CONVENTIONAL ENERGY TECHNICAL ASSISTANCE

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PREFACE

This is the first annual report of progress made in the Conventional Energy Technical Assistance Project (936-5724). A.I.D. authorized this project in September 1980 for implementation by the Office of Energy in the Bureau for Science and Technology. This report summarizes achievements as of January 1982, forecasts expected activities to be undertaken during the remainder of calendar year 1982, and discusses the commitments of authorized funds made so far. The second annual report is planned for release in January 1983.

This report addresses the following four specific objectives:

- to produce a convenient reference that will inform, within the A.I.D. organization, progress made by the Office of Energy to date in implementation of the Conventional Energy Technical Assistance project;

- to advise, within the A.I.D. organization, the nature of prospective activities to be undertaken and carried out during Calendar Year 1982;

- to provide a record of commitments of authorized funding made to date and the basis for establishing future funding commitments; and

- to provide a basis for the preparation of a "short-form" annual progress report which could be distributed widely within A.I.D. missions, selected U.S. embassies and host governments, and within other donor organizations engaged in either/or both lending and technical assistance activities.

1.0 BACKGROUND

1.1 The Project

The Conventional Energy Technical Assistance Project is defined in a Project Paper which was approved on 16 September 1980. The project seeks to enhance indigenous conventional energy supplies of A.I.D. recipient countries by: (1) improving the recipient country's base of information about the geological potential for conventional energy resources within their boundaries; and (2) improving their abilities to plan and manage a program for the exploration and development of such resources. Conventional energy resources are defined as the hydrocarbons (petroleum and natural gas, coals of all ranks, oil shales, and tar sands) and geothermal reservoirs that may exist within national boundaries.

The project is designed to have a planning phase which began in 1980, and a three-year operational life to end in September 1984. The project provides for an evaluation, after the first year, to determine whether it should continue for the remaining two years. This report contains the information needed for making such a determination. Also, the project is designed to complement other energy related activities. Examples are A.I.D.'s project in training for conventional energy development, as well as the assistance activities of the World Bank, the United Nations System, and the Inter-American Development Bank. Also, the project is designed to encourage private-sector investment in conventional energy exploration and production in A.I.D. recipient countries.

The rationale for the project is the provision of a response to the increasingly obvious need of developing countries to enhance their domestic energy supplies in order to foster economic development and reduce dependence on expensive imported sources of supply. The project responds to a Congressional directive, contained in Section 106 of the Foreign Assistance Act of 1961, as amended by Sec. 104 of the International Development Cooperation Act of 1979, to "facilitate geological and geophysical survey work to locate potential oil, natural gas, and coal reserves and to encourage exploration for potential oil, natural gas, and coal resources in developing countries...."

The Technical Assistance reviewed in this report reflects the assistance activities proposed in the project paper and other relevant activities which have been identified through communications with A.I.D. missions, host country governments, and A.I.D. regional bureaus. The ultimate benefit that the Office of Energy seeks to produce from these technical assistance activities

is an impact that can be shown to reduce, or temper the growth of, petroleum imports in developing countries. Because only technical assistance efforts are involved, and these for a limited time, the benefits sought may be measurable either directly or only indirectly, or may be either implied or potential. Such impacts are to be evaluated for each country-level technical assistance project undertaken, after the three-year contemplated life of the project.

1.2 Notification

The project was first announced to the Missions in November 1980. STATE 299690 set forth the main features of the project and invited Mission comments in anticipation of project implementation. Included in the cable was a similar announcement for the companion Conventional Energy Training Project. A follow-up announcement in January 1981 (STATE 020987) discussed potential key criteria to assure the allocation of project resources to those countries which appeared to have the highest potential for reduced petroleum imports.

1.3 Responses

Table 1 contains a list of the countries expressing interest in various categories. Events and activities during 1981 led to the selection of the countries noted in Table 1 (Morocco, Ecuador, Costa Rica, Bangladesh, and Sudan) as the first group for inclusion in the Conventional Energy Technical Assistance Project.

1.4 Implementation Activities

Home-office implementation activities during calendar 1981 led to the development of an in-depth project management plan and to a choice of Bechtel National, Inc. of San Francisco as the primary contractor to undertake implementation of country-level activities. The following review provides details of implementation activities carried out during 1981 on behalf of the Conventional Energy Technical Assistance Project.

2.0 PROJECT MANAGEMENT

2.1 Approach

The basic approach adopted for the implementation of the Conventional Energy Technical Assistance Project involves two distinct types of effort. The first is a definitive identification of country-level activities. The second is the identification of those proposed technologies which appear to offer generic opportunities for effective achievement of the project's goals through adaptation to

CATEGORIZED RESPONSES TO PROJECT ANNOUNCEMENT

CATEGORIES

Countries where activities are sufficiently defined to require an allocation of funds and commitment of personnel.

* Morocco
Senegal
Kenya
* Ecuador
Botswana
Philippines
* Costa Rica

Countries requiring expediting actions to enable reconnaissance for project identification, or follow-up of projects already identified.

Tunisia
Niger
Indonesia
Thailand

Countries where formal requests are promised or way is clear for reconnaissance.

* Bangladesh (March)

Countries where interest exists but nature of action is not clear.

Zimbabwe
Sierra Leone
Sudan
Tanzania

Countries where the potential for conventional energy technical assistance exists, but no direct requests have been forthcoming

Burma
Djibouti
Jordan
Malawi

* Country-level activities are in progress in these countries as discussed in the Annual Report for 1981.

the country-level activities. Diversified sources of contractor support are used to define country-level activities and to identify and assess generic technologies. The services of a single diversified and broad-scope contractor (i.e., Bechtel National, Inc.) are used in the implementation of country-level activities. Finally, efforts will be made to provide technical support, as requested by Mission and A.I.D regional bureaus, in those disciplines and topics where the Office of Energy has in-house experience, or readily available external expertise through the Conventional Energy Technical Assistance Project.

2.2 Specific Country-Level Activity Development

The development of country-level activities spans three phases:

Reconnaissance. During this initial phase, field trips are undertaken by a member of the Office of Energy staff. The objective is to determine at first hand, through discussion with local personnel and visits to local facilities, the nature and extent of interest expressed in the Conventional Energy Technical Assistance Project, and the implications of such interest to achieving project goals. In 1981, reconnaissance visits were made to Morocco (January-February), Senegal (February), Bangladesh (June), and the Sudan (December). Reconnaissance in Ecuador was carried out by the US Geological Survey, under the Resource Services Support Agreement (RSSA) discussed below.

Country-Level Activity Definition. Phase Two occurs when a decision is made to schedule a specific country for implementation activity under the Conventional Energy Technical Assistance Project. Phase Two involves a specialized effort to define the precise activities that are to be implemented ultimately so that: (a) statements of work for each activity can be used as documentation for whatever agreement is to be signed between the A.I.D. Mission and the host country government, detailing the responsibilities of each; (b) feasible work elements are identified for implementation; (c) a budget can be drawn up; and (d) a schedule can be specified. During 1981, the US Geological Survey provided the basis for definition of activities in Ecuador and Costa Rica. In January 1982, an effort to define country-level activities in Bangladesh was begun under an indefinite quantity contract task assigned to Arthur D. Little, Inc. of Cambridge, Massachusetts. A planning assistance project provided by the Office of Energy supplied the basis of country level activity for the Sudan. Formal definition of country level activities for Morocco has not yet begun.

Country-Level Activity Implementation. Upon negotiation of an agreement, the activities defined are assigned for implementation. At the present time the implementation contractor is Bechtel National, Inc. As of January 1982, assignments to Bechtel have been made for Ecuador only.

2.3 Generic Program-Component Development

In this second type of effort, advantage will be taken of the dynamic character of the conventional technologies involved in the production, extraction, conversion, and utilization of a country's indigenous fossil energy resources. The desired goal is quick achievement of opportunities to reduce the importation of petroleum products. Two tasks were launched in 1981.

The first task involves substitution of coal-slurry fuel for petroleum oil by the major fuel consumers in a developing country. Responsibility for this task has been assigned to the indefinite quantity contractor Burns and Roe, Inc., Oradell, New Jersy, and work is now underway.

The second task involves the production of a clean-burning household fuel briquette from coal. In urban areas, this briquette can substitute for kerosene (usually sold at subsidized prices). In rural areas, the briquet can substitute for fuel wood, thereby alleviating undesireable deforestation. The responsibility for this task has been assigned to the indefinite quantity contractor, United Engineers and Constructors, Philadelphia, Pa. Work is expected to begin in March 1982.

2.4 Procurement of Contractor Support

When project activities are in the reconnaissance phase, the country-level activity-definition phase, or are involved with generic technology evaluations, contractor support is sought from a variety of sources. The Office of Energy has available the rosters of indefinite quantity contractors (IQC) throughout A.I.D. from whom technical expertise may be made available. Recently, a solicitation to revise the IQC roster of the Office of Energy was issued. A new IQC list, more current to needs, is expected in June 1982. Four IQC's were utilized in 1981. They were the following: Development Sciences, Inc., Arthur D. Little, Burns and Roe and United Engineers and Constructors.

The US Geological Survey has proved to be a significant source of technical support. A RSSA was negotiated in September 1980, and

extended at no additional cost through September 1982. The scope of work for this RSSA provided for a needs and targets study which will carefully examine A.I.D. recipient countries in light of specific selection criteria. These criteria spell out in some detail the kinds of information to be gathered for each country in order to rank candidates for assistance under the Conventional Energy Technical Assistance Project. The needs and targets study was to be completed by 1 April 1981.

However, once underway, it soon became clear that country identification could best occur by other means, and that the needs and target study would be a valuable input once the countries had already been selected. For example, Bangladesh came into the picture not because of a needs and target study, but rather by a visit of the President of Bangladesh to the United States in September 1980. Other countries were selected because of concurrent A.I.D. technical assistance activities (Morocco), or because of the intense interest that was expressed (Ecuador, Sudan, and Costa Rica).

Accordingly, the focus changed, so that during the year, the US concentrated on countries with manifested interest. Needs and target studies were submitted for Bangladesh and Costa Rica. The study for Morocco is to be ready by the first week of February 1982. A preliminary report is available for West Africa (ECOWAS). Work is beginning on the Sudan. And the USGS, in the first part of 1981, had taken the lead in the development of country-level activities for Ecuador. The net effect of this change in focus has been a significant reduction in costs, now estimated to be below fifty percent of the initial RSSA budget.

During 1981, implementation details of five country-level projects were identified in preliminary fashion, however with adequate certainty to enable a solicitation for implementation-contractor services to be advertised in the Commerce Business daily of 9 July, 1981.

Proposals were due by August 20, 1981. Twelve proposals were received and evaluated by a specially appointed technical panel. An award eventually was made to Bechtel National, Inc. of San Francisco. A contract became effective September 30, 1981. A three year span was estimated for completion of the contract. Five countries were selected, subject to change, with provision made to add additional countries, each the subject of separate proposals and negotiations.

During the proposal eveluation and Bechtel contract negotiation phases, changes took place in the substantive nature of some requests and interest in technical assistance. Thus, the five

countries eventually selected were: Morocco, Bangladesh, Costa Rica, Ecuador, and the Sudan. Also, the change in countries selected pointed to the desirability of incorporating in the Bechtel contract a specified level of short-term (1-2 weeks duration) advisory services of specialist personnel. These specialists are to be used either for countries already identified or new countries. An appropriate modification to the Bechtel contract is now being negotiated and should be effective in early February 1982.

2.5 Internal Technical Support to A.I.D.

During 1981, the Office of Energy responded to a number of requests for technical support from A.I.D. bureaus and missions. The more significant of these requests were:

A.I.D./Senegal. In February, Office of Energy staff visited Dakar to discuss Government of Senegal interest in potential lignite deposits believed to exist because of data developed during past oil exploration. The Government of Senegal has not yet reacted to an offer to provide technical assistance for development of this resource. Such assistance could be warranted for the further identification of the lignite deposits.

Asia/ASEAN. In April, the Office of Energy assisted in the development of the technical components of a five-nation coal training program to be conducted in the United States. This is an emerging activity which should begin in 1982.

Asia/India. For five weeks in late Spring, 81, one staff member from the Office of Energy assisted in the preparation of a project paper concerning an energy collaboration program with the Government of India. This project is one result of the India/United States Treaty for Scientific and Technological Collaboration. An Annex to the project paper identifies and characterizes the prospective collaboration areas between the coal sectors of both countries.

Trade and Development Program (TDP) - Jamaica. In July, the Office of Energy furnished comments to the TDP, Latin American Section, on the technical aspects of a TDP-financed project. The project involves assisting the Jamaican public utility to analyze the conversion of its facilities from oil to coal fuel. A short list of firms for this study is now being considered by the Government of Jamaica.

A.I.D./Jamaica. In January, the Office of Energy and the A.I.D. Mission in Jamaica explored issues raised regarding the rehabilitation of the Jamaican Public Service System, in particular the present critical state of unreliability in meeting that nation's electricity needs.

TDP/Dominica. In January, the Office of Energy provided the TDP, Latin American Section, with details of a project to assess the geothermal prospect of Dominica. The proposed project is based upon a similar undertaking in Jordan.

NE/Egypt. In January, the Near East Bureau requested the Office of Energy to help identify candidates to manage the A.I.D./Cairo project for mineral resource, petroleum, and water resource assessment by satellite remote sensing. The Office of Energy identified a candidate who may be recommended to the mission for the assignment.

3.0 Country-Level Activity Development

Current activities are underway in the five countries covered by the Bechtel contract. Specifically, progress is as follows:

3.1 Morocco

Reconnaissance in Morocco was carried out during all of 1981 through the Office of Energy's resident in Rabat responsible for implementing the Planning Assistance Project. Moroccan interest in conventional energy technical assistance developed further in Washington in November 1981. At that time, the Office of Energy staff met with the Government of Morocco's Minister of Energy and Mines and with the Director of the Moroccan Hydrocarbon Agency, ONAREP.

Responsibility for country-level activity definition has been retained by the Office of Energy. The definitional team mobilized in January 1982, consisted of two Office of Energy staff members, Development Sciences, Inc. representative, a Bechtel representative and a USGS representative. This team began discussions with the A.I.D. Mission and the Government of Morocco on 8 February 1982.

Morocco's energy resources are coal, oil shale and recently discovered natural gas. Moroccan exploration and production efforts in the petroleum and natural gas sector are centered in a newly created organization, ONAREP. The opportunities for technical assistance appear numerous. About nine-person years of effort have been allocated in the Bechtel contract to address the most promising of these proposed activities. Country-level activity identification will be acted upon as may prove appropriate.

At present, considerable technical assistance activity is committed to Morocco. The implementation plan meshes the Conventional Energy Technical Assistance project with the Mission's long-range project in Conventional energy. Also, the country-level activities identified are complementary with those presently being sponsored by the World Bank.

The schedule set forth in a Memorandum of Understanding calls for the identification and definition of country-level activities by the end of February 1982. At that time, implementation responsibility will be assigned to Bechtel.

3.2 Bangladesh

Because of interest expressed in late 1980, a reconnaissance mission to Bangladesh took place in June 1981. The survey conducted by one person each from the Office of Energy and the US Geological Survey, revealed substantial donor activity in the energy area, a broad-scope interest on the part of the Government of Bangladesh in conventional energy, and a focus likely to be placed on the development of natural gas.

At the same time, the A.I.D. Mission has projected a major program of Conventional Energy Technical and Capital Assistance to begin when Office of Energy activities are completed. Thus, it has become clear that the two-fold objective in the country-level definitional step is: (a) the setting of objectives that can achieve results useful to the Office of Energy's Conventional Energy Technical Assistance Project; and (b) the setting of such objectives in a manner that will provide an advanced starting point for the Mission project. At the same time, activities should complement and supplement the activities of other donors.

In December 1981, Arthur D. Little, Inc., an indefinite quantity contractor, was selected to undertake country-level activity definition in Bangladesh. The team was provided with a Bechtel representative who focused on feasibility, cost, and other aspects of the Arthur D. Little recommendations. Also, Bechtel supplied the team's geologist. The ADL team was briefed in Washington in January 1982, and is in Bangladesh at the present time. The team's work will be completed in mid-March 1982. At that time, the Mission should be in a position to negotiate a Memorandum of Understanding with the Government of Bangladesh.

Once the Memorandum of Understanding is signed, responsibility for implementation of A.I.D.s responsibilities will be assigned to Bechtel.

3.3 Ecuador

The country-level activities for Ecuador consist of a one-time effort to provide seminar-workshops for Ecuadorian personnel in subjects related to the exploration and production of oil and gas, both on and off shore. The Government of Ecuador is concerned that it will be difficult in future to sustain present production levels of oil so as to meet export requirements and a growing internal demand for petroleum products. The seminar/workshops are to be carefully structured and to span a seven-week period commencing June 14, 1982. The seminar/workshops should provide increased local capability in oil and gas exploration.

The US Geological Survey began the reconnaissance and country-level activity definition in Ecuador and was later replaced by Bechtel for reasons of administrative simplicity. Bechtel completed the definitional efforts and a Memorandum of Understanding has been negotiated between the Mission and the Government of Ecuador. Activities are now in the implementation phase.

Although a one-time effort is planned by A.I.D. in Ecuador, expectations are that the workshop/seminar will be repeated by A.I.D. elsewhere (e.g., Bangladesh seems a likely location) and possibly repeated within Ecuador by Government of Ecuador agencies. Accordingly, the US Geological Survey is arranging for an independent evaluation of the workshop/seminar activities so as to benefit similar activities in the future. In addition, the Government of Ecuador will supply a counterpart evaluation.

3.4 Sudan

In January 1981, the Office of Energy commenced implementation of an Energy Planning Project in the Sudan. One major activity of this project has been the analysis of the current pattern of energy demand and sources of supply. In the meantime, petroleum has been found in the country, and the development of this resource has recently began.

During implementation of the Energy Planning Project it soon became apparent that there was a significant use of petroleum distillate fuels to supply on-site generation of electricity, both in the industrial and in the residential sectors. Poor reliability of the Blue Nile grid system (BNG) suppling the major population and industrial areas of the Sudan appears to be the reason. The BNG system is supplied by both hydroelectric and thermal sources.

By late 1981, the Government of Sudan and the A.I.D. Mission had set the rehabilitation of the BNG as a major priority for A.I.D. assistance. Funds to provide necessary commodities and part of the technical assistance effort were made available. The Government of Sudan and the A.I.D. Mission then began to look at the Conventional Energy Technical Assistance Project as a means of providing the balance of the technical assistance and initiation of the rehabilitation program.

Project details of the expanded activity were worked out during a visit, in November 1981, to Washington by the Government of Sudan's Minister of Energy, and a visit by a member of the Office of Energy staff to Khartoum that next month. Energy Planning Project staff provided the reconnaissance and much of the country-level activity definition. The relationship of the rehabilitation program to World Bank activities in this area clarified in January 1982, in order to avoid duplication of effort and to assure a complimentary effect in results.

The completion of the country level activity definition and the implementation of activities phased to commodity procurement by the Mission have been assigned to Bechtel. A four person team is expected to begin work soon.

3.5 Costa Rica

Activities in Costa Rica to date have included reconnaissance and some country-level activity definition directed toward the prospect of attractive coal resources. Both these functions were performed and completed in May 1981, by two geologists provided by the US Geological Survey. Their report has been submitted to the Government of Costa Rica. The report recommends a structured program of exploration based on the known coal outcrops in the country so as to establish the nature of Costa Rica's coal resource and justify further study of coal's significance in Costa Rica's energy supplies.

At this writing, the Government of Costa Rica has not indicated to the A.I.D. Mission, whether or not it desires to continue with the recommended activities.

4.1 Generic Program-Component Development

Generic program-component development activities seek to identify technologies, or approaches which offer broad application to country-level activity definition. During 1981, four such activities were begun.

4.1 Coal-Slurry Fuel Technology Transfer and Adaptation

Coal-slurry fuels are suspensions of finely pulverized coal in a fluid so that the coal can be handled and treated as a liquid fuel, thereby obtaining the convenience and adaptability of liquid petroleum. Elimination, or partial elimination, of dependence on residual petroleum fuel oils is a major benefit of coal-slurry fuels. One of the first results of the 1973-74 rise in the world price of petroleum was a serious renewal of interest in coal-oil mixture (COM) fuels. Mixing coal and oil was first proposed in 1870, when industry was beginning to appreciate the convenience of a liquid fuel, but wanted to avoid what was then a high price for fuel oil, as compared to coal. The suspension of coal in fuel oil served the dual purpose of preserving the convenience of a liquid fuel while reducing its cost. Interest renewed periodically whenever world oil prices rose or supplies appeared to be scarce.

The technology involved in the combustion of mixtures of coal and oil has been successfully demonstrated recently in a single stream generator serving an electricity generating station. The test, performed by the Florida Power and Light Co. in its Sanford station, was completed in April 1981.

The test showed that it was feasible to burn coal-oil mixes with coal contents as high as 42% by weight, with about one-third of the energy liberated from combustion coming from the coal. A higher coal content wasn't possible because the equipment wasn't designed to handle it. Other tests have reported successful combustion of up to a 50% coal content.

Cost considerations in the United States have focused attention on a modification of the coal liquid fuel in which oil is replaced with water. A number of companies are working on coal-water mixtures (CWM) that can contain as much as 75% coal by weight. Although the water reduces thermal efficiency, complete independence from petroleum is achieved. There has been no large-scale demonstration of CWM fuels to date, but intense research is being done. In many countries, successful introduction of a COM and eventually, a CWM fuel may mean that it may not be necessary to develop costly ports and inland transportation systems.

In September 1981, Burns and Roe, Inc., an IQC contractor, undertook an analysis of the issues and problems involved in the transfer of coal-slurry fuel technologies to the developing countries. Further, Burns and Roe is to recommend the nature of program components which should be considered. A.I.D. Missions in Portugal and Kenya arranged for collaboration of their host governments in the study. In addition, Burns and Roe offered to include Thailand, a country in which they already had considerable experience.

By January 1982, field work in the three countries had been completed, and the outline and content for the final report defined. Burns and Roe soon will submit draft final reports for comment by the host governments and Missions. Final reports are expected in early May 1982.

4.2 Household Fuel Manufacture by Coal Carbonization

In many countries, the most common domestic fuels for cooking are kerosene with some charcoal or wood. The percentage of kerosene used to wood/charcoal is usually higher in urban areas. Kerosene is attractive because it's smokeless and convenient. However, the cost of kerosene is likely to be highly subsidized. A smokeless coal briquet could be an alternative. Such a briquet has been manufactured in India in uniform size and with consistent burning character for many years.

The coal for these briquets may be local, or it may be imported. The coal is heated out of contact with air (i.e., pyrolyzed or carbonized to produce a solid char). Fuel gases and tars are by-products of the pyrolysis. The gas and tar are derived from the volatile material left in the char so that it may be easily ignited. The char is compressed into small pillow-shaped briquets of convenient size. A binder is needed, cassava starch, for example.

Depending on the character of the coal, surplus energy may be available from the pyrolysis process. This can be diverted to generate electricity. For every ton of coal processed, surplus energy in the gases produced, equivalent to about 0.4 barrels of residual petroleum fuel oil, may be used as boiler fuel for electricity generation. Surplus tar not needed in the briquetting process may be another separate source of boiler fuel.

Under the Treaty of Collaboration in Science and Technology, the United States has an opportunity to obtain technical information relevant to experience in India in the manufacture, distribution, and use of household fuel briquets made by the low temperature carbonization of Indian coals. United Engineers and Constructors, Inc., an Indefinite Quantity Contract with US experience in this technology is collecting relevant information in India, and will provide a report containing the program components that could be incorporated in A.I.D. programs. Countries interested to date in this technology are Niger, Indonesia, and some Central American nations.

4.3 South Pacific Geophysical Survey

The governments of the United States, Australia, and New Zealand have agreed to cooperate in the collection and evaluation of geological and geophysical data of the South Pacific. Two intensively-equipped research vessels will gather the data. One vessel, the US Geological Survey-owned R/VS.P Lee, will assess the hydrocarbon potential in the territorial waters of te Governments of Tonga, Vanuatu, and of the Solomon Islands. The implementing agency for this activity is the Committee for Coordination of Joint Prospecting for Mineral Resources in the South Pacific off-shore areas (CCOP-SOPAC), agency of the United Nations. The three country Agreement provides for the management, evaluation, and utilization of the data collected.

The Office of Energy, through its Conventional Energy Technical Assistance project is participating with A.I.D.'s Asia Bureau and the Department of State in joint funding the project costs. The US Geological Survey is providing the services of its professional personnel from its own account.

A by-product of the Agreement will be the development of a prototype for future consideration of similar off-shore exploration, whenever this becomes appropriate. Off-shore Bangladesh is a potential example.

Field work is expected to begin early in 1982, and be completed in the latter part of 1983, or early 1984.

4.4 Geothermal Potential of Jordan

During 1981, the Government of Jordan and the US Geological Survey identified a project involving an assessment of an indicated geothermal prospect in Jordan. This identification was the result of other USGS work done in Jordan in collaboration with the National Resources Authority of the Government of Jordan.

The structure of the geothermal assessment project comprises four phases, each of which is assigned a specific objective before work for the subsequent phase is authorized. The phases are as follow:

Phase One- The objective is to determine whether or not a geothermal reservoir exists in Jordan of adequate size and temperature. Reasonable assumptions will be used in making this determination.

Phase two- Given positive indications of a geothermal potential, the objective of this phase will be to determine the economic advantages of geothermal electricity production in Jordan. The work involved will be based on the assumptions used to achieve the objective of phase one.

Phase Three- Given a positive conclusion from Phase Two, the objective of Phase Three will be to verify the assumptions used in Phase One and establish the geothermal resource to the satisfaction of potential investors and funding agencies. The work in this phase could involve significant test drilling, an activity outside the scope of technical assistance efforts.

Phase Four- The objective of Phase Four will be the preparation of all information, data, and evaluations needed to obtain the necessary finance for an operating facility.

The work elements in Phase One have been defined, and field work beginning mid February 1982, will require twenty weeks to complete. The work will be performed by personnel from the US Geological Survey with counterparts provided by the Government of Jordan. The US Geological Survey will provide the use of portable instrumentation, while the Government of Jordan will perform the shallow hole drilling for temperature radiant measurements.

The Office of Energy is funding the professional services cost of the US Geological Survey personnel from its Conventional Energy Technical Assistance Project. The Government of Jordan is allocating funds from a current project grant from A.I.D. to cover the expenses.

The Jordan experience is expected to serve a two-fold purpose. If appropriate, Jordan could develop its geothermal resource. Further, Jordan could serve as prototype experience for developing geothermal potential elsewhere.

5.0 PROSPECTIVE NEW ACTIVITIES

Prospective new activities cover a broad scope of efforts. They range from identification of the second group of countries for application of the Conventional Energy Technical Assistance Project to the formation of a technical advisory committee to evaluate the achievements of the Conventional Energy Technical Assistance Project itself.

5.1 Country Identification

In early 1982, reconnaissance activities will begin in Pakistan, Thailand, Philippines, and Kenya. These countries have expressed clear interest in the Conventional Energy Technical Assistance Project. Some of these countries are providing funds for the cost of the travel involved. The USGS will be represented in the Pakistan reconnaissance.

Interest in activities under the Conventional Energy Technical Assistance Project exists in both Niger and Jamaica. In Niger, the results of the household fuel-from-coal evaluation will become of serious interest, assuming favorable results. Niger is a Sahelian country with an operating coal mine in the Sahara. The situation in Jamaica is analogous to that of the Sudan in that Jamaica's electricity sector is in critical need of rehabilitation. However, the method to be used in rendering technical assistance is not yet clear at this time.

Senegal remains dormant. Further activity requires additional stimulation through reconnaissance. Situations in the remaining countries noted in Table 1 are likely to be dormant unless reconnaissance is undertaken.

5.2 Country Selection Criteria

In the project paper, the number of participating countries over the life of the Conventional Energy Technical Assistance project is anticipated to rise to about ten. However, potential participation in the project (Table 1) is double that amount. Accordingly, criteria are needed to guide the selection of countries in the project. Preliminary criteria were listed in the project's notification (State 020987 in January 1981). Since then, because of the experiences in Bangladesh and the Sudan, the degree of commitment of an A.I.D. mission to the continuation of conventional energy technical assistance at some down-stream point has become another criterion.

Accordingly, the selection criteria are the following:

- The potential contribution of project activities to reduce oil import dependency.

- The potential contribution of project activities in helping to overcome technical and/or institutional obstacles to exploration for oil gas or coal resources.

- The potential contribution of project activities toward preventing overlapping activities with other donors and with the private sector.

- The degree of interest and commitment of the host country to the project as voluntarily expressed, or as stimulated by visits between host country and U.S. Government officials. An example of commitment could be host country willingness to allow the private sector to repatriate profits.

- The degree the prospective project(s) take into consideration overall political, social, and economic factors affecting development in the country.

- The longer-term plans of the A.I.D. mission to include conventional energy technical assistance.

(Note: No weighting of each criterion is implied by the order of listing)

5.3 Generic Program-Component Development

Five areas appear suited for prospective new activities. The following specific investigation projects are in various stages of definition, ranging from a draft statement of work to an expression of concept:

Petroleum Refinery Product-Mix Adjustment

Most countries have at least one national oil refinery. Usually these refineries have a relatively small capacity, no more than 100,000 barrels per day, and sometimes as little as 10-20,000. At this scale, it becomes too costly to install processing units capable of adjusting the mix of the product to match market demand. The demand is largely for lower boiling point distillates -- gasoline, kerosenes, and diesel oils. But, depending on the character of the crude oil used, the refining may produce excessive residual high boiling-point fuel oils, which then must be exported.

In effect, refinery management finds itself importing crude oil at world prices in the quantity needed to meet national demand for distillates. At the same time, it must export excess residual fuel oil. And as more people turn to coal, the price of residual oil will go down.

Technical options are available. The principle is either to add hydrogen chemically during refining (hydrocracking or hydrogenation), or to remove carbon chemically (thermal cracking and delayed coking). For the latter, a market would be needed for the petroleum coke produced -- the cement-making industry, for example, if coke were used in place of residual fuel oil. But there would be a significant capital investment required, and operating costs might be high. These would have to be offset by savings resulting from a reduction in imported petroleum.

A statement of work directed to the Mombasa Oil Refinery in Kenya has been drafted. Reconnaissance activities in early February are planned to develop a project which can be assigned to an appropriate indefinite quantity contractor.

Expectations are that the project can be accomplished during calendar 1982. The results should satisfy a two-fold need. The Government of Kenya will be able to make an informed choice of options for modifying the refinery in a manner which the Government considers to be in its best interests. Secondly, the broader principles emerging from the results can be applied elsewhere.

Application of Satellite Remote Sensing

Needed information and data can be collected through detection and measurement from a remote location (earth-orbiting satellite), and processed. The results are observations, or conclusions, about resource potential.

As the data is processing, maps can be produced which show surface and topographic features. And inferences can be drawn concerning whether or not geological structures below the surface lend themselves to the accumulation of hydrocarbons. The advantage of remote sensing is its scope: enormous territory can be explored quickly and evaluated at low cost. The results can help avoid waste.

Remote sensing involves photography from the Landsat satellite of light reflections from approximately one-acre areas. The reflections are passed through filters to isolate selected bands of green, red, and near infrared wavelengths. The data are reconstituted on the ground through computer processing of the signals received from Landsat. Eventually maps are produced on which different areas can be colored to bring out specific features that may be relevant to water presence, forestry, geology, or agriculture.

In 1981, work in the Office of Forestry, Natural Resources and Environment identified, from Landsat images, a structure in Gambia which warranted further investigation for hydrocarbon potential. The work also pointed to the need for greater emphasis on relating Landsat imagery to surface and subsurface conditions, citing Kenya as a case in point. A.I.D. regional remote sensing offices in Ouagadougou and Nairobi provide a basis for an effective collaboration with the Conventional Energy Technical Assistance project.

Reconnaissance to identify potential work elements is planned to occur in Kenya in February 1982.

Underground Coal Gasification

Underground coal gasification is a technology whose time may be near. In contrast to the technologies discussed so far, underground coal gasification should not be considered as developed and ready for use, but rather as one with potential. In particular, it is applicable to coal deposits too deep to be removed effectively or at reasonable cost.

In the coal gasification process, the chemical energy in the coal, rather than the coal itself, is extracted in the form of a combustible gas of nominal calorific value. The objective is to produce in the otherwise undisturbed coal deposit, either a low-calorific fuel gas (where air is the gasifying medium) or a medium-calorific gas (when oxygen/steam is the gasifying medium). This medium gas, almost nitrogen free, can serve as a synthetic gas from which a number of "petrochemical" products can be made, including ammonia and methanol. In general, the technique involves drilling a hole through which the gasifying medium is sent to the coal seam, and another hole, through which the product gases come to the surface.

The coal between the holes may need to be fractured to increase its permeability to gas flow. For steeply-dipping coal beds, and for very thick beds of perhaps 200 feet where the gasification can proceed upward along a near vertical axis, there have been encouraging results in producing consistent levels of fuel gas above 300 Btu/cu. ft.

The best use of the process appears to be in generating electricity at coal sites. Energy is produced from the combustion of the low-calorific fuel gas in a combined-cycle configuration. One advantage is that the total capital cost is distributed over the life of the project (as new holes are drilled and surface installation shifted).

The only activity warranted so far is to monitor progress, such as that presented in the Annual Symposia on Underground Coal Gasification sponsored by the Department of Energy.

Coal Development in Laboratory Facilities

The development of a country's coal resource is likely to involve such technological activities as upgrading the quality of the local coal (beneficiation), the determination of physical properties, and the performance of chemical analyses. Available laboratory facilities are likely to be nonexistent or rudimentary. Adequate local facilities and trained personnel

should be available to provide support to the users of coal by providing proximate and ultimate analysis of coal samples, grindability data, flow sheets for beneficiation plant design, and (if coking properties exist) free-swelling index measurements. A capability to render petrographic analyses could be useful. Equipment to permit such experimental work is usually relatively inexpensive and likely to fit A.I.D. mission assistance budgets. On-the-job-training could be provided through technical assistance. Overseas formalized education and training could be provided by the Office of Energy's Conventional Energy Training project.

Pakistan, Thailand, and the Philippines may be countries where such a concept could fit. Reconnaissance in these countries is planned to occur in February and March 1982. The prospects are that a generic investigation could be identified.

Regional Coal-Training Seminar/Workshops

A program of seminar/workshops, analogous to those being implemented for petroleum exploration and production in Ecuador (see above) should fill a need to educate and train managers, engineers, and operators, in the industries of countries considering switching from oil to coal. The substantive content would focus on the technological difference between the two fuels as it affects procurement, handling, and utilization as well as other topics. A related effort is materializing (as discussed above) for the ASEAN countries for implementation in a U.S. venue. Some preliminary activity in 1981 showed a potential interest in conducting seminar/workshops regionally, with the first one to be conducted in the Caribbean area. No further progress occurred because of the lack of a suitable indefinite quantity contractor. This subject should be reactivated when the new list of IQCs is available later in 1982.

5.4 Technical Support to Regional Bureaus and Missions

The conventional Energy Technical Assistance project will continue to provide technical support during 1982 to A.I.D. regional bureaus and missions in the field as occasions arise.

5.5 Technical Advisory Committee

A technical advisory committee is to be established in late 1982. The committee will be composed of representatives from private industry, government, and academia, so that expert advise will be available to assist the implementation and evaluation of the

conventional energy technical assistance project. The committee's role is to be strictly advisory, not determinative of policy. The committee will provide valuable assistance to the project by offering a cross section of independent opinion to project staff (both in-house and contractor), and by reviewing and commenting on the progress and evaluations noted in the annual reports, this one being the first.

6.0 BUDGET

Budget allocations are shown in Table 2. Allocations for FY 80 and FY 81 are historical. The allocation for FY 82 is planned. In FY 83 and FY 84, two allocations are shown. One is the proposed budget; the other the estimated needs based on the prospective new activities such as is discussed in Section 5.0 above.

TABLE 2

CONVENTIONAL ENERGY TECHNICAL ASSISTANCE EXPENDITURES AND BUDGETS ($ THOUSANDS)

Program Component	ACTUAL OBLIGATION FY 80	FY 81	OYB FY 82	FY 83 Proposed Budget	FY 83 Estimated (7) Budget Requirement	FY 84 Proposed Budget	FY 84 Estimates (7) Budget Requirement
1. Country Projects (1)		1,517.0	1800.0		1101.3		
Bangladesh							
Costa Rica			147.4(8)				
Ecuador					330(9)		850(9)
Morocco							
Sudan					850(9)		850(9)
2. Country Projects (2)							
Pakistan							
Thailand		-	300(3)		1000(3)		2000(3)
Philippines		-	-		500		1000
Niger		-	-		500		1000
Senegal		-	-		100		100
Jordan		-	-		100		300
		-	64(4)		100		200
3. Unidentified Future Country Projects		-	-		800		500
4. Generic Technology Projects							
Coal-Slurry Fuel Substitute							
Household Fuel Production from Coal		80.4	-				
Mombasa Refinery Modification		-	79.0				
In-Country Coal Experimental Station		-	300.0				
Underground Coal Gasification		-	10.0				
		-	-		100		-
5. Unidentified Future Technology Projects		-	-		-		100
6. In-Country Workshop/Seminars					100		100
Coal Exploration, Extraction, and Utilization		-	-				
Geothermal Electricity Production					100		100
Petroleum Exploration and Production		-	40				
		-	- (3)		100		100
7. Miscellaneous Support					100		100
ECOWAS Conference							
Sudan (Corps of Engrs.)		73.6	9				
Sudan (Mini Hydro survey)		9.3	-		-		-
Other		-	-		-		-
		6.9	-		-		-
8. U.S. Geological Survey					-		-
Needs and Targets Studies							
South Pacific Geophysical Survey	250	-	-				
			1,000(6)		100		100
9. Technical Advisory Committee		-	-		-		-
TOTAL	$250	1687.4	2350.0	2,000	5331.3(10)	3,000	7450(10)

NOTES

1. Incorporated in Contract with Bechtel National, Inc. Total value of contract is $4,418,900, allocated to the five countries and to miscellaneous ad-hoc services as follows: Ecuador, $221.4; Bangladesh, $1,296.8; Morocco, $1,273.8; Sudan, $1,041.4; Costa Rica, $331.2; and ad-hoc services, $202.3.
2. Identified for consideration in FY 83.
3. Activities in Pakistan are likely to be Mission funded with technical collaboration by ST/EY. Not included in annual total.
4. Joint funding: 2/3 ST/EY; 1/3 USAID/Amman not included in figure. Implemented by the U.S. Geological Survey under existing RSSA.
5. Included in the Ecuador country project.
6. Joint funding: 33% ST/EY; 33% Asia Bureau; 30% ESF.
7. Estimated Budget Requirement will be affected by funding made available by USAID Mission follow-on of ST/EY in-country project activities.
8. TCC task awarded to identify country-project activities (Arthur D. Little, Inc.)
9. Additional funding requirement not anticipated in the initial Bechtel contract.
10. Some of these requirements can ultimately be met by bilateral projects.

Personnel	Telephone	Intercan	Room #
JACOBS	8902, 8903, 8904, 1272	20	508
BLISS	8902, 8903, 8904, 1272	38	512
EILERS	8902, 8903, 8904, 1202	43	514
WEATHERLY	8902, 8903, 8904, 1202	44	516
HOAN	8918, 8919, 8920, 1272	23	508B
TOTH	8918, 8919, 8920, 1202	28	508C
BALDWIN	8918, 8919, 8920, 1202	29	508D
ROSHEL	8918, 8919, 8920, 1202	40	508E
KADYSZEWSKI	8918, 8919, 8920, 1202	21	508F
VACANT	8918, 8919, 8920, 1202	26	506B
VACANT (conf)	2245, 2246, 2247, 2248	27	506C
MEDLEY	8902/03/04, 1272 ring 8918/19/20, 1202 2245/46/47/48 (FNR)	32	508 area
DAVIS	8918/19/20, 8902/03/04, 1272, 1202, 2245/46/47/48	36	506 area
GILMARTIN	8918/19/20, 1202 ring 8902/03/04, 2172 2245/46/47/48 (FNR)	37	506 area
WP AREA	8902/03/04, 1272	42	516 area