berkeley Laboratory (LBL) and submitted to Los Alamos. Contract arrangements between LBL and Los Alamos to support this proposal have been initiated. Additionally, minor design improvements are being incorporated into the logging tools previously used at Miravalles, and the tools are being prepared for calibration and testing before shipment to El Salvador.

- Los Alamos has provided Insituto de Recursos Hidraulicos y Electrificación (IRHE) with numerous reports and specifications for drilling a small-diameter thermal gradient well. In addition, an IRHE drilling expert visited the Platanares thermal gradient well site in Honduras. The well specifications and drilling plan provided by Los Alamos should serve as guidelines to IRHE for their gradient well. A technical memorandum was also provided to IRHE on the geochemistry of brine samples collected in Panama. A Los Alamos scientist will continue to serve on the Panama Geothermal Advisory Panel.

Geothermal Field Description.

The following major activities will be conducted in support of the geothermal field development component under the new project amendment:

a. Production Well Logging.

The logging truck will be moved to Ahuachapan and set up for logging operations. Downhole measurements of temperature, pressure, flow rate and wellbore diameter will be performed and downhole reservoir brine samples collected in 7 wells in accordance with the Ahuachapan logging program.

The logging truck will then be moved to Zunil to tests in accordance with the Zunil logging program. In 1988, the logging truck will return to El Salvador to log three new wells at Ahuachapan and the new exploration/production wells at Chipilapa. In 1988, the logging truck will also return to Costa Rica to perform flowing logs in Miravalles wells that were unavailable for flow testing in 1986. Logging reports will be prepared for all field operations. CEL, ICE and INDE will receive copies of the reports and all logging data gathered.

b. Slim Hole Logging.

The logging truck will be moved to Amatitlán and set up for logging operations at the slim hole gradient wells. Downhole measurements of temperature, pressure and flow rate will be performed and downhole reservoir brine samples collected. A logging report will be prepared for INDE on the results from the thermal gradient wells.

c. Geophysical Surveys.

Deep DC electrical resistivity investigations will be conducted in the area southeast of the present Ahuachapán geothermal field and extending eastward to the Chipilapa geothermal area. These investigations will be concentrated in those regions being considered by CEL for additional deep drilling efforts. The data obtained from these surveys will be provided immediately to CEL to assist in well siting, and a geophysical report summarizing and interpreting these field investigations will be provided to CEL at a later date.

In 1988, the DC electrical resistivity system will be moved to the Amatitlán geothermal area in Guatemala. A geophysical survey plan will be developed by INDE and Los Alamos taking into consideration existing data on the area and the reservoir and tentative locations for deep production wells. The investigations will then be performed and the data provided immediately to INDE to assist in well siting. A geophysical

report summarizing and interpreting these field investigations will be provided to INDE at a later date.

d. Reservoir Engineering.

Existing data on Ahuachapán and its production history will be compiled by CEL and Los Alamos. This data will be analyzed along with results from the Los Alamos logging operations and used to develop a series of models of the Ahuachapán reservoir and its performance history. Reports summarizing these reservoir models will be prepared for CEL along with fluid reinjection and reservoir management plans. The proposed work will be performed by the Lawrence Berkeley Laboratory under a subcontract with Los Alamos.

Reservoir engineering investigations will be started at Zunil by performing well tests. A conceptual model of the Miravalles reservoir, based on available data from ICE and Los Alamos logging results, will also be initiated.

e. Brine Geochemistry.

During logging operations, downhole reservoir brine samples will be collected at several fields. These samples will be analyzed for various characteristics, and will be provided to CEL, ICE and INDE for separate analysis in their geochemistry laboratories. Technical reports will be prepared for each organization on the results of the Los Alamos analyses.

f. Equipment Support.

The data acquisition system and on board computer in the logging truck will be programmed with the calibration data for each measurement sensor in a logging tool to assure proper interface. Based on the Los Alamos experience, logging truck and logging tool spare parts lists will be developed. The most critical items will be purchased from appropriate commercial suppliers.

All required maintenance support for the equipment will be provided and will include: replacement parts not included above; maintenance and operational checks on the logging truck between field operations; shipping charges for equipment that cannot be repaired in the field; replacement cables and electrodes for the resistivity system; and modifications to the existing logging tools motivated by additional field experience in El Salvador and Guatemala.

When the logging truck is being moved from country to country, a licensed Central American driver from an established transportation firm will be hired to do the driving. Each counterpart organization will be requested to provide support in clearing customs in their respective country. For short-term storage when the logging truck is not in operation, the counterpart organizations will also be requested to provide storage areas with access to electric power. This storage area will most likely be in a geothermal development field managed by the respective counterpart organization.

g. Training Courses.

Regional engineers and technicians will be trained for operation of much of the support equipment. Central American engineers and technicians will be invited to Ahuachapán and Zunil to participate in geothermal well logging courses. These courses will concentrate on the operation and maintenance of the logging truck and logging tools and also on the interpretation of data from the downhole tools.

h. Data Analysis

Given the large financial and technical investments made by the Inter-American Development Bank (IDB) to support the present and future development of geothermal energy in Central America, Los Alamos has maintained a close working relationship with this organization. Important field data that result from this project will be reported to IDB for consideration in their future geothermal development decisions. Los Alamos personnel currently serve on IDB Geothermal Advisory Panels for Guatemala and Panama.

Data generated during the performance of tasks in this component will provide input to the Central American governments and agencies for making invest/discard decisions on proposed geothermal projects. These decision points will occur at the discretion of the countries involved. Decisions influenced by work conducted in this component include siting of new geothermal wells, treatment of existing wells to assure optimum performance, creation or expansion of power plants and other exploitation of the geothermal resource.

i. Contracted Assistance

The services of a senior field geophysicist and field assistant are anticipated to assist the Los Alamos geophysics team during field operations, data interpretation, and report writing.

A contract will be placed with an individual or organization specializing in geothermal well scale control and brine treatment processes. This individual or organization will assist Los Alamos, ICE and the IDB Geothermal Advisory Panel for Costa Rica, on the calcite scale control procedures that should be implemented at Miravalles as the production wells are put into service for the planned 55MW power plant.

A contract may also be retained to participate in reservoir interference testing and other tests at the Zunil geothermal field. This requirement will not be fully defined until Los Alamos and INDE have developed a complete well logging and testing plan. The objective will be to investigate the limited permeability of the Zunil reservoir and the changing production characteristics of some of the wells in this area. Other consultants will be added as required by the project.

GEOTHERMAL FIELD DEVELOPMENT

Proposed Deliverables 5/87 - 6/89

Deliverables	Est. Date Complete
Self-contained logging truck, complete with necessary accessories, tested and shipped.	April 1987
Finalize arrangements for use and storage of logging truck.	April 1987
Selection of high-temperature well-logging tools tested and shipped to Ahuachapán.	May 1987
Begin fabrication of cement bond log tool for slim hole drilling.	May 1987
Well logging training course for CEL personnel held at Ahuachapán.	July 1987

Support Equipment Mgt. Plan developed.	August 1987
Geothermal Equipment Coordinating Committee established for operation and administration of well logging truck.	August 1987
Well logging program conducted in Ahuachapán wells.	August 1987
Deep DC resistivity completed near Ahuachapán and Chipilapa.	August 1987
Logging truck data from Ahuachapán interpreted.	September 1987
Operating instructions for logging downhole tools prepared.	September 1987
Logging truck to Zunil and set up for logging operations.	October 1987
Technical report summarizing the logging results and presenting recommendations for future field activities at Ahuachapán.	November 1987
Complete fabrication for the cement bond tool.	December 1987
Zunil well logging completed.	January 1988
Logging truck moved to Amatitlán and set up to log slim hole gradient wells.	February 1988
Report on Zunil geothermal complete.	April 1988
Logging of Amatitlán slim hole gradient wells completed.	May 1988
Proposals for the operation and maintenance of the well logging truck by Central American entities, after the project has terminated, submitted for ROCAP approval by Los Alamos.	June 1988
Deep DC resistivity completed at Amatitlán.	June 1988

Ahuachapán and Chipilapa well logging follow-up.	July 1988
Complete Amatitlán well logging report.	August 1988
Begin well logging of flowing wells at Miravailles, Costa Rica.	August 1988
Complete follow-up well logging at Ahuachapán and Chipilapa.	September 1988
Report complete on Ahuachapán and Chipilapa.	December 1988
Guanacaste region first of 2 phases of prefeasibility study of site selected by ICE complete.	January 1989
Analysis of well logs from Zunil and Amatitlán.	January 1989
Complete well logging and Miravailles.	March 1989
Technical reports on Zunil operations completed.	May 1989
Report complete on Miravailles well logs.	May 1989
Tecnnical reports on Amatitlán operations completed.	June 1989
Well logging of selected wells at Miravalles complete	June 1989

b. Geothermal Resource

Introduction

Geothermal resource development is an important part of the energy programs in the Central America and Panama. The primary thrust of this component is to assist the region with exploration work prior to individual project feasibility studies.

Prior efforts to identify and develop the geothermal potential of Honduras have been minimal compared with geotnermal activities in other Central American countries. Work on this component to date has been focused on six sites identified in previous studies, and two of these sites have shown sufficient promise to merit continued assessment. Los Alamos, witn ENEE - Honduras and U.S. Geological Survey (USGS) assistance, is performing the assessment at Platanares, the most promising of the six initial locations. A United Nations Development Program (UNDP)-funded Italian team is performing the detailed assessment of the other of these two sites (San Ignacio) and a third site (Azacualpa). Los Alamos performed much of the preliminary assessment at San Ignacio and is also providing advice to ENEE and the UNDP-Italian team.

Decisions must be made by ENEE in early 1988 regarding the possibility of substituting a geothermal power plant for a combustion turbine planned for installation in the early 1990s. The prefeasibility study to be completed under this subcomponent will provide the technical and engineering data required for making the necessary decisions and the solicitations for funding for subsequent development phases.

The objective of this activity is to provide ENEE with a sound technical and economic basis for determining appropriate investments in geothermal resources development in Honduras.

The most significant accomplishments, documents and interactions as a result of activities completed to date are:

- Reconnaissance scale geological and geochemical investigations were completed on six previously identified sites in Honduras. Assistance was given to ENEE on a limited country-wide survey. Geophysics studies (aeromagnetic and gravity maps) were also performed. These studies led to the decision to eliminate the two sites of lowest potential from further consideration.

- Detailed geological and geochemical investigations were completed in Honduras at four sites to further assess their geothermal potential. Results of these investigations were used to select two sites, Platanares and San Ignacio for further study, including detailed geophysics.

- Field work for detailed geophysical surveys was completed at the Platanares and San Ignacio sites. Interpretation of these results will provide important information for modeling the geothermal reservoirs.

- A contract was negotiated with Swissboring Overseas Ltd. for geothermal gradient drilling in Honduras. Based on the results of the investigations described above, two sites at Platanares were selected for gradient drilling. The first hole was successfully completed and drilling has begun at the second site.

- ENEE staff participated in all aspects of the reconnaissance and detailed studies. In addition, a geothermal short course was taught by Los Alamos and USGS at Los Alamos for ENEE staff. This course was designed specifically for the existing geologic conditions in Honduras.

The continuing geothermal reconnaissance work in Honduras will focus on the completion of the prefeasibility study at the Platanares site, integration of the results of the Los Alamos and UNDP-Italian efforts, generation of recommendations for ENEE and limited technical assistance to ENEE in their country-wide geothermal reconnaissance. The work will include analysis of well data, fluid geochemistry, detailed geology and reservoir modeling. If any of the sites studied appear to have significant geothermal potential, Los Alamos will assist ENEE in preparing proposals for feasibility studies and in securing funding to carry out these studies.

Los Alamos has performed limited geothermal reconnaissance work in Costa Rica under this component. A draft plan for a prefeasibility study in the Guanacaste region of Costa Rica was developed with the Instituto Costarricense de Electricidad (ICE), focusing on the area most likely to be developed by Costa Rica when demand for geothermal energy exceeds the capacity of the Miravalles field.

The project's training component served to support a Costa Rican geologist in his field work and provided partial support for his studies toward a Ph.D. at the University of California, Santa Cruz.

The limited field reconnaissance in the Guanacaste region included geology, geochemistry and geophysics and provided the basis for developing a preliminary work plan with ICE for a prefeasibility study. The efforts of a graduate student supported by the project have been used in defining the geology of the Guanacaste region. This information will be useful to ICE in making decisions regarding future geothermal development.

Component Description.

During FY87 and FY88 activities will focus on a better definition of the Platanares geothermal field in Honduras. Some assistance will be provided to Costa Rica in initiating a prefeasibility study in the Guanacaste region.

(a) Drilling, Logging and Well Testing.

The second thermal gradient well at Platanares in Honduras will soon be completed, and logging and testing will be performed.

(b) Geological Investigations.

Core samples taken from the two gradient holes will be studied to evaluate permeability in the formations. Detailed structural mapping of the Platanares site will be done as well to assist in locating sites for future deep exploratory wells.

(c) Geochemical Investigations.

Analyses of water and gas samples from the two gradient holes at Platanares will allow more accurate estimates of reservoir temperature and fluid composition. Geothermometric measurements of regional samples will help locate other potential geothermal sites.

(d) Integrating and Modeling.

The results of all geological, geochemical, and geophysical investigations conducted by Los Alamos, ENEE, and the UNDP-Italian teams will be integrated and used to construct a model of the Platanares geothermal system for use in generating recommendations.

(e) Economic Study.

Using the model of the Platanares site and relevant drilling and construction costs, a preliminary economic study will be completed, comparing geothermal development at one of more of these studied sites with other methods of electricity production.

(f) Recommendations.

Los Alamos will work with the UNDP-Italian team to provide recommendations for ENEE on the potential for geothermal development in Honduras, and a recommendations report will be prepared.

(g) Geological and Geochemical Investigations in Costa Rica and Honduras.

In FY88, Los Alamos will initiate with ICE, a prefeasibility study of an area in the Guanacaste region selected by ICE. Los Alamos will assist ICE in determining the area within the Guanacaste for the prefeasibility study. Such a study will take two or three years. Under this amendment geological and geochemical analysis will be completed.

All of the work to be performed will be carried out in conjunction with the national utilities. The USGS will also participate under Los Alamos guidance.

Various decision points have occurred during previous work on this component. After the initial reconnaissance studies on the original six sites were completed, the two sites with the lowest potential for electricity production were dropped from further consideration. After the detailed geological and geochemical studies at the four remaining sites, two sites were identified as meriting further study, including detailed geophysics and thermal gradient drilling. Project budgetary constraints required Los Alamos to concentrate its subsequent efforts on one of these two sites.

Platanares in Honduras was chosen because it has the highest potential. The other site in Honduras, San Ignacio, lies in the geographic area assigned to the Italian/UNDP project. Los Alamos has recommended to ENEE that San Ignacio be studied by the Italian/UNDP project at the same level of detail as Platanares. At Platanares, decisions have been made regarding where to drill each of two wells and, after completing the first well, whether a second well was necessary. As work continues, the next meaningful invest/discard point will occur when integration and modeling of the resulting data and the economic analysis are complete. At this point, recommendations will be made for ENEE to use in decision-making.

GEOTHERMAL RESOURCE DEVELOPMENT

Proposed Deliverables 5/87 - 6/89

Deliverables	Est. Date Complete
Petrographic Studies on core samples from PLTG-1 and PLTG-2. ENEE geologist to Los Alamos for training and collaborative work.	April 1987
Signed convenio, Los Alamos and ENEE.	May 1987
Topographic map of Platanares geothermal area in preparation for detailed structural mapping.	May 1987
Final draft "Geothermal Development and Management Guide" outlining all development steps from initial reconnaissance through electricity generation completed.	May 1987
Detailed structural mapping at Platanares completed.	June 1987
Third exploration borehole (PLTG-3) at Platanares completed.	June 1987
Well testing, logging, geochemical, and geological sampling PLTG-3.	June 1987
Draft well drilling report.	July 1987

Analysis of water and gas samples from gradient drilling at Platanares.	July 1987
Interpretation of geochemical data from PLTG-1, PLTG-2, and PLTG-3 completed.	August 1987
Preliminary economic study completed focusing on obtaining the best estimates of generating electricity at Platanares.	November 1987
Integrating and modeling of geological, geochemical and geophysical data to construct model of Platanares geothermal system.	November 1987
Well drilling report completed.	December 1987
Draft recommendations report to ENEE	January 1988
Draft well drilling report to ENEE	January 1988
Prefeasibility study completed.	April 1988
Recommendations report completed.	April 1988
Prefeasibility study of selected area in Guanacaste region (Costa Rica) initiated with ICE. Study expected to take 2 years.	June 1989

In addition, the geological and geochemical analyses parts of the study will be completed under this project.

c. Geothermal Direct Heat

Introduction

The direct use of energy from geothermal wells can be less expensive in some applications than the use of conventional or imported fuel oils, providing economic advantages which may encourage development of a country's industrial infrastructure. The CA/P region has abundant geothermal resources that could be utilized for direct heat applications. Appropriate direct heat installations that encourage expansion of the industrial sector could result in employment generation and the opening of new export markets.

Since the use of geothermal direct heat is not presently widespread in the CA/P region, it was determined that a demonstration facility would be an effective tool for introducing the Region to the benefits inherent in direct heat application. This component was established to coordinate the public and private sector activities necessary to carry out such a demonstration on a pilot scale, and to perform a prefeasibility study of a larger scale commercial application.

Although all the countries in the region have a potential need for such applications, Guatemala was selected as the site for this demonstration because more interest was found within the public and private sectors. A successful demonstration of the application of geothermal direct heat for industrial use is expected to be the model for similar facilities throughout the region.

Existing industries have been identified at both Zunil and Amatitlán which have geothermal process heat requirements that are compatible with the available geothermal resources. However, Guatemala has offered the use of existing wells at Zunil for this demonstration. A site has been identified which is conveniently located near a small lower temperature well for the initial demonstrations, and next to a much larger high temperature well for possible large scale use in the future. Presently, efforts are being concentrated on establishing the first demonstration facility at Zunil. Los Alamos, the Ministerio de Energía y Minas (MEM) and the Instituto Nacional de Electrificacion (INDE) are coordinating their efforts to achieve a successful demonstration at the earliest possible date. The plant will demonstrate the denydration of fruits and vegetables in a dehydration tunnel facility using geothermally heated air. Large quantities of

fruits and vegetables are grown year-round in the Zunil area, primarily by small producers. Presently these crops are marketed fresh in Guatemala and the rest of Central America. Some of these crops would benefit from drying or dehydration which would extend shelf life and reduce spoilage losses. Producers would be in a better position to ship longer distances, store crops and take advantage of varying market conditions. Dehydration will also complement other AID projects which are seeking to assist the region in opening new non-traditional export markets.

The longer term development objective is to use geothermal energy in a commercial agribusiness processing center at Zunil. It is anticipated that the processing will include freezing, cold storage and dehydration with the products intended primarily for export to U.S. and European markets.

The most significant accomplishments, documents and interactions as a result of the activities completed to date are:

- A survey of existing industries on the Amatitlán and Zunil areas was carried out by MEM, INDE, the Instituto Centroamericano de Investigaciones y Technología Industrial (ICAITI) and Los Alamos. Plant operating and energy use data were compiled. Also, ICAITI and Los Alamos studied the potential for new industries that could use geothermal direct heat.

- INDE, MEM and Los Alamos determined the effects of the direct use of Guatemala's geothermal resources on the country's electric power development plans, particularly on the Zunil development program being funded by the Inter-American Development Bank (IDB). The benefits of a more diversified use of the geothermal resource were also studied. It was determined that properly designed direct heat utilization would not seriously affect geothermal electric power development.

- Letters of Agreement were signed between MEM, INDE and Los Alamos for demonstration of the direct use of geothermal heat, using a slim-hole well at Zunil that no longer was being used for conventional geothermal purposes.

- Preliminary plans and designs were prepared by Los Alamos and INDE for a heat delivery system in a pilot fruit and vegetable processing plant. Flow conditions will allow operation over a wide range of conditions to permit

testing of a variety of agricultural products. The well and heat delivery system will closely simulate the characteristics of future, larger systems. Construction of this system is now approximately 50% complete.

- A working relationship was established with the Gremial de Exportadores del Occidente (Gremial), a chapter of the Guatemala Industrial Chamber of Commerce. The scope of work and terms of reference for a contract with the Gremial have been developed. Under the contract, the Gremial will perform a crop survey and establish CIF U.S. port costs for the products deemed most feasible for export. The Project is receiving strong support from the Instituto Nacional de Cooperativas (INACOP), the Direccion Sectorial de Agricultura (DIGESA) and the Guatemalan Ministry of Development.

- In mid-1986 a project advisory committee was formed to provide production and marketing advice and to coordinate activities with other relevant projects. Official representatives on the committee are from INDE, MEM, the Gremial, AID and Los Alamos. Ex-oficio participation is expected from DIGESA, INACOP and other public and private sector organizations.

Component Description.

The major tasks in the direct heat component are described below.

a) A prefeasibility study of the design and costs of a full-scale geothermal powered processing plant at Zunil will be performed by a private subcontractor specializing in food-processing plants. Technical backup will be provided to the private sector in negotiation for financing of the full-scale plant at Zunil.

b) A second series of tests in the pilot plant at Zunil will be performed. Products and dehydration tecnniques not tested in the initial plant operating tests will be evaluated. The objectives are to broaden the operating experience of the Guatemalan crew and test additional markets.

c) A National Geothermal Direct Heat Advisory Committee will be established in Guatemala. The Committee's primary purpose is to review past exploration studies, recommend three new exploratory drilling sites at Amatitlán to INDE and recommend additional direct heat uses.

d) Drilling equipment will be purchased to upgrade INDE's drilling rig and capabilities. The list of required equipment was discussed with INDE in 1985 and will be modified for new requirements.

e) A Geothermal Industrial Park Committee composed of members of the Guatemala public and private sectors will be established to advise on potential industrial uses of direct heat. Technical assistance will be provided, as necessary, to the Geothermal Industrial Park Committee.

f) A long-term development and management plan for a geothermal industrial park park at Amatitlán will be developed with assistance from the Guatemala Chamber of Commerce or anotner appropriate institution.

g) Existing industry needs and other potential applications at Ahuachapán will be surveyed with the CEL and the Salvadorean Chamber of Industry. Direct heat production costs will be evaluated.

h) Three seminars to generate interest in the public and private sectors will be conducted by the GREMIAL, with assistance from INCAE when necessary. One seminar will be held with each sector and a follow-up seminar will be held for those showing further interest after the first two seminars. A summary report of the workshop with recommendations will be written with Salvadorean co-authors.

Two commitments by Guatemalan counterparts are needed before the prefeasibility study for a full-scale plant design and operation at Zunil can be conducted. INDE has to commit to providing a source of geothermal heat adequate for a full-scale processing plant. The commitment has to include a guarantee of costs and delivery. The Gremial of Exporters has to commit to providing a plant site compatible with the combined requirements of a commercial plant operation and geothermal heat delivery.

Two favorable results are needed before the development of a large scale plant can continue: the prefeasibility study has to show economic viability, and, the pilot plant operation must reveal no serious unanticipated problems such as a lack of interest by the farmers, unavailability of foodstuffs, or a significant shift in processing techniques.

Consultants will be employed for the Zunil subcomponent in the areas of: alternative energy development; food processing plant design, equipment and operation; crop production; and market surveys. At Amatitlán, consultants will be used to create a comprehensive Geothermal Industrial Park development plan including prefeasibility and design studies. Assistance may also be required from a drilling company and a manufacturer of wellhead generators. A consultant will be needed at Ahuachapán to assist with the survey of potential development options.

GEOTHERMAL DIRECT HEAT

Proposed Deliverables 5/87 - 6/89

Deliverables	Est. Date Complete
. Commitments made by INDE to provide a source of geothermal heat adequate for processing plant (including the guarantee of costs and delivery), and, by the GREMIAL to provide a plant site compatible for commercial plant operations.	October 1987
. Zunil drying/dehydration demonstration plant operational.	November 1987
. Prefeasibility study of commercial-scale agricultural processing plant at Zunil complete (Report with recommendations).	February 1988
. Los Alamos portion of drying/dehydration demonstrations at Zunil complete.	March 1988
. Agreement signed with CEL for direct heat studies at Ahuachapán.	February 1988
. Agreements signed with the INDE and Guatemalan industrialists for direct heat studies at Amatitlán.	May 1988
. Summary report of Zunil drying/dehydration with recommendations complete.	June 1988

• Survey report of direct heat applications at Ahuacnapán complete.	July 1988
• Survey report of direct heat applications at Amatitlán complete.	October 1988
• Prefeasibility study of selected direct heat application at Ahuachapán (Report with recommendations).	March 1989
• Prefeasibility study of selected industrial direct heat application at Amatitlán (Report with recommendations).	June 1989

3. Costa Rica Mineral Reconnaissance.

The mineral resource assessment of Costa Rica began in January, 1986 as a cooperative effort between Los Alamos National Laboratory (Los Alamos), the U.S. Geological Survey (USGS), the Ministerio de Industria, Energía y Minas (MIEM), and the Universidad de Costa Rica (UCR).

The primary objective of the Mineral Resource Assessment of Costa Rica is to stimulate the growth of the local mining industry by providing geochemical and geological data that will encourage future exploration. This data will provide technical information to the Costa Rican Government to help in making investment/discard decisions concerning development of their minerals industry. The data also provide information that can be used in other areas such as land-use management and planning.

The work completed through December 1986 includes a Preliminary Mineral Resource Assessment (PMRA) Folio with a detailed study of the Costa Rica Gold Belt, a Stream-Sediment Sampling Manual, a Geochemical Atlas of the San Jose and Golfito 1:200,000 scale quadrangles, and both on-the-job and formal classroom training for Costa Rican participants. When these data are disseminated, exploration activities by commercial mining companies could be stimulated.

The Geochemical Atlas consists of color-coded geochemical maps derived from analytical data for stream-sediment samples collected in Costa Rica. The samples were analyzed at the Los Alamos Research Reactor, a state-of-the-art facility that provides analysis for a large suite of elements. The geochemical data was verified, compiled, and interpreted and the geochemical maps were produced using computer facilities at Los Alamos.

In Costa Rica, the majority of previous exploration activities have been limited to areas containing known gold mines. It is expected that a reconnaissance exploration project will encourage exploration activities in areas previously unsuspected of containing mineralization.

The genetic models and geochemical maps generated from this study serve to identify areas with favorable mineralization characteristics. In particular, the geochemical data displayed as computer generated color-coded maps provide a comprehensive picture of the regional framework and of areas containing potential mineralization. Several areas with potential for gold mineralization have thus been identified. The next step is to examine these regions and determine whether further study, and possibly development, is warranted.

The most significant accomplishments, documents and interactions as a result of activities completed to date are:

- A bilingual draft of the preliminary mineral resource assessment, compiling existing geological data, was completed. It contains countrywide maps and identifies genetic mineralization models applicable to Costa Rican geology and provides Costa Rica with a current and concise geological compilation of data and information that previously was unavailable or very difficult to obtain.

- A Mineral Resource Development System (MRDS), listing all known mineral occurrences in Costa Rica, was completed and included with the PMRA software. It allows compilation, editing, storage, and dissemination of this data. It is available for IBM-PC systems. Costa Rica can now inventory their known mineral occurrences, update the list with new discoveries, and readily identify characteristics of each occurrence.

- A regional and genetic mineralization study of the Gold District was prepared and is included with the PMRA. The types of gold deposits existing in Costa Rica can now be better understood. This information can be used to better focus future exploration activities.

- The geochemical atlas for the San José and Golfito 1:200,000 scale quadrangles is near completion. These bilingual maps provide basic geochemical data for about 25% of Costa Rica. This information can be used by Costa Rica agencies and private mining companies to focus mineral exploration activities within specific geographic regions, reducing exploration costs.

- A bilingual sampling manual was prepared documenting the stream sediment sampling procedures utilized by Los Alamos, MIEM, and UCR personnel. The sampling manual can be used to replicate sampling procedures in future reconnaissance.

- Three formal training courses and on-the-job training were provided to over 150 Costa Ricans, exposing them to state-of-the-art geological and exploration techniques used by Los Alamos and the USGS.

In 1987, efforts will focus on completing the analysis of samples collected in 1986 and in completing the ore deposit modeling (USGS), and the geochemical atlas of the San Jose and Golfito quadrangles (Los Alamos). Properly utilized and disseminated, the total package is expected to stimulate exploration and attract investors. Close cooperation between the Costa Rican government, AID, Los Alamos, and the USGS is necessary to develop utilization and dissemination mechanisms.

Component Description

During FY87, mineral reconnaissance activities in Costa Rica will consist of four components:

a) Formal Transfer of Findings and Dissemination of Results

To ensure the most effective use of the results of the Mineral Reconnaissance of Costa Rica, these results and all supporting data must be transferred to Costa Rican agencies and must be made available to the mining industry. Los Alamos and the U.S.G.S. will work closely with the Costa Rican Government to assure the most effective utilization of the results by both the government and private industry. Alternative methods of disseminating the data will be considered. In line with previous findings, Los Alamos, USGS and counterpart personnel will examine the 1986 data in more detail. Emphasis will be directed toward identifying areas most favorable for follow-up work and where exploration firms would have the most interest. Cooperative field work efforts will be emphasized for the areas identified as having the greatest potential for mineralization. Field work will take two to three weeks and probably will be conducted in the Fall of 1987.

b) Effective Utilization Study

An analysis will be performed by an independent consultant on utilization of information generated by the mineral reconnaissance activities. A list of the steps the government of Costa Rica can undertake to exploit the current data and suggestions for future work will be provided.

c) Analysis of Previously Collected Samples

Approximately 2500 samples were collected in 1986, but approximately 400 are not yet analyzed. These were collected in ares that may be an extension of the Costa Rican Gold Belt. Analysis of these samples has been requested by the AID office in Costa Rica. These samples will be analyzed and the results stored on magnetic tape. The analysis will be edited to provide accurate results that can easily be interpreted. The tapes and edited data will be provided to MIEM for possible future evaluation.

d) Training.

Training activities will be conducted at Los Alamos and USGS to enhance the participation of Costa Rican scientists. One counterpart scientist will visit USGS facilities for four to eight weeks to learn the use of the MRDS system. This system uses IBM-PC compatible software to compile, store, and disseminate previously tabulated mineral occurrence data. This training will provide Costa Rica with the ability to inventory their known resources, add new discoveries, and manipulate the data to allow for maximum utilization of the information. One counterpart scientist will visit Los Alamos facilities for four to eight weeks for training in the use of previously developed software. This training will emphasize data processing techniques necessary to prepare raw geochemical data for evaluation and will allow the counterpart scientist to manipulate previously collected data into formats most useful to MIEM and UCR.

Analysis of economic and financial factors and the potential for investment activity will be initiated as soon as possible. A logical first invest/discard decision point will occur when the initial technical phase and the draft effective utilization study are complete. This is expected to occur by approximately July 1, 1987. At that time the government of Costa Rica will be able to determine the feasibility of proceeding with mineral development using the information generated by this component.

A consultant will complete an effective utilization study of the information generated by the mineral reconnaissance activities to identify the next development activities. No more than 50 working days will be required. This expert may request the assistance of one or two other consultants, with total time not to exceed 14 days.

COSTA RICA MINERAL RECONNAISSANCE

Proposed Deliverables 5/87 - 6/89

Deliverables	Est. Date Complete
Transfer results of mineral reconnaissance to Costa Rica.	April 1987
Plan next stage of field work in areas of potential.	April 1987
Analysis on utilization of information from mineral activities completed.	May 1987
Costa Rican counterpart to USGS to learn MRDS, and Costa Rican counterpart to Los Alamos to train in utilization of data.	July 1987
Analysis of 400 previously collected samples with tape provided to MIEM.	September 1987
Field work in Costa Rica in areas of potential.	September 1987
Final report on Costa Rican mineral reconnaissance.	December 1987
Cost/Benefit economic feasibility studies complete for viable mineral investment opportunities.	January 1988
Transfer of all findings and investment packages to the Government of Costa Rica.	February 1988

4. Evaluation of Peat Deposits of Central America

Introduction

Peat is an organic-rich sediment produced in swamps and marshes from partially decayed plant material. When peat is dried, it can be used for energy applications as it has many of the same characteristics as low grade coal. Peat is being used as a fuel for boilers, primarily in northern Europe and the USSR. Approximately 6000 MW of peat-fired electric power production capacity exist worldwide. Peat actually has many more uses other than as a combustion fuel. It can also be used as a substitute feedstock for the liquid and gaseous fuel synthesis processes presently utilizing coal feedstocks, as a feedstock for many of the products derived from coal chemistry, and lastly, for a wide range of agricultural and horticultural uses. Currently more peat is mined worldwide for agricultural/horticultural uses than for energy uses. Because peat retains some of its original organics, it can be used as a soil enhancer (especially important for tropical soil which loses organics rapidly), in yeast production, as a cattle feed or as a source of biological compounds such as steroids.

Peat's usefulness depends on its characteristics and on the location of the deposits. Peat can have high ash or sulfur content, which may limit its potential applications. The mining of peat involves a relocation of water, and the effect of this on the surrounding area must be examined. After the peat is removed, some reclamation of the area must be done.

Peat is considered an appropriate energy source for Less Developed Countries (LDCs). Mining methods used in peat development are labor intensive and do not require a large investment in capital equipment; therefore, money is spent on providing jobs rather than on foreign equipment or energy. Existing combustion systems are easily adaptable for peat because the combustion characteristics of peat are somewhere between those of wood and coal. Reclaimed peat lands can become more productive either by the creation of lakes (useful for aquaculture), or by the creation of farm land improved by mixing the peat with the underlying mineral soil.

After a brief peat survey funded by IDB, AID funding to Los Alamos for peat evaluations began in 1985 in support of the identification and evaluation of various end uses of peat and of a limited amount of reconnaissance work.

Helicopter searches were carried out and identified large new areas of quality peat on the Atlantic coasts of both Costa Rica and Panama. The search in Panama, carried out at the request of the Panamanian government, resulted in the discovery of an extremely large and high quality deposit at Bocas del Toro in northwestern Panama.

The most significant project accomplishments, documents and interactions as a result of activities completed to date are:

- University of Costa Rica agronomists have found that peat from a deposit near Los Chiles has the ideal composition for a soil enrichment product consisting of peat inoculated with organisms that promotes the growth of legumes such as soybeans and common table beans. As a result, a small agro-industry has been started to produce this product on a laboratory scale, and tests have shown that the product can increase crop yields considerably. The plan is to expand sales to all of Costa Rica and possibly all of Central America. The present Costa Rican market is about $200,000/yr and an estimate of the Central American market is over $1,000,000/yr.

- Using local funds, the Costa Rican oil refinery (RECOPE) is mining one of the deposits discovered near El Cairo. This peat is being prepared for various combustion tests and for industrial fuel tests (e.g. in a Costa Rican cement plant). RECOPE is also preparing a proposal to the IDB for further funding of an energy application of peat in Costa Rica.

- An extensive peat deposit has been found in northwestern Panama near Changuinola, which in every measure of quality is equal to or better than European peat deposits that are presently being used to fuel power plants. Its average heating value is equivalent to a subbituminous coal, about 10,000 BTU/lb dry. This deposit has the potential to fuel a much needed electric power plant for the area. IRHE is currently preparing a proposal to submit to the Inter-American Development Bank for a prefeasibility study of such a power plant.

- A preliminary survey and evaluation of worldwide end-uses of peat was completed in September 1985. Based on this information, 27 end-uses of peat were evaluated for their relevance to Central America with the focus on electricity production, home cooking fuel, boiler fuel, and agricultural/horticultural uses.

- A four-day training course on peat science and technology was held in San José, Costa Rica in December 1986. This course was designed to provide training in peat reconnaissance, characterization and use for Central American scientists and engineers who are participating in the AID peat component. The course was attended by 35 participants.

- The peat component has generated considerable interest in Panama and Costa Rica. Panama has allocated $500K of their own funds this year to continue characterization and testing of the Changuinola deposit. Costa Rica has allocated $400K of their own funds this year to continue exploration and characterization.

This component is subdivided into two subcomponents, representing two areas of peat utilization for energy purposes: electric power production focused on the use of the Changuinola peat deposit in Panama and utilization of Costa Rican peat for a combined process heat/electrical power plant.

The electric power subcomponent consists of assessing the practicality of a peat-fired power plant to support the needs of the town of Changuinola in northwestern Panama. Changuinola is presently using approximately 6.4 MW of electricity generated solely from imported diesel fuel. IRHE is preparing a proposal to the IDB for funding for prefeasibility studies of this project.

The industrial fuel subcomponent is presently focused on the utilization of peat as a substitute for fuel oil in a combined process heat/electrical plant at the RECOPE refinery near Limón, Costa Rica. A peat deposit of suitable size and quality exists within one kilometer of the refinery. RECOPE is preparing a proposal to IDB for further studies on this application.

Component Description

Two tasks are proposed for this component: the first task is to assist in gathering information needed for IRHE to prepare a proposal to the IDB for funding a prefeasibility study of a power plant in the Changuinola area of northwestern Panama; and the second task is to examine the use of peat as a fuel for industrial boilers.

a) Panama Power Plant

A preliminary viability study on the use of peat from the Bocas del Toro area near the town of Changuinola for an electrical power plant will be completed in 1987. Results from this study will be used to determine whether construction of a peat-fired power plant could yield significant economic returns. If the results of this study are positive, funding will be requested from the IDB by Panama to support a prefeasibility study for the power plant. The tasks proposed for this component will assist Panama in preparing a proposal for the IDB, and in initiating long-term testing to provide data that will allow a better estimate of the mining costs for the Changuinola peat. IDB requires that a number of economic studies be done using standard computer codes and procedures. Los Alamos will assist IRHE by running the codes on Los Alamos computers and by providing technical and economic information.

To provide data for mining costs estimates, long-term testing will be initiated on the Bocas del Toro peat to determine its characteristics in detail. A small plot in the Changuinola peat deposit will be tested to determine depth contours, peat characteristics, surface topography and drainage patterns. Tests will also be made to determine air-drying characteristics and load-bearing capacity.

Environmental tests will be initiated to measure the water quality in the peat test area and the present water quality in potential drainage areas. The environmental studies will also include investigation of local water flow and drainage patterns. A survey of present water area usage will also be initiated.

If IDB funding is obtained, a prefeasibility study will be performed on constructing a peat-fired power plant near Changuinola. Depending on the results of this prefeasibility study, a decision will be made on whether to continue plans for the construction of the power plant.

b) Industrial Boiler

Los Alamos will provide advice to RECOPE on evaluating the peat deposits near Limon for use in industrial boilers. RECOPE will: determine the type, extent, and depth of the peat in the area; determine a representative ash, sulfur, and heat content for each type of peat; complete drying tests on the El Cairo peat; monitor water quality in the bog near the refinery; and survey present water usage patterns. The feasibility of using solid fuel boilers in the refinery is being examined by Fluor, Inc. with RECOPE funding. Results of this study will be used to provide cost estimates for using peat in industrial boilers either in the refinery or at other locations.

By the end of FY87, assessment of the mining characteristics of the Bocas del Toro peats will be completed. By that time, Costa Rica and Panama will have the requisite skills and information to effectively pursue identification and development of indigenous peat resources. Thus, the beginning of FY88 is an appropriate invest/discard juncture for determining whether additional funding will be necessary to further evaluate peat deposits. Specifically, at the end of FY87 the proposal for funding of a prefeasibility study will have been submitted to IDB and a decision made on continuing the project with IDB funding. Also, by the end of FY87 adequate information will be available on the peat in the Limon area of Costa Rica to determine whether a proposal should be made to seek additional funding for prefeasibility studies regarding the use of peat in the refinery or in other industrial applications.

Consultants with expertise in peat mining and the environmental effects of peat mining are required for this project. They will assist in the long-term testing to be done of the peat in Changuinola, Panama and in Moin, Costa Rica. Consultants will also be responsible for generating work plans for the environmental testing to be carried out by IRHE and RECOPE and for providing technical assistance on the mining aspects of the work.

EVALUATION OF PEAT DEPOSITS IN CENTRAL AMERICA

Proposed Deliverables 5/87 - 6/89

Deliverables	Est. Date Complete
. Preliminary viability study on using Changuinola peat for electrical power plant completed.	June 1987
. Complete report on preliminary viability study on using Costa Rican peat in industrial boilers.	July 1987
. Technical assistance to IRHE to accomplish the following:	
Surface vegetation map prepared for Bocas del Toro deposit.	July 1987
Topographic map prepared showing surface elevations and contours for the Bocas del Toro deposit.	July 1987
Natural water flow directions determined for Bocas del Toro deposit.	July 1987
Isopach (peat thickness) map prepared for the Bocas del Toro deposit.	July 1987
Vertical and lateral variations in peat quality determined for Bocas del Toro deposit.	August 1987
Composition of material directly beneath peat determined for Bocas del Toro deposit.	August 1987
. RECOPE proposal prepared with Los Alamos technical assistance, submitted to IDB for funding for prefeasibility studies on developing peat resources.	September 1987

• IRHE proposal prepared with Los Alamos tecnnical assistance, submitted to IDB for funding for prefeasibility studies on using peat for Changuinola power plant.	September 1987
• Technical assistance to RECOPE to accomplish the following:	
Surface vegetation map prepared for Moin deposit.	October 1987
Topographic map prepared snowing surface elevations and contours for the Moin deposit.	October 1987
Natural water flow directions determined for Moin deposit.	October 1987
Isopach (peat thickness) map prepared for the Moin deposit.	October 1987
Vertical and lateral variations in peat quality determined for Moin deposit.	November 1987
Composition of material directly beneath peat determined for Moin deposit.	November 1987
Complete environmental tests measuring water quality, flow, drainage patterns and present water usage at the Moin deposit.	January 1988

5. Investment Analysis, Promotion and Monitoring

At appropriate stages determined for each activity and country, Los Alamos National Laboratory, in coordination with ROCAP, the respective host country governments, and project technical assistance, will assist in advancing tecnnical accomplishments of the project toward potentially realizable investment projects. A key element needed for these efforts is access to complete engineering cost data. With appropriate cost models, it will be possible to undertake comprehensive economic and financial analyses for each of the natural resource components for each country, and to divide the results into public and private sector investment packages according to specific criteria. (See Section V. A. Economic/Investment Analysis Guidelines).

Prior to initiation of the economic and financial analyses, and in tandem with further progress in the engineering and technical work, Los Alamos will undertake a feasibility study to facilitate subsequent detailed project investment studies. This will include a survey of all available energy related economic and financial data on Central American economic and business sectors, regional government development plans, and national and sectoral policy guidelines. Given the current financial position of the region's economies, it is imperative tnat a priority ranking be made of future energy and mineral related investments with emphasis placed on least-cost and maximum return solutions.

The analysis carried out by Los Alamos will also include familiarization with both the public and private sector investment communities and determination of present market conditions as they pertain to Central America. For example, large credit exposure in Central America has created an environment where non-traditional financing and investments may be possible for higher risk investment projects. It is anticipated that such financial arrangements will include debt/equity swaps.

There are a considerable number of public and private sector trade and development organizations which provide information on investment climate and funding sources, and in some cases, represent potential investor groups. In an effort to attract new investment activity and support in the region, Los Alamos will immediately begin to establish contact with the following entities:

- Caribbean and Central American Action, Council of the Americas, U.S. Chamber of Commerce, and the American Manufacturers Association. Briefings will be provided on the Central American Project and working relationships established.

- Commercial and investment banks will be examined as possible sources of blocked-funds financing.

- Major trading companies and "turnkey" contractors will be tapped as sources of blocked-funds financing and of potential investor interest.

- Eximbank, OPIC, World Bank and the IDB could also be sources of potential funding, investor referrals and specialized knowledge.

In order to efficiently orchestrate the completion of technical work, prepare economic and financial analyses and provide maximum awareness and information to the investment community, the following five-step approach will be followed:

(a) Name an advisory group consisting of business, banking and investment banking representatives to assist in establishing communications and negotiating with the investment community;

(b) Meet with the advisory group of business, banking and investment banking representatives to brief them on the project, to solicit their advice on preparing a preliminary list of potential investment opportunities flowing from the various project components, and to recommend organizations to be contacted to pursue the investment objectives referred to above;

(c) Los Alamos will arrange for consultations with the advisory group and ROCAP, hire appropriate consultants to provide the economic, financial analyses and technical services needed to assemble investment packages, and distribute this information to the investment community;

(d) Organize a series of meetings to present and discuss potential investments with appropriate public and private sector organizations; and

(e) As specific investment prospects near realization, Los Alamos and Central American host government technical teams will work together in coordinating their support for the investment process.

These five steps will facilitate the transition of the Project from the technology and theoretical stages to actual profitable investment opportunities. The employment of innovative investment packaging to attract private sector interest will also require that project continuity and follow-up work in the region be maintained.

INVESTMENT ANALYSIS
PROMOTION AND MONITORING

Proposed Deliverables for Invest/Discard Activities

• Information on Costa Rica mineral reconnaissance provided to private sector (assuming Costa Rica agrees to this action).	June 1987
• Series of briefings on Central American Project initiated with U.S. Chamber of Commerce, American Manufacturers Association and similar organizations as an introduction to ongoing working relationships.	October 1987
• Advisory group of business, banking and investment banking representatives named to assist in establishing communications and negotiating with the investment community.	December 1987
• Series of meetings initiated with Advisory Group to solicit their recommendations on potential investment opportunities.	January 1988

• Pre-packaging feasibility study initiated to facilitate subsequent detailed project investment studies.	January 1988
• Pre-packaging feasibility study completed.	April 1988
• Plan of action on specific investment prospects created by Los Alamos and Central American host government technical teams.	1988-1989
• Provide technical assistance to allow IRHE to complete environmental tests measuring water quality, flow, drainage patterns and present water usage at the Bocas del Toro deposit.	January 1988
• Peat resource assessment component completed.	February 1988
• IDB funded study in Panama on Changuinola peat options complete.	February 1989
• IDB funded study in Costa Rica on peat options complete.	February 1989

IV. COST ESTIMATES AND FINANCIAL PLAN

A. Summary Description

The proposed project amendment will provide funding for a two year extension of the existing Central America Energy Resources Project, being implemented under a PASA agreement with the Department of Energy. The $15,595,000 estimated total cost for the two year extension will include $10,000,000 in AID ESF grant funds ($5,000,000 to be obligated in FY 1987 and $5,000,000 to be obligated in FY 1988), and $5,595,000 in local currency contributions from the Central American countries participating in the project.

SUMMARY COST ESTIMATES
($000)

PROJECT COMPONENTS	AID FUNDS (FX)	PARTICIPATING CNTRY CONTRIB. (LC)	TOTAL BUDGET
1. Energy Planning Assist.	800	250	1,050
2. Geothermal Energy Development			
a. Geothermal Field	3,365	910	4,175
b. Geothermal Resource Development	1,350	2,000	3,350
c. Geothermal Direct Heat	910	400	1,310
3. CR Mineral Reconnaissance	325	35	360
4. Evaluation of Peat Deposits of Central America	225	2,000	2,225
5. Management Investment Analysis, Promotion and Monitoring	1,600	0	1,600
Contingency and Inflation	1,425	0	1,425
TOTAL PROJECT	$10,000	$5,595	$15,595

B. Detailed Amendment Budget (In U.S.$)

1. Energy Planning Assistance

Organization/Quantity/Category	Unit Cost	Total Cost
Personnel		
3.1 Economists	129,100	400,300
17 Round Trips	1,000	17,000
216 Days of Per Diem	80	17,880
Sub-Total		434,580
24 Consultant Days	458	10,980
3 Round Trips	1,000	3,000
24 Days of Per Diem	80	1,920
Sub-Total		15,900
Total Personnel		450,480
Contracts		
INCAE		
Personnel		40,000
Travel		8,000
Materials and Services		5,000
Four Workshops ($25,000 each)		100,000
Sub-Total		153,000
SIECA		
Personnel		17,000
Travel		10,000
Materials and Services		4,000
Sub-Total		31,000
Total Contracts		184,000
Materials, Equipment and Other Costs		
Local Expenses		4,000
Computer Hardware and Software		30,000
Total Materials, Equipment and Other Costs		34,000
Overhead and Administration		
Division and Group Overhead		66,000
Other Administration		65,520
Total Overhead and Administrative		131,520
Project Component Total		$800,000

2. Geothermal Energy Development

a. Geothermal Field

Organization/Quantity/Category	Unit Cost	Total Cost
Personnel		
0.6 Geochemists	119,900	71,940
5 Round Trips	1,000	5,000
25 Days of Per Diem	80	2,000
Sub-Total		78,940
1.0 Chemical Technician	71,480	71,480
5 Round Trips	1,000	5,000
25 Days of Per Diem	80	2,000
Sub-Total		78,480
2.1 Geophysicists	124,510	261,470
7 Round Trips	1,000	7,000
147 Days of Per Diem	80	11,760
Sub-Total		280,230
3.2 Geophysical Field Technicians	66,870	213,980
7 Round Trips	1,000	7,000
147 Days of Per Diem	80	11,760
Sub-Total		232,740
3.6 Logging Engineer	110,680	398,440
8 Round Trips	1,000	8,000
260 Days of Per Diem	80	20,800
Sub-Total		427,240
11.0 Logging Technicians	71,480	786,280
22 Round Trips	1,000	22,000
420 Days of Per Diem	80	33,600
Sub-Total		841,880
109 Consultant Days	458	49,920
6 Round Trips	1,000	6,000
30 Days of Per Diem	80	2,400
Sub-Total		58,320
Total Personnel		1,997,830
Contracts		
Reservoir Engineering		
Personnel		280,000
Travel		8,000
Materials and Services		62,000
Sub-Total		350,000

In-Country Coordination	
Personnel	100,000
Travel	10,000
Materials and Services	10,000
Sub-Total	120,000
Brine Analysis	42,000
Materials and Services	8,000
Sub-Total	50,000
Regional Truck Transportation	
Personnel	16,000
Travel	2,000
Materials and Services	2,000
Sub-Total	20,000
Total Contracts	540,000
Materials, Equipment and Other Costs	
Local and Field Expenses	45,000
Support Equipment Parts and Tools	65,000
Logging Cables	100,000
Miscellaneous Equipment and Supplies	100,000
Shipping	45,000
Total Materials, Equipment and Other Costs	355,000
Overhead and Administration	
Division and Group Overhead	161,000
Other Administration	311,170
Total Overhead and Administrative	472,170
Project Component Total	$3,365,000

b. Geothermal Resource

Organization/Quantity/Category	Unit Cost	Total Cost
Personnel		
8.1 Geologists/Geochemists	119,900	971,190
22 Round Trips	1,000	22,000
200 Days of Per Diem	80	16,000
Total Personnel		1,009,190
Contracts		
USGS		
Personnel		111,000
Travel		24,000
Materials and Services		15,000
Sub-Total		150,000
Geochemical Analysis Services		
Personnel		20,000
Materials and Services		8,000
Sub-Total		28,000
Total Contracts		178,000
Materials, Equipment and Other Costs		
Local Expenses		5,000
Total Materials, Equipment and Other Costs		5,000
Overhead and Administration		
Division and Group Overhead		130,000
Other Administration		27,810
Total Overhead and Administrative		157,810
Project Component Total		$1,350,000

c. Geothermal Direct Heat

Organization/Quantity/Category	Unit Cost	Total Cost
Personnel		
2.0 Engineers	129,100	258,200
12 Round Trips	1,000	12,000
70 Days of Per Diem	80	5,600
Sub-Total		275,800
320 Consultant Days	458	146,560
8 Round Trips	1,000	8,000
50 Days of Per Diem	80	4,000
Sub-Total		158,560
Total Personnel		434,360
Contracts		
Food Processing Plant Design		
Personnel		44,000
Travel		13,000
Materials and Services		7,000
Sub-Total		64,000
Industrial Park Development		
Personnel		66,000
Travel		20,000
Materials and Services		10,000
Sub-Total		96,000
Total Contracts		160,000
Materials, Equipment and Other Costs		
Local Expenses		5,000
Equipment and Supplies		150,000
Workshops		18,000
Total Materials, Equipment and Other Costs		173,000
Overhead and Administration		
Division and Group Overhead		70,000
Other Administration		78,640
Total Overhead and Administrative		142,640
Project Component Total		$910,000

3. Costa Rica Mineral Reconnaissance

Organization/Quantity/Category	Unit Cost	Total Cost
Personnel		
1.21 Geologists	119,900	145,100
5 Round Trips	1,000	5,000
64 Days of Per Diem	80	5,120
Sub-Total		155,220
94 Consultant Days	458	43,050
3 Round Trips	1,000	3,000
36 Days of Per Diem	80	2,880
Sub-Total		48,930
Total Personnel		204,150
Contracts		
USGS		
Personnel		23,000
Travel		4,000
Materials and Services		3,000
Sub-Total		30,000
Geochemical Analytical Laboratory		
Personnel		31,000
Materials and Services		9,000
Sub-Total		40,000
Total Contracts		70,000
Materials, Equipment and Other Costs		
Local Expenses		8,000
Total Materials, Equipment and Other Costs		8,000
Overhead and Administration		
Division and Group Overhead		28,000
Other Administration		14,850
Total Overhead and Administrative		42,850
Project Component Total		$325,000

4. Evaluation of Peat Deposits of Central America

Organization/Quantity/Category	Unit Cost	Total Cost
Personnel		
0.48 Peat Geologist	119,900	57,550
4 Round Trips	1,000	4,000
48 Days of Per Diem	80	3,840
Sub-Total		64,390
0.47 Engineer	129,100	60,680
4 Round Trips	1,000	4,000
48 Days of Per Diem	80	3,840
Sub-Total		68,520
76 Consultant Days	458	34,800
4 Round Trips	1,000	4,000
48 Days of Per Diem		3,840
Sub-Total		42,640
Total Personnel		176,550
Materials, Equipment and Other Costs		
Local Expenses		2,000
Total Materials, Equipment and Other Costs		2,000
Overhead and Administration		
Division and Group Overhead		22,000
Other Administration		24,450
Total Overhead and Administrative		46,450
Project Component Total		$225,000

5. Management, Investment Analysis, Promotion and Monitoring

Organization/Quantity/Category	Unit Cost	Total Cost
Personnel		
4.0 Managers	129,100	516,400
24 Round Trips	1,000	24,000
120 Days of Per Diem	80	9,600
Sub-Total		550,000
401 Consultant Days	458	183,660
6 Consultant Trips	1,000	6,000
30 Days of Per Diem	80	2,400
Sub-Total		192,060
Total Personnel		742,060
Contracts		
Investment and Economic Analysis		
Personnel		430,000
Travel		20,000
Materials and Services		50,000
Sub-Total		500,000
Evaluation		
Personnel		125,000
Travel		10,000
Materials and Services		15,000
Sub-Total		150,000
Regional Assistance		
Personnel		30,000
Travel		5,000
Materials and Services		5,000
Sub-Total		40,000
Regional Coordination		
Personnel		100,000
Travel		18,000
Materials and Services		45,000
Sub-Total		163,000
Total Contracts		853,000

Materials, Equipment and Other Costs	
Local Expenses	5,000
Total Materials, Equipment and Other Costs	5,000
Project Component Total	$1,600,060
Contingency and Inflation	1,425,000
GRAND TOTAL	$10,000,000

C. Methods of Implementation and Financing

The entire $10,000,000 in AID funding will be implemented through a PASA agreement with the Department of Energy (Los Alamos National Laboratory), and the direct payment method of financing will be employed. Payments will be processed through AID Washington, FM/PAFD, which will then transfer the charges to the Mission through the advice of charge mechanism.

D. Projection of Expenditures by Fiscal Year

The following chart presents the projected expenditures from AID financing, by fiscal year, beginning in the fourth quarter of FY 1987 and ending in the third quarter of FY 1989.

PROJECTION OF EXPENDITURES BY FISCAL YEAR
AID FINANCING ($000)

COMPONENT	FY 1987	FY 1988	FY 1989
Management	552	1,327	1,146
Energy Planning Assistance	165	365	270
Geothermal Field Development	1,000	1,600	765
Geothermal Resource Development	600	650	100
Geothermal Direct Heat	260	400	250
Peat Resource Development	225	0	0
Costa Rica Mineral Reconnaissance	325	0	0
TOTALS	3,127	4,342	2,531

E. Financial Management and Reporting Requirements

As with the previous Project Agreement, disbursements for activities funded under this amendment will be processed through AID Washington, FM/PAFD. However, as ultimate financial management responsibility rests with the Mission and the Los Alamos Program Management Office, Los Alamos will be required to submit six month work plans to ROCAP for approval prior to utilizing project funds, as well as quarterly accrued expenditure reports. The expenditure reports provided to ROCAP will serve as management tools, and will contain a level of detail to be agreed upon by ROCAP and Los Alamos at a later date.

This procedure will hold throughout the life of this two year project amendment, with the exception of the remainder of FY 1987, for which Los Alamos will submit for ROCAP approval a five month work plan covering the period of May through September 1987. It is expected that each subsequent six month work plan will be submitted by Los Alamos at least one month before the start of the corresponding period, to allow sufficient time for review and modification, and to avoid a break in fund availability.

At no time shall the combined total of actual disbursements and outstanding advances requested by Los Alamos exceed the budgeted amount corresponding to ROCAP approved work plans. The Department of Energy will not draw down on committed funds until such time as ROCAP officially advises that a given work plan and funding level have been approved.

All technical assistance service contracts under the project amendment shall be managed by the Los Alamos Program Management Office, and thus will only be reimbursed at cost plus the normal 10% management fee. The 83% burdened rate applied to Los Alamos consultant services, working under the supervision of the Projects Division, shall not be considered allowable costs under the project amendment for short-term contracts.

F. Contributions by Participating Countries

Local currency contributions to the project by the participating countries have been estimated at $5,595,000, or 37% of the total project activity covered under this amendment. A breakdown by country, and major project component, is as follows ($000):

COMPONENT	C. RICA	PANAMA	HONDUR	GUATE	EL SALV	TOTAL
Energy Planning	100	40	30	40	40	250
Geothermal Develop.	610	300	400	600	1,000	2,910
Geother. Direct Heat	0	0	0	400	0	400
Peat Deposits	800	1,200	0	0	0	2,000
Minerals	35	0	0	0	0	35
TOTALS	1,545	1,540	430	1,040	1,040	5,595

Description of Participating Country Contributions

Costa Rica:

- Minerals: The MIEM and the UCR are expected to contribute one person-year for year one.

- Energy Planning: The DSE of the MIEM will cooperate with three person-years to develop energy modeling programs for Costa Rica, which will later be transferred to the other participating countries.

- Peat: RECOPE has budgeted $400,000 each year for peat assessment and peat end-use development.

- Geothermal: ICE will use an estimated $360,000 in IDB loan money in year two.

Panama:

- Energy Planning: CONADE will provide one person-year to the Energy Data Base.

- Peat: Panama has budgeted $400,000 in year one for peat resource development, and is requesting IDB funding for year two.

- Geothermal: IHRE has programmed $150,000 per year for geothermal assessment.

Honduras:

- Energy Planning: CONSUPLANE is providing two person-years per year to the development of their energy data base and planned energy surveys.

- Geothermal Development: ENEE is expected to seek AID and other donor funding plus UNDP funds and government funds for additional geothermal site assessments.

Guatemala:

- Energy Planning: MEM will provide two person-years for data base development.

- Geothermal Development: INDE will support Los Alamos well logging activities and Zunil II and Amatitlan Assessments at an annual estimated cost of $300,000.

- Geothermal Direct Heat: INDE is providing all labor, heat loop and well head management for the duration of the project.

El Salvador:

- Energy Planning: CEL will provide 3 person-years for data base development and expansion.

- Geothermal Field Development: CEL will contribute $500,000 per year from IDB and government funds.

Los Alamos Contributions to the Central American Energy Resources Project

The following assistance/services have been provided by Los Alamos to the Central American Energy Resources Project at no cost to the project.

. Managerial, technical and marketing assistance has been provided by a high level Laboratory manager. Currently this assistance requires approximately 25% of his time.

. Managerial, technical and marketing assistance has been provided by a middle level Laboratory manager. Currently this assistance requires approximately 90% of her time.

. Data base creation and maintenance of the computerized management tool, PROJECT/2, currently requires approximately 95% of the time of a data analyst.

. Secretarial services related to this project currently require approximately 65% of the time of an Executive Secretary and 40% of the time of an Administrative Assistant.

. Subcontracting assistance has been provided by the Department of Energy, Los Alamos Area Office. Currently this assistance requires approximately 5% of the time of a Contracting Officer.

. This program has made unique demands on many of the Laboratory's support organizations, often requiring an above normal amount of time and effort from the support staff. This extra assistance has been provided by Accounting, Budgeting, Contracting, Purchasing, Shipping, Legal, Consultant Assistance, Visitor Services, Security and Travel. Time requirements vary from 5% to 25% of the time of a full time equivalent for support services in each of these areas.

. Title of ownership and all insurance requirements for the operation and maintenance of the well logging truck will be the responsibility of Los Alamos over the life-of-project. The truck will revert back to the ownership of AID once the project has terminated.

G. Procurement Plan

Los Alamos procedures for contracting with private firms, other national laboratories and educational institutions are based on the University of California Purchasing Policy, Prime Contract No. W-7405-ENG-36 and Department of Energy Subcontracting Policies and Procedures for operating and On-site Services Contracts. A contract staff is available at Los Alamos to resolve any difficulties in contracting. Procurements are in compliance with the Buy American Act; however, contracts can be negotiated for foreign purchases when such action is determined to be appropriate. Los Alamos policies define the criteria for such a determination.

All contracts for personnel negotiated under the project amendment will adhere to AID procurement regulations in terms of compensation and employee benefits. Given the number of contracted personnel anticipated during the two-year life-of-project, it is imperative that DOE and Los Alamos contracting offices closely coordinate all contracting activities with AID, and that the contracts are in accordance with AID contracting rules and regulations.

H. Accounting Control

All funding resources are provided to Los Alamos through the Department of Energy. Cost control procedures at the Laboratory are defined by the Department of Energy, which is the government agency under which the Laboratory is owned and operated. The standardized accounting system of the Laboratory complies with the Budget and Accounting Procedures Act of 1950 and fulfills the requirements of other Federal statutes and government regulations. The system is designed as a management tool for the allocation, forecasting and monitoring of financial resources to determine progress toward the completion of project objectives. The Program Office allocates funds to each project component based on previously agreed upon activities to be performed in the fiscal year (FY). A monthly cost forecast is prepared by each Project leader. This information is stored in a computerized data base that is the core of the Laboratory cost control system.

Under this computerized system, a unique digital code identifies each project, the organizational unit being charged to the project and the particular type of expenditure. All costs associated with the project can be traced by these identifiers back to their original source document, i.e., purchase order, travel expense, time report.

Data on the status of all purchase requests and purchase orders is available via computer reports. Manpower and material expenditures can be evaluated against forecasts to identify potential concerns. This system allows the managers to monitor the commitments of any component in the project.

The diversity of the components in this project has prompted the Program Office to institute a specialized computer management tool called PROJECT/2. This provides an integrated cost and scheduling system for project control. Utilizing the critical path method to monitor schedules and breakdown costs, PROJECT/2 enables management to plan, schedule and control projects of varying size. While the system was only recently installed, it is already proving to be an effective tool in identifying schedule and/or resource problems. This tool offers an added dimension which was lacking in the standard Laboratory monitoring system; that being the ability to break down component activities into specific tasks and assign time and resources to each task for subsequent evaluation. PROJECT/2 will become increasingly valuable to both the Program Office and Project leaders in their review of ongoing and proposed activities.

I. Audit

In addition to the fiscal review conducted by the Project Manager, Laboratory accounting records are subject to audit from several sources. An internal audit staff is attached to the Laboratory Controller's Office and conducts random audits to verify the integrity of the existing cost control system. The University of California, funded by the Department of Energy to operate Los Alamos National laboratory, also maintains an audit staff at the Laboratory to inspect procedures. In addition, the Laboratory is scrutinized periodically by independent auditors representing the Department of Energy, General Accounting Office, Inspector General and other entities. AID also reserves the right to conduct an audit of this project. Such continuous auditing assures that the Laboratory's cost control and reporting system meets AID standards for accuracy, reliability and integrity.

In light of the implementation method to be employed under this project, a PASA Agreement with another U.S. Government Agency, and tne level of audit coverage already provided, it is not necessary to set aside project funding for additional coverage. However, Los Alamos and the Department of Energy will be required to provide ROCAP with copies of all audits and/or financial reviews related to project activity, not less than annually.

V. SUMMARY PROJECT ANALYSES

A. Economic/Investment Analysis Guidelines

For all ongoing and future activities carried out under the Central America Energy Resources Project, the investment potential of specific energy and mineral resource development must be examined. This issue was first raised during the recently completed project evaluation. It was pointed out that the technical aspects of mineral identification must be followed by analyses that focus on the economic and financial rates of return, on risk assessment, and on the proper vehicle for promotion and investment.

These efforts will, of course, rest on the collection of a comprehensive set of engineering cost data. The projected total costs of any resource development will be divided into its fixed and variable components, and will include the effects of scale economies encountered at each relevant level of production.

With appropriate cost models, it will then be possible to investigate economic and financial viability and to package the project for public or private investment. Accordingly, for each resource development component covered in this Project Paper Amendment, the economic and financial analysis will proceed as follows:

1) The economic analysis will compare the rate of social return to the exploitation with the opportunity cost of capital in the respective country. For this effort, conventional internal rate of return (IRR) or net present value calculation should be used. Special attention must be applied to the use of accurate shadow prices for the factors of production and for foreign exchange.

2) If the proposed energy or mineral exploitation is determined to be economically viable, the analysis can turn to the financial aspects of the project and calculate the likely financial internal rate of return (FIRR) to the exploitation. The value of FIRR, as well as the amount of the initial cash outlay, will help determine if the investment is best suited to public or private investment.

3) If it is decided that the project is best suited for public sector investment, it should be packaged as a bankable project for a prospective external donor. In addition to the economic and financial analyses discussed above, the

package could include an impact analysis and a discussion of the policy environment. The impact analysis would attempt to measure the significance of the investment in terms of several relevant macroeconomic variables including GDP, employment, the balance of payments, etc. The discussion of the policy environment would examine those elements of the policy matrix, e.g., tax rates, domestic interest rates, exchange rates, that may affect the viability of the investment and which would be likely subjects for a policy dialogue between the host government and the external donor. Financial constraints imposed by economic policies aimed at maintaining equilibrium of the economy (savings/investment, real prices/subsidies, chosen objectives/financial resources) must be borne in mind.

4) To respond to private investment interest, it will be necessary to perform financial analysis, i.e., the FIRR and cash flow projections, as well as a description of the investment climate that would interest a prospective private investor: tax rates, investment incentives, equity/debt swap potential, wage rates, labor union activity and the like.

The decision as to whether a project is best suited to public or private investment may not be obvious, ex ante. In such a case, consultations among the contractor, ROCAP, Los Alamos and the government of the respective country may be appropriate before a project is packaged for a suitable investor.

Discussion of Specific Components

In addition to the above, the analysis on each project component will focus on the following specific items:

1) Peat Resources in Costa Rica and Panama

An economic analysis of the exploitation of peat as an alternative energy source will be undertaken. Based on cost data, a sensitivity analysis will be conducted in order to evaluate the economic viability of peat exploitation under several scenarios of alternative fuel costs.

2) Costa Rica Mineral Inventory

As in the case of peat, a complete economic analysis of the data gathered during geochemical surveys will be undertaken.

3) Geothermal Electric Power Development for all Countries in Central America

The successful exploitation of geothermal power will rest on a complete analysis of this energy source vis-a-vis other alternatives. Comparative energy prices have a strong influence on consumer choices among energy alternatives. They are determined to a large extent by relative end-use efficiencies which vary widely according to the type of energy used, its application, type of equipment used, and equipment power output. To provide appropriate signals to consumers, prices must reflect the economic cost of the energy form in question.

Once a cost model is available, it should be possible to compare the viability or the efficiency of geothermal power with alternative such as fossil based fuels and hydropower. One very important component of this research will be a determination of the proper blend of various energy alternatives within the national grid or within the national power system to determine at what point geothermal power would substitute for other sources.

4) Geothermal Direct Heat Program for Guatemala and Other Central American Sites

The economic and financial analysis will focus on a study of commercial scale, agricultural-processing applications of geothermal direct heat. The components of such a study should be the identification and quantification of production metnodologies and costs, product markets, marketing mechanisms, transportation mechanisms, transportation and marketing costs, and the competitiveness of product quality and price.

It will eventually be necessary to develop a comprehensive economic and financial analysis of each natural resource component. This shall include cost analysis, an economic rate of return, financial analysis and, when needed, a description of the policy and investment climate for each potential investment.

An outline of the work is as follows:

a) Using the technical data gathered during the survey phase, develop a complete cost model including average and marginal costs at each relevant level of production.

b) Using the cost analysis developed in A) above, conduct a complete economic analysis of the exploitation to include:

1. Selection and discussion of the appropriate shadow prices for the inputs. Special attention must be paid to overvalued exchange rates, fiscal subsidies, and the tax and external tariff regimes.

2. A calculation of the economic viability of the development employing once of several commonly accepted methods: economic internal rate of return (EIRR), net present value, etc.

3. A sensitivity analysis that examines changes in the EIRR brought about by different assumptions with regard to the key variables.

4. A discussion of the calculated EIRR in the contest of opportunity cost of capital in the respective country.

c) If the analysis in A) and B) above indicates that the development is likely to prove economically viable, a financial analysis of the exploitation will be developed that will include:

1. a financial internal rate of return (FIRR) including sensitivity analysis.

2. a cash flow analysis.

d) Examine, in detail, the policy and institutional environment that the potential investor, private or public, is likely to encounter in the respective country. This will include, but not be limited to, the following:

1. wage levels, availability of skilled labor, labor-management relations, and labor legislation;

2. recent trends in fiscal and monetary policy and the resulting economic performance;

3. the extent of investment incentives offered to foreign investors such as tax holidays, tariff exemptions and the like;

4. the nature of the supporting infrastructure, i.e., the power grid, telecommunications, the road/rail net, etc.

e) If the project is best suited for public sector investment, analyze the likely impact of the project on key economic variables: the balance of payments, the gross domestic product, employment, relative prices, etc.

B. Institutional Analysis

Background

The Los Alamos National Laboratory was founded in 1943 and designated a U.S. national laboratory in 1981. The laboratory, located in New Mexico, is owned by the U.S. Department of Energy and is operated by the University of California. It presently employs approximately 8,000 employees. The Laboratory's primary focus is in weaponry testing and defense, and includes conventional and non-conventional energy development as well. The Laboratory has recently become more involved with the private sector and developing countries in technology transfer and cooperative programs.

Prior Experience in Related Technical Fields

To meet the needs of its weapons testing programs, Los Alamos has assembled a complete geosciences team. With the increased empnasis on alternative energy caused by the oil crises of the 1970s, this team expanded into geothermal exploration. The hot dry rock technology is being investigated and demonstrated by Los Alamos, in conjunction with Germany and Japan, at the Fenton Hill Site near Los Alamos. This effort has allowed Los Alamos to develop considerable expertise in high temperature systems. In St. Lucia under financing by the Carribean Development Bank, Los Alamos carried out geothermal reconnaissances and assessments which are now the basis for St. Lucia's Geothermal Energy Development Project.

In support of its mission, Los Alamos has also developed expertise in other areas which are applicable to the studies being carried out under this amendment. Among these are: mineral geology, hydrocarbon technology, alternative energy assessment, energy economics and energy systems. In addition, the Los Alamos computer system is among the most advanced in the world.

Prior AID Experience

In early 1985, DOE signed a PASA agreement with AID to utilize Los Alamos' unique technical expertise throughout the region. The areas of expertise included in the work under the original project paper were: geothermal reconnaissance and assessment; mineral reconnaissance; peat reconnaissance and end use; energy planning; and geothermal industrial process heat utilization.

The first phases of Project 596-0134 were to determine the natural resources in each of the countries in the region, assess their development potential, train in-country personnel, establish regional and national energy data bases and begin the energy planning process in the CA/P region.

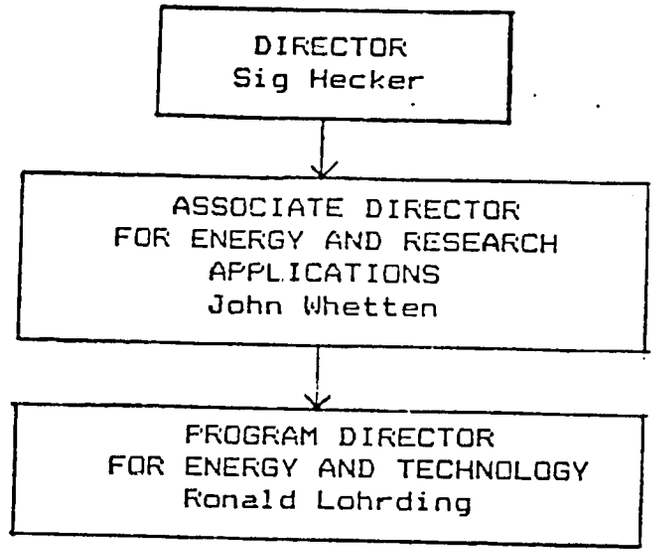
Los Alamos has been successful in meeting the major project objectives and has developed good working relationships with counterparts and institutions associated with the project.

Project Management

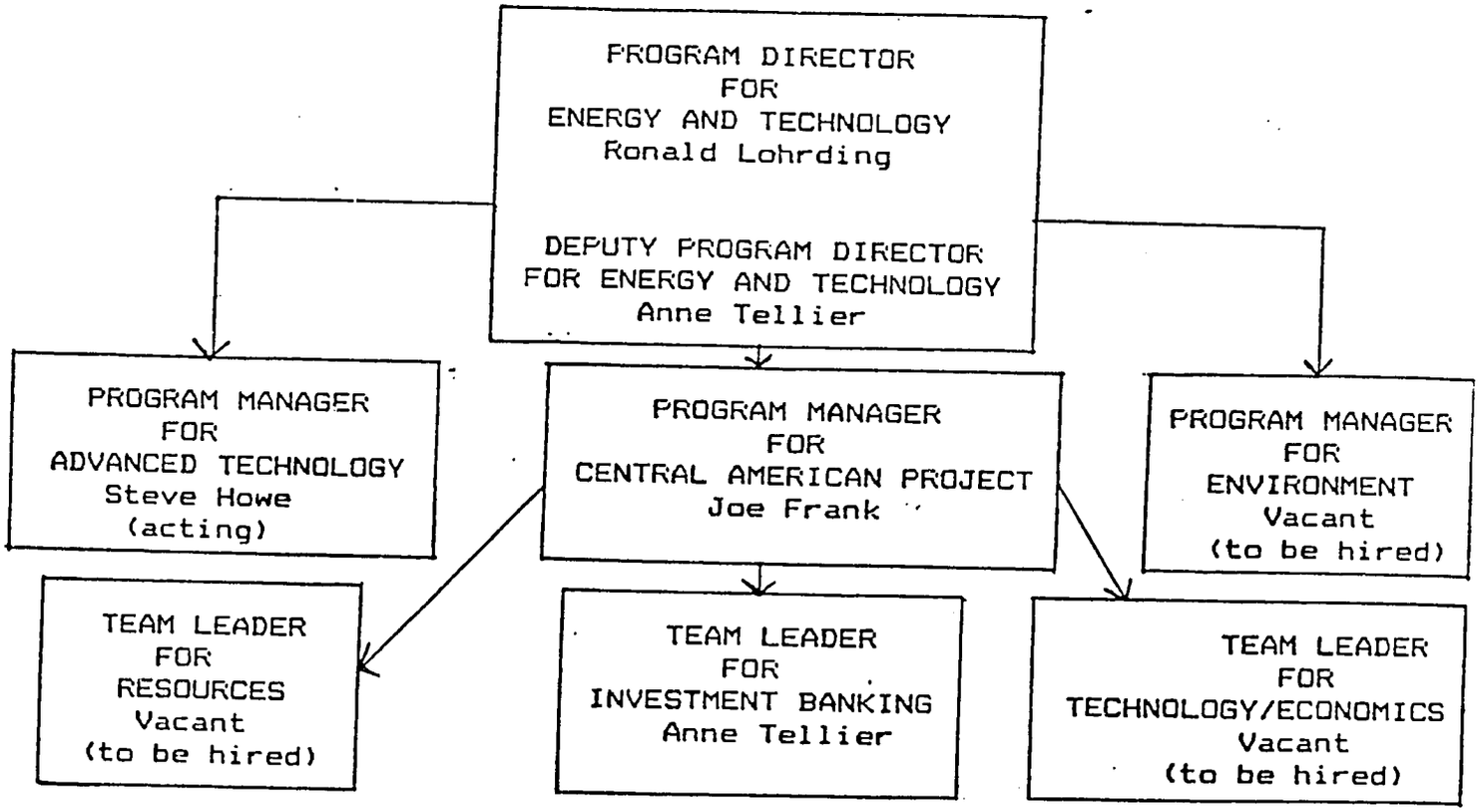
Project management has been modified to respond to the unique needs of this project and its considerable participants and beneficiaries. A diagram of the new management structure (Figure 1) reflects a hybrid blend of matrix and line management organizational structures. The Laboratory itself is organized in a similar manner, and this new format will allow the Central American Project to take advantage of the strengths inherent in this type of system.

Figure 1

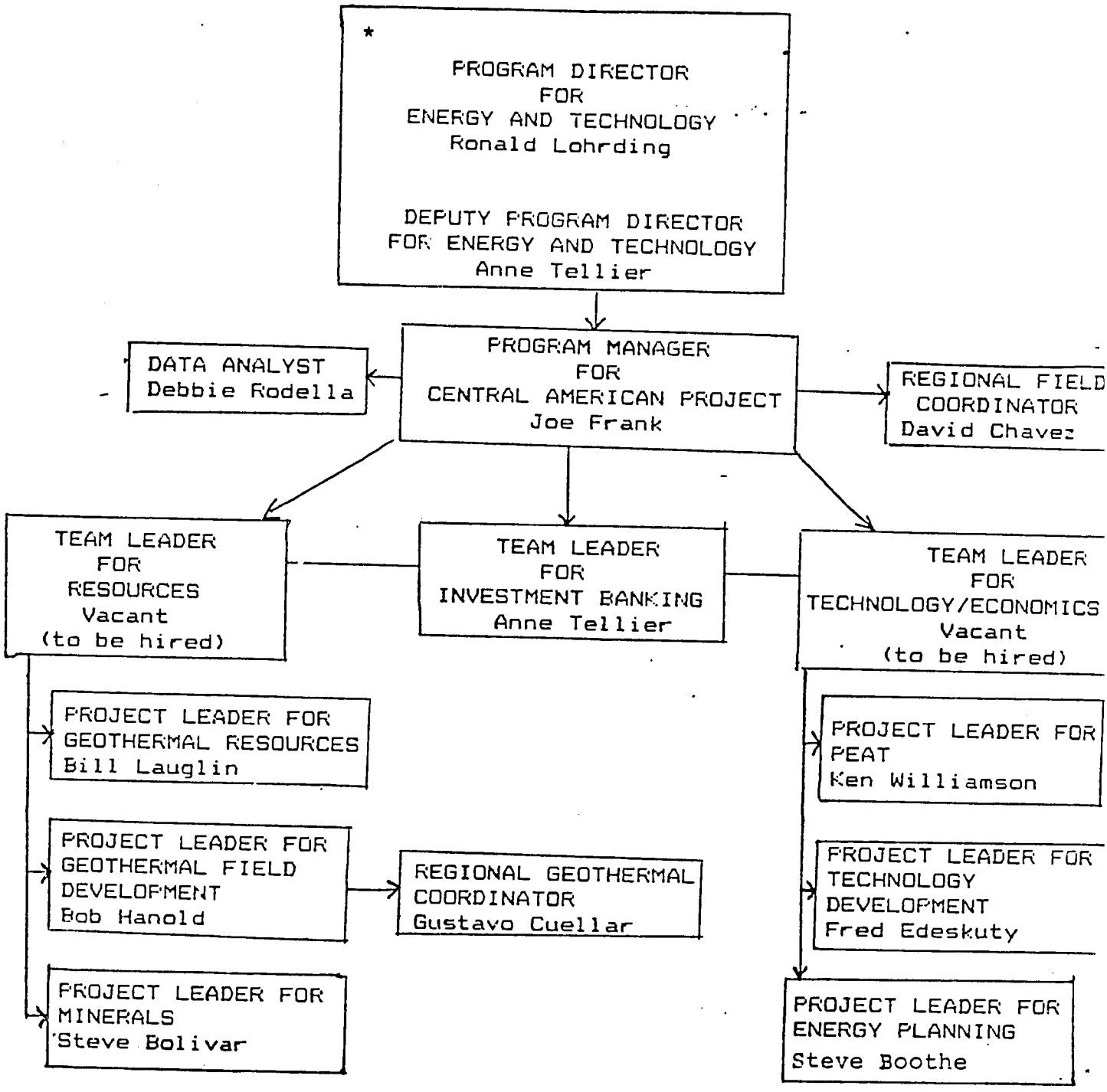
LOS ALAMOS NATIONAL LABORATORY MANAGEMENT CHART



ENERGY AND TECHNOLOGY OFFICE MANAGEMENT



CENTRAL AMERICAN PROJECT MANAGEMENT



*These ET Office managers are less than full-time on the Central American Project. None of their time is charged to the Project.

Overall project management will be the responsibility of the Program Director for Energy and Technology, while full time management and project supervision will be carried out by the Los Alamos Program Manager.

The Energy and Technology Program Office provides the primary point of contact with the AID/ROCAP office in Guatemala, while the various technical divisions at Los Alamos, under the management and supervision of project leaders, provide the scientific expertise needed to address project component technical matters. In this way, a series of diverse technical activities associated with the Central American Project can be monitored at several levels within the overall Los Alamos management structure.

Project management and decision-making responsibilities for the project are centered at Los Alamos in the Program Office; however, regional field coordination is provided by two Los Alamos representatives located in Central America. The Regional Coordinator is in Guatemala City and a Geothermal Field Coordinator is located in San Salvador. These two individuals will respond to local concerns and issues, resolve logistical problems and maintain contact with AID/ROCAP and appropriate country counterpart personnel. Their familiarity with the region and proximity to regional activities is important for the success of the project.

The primary role of the Regional Coordinator is to serve as liaison with AID/ROCAP, bilateral missions and regional counterparts. The Regional Coordinator provides assistance and daily oversight to the project, with constant communication maintained between he and the Program Manager. In addition, the Coordinator has been assigned a primary role in the Direct Heat Demonstration component being carried out in Guatemala. On the geothermal technical and administrative side, the Field Coordinator has a primary role in the evaluation of geothermal activities and the determination of and planning for geothermal component activities.

The project components require a blend of the technical expertise found at Los Alamos and other national laboratories, educational institutions and in the private sector. Guidance and assistance is provided by the Program Office in the selection and contracting of appropriate services. Counterpart support in the region, in the form of technical expertise and policy coordination, is also incorporated into each project component.

The primary objective of the Project Management component is to provide the central focus for strategic planning and organization of the various component activities. In carrying out the project objectives, Project Management will be facilitated by the implementation of PROJECT/2, a computerized management and accounting tool. This computerized system has given the project's Program Office added capabilities in planning for the Central American Program, and in monitoring technical and financial accountability and progress toward accomplishing objectives.

The components of the project are managed by three Team Leaders: one for Technology/Economics; one for Resources; and one for Investment Banking. Team Leaders will work closely with the Project Leaders to develop the component strategies, prepare work plans, monitor performance, and identify and resolve potential problems. Project Leaders will have full responsibility for accomplishing the objectives of the individual project components. They will help ensure the technical quality of component activities and will assist in monitoring component progress. Various scientific and technical personnel from Los Alamos, host governments and other organizations will collaborate in performing the tasks defined in each component.

Coordinating these management tasks to effectively achieve the project's objectives is also the responsibility of the Program Office. The Program Office staff, consisting of the Program Manager, Regional Field Coordinator, Geothermal Coordinator, three Team Leaders and a PROJECT/2 Systems Analyst, will be assigned full time to the Central American Project. Personnel costs of the Team Leader for Investment Banking and the Systems Analyst will not be funded under the project, rather they will be provided for by Los Alamos project counterpart funds. The Geothermal Field Coordinator will be partially financed out of Los Alamos management funds. The multi-disciplinary project team includes project personnel who are proficient in Spanish, familiar with the region, skilled in project management and implementation and fully capable of achieving the objectives of the project.

Contracting for short term technical assistance will be used by the program office and at the request of technical groups as needed, and such assistance will charged to the corresponding project component.

Two Los Alamos scientists are currently participating on geothermal energy evaluation panels, one taking place in Guatemala and the other in Panama. These panels meet twice a year for one week to assess progress and plan the direction of future geothermal work. Participation by Los Alamos was requested by the countries and the organizations which provide funding for their geothermal development programs. The travel, expenses and personnel costs associated with these panels will be funded out of the project's management component.

Major Counterparts

Los Alamos has established or is in the process of establishing counterpart relationships with the most appropriate national and regional counterparts for specific technology or project activities. The major counterparts are:

Costa Rica:

- Minerals:	Ministerio de Industria, Energía y Minas (MIEM) and Universidad de Costa Rica (UCR)
- Energy Planning:	MIEM
- Peat:	Refinadora Costarricense de Petroleo (RECOPE)
- Geothermal:	Instituto Costarricense de Electricidad (ICE)

Panama:

- Energy Planning:	Comisión Nacional de Energía (CONADE)
- Peat:	Instituto de Recursos Hidraulicos y Electrificación (IRHE)
- Geothermal:	IRHE

Honduras:

- Energy Planning:	Consejo Superior de Planificación Económica (CONSUPLANE)
- Geothermal Development:	Empresa Nacional de Energía Eléctrica (ENEE)

El Salvador:

- Energy Planning: Comisión Ejecutiva Hidroeléctrica del Río Lempa (CEL)
- Geothermal Development: CEL

Guatemala:

- Energy Planning: Ministerio de Energía y Minas (MEM)
- Geothermal Development: Instituto Nacional de Electrificación (INDE)
- Geothermal Direct Heat: MEM, INDE, GREMIAL DE EXPORTADORES

Regional Institutions

- Energy Planning & Training: Instituto Centroamericano de Administración de Empresas (INCAE)
- Peat End Use: Instituto Centroamericano de Investigación y Technología Industrial (ICAITI)
- Regional Data Base and Planning: Secretaría Permanente del Tratado General de Integración Económica Centroamericana (SIECA)

Los Alamos has also provided personnel with expertise in energy and minerals development to the OAS Employment Generation Missions in Honduras, Costa Rica and the Dominican Republic, and is providing experts to the IDB Geothermal Development Committees in Panama and Guatemala.

VI. IMPLEMENTATION AND MONITORING PLAN

A. Implementation Scnedule

Central American Energy and Resource Project

Chronogram of Proposed Activities for 5/87 - 6/89

May 1987	Project Paper Amendment authorized, 5 month work plan approved by ROCAP, PASA agreement signed, and disbursement of funds approved by DOE. Begin Ahuachapán well logging.
May 1987	Management Plan for the operation and maintenance of the well logging truck in Central America approved by ROCAP.
June 1987	Econometrics software selected and transferred to counterparts with instructions in its use.
July 1987	Effective utilization study of Costa Rica mineral reconnaissance completed.
August 1987	Regional computer hardware enhancement completed.
	Complete Ahuachapán well logging.
	Deep DC resistivity completed near Ahuachapán and Chipilapa.
September 1987	Regional seminar held on integration of national energy-planning effort.
	Prices incorporated in Costa Rica energy demand model.
	Report prepared on energy demand modeling literature survey and methodology selection.
	IRHE proposal prepared with Los Alamos technical assistance, submitted to IDB for funding for prefeasibility studies on using peat for Changuinola power plant.
	RECOPE proposal prepared with Los Alamos technical assistance submitted to IDB.

	Peat resource assessment completed.
	Costa Rica mineral reconnaissance component completed.
	All MOUs will be negotiated and signed with the project's Ministerial counterparts prior to the end of FY87.
October 1987	Begin Zunil well logging.
November 1987	Operations begun at Zunil drying/dehydration demonstration facility.
December 1987	Recommendations provided to ENEE on potential for Honduras geothermal development.
	Prefeasibility study of Zunil agricultural processing plant complete.
January 1988	Energy demand model selected and adapted to region.
	Planning assistance provided to El Salvador, complementing IDB-sponsored planning project.
	Assistance provided to Guatemala in construction of information system and adaptation of Costa Rican energy demand model to Guatemala.
	Planning assistance provided to Honduras in energy consumption survey techniques.
	Consultation completed with Panama on their national energy plan.
	Zunil well logging completed.
February 1988	Logging of Amatitlán slim hole gradient wells begun.
March 1988	Platanares well drilling report complete.
April 1988	Prefeasibility study of Guanacaste region initiated with ICE (ongoing for 2-3 years).
	Prefeasibility study of Honduras geothermal potential completed.

May 1988	Logging of Amatitlán slim hole gradient wells completed.
	Initial Zunil drying/dehydration demonstration complete.
June 1988	Deep DC resistivity completed at Amatitlán.
	Amatitlán direct heat studies begun.
February 1989	Project evaluation begun.
	IDB funded study in Panama on Changuinola peat options complete.
April 1989	Project evaluation completed.
June 1989	Scheduled end-of-project.

B. ROCAP Management and Monitoring

Project management responsibility will rest with the ROCAP General Development Office, and will be assisted by the Project Development and Controller's Offices. The Regional Energy Advisor will have day-to-day supervision over the execution of this project amendment.

ROCAP will be assisted in routine project monitoring by periodic reporting from Los Alamos and close collaboration with the Los Alamos project management team. Semi-annual review meetings, and other meetings as necessary will be held between ROCAP and Los Alamos staff to assure proper coordination.

In addition, although ROCAP will maintain primary oversight and control of the implementation process, the bilateral missions in each country will have the opportunity to participate in the negotiation of Memorandums of Understanding (MOUs) between Los Alamos and the governments of the region regarding project objectives, activities and strategy in each country. They also will have the responsibility of guiding and directing activities and interventions programmed or being conducted in their host-country.

1. Host-Country Counterpart Participation and Contributions

Host-country and regional counterparts have been or will be established for virtually every project activity anticipated under this amendment. MOU's and other written agreements will be prepared, negotiated and/or amended with each counterpart in order to clearly establish the nature of the relationship and the general and specific responsibilities of each party. An illustrative list of counterpart agencies is included in the institutional Analysis (See Section V.B). These agreement documents will be attached to the corresponding annual work plans. An estimate of the total host-country counterpart contribution, both in-kind and level of effort, is included in the financial plan. Los Alamos will continue to seek to obtain commitments from host-country counterparts for adequate contributions to complement the grant-funded assistance under this project.

2. Implementation Procedures

This Project Paper Amendment will be implemented over a period of approximately two years. The planned project completion date is June 30, 1989, however, this date may be extended in the future based on unavoidable delays or other factors.

The primary implementation document will be the fifth amendment to the existing PASA agreement between AID and DOE. However, control of the implementation process will be derived from the exchange of detailed semi-annual work plans from Los Alamos, and corresponding written approval of these work plans by ROCAP to the Department of Energy Office in Albuquerque.

- Work Plans and Implementation Letters

Work plans will be prepared by Los Alamos which will: (a) summarize past and proposed expenditures by component; (b) outline activities, travel, outputs and timing by component; (c) detail anticipated costs by task and by category (including disaggregating salary, contract, travel and perdiem costs); (d) estimate person/days in the region and at Los Alamos to be billed to the component or task; and (e) eventually be keyed to the management control planning system.

These detailed work plans will be received, reviewed and approved by ROCAP. Prior to the initiation of any work described in the work plan, ROCAP (the General Development Office, the Project Development Office and the Controller's

Office) will prepare an "Implementation Letter". These implementation letters will authorize Los Alamos to begin work on activities that have been well-defined and explained by Los Alamos, and approved by ROCAP with the notification to DOE in Albuquerque. Tasks proposed by Los Alamos which require further clarification or justification prior to approval will be identified in the implementation letter, along with instructions for specific information or actions that ROCAP deems necessary prior to approval. Additional letters from ROCAP project management may also be issued at any time in order to guide the process of project implementation.

In order to avoid delaying the preparation of the first approvals and implementation letters, it was agreed during meetings held in Los Alamos the week of January 12, 1987, that Los Alamos would submit to ROCAP by Feb. 20, 1987 drafts of the proposed work plans. This date has subsequently been altered at the request of Los Alamos to April 3, 1987. The work plan to be submitted will cover approximately 5 months from May 1, 1987, to September 30, 1987. This is being done to avoid putting too much pressure on the Los Alamos staff and also to allow for to adjustments in planning for the fiscal year. At the January meeting it was also agreed that the first annual work plan would be prepared and submitted to ROCAP by August 28, 1987, covering the period from October 1, 1987 to September 30, 1988, and well as the detailed project component workplan for the next six months, beginning October 1 and ending March 31, 1988. (Project funding will be authorized and disbursed against cost submissions by Los Alamos over each six month period.)

- Semi-Annual Work Plan

The semi-annual workplan will effectively revise annual workplans by providing detailed schedules, budgets, and expected levels of effort. ROCAP approval will be required prior to performing the work outlined. Semi-annual work plans will be submitted to ROCAP beginning with FY88 work. These plans will be submitted one month prior to the start of each quarter.

To prevent any delays in ongoing project implementation, Los Alamos will be expected to submit to ROCAP the detailed budget and work plan for subsequent six month periods at least one month prior to the termination of the previously approved semi-annual work plan. ROCAP expects that all work plans, particularly the annual work plans, will be the result of prior discussions and negotiations with counterparts in the region and local USAID offices.

Scopes of work and budgets of all subcontracts entered into by Los Alamos with Project funds will be reviewed by ROCAP prior to implementation. Whenever possible, the scopes of work and budgets will be summarized in semi-annual work plans.

Travel authorization (country clearance) requests must be received by USAID missions at least 10 working days prior to the planned arrival of Los Alamos personnel in the region. These travel requests should make reference to the work and trips described in the quarterly work plans.

- Annual Reports

Annual reports summarizing the Project's activities and accomplishments will be prepared and submitted to ROCAP. These annual reports will review and explain the evolution of various project components and subcomponents during the prior year. These reports will be submitted to ROCAP on a fiscal year basis, therefore, the first report will be due in October 1987, and will cover the period from October 1, 1986 to September 30, 1987. It is expected, for example, that the first annual report will describe how the first project evaluation completed in September 1986 effected the direction and implementation of the Project during FY 87. This report will be submitted in at least 10 copies for distribution to AID/Washington and bilateral USAIDs.

Throughout the Project period the Los Alamos Project Manager will also present quarterly status reports to ROCAP describing aspects of the Program, problems encountered, and a narrative summary of the plans for the next quarter. These reports will contain other information ROCAP may reasonably request in a form acceptable to ROCAP, but need not repeat the detailed information that will have already been presented in the semi-annual workplans.

3. Project Amendment Evaluation

A Project evaluation will be performed under this amendment during the last six months of this amendment. The focus of this evaluation will be on the extent to which the Project has improved in relation to recommendations made in the first interim evaluation completed September 1986, and the degree of success in completing tasks and objectives that are defined in this amendment document and subsequent work plans. This evaluation will also closely examine overall progress under the Project and assist in decisions regarding time extensions, future funding and project direction.

The end-of-project evaluation will be financed out of project resources. The evaluation will be performed by an outside contractor who will submit a report to ROCAP and Los Alamos. The report is intended to:

- Evaluate the progress toward achievement of the project purpose and stated objectives;
- Determine if the project purpose was accomplished during the time frame established in the Project Paper;
- Determine whether implementation plans were adequate to achieve the project purpose; and
- Assess the need for and nature of possible future activities.

The specific work statement for this subcomponent will be developed by ROCAP and Los Alamos, with the contracting process being carried out by ROCAP.

Project activities will be closely coordinated with AID/ROCAP through the Los Alamos Project Office, with communications maintained by telephone, facsimile, mail and in person. All modifications of previously approved project activities will be discussed with and approved by AID/ROCAP.

PROJECT AMENDMENT LOGICAL FRAMEWORK

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS
Program Goal: Stabilization of Central American economies and energy balances	Measures of Goal Achievement: A. Economies 1. Employment rate returns to 1980 level 2. Balance of payments returns to 1980 level 3. Balance of trade returns to 1980 level 4. Emigration/migration balance B. Energy Balances 1. Stable oil consumption and imports 2. Stable energy cost per calorie 3. Neither energy deficits nor idle capacity 4. Deforestation/reforestation balance
Program Subgoal: Energy- and mineral-based industrial growth and efficiency	MEASURES OF SUBGOAL ACHIEVEMENT: A. New Energy Plants 1. Electricity generated 2. Direct heat generated 3. Sales, profits, cost coverage 4. Employment generated B. New Energy-Based Industry 1. Value of products 2. Sales, profits 3. Employees C. Mining Industry 1. Value of production 2. Sales, profits 3. Employment 4. Revenues to government D. Energy Efficiency 1. Energy saved 2. Natural resources protected
Project Purpose: To increase the growth and efficiency of energy investments and improve the policies and planning mechanisms of energy sectors in each country of the region.	Conditions Indicating Purpose Achieved: Eight (8) energy investment opportunities identified, feasibility determined and government, investor, and/or other donor presentation activities underway. National energy planning and policy matrices enhanced, thus permitting a more efficient allocation of energy resources. Data generated and shared with Central American governments and agencies and other donors will permit informed invest/discard decisions on proposed geothermal projects. ENEE will possess a sound technical and economic basis for determining appropriate investments in geothermal resource development in Honduras. A successful demonstration of the application of geothermal direct heat for industrial use established to serve as model for similar facilities throughout the region. The viability of a peat-fired power plant in northwestern Panama will be determined. The feasibility of peat as a substitute for fuel oil in a combined process heat/electrical plant at the RECOPE refinery near Limón, Costa Rica will be determined. Completed mineral reconnaissance data for Costa Rica will have been disseminated, in coordination with the CCCR, LANL, USGS and AID, in order to stimulate exploration and attract investors.

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
I. ENERGY PLANNING ASSISTANCE			
A. Energy Planning			
1. National and Regional Energy Situation Analysis Update	National counterparts and SIECA personnel trained and provided with LANL technical assistance to update ESA as needed.	Annual Update	Counterpart personnel available for training on a timely basis. Current energy data available.
2. Additional Data Base Design, Development and Operation	Data base information to include financial, pricing, economic and social data.	Evaluation	Counterpart organizations gather additional information.
3. Energy Demand modeling Improved.	Pricing effects incorporated into demand models.	Evaluation.	Countries will identify energy modeling requirements.
4. Regional Data Base and Analyses Center	SIECA will be contracted as the regional center.	Signed contract.	
5. Energy Policy Studies and Analysis	Each national counterpart, with LANL assistance, will do a study essential for energy and investment decision-making.	Completed studies.	National governments define the study area and provide sufficient personnel.
B. Training			
1. Energy Data Gathering	12 national and regional counterpart technicians trained per workshop in energy data information gathering and survey development (4 workshops).	Verification that data and information gathered is valid and consistent.	
2. Energy Data Storage and Manipulation (SICAPE)	30 national and regional counterpart technicians trained per workshop (4 work-shops).	Workshops reports.	
3. Hardware & Software Training	30 national and regional counterpart technicians trained per workshop (4 work-shops).	Evaluation	Qualified middle-level technicians available.

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
4. Energy Data Analysis and Utilization	12 planners trained per workshop in energy data analysis (4 workshops).	Evaluation	Workshops are feasible
5. Energy Decision-Makers Forum	10 high-level (ministry) officials shown how to use SICAPE in energy policy decision making.	Evaluation & counterpart feedback.	Stable governments/democracies in Central America.
C. Computer Systems Capability Upgraded	LANL and counterparts agree on software & equipment required.	Equipment installed and software programs operational.	Government counterpart budgets sufficient to maintain equipment and provide training.
2. GEOTHERMAL FIELD AND RESOURCE DEVELOPMENT, AND GEOTHERMAL DIRECT HEAT			
A. Resource & Reservoir Development			
1. Existing Fields			
(a) Ahuachapán			
. The evaluation of available geological-geophysical-hydrological and reservoir production and injection data complete.	Ahuachapán field data including production and injection history well test data, geophysical and pertinent drilling record data compiled and analyzed.	Evaluation, Government records.	Access to government information and records remains good.
. Deep resistivity studies South East of the existing production field complete.	- Using Ahuachapán Data LBL will develop a conceptual model, natural state model and explotation map of the Ahuachapán reservoir.	SICAPE Evaluation.	Access to government information and records remains good.
. Well logging operations on wells decided upon by CEL. Los Alamos and AID have been completed.	-Logging for selected parameters will be complete for 4 wells. -Logging report complete -Geochemical sampling of wells being logged and geochemical analysis complete.	Evaluation Progress Reports	Access to government information and records remains good.

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
(b) Zunil I, Guatemala			
• Well logging of selected wells complete. • D.C. resistivity survey complete. • Geochemical brine analysis complete.	• 5 wells will be logged for selected parameters. • Data from resistivity lines will be collected and analyzed. • Well logging report complete. • Brine samples from logged wells collected and analyzed.	Evaluation	Component activity carried out on schedule.
(c) Miravalles, Costa Rica			
• Well logging of selected wells complete. • Geochemical brine analysis complete.	• Logging of 5 wells complete. • Geochemical sampling of brine samples complete • Logging report submitted to ICE.	Evaluation	Component activity carried out on schedule.
2. New Fields			
(a) Amatitlán, Guatemala			
• D.C. resistivity studies complete.	- Deep resistivity plan developed with INDE (and IDB).	Evaluation	Component activity carried out on schedule.
(b) Platanares, Honduras			
• Prefeasibility study with recommendations complete.	- Pre-feasibility study complete. - Detailed structural mapping complete.	Evaluation Investment Prepackage	Component activity carried out on schedule.
(c) Chipilapa, El Salvador			
• Deep resistivity studies complete. • Reservoir engineering study complete.	- Deep resistivity plan complete. - Data from of D.C. resistivity lines collected.	Evaluation	Component activity carried out as planned.

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
• Selected technical assistance to CEL complete.	- Reservoir engineering plan developed with CEL.	Evaluation	Well logging track properly maintained and training programs carried out.
(d) Zunil III, Guatemala			
• Deep resistivity study complete.	- Deep resistivity plan with INDE.	Evaluation	Well logging track properly maintained and training programs carried out.
• Selected technical assistance to INDE complete.	- Data from of D.C. resistivity lines collected.		
(e) Guanacaste Region, Costa Rica			
• First of 2 phases of pre-feasibility study of site selected by ICE complete.	- Detailed work plan prepared with ICE. Phase I geological, geochemical and geophysics field work complete.	Evaluation	Well logging track properly maintained and training programs carried out.
B. <u>Support Equipment</u>			
• A comprehensive geothermal support equipment mangement plan developed.	• 10 national counterpart technicians trained in geothermal logging surveys (3 workshops).	Evaluation	Government's energy budgets sufficient to retain good personnel.
• Logging survey training complete.	• 10 national counterpart personnel trained in geothermal equipment management and maintenance.	Evaluation	Government's energy budgets sufficient to retain good personnel.
• Geothermal equipment management and maintenance training complete.	• 10 national counterparts trained in the use of D.C. resistivity and AMT equipment (3 workshops).	Evaluation	Government's energy budgets sufficient to retain good personnel.

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
C. End Use			
• The drying/dehydration demonstration will be completed and handed over to the private sector.	• Operations agreement reached between Gremial, INDE, MEM, Los Alamos.	ROCAP Monitoring and records	Budget support of government energy agencies adequate to follow-up on key recommendations.
• The detailed study of the commercial scale, agricultural processing plant will be complete.	• Market study team contracted. • Technical design team contracted. • Package presented to potential donors/investors.	Evaluation	Geothermal end-use investments are economically viable in Central America and Panama.
• A preliminary evaluation with invest/discard decision of the direct heat potential of the Pavana geothermal site in Honduras will be complete.	• Identify counterparts and implement commitments and agreements. • Market study team contracted.	Evaluation	Geothermal end-use investments are economically viable in Central America and Panama.
• A preliminary evaluation with invest/discard decision of the low and medium-enthalpy use of geothermal heat at Amatitlán in coordination with INDE and IDB efforts.	• Identify counterparts and implement commitments and agreements. • Market study team contracted.	Evaluation	Geothermal end-use investments are economically viable in Central America and Panama.
3. COSTA RICA MINERAL RECONNAISSANCE			
A. Economic Analyses Complete	A.1 Cost-benefit and economic feasibility provide information for investment/discard decision A.2 Justification for further chemical analysis, if any.	Evaluation	GOCR participates actively and assumes responsibility for guiding ongoing decisions.
B. Findings transferred to GOCR	B.1 Briefings held B.2 Decisions made as to next steps. B.3 Packaging assistance for mineral industry.	Meeting reports	
		Further investment occurs.	An investment option is proven.

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
4. EVALUATION OF PEAT DEPOSITS IN CENTRAL AMERICA			
A. Proposals assisted for pre-feasibility studies prepared for Panama.	A.1 Economic and technical viability study of Panama power plant completed. A.2 Assistance provided to IHRE for proposal for pre-feasibility study submitted by IHRE to IDB. A.3 Environmental tests completed.	Evaluation	Most of the economic and technical data is available under the original project.
B. Financial, Technical and Marketing Prefeasibility completed with RECOPE.	B.1 RECOPE assisted in finishing financial, technical and marketing prefeasibility of Costa Rican peat deposit.	Evaluation	Project to date provides necessary data inputs.
5. INVESTMENT ANALYSIS, PROMOTION AND MONITORING			
1. Ongoing Invest/Discard decision making capability for each geothermal reservoir being addressed under the PP Amendment.	Ahuachapan (El Salvador), Platanares (Honduras), Miravalles (Costa Rica), Zunil (Guatemala), continued exploitation, development and investment analysis based on risk/refund procedures and cost effective approaches.	Periodic reporting to LANL/ROCAP	Close monitoring is done by both LANL and ROCAP.
2. Geothermal Process heat existing fields and demonstrations, and new well logging sites involving potential investment and commercial applications.	Invest/discard decision making techniques employed for existing fields, new well logging sites in each country. Estimated amount: El Salvador 1; Honduras 1; Costa Rica 1 and Guatemala 2.	Periodic reporting and site visits by LANL and ROCAP.	Close monitoring capabilities by LANL, ROCAP and CA/P counterparts.
3. Cost/benefit approach employed by LANL management in monitoring Technical Assistance mechanism in place at LANL headquarters to allow for quick access to technicians and financial/economic analysis, and investment promotion campaign personnel.	Pert chart/computer monitoring system (MIS) operational at LANL IQC mechanism providing approximately 30 person months of assistance over the life of project.	Quarterly work plans analyzing use if IQC and projected investment analysis decision making capability.	Contract established during first quarter of implementation.

Model Scope of Work for Investment Analysis

1. Background

In a recent evaluation of the Central America Energy Resources Project, it was emphasized that the investment potential of specific energy and mineral resource exploitation or development must be carried out for all ongoing and future activities carried out under the project. For example, the technical aspects of mineral identification by themselves are not sufficient. They must be followed by analyses that focus on the economic and financial rates of return, and on the proper vehicle for promotion and investment. For this purpose, Los Alamos will contract with an outside consultant to provide the necessary services.

2. Scope of Work

Accordingly, the contractor will, on request, develop a comprehensive economic and financial analysis of each natural resource component. This shall include, but not be limited to, a cost analysis, an economic rate of return, a financial analysis and when needed, a description of the policy and investment climate for each potential investment.

3. Work Requirements

A. Using the technical data gathered during the survey phase, develop a complete cost model including average and marginal costs at each relevant level of production.

B. Using the cost analysis developed in A. above, conduct a complete economic analysis of the expoitation to include:

- Selection and discussion of the appropriate shadow prices for the inputs. Special attention must be paid to overvalued exchange rates, fiscal subsidies, and the tax and external tariff regimes.

- A calculation of the economic viability of the development employing one of several commonly accepted methods: economic internal rate of return(EIRR), net present value, etc.

- A sensitivity analysis that examines changes in the EIRR brought about by different assumptions with regard to the key variables.

- A discussion of the calculated EIRR in the contest of the opportunity cost of capital in the respective country.

C. If the analysis in A. and B. above indicates that the development is likely to prove economically viable, and all of the principals agree that it is likely to prove economically viable, the contractor will develop a financial analysis of the expoitation that will include:

- A financial internal rate of return(FIRR) including a sensitivity analysis.

A cash flow analysis.

D. Examine, in detail, the policy and institutional environment that the potential investor, private or public, is likely to encounter in the respective country. This will include, butr not be limited to, the following:

- wage levels, availability of skilled labor, labor-management relations, and labor legislation;

- recent trends in fiscal and monetary policy and the resulting economic performance;

- the extent of investment incentives offered to foreign investors such as tax holidays, tariff exemptions and the like;

- the nature of the supporting infrastructure, i.e., the power grid, telecommunications, the road/rail net, etc.

E. If the project is best suited for public sector investment, analyze the likely impact of the project on key economic variables: the balance of payments, the gross domestic product, employment, relative prices, etc.

4. Level of Effort

It is estimated that 770 man-days of effort will be required on an as-needed basis over a two year period. A team of four persons is contemplated: team leader, financial analyst, resource economist, and industrial engineer.

5. Type of Contract

6. Contracting Procedures

7. Illustrative Budget

Personnel: 770 man-days at $250 per day	$192,500
Overhead	192,500
Per diem	61,600
Travel	53,400
TOTAL	$500,000

IEE and Environmental Threshold Decision

The potential environmental impact of the activities proposed in this document is expected to be minimal. Permission from the appropriate government and/or private officials will be obtained before conducting any shallow-gradient drilling to support geothermal reconnaissance exploration and before removal of large peat samples for laboratory testing. The environmental impact of demonstration projects for geothermal process heat applications or peat end uses, will be addressed on a case by case basis for the most promising applications selected in consultation with Guatemalan, Costa Rican, Honduran and AID and ROCAP Officials.

INITIAL ENVIRONMENTAL EXAMINATION

I. Basic Project Date

Project Location:	Central America and Panama
Project Title:	Central America Energy Resources
Project Number:	596-0134, Amendment No. 5
Funding:	$10,0000,000 (G)
Life of Project:	2 Years
Date:	March 19, 1987
Action Recommended:	Negative Determination

II. Description of Project:

The Central America Energy Resources Project is designed to address the problems in Central America related to energy and mineral resource exploitation and utilization. The goal of the project is to improve economic conditions in Central American and to help create employment through increased and more efficient utilization of the region's energy and natural resource endowment. The purpose of the project is to introduce new research methodologies into the region that will allow each of the participating countries to better analyze and assess their current and future energy needs, to develop non-traditional sources of energy such as geothermal and low-grade fossil fuel resources, and to more efficiently utilize their energy resources.

The project is composed of the following five major components:

1. Energy Planning Assistance
2. Geothermal Energy Development
   a. Geothermal Field
   b. Geothermal Resource
   c. Geothermal Direct Heat
3. Costa Rica Mineral Reconnaissance
4. Evaluation of Peat Deposits of Central America
5. Investment Analysis, Promotion and Monitoring

Life-of-Project funding for the Project Amendment is $10.0 million.

III. Impact and Evaluation

The project amendment is primarily development of existing geothermal reservoirs, and research and training oriented. If research and exploration programs should lead to subsequent recommendations that a particular resource be exploited, such a recommendation would include a full analysis of the potential environmental impact of such exploitation. This will also be true of the geothermal component.

The Peat end use study proposed for the project includes an analysis of non-extractive uses for peat, i.e., the long term economic, environmental, and social benefits of leaving the peat in site and using it for agriculture, forestry, watershed management, and parks.

IV. Environmental Determination

The proposed project is not one which will have a significant environmental effect in and of itself. In view of the nature of the project and of the recommendations outlined in part III of this IEE, a negative threshold determination is recommended.

Nadine Plaster
Director
ROCAP

USAID GUATEMALA

AGENCY FOR INTERNATIONAL DEVELOPMENT
UNITED STATES A. I. D. MISSION TO GUATEMALA

USAID/GUATEMALA or c/o American Embassy
APO MIAMI 34024 Guatemala City, Guatemala, C.A.

LAC/DR-IEE-87-09

ENVIRONMENTAL THRESHOLD DECISION

Project Location	:	Central America Regional
Project Title and Number	:	Energy Resources Amendment
Funding	:	$10,000,000 (G)
Life of Project	:	Two years
IEE Prepared by	:	ROCAP/Guatemala
Recommended Threshold Decision	:	Negative Determination
Bureau Threshold Decision	:	Concur
Comments	:	Peat component will include detailed environmental impact assessment and recommendations for land reclamation. Environmental costs will be included in peat economic assessments.
Copy to	:	Nadine Plaster, Director ROCAP/Guatemala
Copy to	:	Frank Zadroga ROCAP/San José
Copy to	:	Lars Klassen, LAC/DR
Copy to	:	IEE File

James S. Hester March 19, 1987
James S. Hester
Chief Environmental Officer
Bureau for Latin America and the Caribbean

Job Descriptions
For Los Alamos Key Project Staff

Deputy Program Director for Energy and Technology

Work as a member of an interdisciplinary group in the Energy and Technology Office which manages the Laboratory's Central American Energy Resources Project. Provide technical and managerial backup to the Program Director for Energy and Technology. Report to the Program Director, acting on his behalf in his behalf in his absence. Responsible to the Program Director to assure the Program Managers are addressing management, program development, policy development, long-term strategy and operational plans of their assigned Energy and Technology projects. Provides leadership in the development and management of Energy and Technology program components. Foster the communication, coordination, cooperation and teamwork necessary to achieve goals of the Office projects. Assist with liaison and coordination with funding agencies. Provide oversight for fiscal and technical status of the projects.

Demonstrated ability to manage multifaceted, multidisciplinary programs in the development and application of energy technologies. Broad professional knowledge of Laboratory technical activities and expertise. Familiarity with Laboratory policies and procedures relevant to reimbursable program funding required. Familiarity with Latin American customs and mores desirable.

Central American Program Manager

Work as a member of an interdisciplinary group in the Energy and Technology Office which manages the Laboratory's Central American Energy Resources Project. Responsible to the Program Director for Energy and Technology for the management, program development, policy development, policy development, long-term strategy and operational plans of the Central American Energy Resources Project. Provides direct leadership in the development and management of program components. Foster communication, coordination, cooperation and teamwork necessary to achieve goals of the Central American Energy Resources Project. Responsible for liaison and coordination with ROCAP,

regional organizations and other funding agencies. Supervise regional project coordinator, team leader for technology/economics and team leader for resources. Responsible for overall fiscal and technical status of the Central American Energy Resources Project.

Demonstrated ability to manage multifaceted, multidisciplinary programs in the development and application of energy technologies. Broad professional knowledge of Laboratory technical activities and expertise. Demonstrated ability to read, write and speak Spanish at State Department proficiency level 3. Familiarity with Latin American customs and mores required.

Regional Coordinator

Work as a member of an interdisciplinary group on the Los Alamos Central American Energy Resources Project. Services include, but are not limited to, the following:

Provide in-country logistic support to field teams throughout the region. This includes advance coordination with AID missions and counterpart organizations for the provision of personnel, supplies, transportation and lodging for successful completion of field work. Maintain communications on behalf of Los Alamos on energy related matters with missions, regional organizations, the private sector, the country governments and other entities and provide information on energy technologies. Promote the program by serving as liaison between knowledgeable people in the region and headquarters in Los Alamos. Maintain a thorough understanding and current knowledge of the energy problems and needs and the technical and institutional capabilities of the region through developing a working relationship with these entities. Assist Los Alamos in collaborating with regional and national information bases in assembling, analyzing and updating regional and national energy data, balances and summaries of regional and national energy programs. Advise Los Alamos on energy resource and development issues and development of appropriate regional and national energy sector strategies and programs. Insure the maintenance of a smooth working relationship between Los Alamos and ROCAP and AID bilateral missions. Report to the Central American Energy Resources Program Manager.

Demonstrated experience in energy technologies, energy program planning, development and technology transfer. Private and public sector experience in above areas. Familiarity with AID, ROCAP and regional organizations. Residence in the region required. Demonstrated ability to read, write and speak Spanish fluently. Familiarity with Latin American customs and mores required.

Geothermal Field Coordinator

Work as a member of an interdisciplinary group on the Los Alamos Central American Energy Resources Project. Services include, but are not limited to the following:

Provide logistical and technical support to Geothermal components. Report to the Geothermal Field Development Project Leader. Provide liaison between Los Alamos Laboratory and regional government entities such as the CEL, a government owned utility in San Salvador. Coordinate the relationships for geothermal activities between Los Alamos representatives, regional organizations and local authorities. This coordination may include, but is not limited to, advance preparations for field teams executing project component activities, advance coordination with relevant local and regional entities, evaluation of current activities in the region, planning activities to identify future project components, promotion of alternative energy options and follow-up on field activities.

Expertise is required in renewable and non-renawable energy technologies, energy planning, energy supply and demand, energy management, energy analysis and energy efficiency techniques. Familiarity with pertinent regional agencies and their staff is also necessary, as is a thorough understanding of procedures and regulations relevant to Los Alamos activities in the region. Residence in the region desirable. Demonstrated ability to read, write and speak Spanish fluently. Familiarity with Latin American customs and mores required.

Data Analyst

Work as a member of an interdisciplinary group in the Energy and Technology Office. Responsible to the Program Director for Energy and Technology for creating, maintaining and manipulating information on computerized data bases. Serve as focal point for PROJECT 2 computerized project management system

being used to schedule and evaluate performance on the Central American Energy Resources Project. Responsible to meet with technical staff working on the Central American Program to obtain information on schedules, milestones, budgets, manpower loading and other significant factors. Create files necessary to generate PROJECT 2 schedules and reports. Update files and generate both specialized and routine reports necessary to track progress and expenditures. Prepare specialized visual materials for briefings and reports.

Demonstrated proficiency in use of PROJECT 2. Experience with text and graphic editors and file systems. Required to perform a wide variety of work assignments with minimal supervision, applying creativity to resolving problems.

Team Leader for Technology/Economics

Work as a member of an interdisciplinary group in the Energy and Technology Office which manages the Laboratory's Central American Energy Resources Project. Responsible to the Program Manager for coordinating the engineering and economics components of the Project. Duties include: project development, work plan preparation, performance monitoring and fiscal control. Work cooperatively with Laboratory managers, project leaders in the technical divisions, and staff members to foster the communication, coordination, cooperation and multidisciplinary technical teamwork necessary for the success of the Project. Position will involve liaison and coordination with U.S. government and multilateral funding agencies and with personnel from public and private organizations in the region. Responsible for coordinating field activities related to the engineering and economic components. Considerable travel to Central America is essential. Assist Program Manager in policy development, long-term strategy and operational plans.

Demonstrated technical knowledge and ability to administer multifaceted, multidisciplinary programs in the development and application of energy technologies. Experience with project management systems, such as the PROJECT/2 system supported by the Laboratory. Demonstrated ability to read, write and speak Spanish at the State Department proficiency level 3. Familiarity with Latin American customs and mores is desirable.

Team Leader for Investment Banking

Work as a member of an interdisciplinary group in the Energy and Technology Office which manages the Laboratory's Central American Energy Resources Project. Responsible to the Program Manager for coordinating the investment analysis and investment banking review aspects of the Project. Duties include: project development, work plan preparation, performance monitoring and fiscal control. Work cooperatively with Laboratory managers, project leaders in the technical divisions and staff members to foster the communication, coordination, cooperation and multidisciplinary technical teamwork necessary for the success of the Project. Position will involve liaison and coordination with U.S. government and multilateral funding agencies and with personnel from public and private organizations in the region. Responsible for coordinating activities related to the investment aspects of the components. Travel to Central America will be required. Assist Program Manager in policy development, long-term strategy and operational plans.

Demonstrated ability to administer multifaceted, multidisciplinary programs in the development and application of energy technologies. Experience with project management systems, such as the PROJECT/2 system supported by the Laboratory. Familiarity with the investment community and investment options. Spanish speaking ability is desirable. Familiarity with Latin American customs and mores is desirable.

Team Leader for Resources

Work as a member of an interdisciplinary group in the Energy and Technology Office which manages the Laboratory's Central American Energy Resources Project. Responsible to the Program Manager for coordinating the resources components of the Project. Duties include: project development, work plan preparation, performance monitoring and fiscal control. Work cooperatively with Laboratory managers, project leaders in the technical divisions and staff members to foster the communication, coordination, cooperation and multidisciplinary technical teamwork necessary for the success of the Project. Position will involve liaison and coordination with U.S. government and multilateral funding agencies and with personnel from public and private organizations in the region. Responsible for coordinating field activities related to the resources components. Considerable travel to Central America is

essential. Assist Program Manager in policy development, long-term strategy and operational plans.

Demonstrated technical knowledge and ability to administer multifaceted, multidisciplinary programs in the development and application of energy technologies. Experience with project management systems, such as the PROJECT/2 system supported by the Laboratory. Demonstrated ability to read, write and speak Spanish at the State Department proficiency level 3. Familiarity with Latin American customs and mores is desirable.

Project Leader for Energy Planning Assistance

Responsible for technical management of the Energy Situation Analysis component of the Central American Energy Resources Project. Serves as liaison between the scientific and technical staff working on this component and the Team Leader for Technology/Economics. Assures the technical quality of work performed under this component. Interacts with the Team Leader on day-to-day issues associated with component planning and execution. Coordinates the activities performed under this component to assure deliverables are met. Monitor component performance and resource allocation to identify potential problems. Work with Team Leader to avert potential problems.

Demonstrated technical knowledge of energy economics. Familiarity with project management systems, such as PROJECT 2.

Project Leader for Technology Development

Responsible for technical management of the Technology Development component of the Central American Energy Resources Project. Serves as liaison between the scientific and technical staff working on this component and the Team Leader for Technology/Economics. Assures the technical quality of work performed under this component. Interacts with the Team Leader on day-to-day issues associated with component planning and execution. Coordinates the activities performed under this component to assure deliverables are met. Monitor component performance and resource allocation to identify potential problems. Work with Team Leader to avert potential problems.

Demonstrated technical knowledge of geothermal development, energy systems and/or engineering economics. Familiarity with project management systems, such as PROJECT/2.

Project Leader for Peat Resource

Responsible for technical management of the Peat Resource component of the Central American Energy Resources Project. Serves as liaison between the scientific and technical staff working on this component and the Team Leader for Technology/Economics. Assures the technical quality of work performed under this component. Interacts with the Team Leader on day-to-day issues associated with component planning and execution. Coordinates the activities performed under this component to assure deliverables are met. Monitor component performance and resource allocation to identify potential problems. Work with Team Leader to avert potential problems.

Demonstrated technical knowledge of peat development and/or engineering economics. Familiarity with project management systems, such as PROJECT 2.

Project Leader for Geothermal Resource Development

Responsible for technical management of the Geothermal Resource Development component of the Central American Energy Resources Project. Serves as liaison between the scientific and technical staff working on this component and the Team Leader for Resources. Assures the technical quality of work performed under this component. Interacts with the Team Leader on day-to-day issues associated with component planning and execution. Coordinates the activities performed under this component to assure deliverables are met. Monitor component performance and resource allocation to identify potential problems. Work with Team Leader to avert potential problems.

Demonstrated technical knowledge of geothermal resource development. Familiarity with project management systems, such as PROJECT 2.

Project Leader for Geothermal Field Development

Responsible for technical management of the Geothermal Field Development component of the Central American Energy Resources Project. Serves as liaison between the scientific and technical staff working on this component and the Team Leader for Resources. Assures the technical quality of work performed under this component. Interacts with the Team Leader on day-to-day issues associated with component planning and

execution. Coordinates the activities performed under this component to assure deliverables are met. Monitor component performance and resource allocation to identify potential problems. Work with Team Leader to avert potential problems.

Demonstrated technical knowledge of Geothermal Field Development. Familiarity with project management systems, such as PROJECT 2.

Project Leader for Minerals Assessment

Responsible for technical management of the Minerals Assessment component of the Central American Energy Resources Project. Serves as liaison between the scientific and technical staff working on this component and the Team Leader for Resources. Assures the technical quality of work performed under this component. Interacts with the Team Leader on day-to-day issues associated with component planning and execution. Coordinates the activities performed under this component to assure deliverables are met. Monitor component performance and resource allocation to identify potential problems. Work with Team Leader to avert potential problems.

Demonstrated technical knowledge of mineral reconnaissance and development. Familiarity with project management systems, such as PROJECT 2.

EVALUATION RECOMMENDATIONS AND RESULTANT ACTIONS

1. Project Evaluation Recommendations

The recommendations presented here have two foci:

- areas that require further assistance, based on project progress to date, and
- request for additional assistance from Los Alamos by Central American institutions.

Energy Planning and Situation Analysis

Policy seminars are needed to convert high-level energy decision-makers into sophisticated advocates of the Los Alamos project's energy analysis and planning products. These seminars must be short and non-technical. The Instituto Centroamericano de Administración de Empresas (INCAE) has experience in organizing and carrying out this type of activity, and Los Alamos should work with them.

The validity and reliability of the energy data base should be improved by introducing rigorous data collection and statistical methods. For example, expanded energy surveys should provide information on automobile and truck numbers, gasoline and diesel use, home cooking fuels and electricity growth potential. Economic and demographic components should be added to the data base to cover fuel and energy prices, employment and balance of trade.

The project must address the comparison of alternative policies and projects regarding import substitution, job creation and balance of trade. At a minimum, the system must be able to help Los Alamos and Central American governments select and design project components.

In the area of energy analysis and planning, the project should consider a technical assistance approach that includes resident advisors and more experienced personnel with good Spanish skills.

Geothermal Resource and End-Use Assessment

To help Central America develop its abundant geothermal resources, the Los Alamos project should help design and install

investment mechanisms and strategies, perhaps similar to those used successfully in the Phillippines. Technical information cannot make up for a lack of investment mechanisms to develop resources.

Rehabilitation of the Ahuachapán geothermal installation in El Salvador should be the project's top priority. There is a chance for an immediate payoff, and enormous gains for the Salvadorean energy balance and economy.

In Honduras, the Platanares exploratory drilling program should be funded to completion. Money must be added so that exploratory drilling will permit an invest/discard decision regarding Platanares. The drilling must be sufficient to either prove or disprove the existence of an economic geothermal reservoir. The economic feasibility of geothermal electricity generation and direct-heat applications should be tested for the Pavana area near the Choluteca foreign-trade zone in Honduras.

Los Alamos should carefully evaluate and more fully develop a strategy for utilization of the geothermal well-logging truck. Without a carefully designed plan for maintenance of that complex system, with budgets and an organizational framework, the equipment may deteriorate.

The use of geothermal direct heat deserves more attention. Thus, a serious study of the economic feasibility of commercial-scale, geothermal direct-heat applications should be carried out in Guatemala. The small-scale geothermal dehydration pilot demonstration at Zunil must not be confused with the study of commercial-scale economic feasibility. A comprehensive set of agreements should be drawn up between Los Alamos, Instituto Nacional de Electricidad (INDE) and GREMIAL covering provision of the geothermal energy supply, administrative responsibility for the project, operational budgets and use of profits.

Peat Resource and End-Use Assessment

The peat resource assessment should include focused pre-feasibility analyses. If the results are negative, resource identification efforts should be halted for now. The pre-feasibility analysis must estimate mining and transportation costs, and determine the maximum costs at which peat can economically replace alternative fuels. The pre-feasibility work should focus on producing energy and fuel cost criteria that warrant pursuing the possibilities for peat once again. Simple economic techniques of the "risk-analysis" type are called for.

Peat end-use demonstrations should be stopped for the time being, with the exception of the stove experiment in Guatemala, where commitments have already been made. Pre-feasibility analyses of high-potential end-uses, including the 30- and five-MW electricity generation plants proposed for Panama and Costa Rica, should be carried out. These analyses must include financial and market assessments.

Costa Rica Mineral Reconnaissance

The geochemical analysis process should be streamlined and speeded up. One possibility is to switch to two-track data processing, where selected elements are processed now and the remaining ones left for analysis at a later date. The elements to be processed now must be selected jointly by Los Alamos and USGS. The criteria for element selection should be derived from USGS' geological work. If Costa Rica must wait until data for all 45 elements are processed and analyzed, then the attraction of investors and eventual economic benefits will be delayed. Also, pre-feasibility work of the risk, cost-benefit type should be added to the mineral inventory work carried out in Costa Rica.

Satisfactory formal arrangements must be made for storing geological and geochemical data and analyses in Costa Rica. Candidates as repositories for the data are the University of Costa Rica (UCR) and MINASA. Wherever the data are stored, both institutions should have access to the information.

Countries other than Costa Rica may request mineral inventories. For those, only the PMRA carried out by USGS should be considered initially. Geochemical work by Los Alamos should wait until the geological work is done and specific areas that warrant geochemical analysis have been identified.

Private-Sector Involvement

The involvement of investors in energy development and energy-based industry will require the development of investment mechanisms and campaigns to attract public- and private-sector investors. This is an area that requires the project's attention if it is to produce economic benefits. Energy resources identified by the project must be analyzed and described to meet the requirements of the investment, as opposed to research solely for the scientific community. These efforts will require personnel with expertise in public- and private-sector investment, energy and energy-based industry, and Central American energy affairs.

Development of Technical and Managerial Skills--Technology Transfer

A key to effective transfer of technical and managerial skills (technology transfer) is to identify for each project component the degree of Central American self-sufficiency that is both feasible and worthwhile. Then, a self-sufficiency program should be designed as well as a schedule for reducing project assistance as self-sufficiency is reached.

Self-sufficiency objectives should vary according to the project component. For energy analysis and planning, a high degree of self-sufficiency is desirable. In the geothermal area, the development of Central American investment mechanisms is more important than self-sufficiency in assessing the resource. For the mineral inventory component, establishment of a serious mineral investment and development program must accompany technological self-sufficiency. For the peat assessment program in Costa Rica, technology transfer efforts must be directed at combining economic expertise with the geological skills already attained.

So far, technology transfer issues of an organizational nature have not been not addressed. There should be:

- diagnoses of the organizational structure surrounding energy-based development in the individual Central American countries;
- selection of "targets of opportunity", where self-sufficiency and economic benefits are feasible; and
- tailored, country-specific, organizational strengthening programs in the areas of energy planning and investment in energy-based development.

Project Coordination and Management

The project should form a Central American task force with full-time technical and management members. The project team should be truly multidisciplinary, including financial, economic and technology transfer experts, and Central Americans. The advisory committee should also be truly multidisciplinary. The locus of decision-making within the project should be shifted toward Central America and people in more direct daily contact with the region's energy and economic problems.

Technical assistance teams should be streamlined, and members should travel only when there is fieldwork to be done that no one else can handle. Project reporting should shift to meeting investment-community criteria, as should the monitoring reports sent to ROCAP.

There should be critical reviews of project progress at regular intervals. During these reviews, invest/discard decisions are analyzed and implemented, according to information generated by the project and changing economic circumstances in Central America.

Project monitoring and the SICAPE energy information system should be combined to the extent possible, since they share information and communications needs. In addition, modems and electronic mail should be included in the system, if possible.

Memoranda of understanding between the Los Alamos project and Central American institutions should be reviewed, sharpened and strenghthened. They should define objectives and responsibilities, and overseas Los Alamos staff should be given the authority to develop these memoranda.

Project Design and Strategy

1. Intervening Investment Mechanisms

The Los Alamos project is a scientific and technological project with economic objectives. Between the technological and scientific work and the achievement of economic objectives, there are many intervening processes and obstacles that must be addressed. Intervening mechanisms between science and economics are missing from the project's design and thus, from project operations. The processes and obstacles here consist of investment mechanisms, the investment climate, investment campaigns and government energy development policy.

2. Cost-Effectiveness

In general, Los Alamos' work has been technically excellent, but not always cost-effective in reaching AID's economic objectives. Areas where the lack of cost-effectiveness is most evident are energy analysis and planning, the geothermal resource assessment and geochemical portion of the Costa Rican mineral inventory. Two of the more important reasons for Los Alamos's problems in achieving cost-effectiveness are a lack of multidisciplinary teams that include experts in the areas of

economics, energy planning, energy investment and technology transfer, and a lack of well-defined invest/discard decision points toward which the technological and scientific work is directed.

As much intellectual rigor should be applied to the strategic planning for using energy as a lever for economic development as the project's technical and scientific work. Also, simple pre-feasibility calculations should precede expensive feasibility studies, so that only opportunities with high economic promise receive attention.

3. Role of Regional Institutions

The Los Alamos project is more a series of bilateral projects within a region, than it is a regional project. The exception is the energy analysis and planning component, where there has been significant collaboration and information-sharing among the Central American countries. The geothermal logging truck, which will require sharing resources and responsibility, also qualifies as a regional effort.

Currently, for the energy analysis and planning component, SIECA in Guatemala serves (at least theoretically) to unite the data bases of the various countries. INCAE serves as consultant on analysis and computer software matters. Expansion of both their roles into energy policy and planning areas will be necessary if economic benefit is to be derived from this activity. With regard to the energy resource and end-use components, the Instituto Centroamericano de Investigaciones y Tecnología Industrial (ICAITI) is a potential source of further coordination and follow-on activity.

Resultant Los Alamos Actions

Subsequent to the presentation of the results, Los Alamos and ROCAP discussed the plan of action for identified issues. These issues and the actions taken to resolve them are presented by project component.

Energy Planning and Situation Analysis

The evaluation determined that the CAP project has established a good foundation for energy policy analysis. Recommendations for strengthening the component were to include experts with experience in developing country environment and knowledgeable in Spanish.

In response to these recommendations, key staff on the Energy Planning and Situation Analysis component will receive additional training in Spanish language at no cost to the CAP. A short-term contracting mechanism, similar to an IQC, will be established with a qualified firm capable of providing required technical expertise in a cost effective manner. Technical and investment banking personnel will be contracted for specific activities which require more of an in-country presence and greater specialized talent than Los Alamos is currently capable of providing. In addition, SIECA's participation in this component has been increased to assure development of expertise within the Central American region. These actions have strengthened the performance in this component.

Geothermal Resource and End-Use Assessment

The evaluation determined that the diagnosis of energy production problems for existing geothermal installations in Costa Rica and El Salvador has proceeded well and made scheduled progress toward achieving the objectives. The report noted "The Los Alamos project has the opportunity to make a historic contribution to the Salvadorean energy balance by solving a grave output problem at the Ahuachapán geothermal field". The geothermal support equipment component was determined to be proceeding on schedule. Issues identified pertained to the self-contained geothermal well-logging truck that was being fabricated for use in Central America. A mechanism had not been defined for the sharing of this equipment, including its operation and maintenance between the participating countries of Central America.

In response to the urgency of the problem at Ahuachapán, additional funds and effort have been directed to the activity. In addition, another task was defined for this component. This task is for Los Alamos to coordinate a written agreement among participants regarding scheduling, maintenance, operations, costs, transportation, and related details. Progress to date includes requesting an AID-Mission license plate for the vehicle to define ownership, negotiating with a regional transport company for moving of the truck, arranging with the utility companies in El Salvador and Guatemala for storage of the vehicle between site use, and general discussions with participants regarding the contents of a written agreement.

Geothermal Direct-Heat End-Use

This component includes a study to test the economic feasibility of commercial-scale, geothermal direct-heat operations, and a small-scale demonstration of geothermal direct heat for dehydrating produce. The evaluation noted that the demonstration effort needed more defined working arrangements with the domestic agricultural export guild (the Gremial) if the organization was to carry out the demonstration's commercial aspects.

The formal agreement with the Gremial defining working arrangements will be signed in April, 1987. In response to other concerns of the evaluation team, a study of the economic feasibility of commercial geothermal direct-heat applications has been initiated in Guatemala. The Los Alamos Project Office has been working closely with this component to assure that progress is timely.

Peat Resource and End-Use Assessment

The evaluation found the work of this component "proceeding well and the quality of Los Alamos' fieldwork has been good". It was noted that a prefeasibility analysis was needed of the economics, markets, and costs of alternatives to peat. The end-use assessment was determined to be a "thorough inventory of 27 worldwide peat uses, of which 14 might have potential for Central America". Concern was expressed over the economic viability of peat as an energy source.

After discussion, AID/ROCAP and Los Alamos agreed that this component has matured into an economically feasible project that should seek funding from other sources. As a result, the component will complete an orderly phase out from the CAP by September 1987. Funding to develop the peat resources will be sought from the Inter-American Development Bank and the private sector.

Costa Rica Mineral Reconnaissance

Major tasks in this component were a geochemical survey, a preliminary mineral resource assessment, and a gold district study. The evaluation found that while results were not yet available, the completed sampling had encompassed more territory than originally planned, without exceeding the original estimated costs. It was the opinion of the evaluation team that only site specific sampling should be

performed at sites determined by results of the preliminary mineral resource assessment. This opinion reflects an existing controversy within the scientific community over the most effective methods of mineral reconnaissance. AID/ROCAP expressed concern over the economic feasibility of continuing this component, arguing that the short-term economic benefit to Costa Rica appeared minimal. Another issue was the need for a formal arrangement for storing geological and geochemical data and analyses in Costa Rica.

After many discussions with AID/ROCAP it was agreed that funding for this component will be from AID Bilateral Missions and other appropriate sources or the component will be shutdown. The decision on whether to proceed will depend upon the desires of the Costa Rican Government. Discussions on this component are scheduled in March 1986 between Costa Rica, AID/ROCAP, USGS, and Los Alamos. Discussions are underway to finalize an agreement designating a repository for data collected in this component.

Private Sector Involvement

Ultimately, the CAP proposed to involve the local and U.S. private sector so that the resource and development activities conducted in the components could lead to job-creating investments in commercial and industrial activities. The project was criticized for failing to fully develop such collaboration; however, it was noted that time still remained to create investment opportunities.

In response, this activity was made the assigned responsibility of a Team Leader, giving it more visibility and accountability. Los Alamos also pointed out that the original schedule for project activities had envisioned the investment activities as follow-on based on results of the other components. Thus, it may have been premature for the evaluation team to expect much effort in this task. An expert in the investment sector has been hired as a consultant on this task. Preliminary contacts have been made with various members of the investment community. As planned, increasing attention will be placed on this task as component results provide data for an investment campaign. Emphasis has been placed on making the technical staff aware of the need to involve the private sector.

Development of Technical and Managerial Skills -- Technology Transfer

The CAP has as an overall goal, the development of technical and managerial skills to gain self-sufficiency in areas critical to energy-based economic development. The evaluation revealed that progress towards this goal was satisfactory. Recommendations for this task included identifying objectives for self-sufficiency within each component. This action is being incorporated into program planning. Activities in this area are coordinated closely with AID/ROCAP.

Project Coordination and Management

The evaluation team felt more strategic planning was required to reach the project's economic goals and purposes.

As a result of the evaluation and ensuing discussions with AID/ROCAP, numerous changes were made in project coordination and management. Travel to the region is subjected to a more rigorous examination by both AID/ROCAP and Los Alamos. Program Reviews are formally scheduled on a semi-annual basis, between Los Alamos management, Project Leaders, and Principal Investigators. These reviews examine component scheduling, progress, and budgets. Program management has been streamlined with a more active role identified for the regional Project Coordinator and Regional Geothermal Coordinator. Details of the management structure are presented in the component description section of the Project Paper. A computerized project management system, PROJECT/2, was implemented as a management tool to aid in strategic planning and monitoring.

Some of the recommendations of the evaluation team were not appropriate for implementation due to the federal regulations governing Los Alamos activities. For example, regional project representatives cannot be given the authority to develop and implement memoranda of understanding between Los Alamos and Central American Institutions, since only Los Alamos management staff are familiar with the regulations governing such arrangements and only Los Alamos management staff can sign such agreements. Other similar issues were discussed and resolved with AID/ROCAP.

Summary

Insight offered by the independent evaluation team provided valuable information to the CAP. Action has been taken to address the issues identified in the evaluation. The impact of the changes can already be seen in each of the project components; however, these changes will become more obvious as time passes and their full impact is felt.

LIST OF PROJECT DESIGN PARTICIPATION

Project Development Committee

ROCAP

Carl Duisberg	REA
Michael Lofstrom	PDO
Elena Brineman	GDO
Richard Goughnour	DCONT
Robert Van Horn	RCMO

AID/W

James Hester

Los Alamos

Ron Lohrding
Joe Frank
Ann Tellier
David Chávez
Gustavo Cuellar
Gabriel Dengo

Department of Energy

Kathleen Reese
Sam Mares

Evaluation Team

Associates in Rural Development (ARD)

Project Review Committee

Nadine Plaster	DIRECTOR
William Schoux	DEPUTY DIRECTOR
Michael Deal	PPD
Joe O.Hill, Jr.	CONT

ORIGIN ROCP INFO AMB DCM AID ECON CHRON/5

VZCZCGTI *
PP AULHO
DE AMEMBG 08323/01 223 **
ZNR UUUUU ZZH
P 0822162 AUG 86
FM AMEMBASSY GUATEMALA
TO SECSTATE WASHDC PRIORITY 8460
BT
UNCLAS GUATEMALA 08323

CLASS: UNCLASSIFIED
CHRGE: ROCP 8/8/86
APPRV: DIR:WBLASTER
DRFTD: REA:DUISBERG
CLEAR: GDO:EBRINEMAN
PO:RBLANEY
PDO:ADEAL
DD:JDYRE
DISTR: ROCP

AIDAC

ROCAP

FOR LAC/DR, AL BISSET

E.O. 12356: N/A
SUBJECT: LOS ALAMOS PROJECT AMENDMENT (596-0134), FY 86 FUNDS

REF. TELCON 7 AUGUST DUISBERG/HATZIOLOS

1. ROCAP APPRECIATES LAC/DR ASSISTANCE WITH CONGRESSIONAL NOTIFICATION ON DOLS 1 MILLION AMENDMENT FOR SUPPLEMENTAL FY 86 FUNDS FOR THE CENTRAL AMERICAN ENERGY RESOURCES PROJECT (596-0134). HOWEVER, WE BELIEVE THAT THE DIRECT CONTACT BY LAC/DR WITH LANL MANAGEMENT TO DISCUSS BUDGETS AND WORK PLANS RUNS THE RISK OF USURPING ROCAP'S ARDUOUSLY EARNED AUTHORITY AS PROJECT MANAGER. THROUGH THE LAST 7 MONTHS OF MEETINGS AND CONSTANT COMMUNICATION, ROCAP GAINED A MODICUM OF CONTROL OVER THE PROJECT. THE PROJECT EVALUATION, CURRENTLY UNDERWAY, WILL GIVE ROCAP AND AID THE SUBSTANTIVE AND OBJECTIVE PERSPECTIVE WE NEED TO BETTER CONVINCE LANL TO ADJUST THE ORIENTATION, OPERATION AND FOCUS OF THE PROJECT. WITHOUT CAUTION, LAC/DR DISCUSSION OF BUDGETS AND PROGRAMMING WITH LANL WILL DERAIL ROCAP'S PROJECT MANAGEMENT EFFORTS.

2. ROCAP'S EXPERIENCE WITH THE PROJECT TO DATE COUPLED WITH INITIAL OBSERVATIONS BY THE EVALUATION TEAM LEAD US TO RECOMMEND BUDGETING FOR THE DOLS 1 MILLION FY 86 FUNDS AMENDMENT IN THE MANNER DESCRIBED BELOW. WE RECOGNIZE THAT LANL HAS ITS OWN AGENDA AND THAT THERE MAY BE REASONS TO MAKE ADJUSTMENTS IN THIS PROPOSED BUDGET. (FOR EXAMPLE, IT MAY BE THAT THE US DOLS 300,000 FOR GEOTHERMAL ASSISTANCE TO EL SALVADOR AND PANAMA IN THE FINAL AMENDMENT TO THE ORIGINAL US DOLS 12.2 MILLION ADEQUATELY COVERS THE NEAR TERM PRIORITY NEEDS IN ANUACHAPAN. IN THAT CASE, THE USDOLS 250,000 SUGGESTED IN THE BUDGET BELOW SHOULD BE TRANSFERRED TO HONDURAS GEOTHERMAL). THIS BUDGET REPRESENTS OUR ESTIMATE FOR THE BEST ALLOCATION OF THE FUNDS IN ORDER TO ACHIEVE AN EFFECTIVE AND SUCCESSFUL PROJECT THAT IS RESPONSIVE TO THE PRIORITY NEEDS IN THE REGION AND MAKES THE GREATEST USE OF THE EXPERTISE AND SKILLS LANL

HAS TO OFFER.
3. PROPOSED BUDGET FOR DOLS 1 MILLION AMENDMENT WITH SUPPLEMENTAL FY 86 FUNDS.

EL SALVADOR GEOTHERMAL TECH ASSIST (REHABILITATION OF AHUACHAPAN GEOTHERMAL FIELD)	DOLS	250,000
ENERGY PLANNING ASSIST GUATEMALA AND HONDURAS		50,000
HONDURAS GEOTHERMAL VEGETABLE FRUIT GEOTHERMAL PROCESSING FACILITY FEASIBILITY STUDY (5-6 PERSON MONTHS)		150,000
ZUNIL PILOT PLANT (MATERIALS AND EQUIPMENT)		50,000
HONDURAS WELL DRILLING (TO SUPPLEMENT EXISTING CONTRACT)		150,000
HONDURAS GEOTHERMAL FIELD WORK (ESPECIALLY PLATANARES)		100,000
PEAT RISK AND COST/BENEFIT ANALYSIS		50,000
MINERALS RISK AND COST/BENEFIT ANALYSIS		50,000
WORK WITH REGIONAL INSTITUTIONS (INCAE, ICAITI AND SIECA)		75,000
CONTINGENCY		75,000
TOTAL	US DOLS	1,000,000

4. IT IS VERY IMPORTANT THAT LOS ALAMOS NOT INITIATE ANY DETAILED PLANNING FOR THE FY 1987 DOLS 5.3 MILLION BUDGET UNTIL ROCAP AND LANL HAVE THE FULL FEEDBACK AND BENEFIT OF THE PROJECT EVALUATION. AN EARLY DRAFT OF THE EVALUATION REPORT SHOULD BE AVAILABLE NLT AUGUST 22, AND A REVIEW OF AND BRIEFING ON THE EVALUATION

RESULTS IS TENTATIVELY SCHEDULED FOR THE WEEK OF SEPTEMBER 9 AT LOS ALAMOS.

5. DEPENDING ON THE REQUIRED TIMING FOR THE SUBMISSION OF THE DETAILED BUDGET AND WORK PLANS FOR THE DOLS 1.0 MILLION IN SO SUPPLEMENTAL FUNDS, MOCAP SUGGESTS THAT FINAL AMENDMENT DOCUMENTATION BE PREPARED WITH LANL IMMEDIATELY AFTER THE EVALUATION REVIEW (WEEK OF SEPTEMBER 9).

6. PLEASE PROVIDE ANY COMMENTS REGARDING TIMING OR CONTENT FOR AMENDMENT. ALSO ADVISE WHO FROM AID/W PERSONNEL WILL BE ABLE TO PARTICIPATE AT LANL IN THE EVALUATION DEBRIEFING. PLASTER. PIEDRA

BT
#8323

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134