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

PROJECT PAPER

498-0272
ASIA REGIONAL
ENERGY COOPERATION IN DEVELOPMENT

UNCLASSIFIED

BEST AVAILABLE

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ASEAN ENERGY PROJECT

498-0272

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AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT DATA SHEET

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

Amendment Number

DOCUMENT CODE: 3

2. COUNTRY/ENTITY: Asia Regional

3. PROJECT NUMBER: 498-0272

BUREAU/OFFICE: ASIA/PD

5. PROJECT TITLE (maximum 40 characters): Energy Cooperation in Development

6. PROJECT ASSISTANCE COMPLETION DATE (PACD): MM 10 DD 30 YY 84

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

A. Initial FY 81 B. Quarter 4 C. Final FY 81

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

A. FUNDING SOURCE	FIRST FY B. FX	C. L/C	D. Total	LIFE OF PROJECT E. FX	F. L/C	G. Total
AID Appropriated Total						
(Grant)	(1,000)	( )	(1,000)	( )	( )	( )
(Loan)	( )	( )	( )	( )	( )	( )
Other U.S. 1.						
Other U.S. 2.						
Host Country						
Other Donor(s)						
TOTALS						

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) ST	740	878				1,000		1,000	
(2)									
(3)									
TOTALS						1,000		1,000	

10. SECONDARY TECHNICAL CODES (maximum 5 codes of 3 positions each)

11. SECONDARY PURPOSE CODE: 742

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

A. Code	BF	TECH					
B. Amount	700	700					

13. PROJECT PURPOSE (maximum 480 characters)

To support ASEAN Programs to substitute coal in power sector, increase the efficiency of energy in buildings, and develop and apply alternative energy systems for water pumping.

14. SCHEDULED EVALUATIONS

Interim MM YY MM YY

Final MM 10 YY 84

15. SOURCE/ORIGIN OF GOODS AND SERVICES

[X] 000 [ ] 941 [ ] Local [ ] Other (Specify)

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

17. APPROVED BY

Signature: Jon D. Holstine

Title: AA/ASIA

Date Signed: MM 08 DD 17 YY 81

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

MM 08 DD 05 YY 81

AID 1330-4 (8-79)

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

PROJECT AUTHORIZATION

Name of Country: INDONESIA
on behalf of the ASEAN
(Association of South East Asian
Nations) Countries of Indonesia,
Philippines, Malaysia, Singapore
and Thailand

Name of Project:
Energy Cooperation in Development
Project No.: 498-0272

1. Pursuant to Section 106 of the Foreign Assistance Act of 1961, as amended, I hereby authorize a Grant to Indonesia for the Association of South East Asian Nations (ASEAN) Energy Cooperation in Development Project (The "Project") on behalf of the ASEAN countries of the Philippines, Singapore, Malaysia, Thailand and Indonesia, involving planned obligations of not to exceed One Million United States Dollars ($1,000,000) in grant funds over a three (3) year period from date of authorization, subject to the availability of funds in accordance with the AID OYB/allotment process, to help in financing foreign exchange costs and local currency costs for the Project.

2. The Project will support ASEAN programs in energy with particular emphasis on substituting coal in the power sector, increasing efficiency of energy use in buildings, and developing systems for water pumping. The proceeds of the AID grant will finance short term training, demonstration of solar devices and required technical assistance.

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

4. Source and Origin of Goods and Services

Goods and services, except for ocean shipping, financed by AID under the Project shall have their source and origin in the United States or the Philippines, Malaysia, Singapore, Thailand and Indonesia, except as AID may otherwise agree in writing. Ocean shipping financed by AID under the Project shall, except as AID may otherwise agree in writing, be financed only on flag vessels of the United States.

Signature _____
Assistant Administrator
Bureau for Asia

Date 17 AUG 1981

ASEAN - ENERGY COOPERATION IN ENERGY DEVELOPMENT

III. SUMMARY AND RECOMMENDATIONS

A. Borrower/Executing Agency:

The Government of the Republic of Indonesia (ROI) will be the Grant Recipient. The executing agency will be the Department of Energy (DOE), specifically the Office of International Affairs. Implementing agencies for individual subprojects will include other U.S. sub-contract agencies and local institutions within the ASEAN member countries.

B. Amount of Grant: $ 1.0 million

C. Purpose of Project:

The purpose of this second ASEAN-U.S. energy project is to support ASEAN programs to substitute coal in the power sector, increase the efficiency of energy use in buildings, and develop and apply alternative energy systems for water pumping.

D. Project Description:

The project consists of three basic components which were identified as ones of common interest among the five ASEAN countries.

The components include, (1) training for coal utilization, (2) energy conservation in buildings and (3) water pumping with photovoltaic and solar collectors.

While all three components have a basic training aspect, the water pumping component will include a demonstration of the capture of energy through photovoltaic arrays, solar thermal, and bio-gas from farm waste.

Energy conservation in buildings will require the testing of energy efficiencies with a pre-design function for the optimization of energy conservation both in new and rehabilitated buildings. The design function will be established using building parameters, coefficients of various materials, special setting of building, weather and alternative cooling sources. Tailored into a computer simulation model these techniques will assist architects and engineers to establish useful building codes enabling the ASEAN country building agencies to conserve fuel and develop cost-effective design alternatives for buildings.

E. Outputs:

This project will result in a small increase in the capacity of ASEAN countries to:

a. manage coal substitution programs;
b. formulate energy efficiency regulations; and
c. manage alternative energy demonstration projects.

Oil savings from coal substitution and improved energy efficiency in buildings will benefit the overall economy of the ASEAN countries, while the development and eventual manufacture of solar, wind, or biomass pumping systems will not only reduce oil demand but also provide a sustainable energy source for rural farmers and villages.

F. Budget:

A PASA agreement will be signed in FY 81 with the Department of Energy for $1,000,000 to be spent over 3 years. The budget would breakdown as follows:

a.	Coal Training	$ 336,150
b.	Energy Conservation in Buildings	158,000
c.	Demonstration of Water Pumping Technologies	353,100
d.	Evaluation	15,000
e.	Contingency (15%)	137,750
	TOTAL	$1,000,000

G. Implementation:

The Science Advisor in the Secretariat in Jakarta accepted the responsibility of convening a meeting of experts to develop the details of the project. At that meeting the ASEAN Liaison Officer solidified the AID-ASEAN administrative linkage. The ASEAN secretariat requested views on implementation mechanisms, providing for increased Secretariat involvement in coordination. These discussions led to selection of an overall lead country and specific coordinator for each of the three components (e.g. coal -- Indonesia; conservation -- Singapore; water pumping -- Maylasia. Indonesia was elected to undertake the overall lead country role.

H. Relationship to Bilateral and Regional Projects:

AID is funding large alternative energy projects in Thailand and the Philippines and an energy component of a Science and Technology project (Puspiptek) in Indonesia. This ASEAN project will complement and support these efforts. First, neither training in coal technologies nor technical assistance for energy conservation in buildings is included in these projects. Secondly, the alternative water pumping component will permit the comparison of the photovoltaic and wind pumping systems currently planned in the bilateral projects with Thailand and the Philippines as well as the comparisons of these systems with biomass/biogas-powered systems.

The coal training activity and the energy conservation component will help delineate opportunities for further technical assistance and training programs that can be pursued through the current and planned ST/EY projects in conventional energy training, conventional energy technocal assistance and energy efficiency and conservation. The planned Puspiotek Energy Laboratory project in Indonesia will also provide a vehicle for developing regional programs that build on this project.

I. Recommendation:

That a $1 million grant to ASEAN be authorized for this project.

IV. Project Description

A. Background

Energy has played an important role in the ASEAN-U.S. economic dialogue over the past three years. The joint communique of the August 1978 ASEAN-U.S. Economic Consultations in Washington, D.C., first identified energy as a major area for U.S.-ASEAN cooperation. This agreement followed the Vice-President's pledge of U.S. support for ASEAN's efforts to develop alternative energy sources during his May 1978 trip to Asia. This position was reiterated by the Secretary of Energy at the ASEAN-U.S. Economic Consultations and later by the Secretary of State during his meeting with ASEAN Foreign Ministers in mid-1979. Shortly thereafter, the United States formally proposed to initiate cooperation in the energy area with ASEAN by sponsoring a 3-week technical study visit in the United States.

Sponsored by AID in conjunction with the Departments of State and Energy, the ASEAN Energy Study Mission was conducted May 25-June 13, 1980 and consisted of two experts from each of the five member countries (Indonesia, Malaysia, Philippines, Singapore and Thailand) plus ASEAN's Director for Science and Technology. The purpose of the fact finding mission was to familiarize ASEAN officials with current U.S. programs in alternative energy and to begin a dialogue on possible areas for cooperative energy programs.

The ASEAN team visited a wide range of U.S. energy institutions and alternative energy facilities, including the world's largest facilities in the following areas:

- geothermal;
- solar photovoltaic
- solar thermal; and
- coal slurry

Wind, coal combustion and conversion technologies were also highlighted, including a tour of coal liquefaction and gasification pilot plants. The study mission concluded with discussions at the Department of State on long-term energy cooperation between the United States and ASEAN to reduce dependence on petroleum-based fuels by promoting the use of alternative energy sources and improving the efficiency of energy use.

Following the study mission, the United States position on U.S.-ASEAN cooperation was stated by the Secretary of State at the June 1980 U.S.-ASEAN meeting in Kuala Lumpur: "We hope to increase our energy cooperation with ASEAN. We hope that the recent tour of the United States by ASEAN energy experts will generate new projects for cooperation, particularly in the area of non-conventional energy sources." Later in July 1980, the United States formally proposed an initial project, to begin as soon as practicable, consisting of the following three elements:

1. Technical Assistance: U.S. sponsors one energy technology expert at AIT* for a period of 2 years. This expert will teach energy courses and be available for consulting and field research in ASEAN countries. Possible areas would be in liquid fuels from biomass and conservation.

*Asian Institute of Technology

2. Professional Development: ASEAN Energy Technology Seminar. Two-week seminar in Bandung, Indonesia, for six participants from each ASEAN country. Possible modules were:

- coal gasification and liquefaction;
- biomass;
- photovoltaics;
- conservation technology; and
- coal resource assessment techniques.

3. Information Exchange: Support for AIT's Renewable Energy Resource Information Center (RERIC). Provision of support for RERIC in the form of personnel, publications, mailing expenses, travel, computer time and microforms, acquisitions, equipment, and subscriptions for ASEAN countries.

This proposal was accepted by ASEAN and resulted in a $440,000 first ASEAN-U.S. Energy Cooperative Program to be implemented by AIT. This project was approved during the Third ASEAN-U.S. Dialogue in September 1980. At the dialogue, ASEAN presented a memorandum on energy cooperation that proposed the "development of a long-term cooperative program to assist the ASEAN countries in reducing their dependence on fossil fuels by promoting the use of alternative energy sources and improving the efficiency of energy use." The U.S. indicated its readiness to begin discussions on a second energy project and in January 1981 Asia Bureau representatives visited all five countries to develop a concept for this second project. The preliminary report was submitted to ASEAN on February 18, 1981. On March 31, 1981 the ASEAN Liaison Officer in Manila reported the report's proposals had been approved by the ASEAN Committee on Science and Technology (COST). Then, the ASEAN Standing Committee, at its regular June meeting, approved the COST decision, assigned responsibility to the ASEAN Secretariat in Jakarta for coordination of detailed project planning arrangements, and designated Indonesia as the primary ASEAN project implementing country.

B. General Description

1. Coal Training Course

All five ASEAN countries are developing or considering coal substitution projects in the power sector. Thailand, the Philippines, and Indonesia, in particular, have ambitious coal/lignite development and utilization plans that will tax severely available technical personnel. This project will finance an intensive, 9-week coal utilization training course. Five weeks will involve course work on technical, economic, and environmental aspects of coal extraction, trans-

portation, and conversion. The remaining period will permit internships in laboratories and field plants, tailored to the needs of individual participants. Approximately 30 participants will be accepted for training and on-the-job exposure. DOE's Argonne National Laboratory will provide administrative management for this component.

2. Energy Conservation in Buildings Analysis

Urban growth in the ASEAN countries is fostering increased demand for energy in buildings, especially for space cooling. Thirty percent of Singapore's electricity consumption is for air conditioning. ASEAN countries area considering measures to improve energy efficiency in buildings. One approach, adopted by Singapore, is to set a value for the overall thermal efficiency of the building envelope - the Overall Thermal Transfer Valve (OTTV). All new buildings must achieve an OTTV of 45 watts/square meter by January 1, 1982. The Philippines is attempting to formulate efficiency regulations for appliances in buildings. This project will provide technical assistance to help review ASEAN experiences in this area and analyze the costs/energy saving potential of various policy and technical approaches. A computer program will be developed that can be used by architects, builders, and planners in comparing various modifications.

3. Comparative Design, Testing, and Evaluation of Alternative Energy Systems for Water Pumping

The increasing cost of diesel fuel and centrally-generated electricity is prompting greater attention to the use of alternative energy sources/technologies for water pumping in rural areas. Solar, wind, and biomass powered pumps are being installed in ASEAN countries. These efforts can be accelerated through a systematic program of training, technology assessment, system selection, adaption, testing and evaluation. DOE's Solar Energy Research Institute (SERI) will manage this component on the project. Inputs will include U.S. technical assistance and equipment. Among other things, the potential for the licensing and manufacturing of promising U.S. or locally-made systems in the ASEAN region will be explored. The component will end with an ASEAN-US Symposium on Solar Pumping.

C. ASEAN Energy Situation

The Association of Southeast Asian Nations (ASEAN) has the distinction of having one of the fastest economic growth rates in the world. In spite of the recession among the industrialized nations, ASEAN has been able to maintain its traditional economic growth rate of about 7% (see Table 1). However, all five ASEAN countries realize that if they are to maintain this growth rate, it will be necessary for them to solve the twin problems of securing future supplies of energy, and to minimize the recessionary effect of rising oil prices upon their economies. To fully understand this problem, one has to realize the significant facts on the ASEAN energy scene as defined by the ASEAN Council on Petroleum (ASCOPE):

1. Energy demand will grow at a rate of up to 14 percent annually

2. By the year 2000, total population is expected to reach 349 million

3. ASEAN oil requirement is forecast to increase to 7 million barrels a day by the year 2000 an increase of 6 million barrels per day.

From the point of view of the region's economic advancement effort, and in light of the energy consumption rates being directly interrelated with levels of economic growth, the ASEAN Governments here have no other choice than to face the increase in oil consumption. Oil being expensive, they will have to programme their longterm requirements carefully. The apparent solution is to develop indigenous energy resources and to diversify away from oil upon which their economies are so dependent. This will be no easy task; so, in recognition of the difficulties ahead, the ASEAN countries are pursuing both national and regional energy strategies.

Philippine President Marcos urged this regional development program at the opening of the Third Annual Meeting of the ASCOPE National Council in October 1977, "While emphasis should be placed on the mechanics of sharing petroleum resources and for developing capacities for oil exploration and efficient extraction, ASCOPE should match priorities with the will to develop alternative sources of energy within the region. For it is in this sphere that action, if fruitful, will ensure ASEAN self-reliance in energy".

Table I

Rate of Economic Growth
(%Yr)

	1975-80	1980-85	1985-90	1990-2000	
Indonesia	5.7	5.5	6.1	6.1	
Malaysia	9.5	7.9	7.6	7.5	
Philippines	8.5	8.3	8.5	8.5	
Singapore	5.4	6.8	6.8	6.8	
Thailand	6.8	5.9	5.9	5.9	

Source: WOCOL

Although the energy situations of the ASEAN countries vary substantially, one key common element is that as their economies modernize, consumers are switching from non-commercial to commercial fuels. Hence, the twin problems of deforestation and increased reliance upon oil, whether imported at high cost in the case of Thailand, Singapore, and the Philippines, or reserved for domestic use at the expense of export revenues (Indonesia and indirectly, Malaysia).

The ASEAN economies are reliant upon oil as an energy source and this dependence is increasing rapidly in all consuming sectors including for power generation purposes. All five countries import oil from the Middle East and rely upon oil as the major source for electric power generation. Indonesia and Malaysia import lower-cost, high-sulphur, heavy crude oil for domestic consumption and export their low-sulfur, light oil at premium prices. Total crude oil imports into the region from the Middle East alone in 1979 averaged approximately one million barrels per day.

For Thailand, Singapore, and the Philippines, the high and growing oil import bill undermines their economic growth and development by draining foreign exchange reserves that could otherwise be used to purchase other key imports, particularly high technology products which are not locally available. For example, Thailand's National Energy Administration estimates that oil imports in 1981 will account for 76% of total commercial energy requirements and absorb 37% of the nation's export earnings. Estimated oil import costs of $3 billion in Thailand and $2.7 billion in the Philippines represented 44% of total export earnings in 1980, compared with 11% in 1973. Aside from the large balance of payments deficit that results, inflation and income distribution problems also arise.

For Indonesia and Malaysia which are both net oil exporters, rising and perhaps uncontrolled domestic oil consumption depletes their domestic reserves at a rate faster than new discoveries. Thus, the day when they become net importers of oil is hastened. Since both countries rely heavily upon oil exports as a major earner of foreign exchange, it is in their interest to prolong the life of their oil reserves for as long as possible. Although it has the region's largest reserves of oil and gas, Indonesia has already decided to develop its coal reserves solely for domestic use to conserve its oil resources for the purposes of export.

The necessity for the substitution of oil by other energy sources is clear. The three ASEAN importers (Thailand, Singapore, and the Philippines) are embarking upon programs to develop what domestic energy sources they have to avoid going bankrupt. These efforts are designed also to strengthen their industrial infrastructure by establishing a domestic energy industry and, in the case of Singapore, to emphasize energy conservation.

Similarly, the ASEAN oil exporters (Indonesia, Malaysia) are planning oil substitution programs relying upon domestic energy sources such as coal and the alternative fuels to prolong their export capability.

Given these energy problems facing the ASEAN countries, government planners and policy makers face many policy options from which they will have to make difficult decisions incorporating economic, technical, energy, social, environmental and political considerations. Due to the long lead times associated with energy projects, it is necessary for governments to make their decisions now if the various proposed energy projects are to be operating in time to avert what many consider to be an impending but avoidable economic catastrophe . However, in order to make these decisions all of the ASEAN countries are seeking external assistance or gathering the necessary information, including project feasibility studies in particular. For example, prospects for oil substitution are brightest in the power sector given the technical limitations for substitution in the transportation area, planned construction of new plants having dual-fired boiler capability and the existence of domestic coal and gas reserves in several countries. For others, the prospects of secure supplies of imported coal priced on the basis of market forces alone makes a favorable alternative to imported oil.

The possible share of coal-fired power generation was surmised by country based on their respective power development programs. Their percentage share to the total year-2000 electricity production are projected to be as follows:

TABLE 2

Assumed Percentage of Coal - Fired Power Generation

	1990	2000
INDONESIA	80	80
MALAYSIA	30	30
PHILIPPINES	20	20
SINGAPORE	70	80
THAILAND	15	20

Source:WOCOL

Information on steam coal use in sectors other than electricity is not sufficiently available.

Although Indonesia is by far the richest of the ASEAN countries with respect to coal, Thailand, and Malaysia also have identified both medium grade coal as well as an abundance of lignites. While still lagging behind, the Philippines have already made efforts to introduce incentives to spur private sector investment into conversion from oil fired to coal fired boilers.

The principal costacle to these oil substitution strategies is their high capital cost and large foreign exchange component. Although it can be shown that the payback on such investments would be well worth the outlay over time, the problem is accumulating sufficient funding to begin the projects and to acquire sufficient indigenous expertise to manage them out of the ASEAN labor force. Moreover, although the technology exists for many of these policy alternatives, some of it is untried under ASEAN environmental conditions. Since the necessary technology is not locally available, decision makers are unsure as to which specific technology to adopt (solar, PV or thermal; fluidized bed or coal gasification; etc.).

At this point, the ASEAN countries are in the early stages of developing a structure of energy cooperation. Their focus, thus far, has been on information exchange and on the issue of emergency petroleum sharing. Within the framework of the ASEAN Committee on Petroleum, an emergency petroleum scheme is in effect whereby a 20% shortfall in the domestic oil requirement of an ASEAN country would trigger a sharing of supplies.

BEST AVAILABLE

The ASEAN Committee on Industry, Minerals and Energy (COIME) and the Committee on Science and Technology (COST) have been tasked to undertake all ASEAN energy related programs. At the First ASEAN Economic Ministers Meeting in Bali in September 1980, COST was given jurisdiction over those energy technologies that had not yet reached the commercial stage, COIME over non-oil and gas matters. The meeting also highlighted coal development and utilization as a major area for ASEAN cooperation. The COST has a Subcommittee on Non-Conventional Energy which has recently developed a proposal for consideration by external donors. It proposes projects in the following areas and a focal country for each area:

Coal, hydro ----------Indonesia
Biomass & Geothermal-Philippines
Solar----------Thailand
Solar Pumping and Crop
Drying----------Malaysia
Solar Cooling--------Singapore

A primary need exists for training of ASEAN personnel in these areas and for in increase in ASEAN energy R&D efforts. Since ASEAN's private sector is not capable of such endeavors, it is necessary for the ASEAN governments to provide financing and other subsidies and incentives to encourage such endeavors. Unfortunately, ASEAN governments lack the necessary financial, technical and human resources to accomplish this task properly. Thus, there is a need for external assistance in these areas.

D. The Lead Agency and AID Counterpart

Following its request for a U. S. assisted project in energy, ASEAN/COST identified Indonesia as the lead or "focal" country to act on behalf of ASEAN throughout the project. Indonesia, in turn, named the Indonesian Institute of Sciences (LIPI) to act on behalf of ASEAN and to sign the project agreement with the U.S. To facilitate AID requirements, USAID/Jakarta was assigned responsibility for working with L.I.P.I. on implementation activities in Indonesia. The ASEAN Liaison Office in Manila will be responsible for coordination with, USAID/Jakarta and L.I.P.I., the management of project activities in the other ASEAN countries. The project agreement will be signed between L.I.P.I. and USAID/Indonesia. In terms of AID's role, a PASA through the DOE will indicate the selection and contracting of the Government Cooperative labs and specify the respective scopes of work. Those agencies anticipated are Argonne National Labs, Chicago, Ill.*; Lawrence-Berkely Lab., Berkeley, CA; and Solar Energy Research Institute, Golden, Co.

E. Host Countries & Focal Agencies

Although several government agencies and institutions within each country will ultimately participate in the project at one time or another, each country was asked to identify a lead or "focal" agency to coordinate its participation in the project and to be responsible for the implementation of project components assigned to it. The following lead agencies have been named:

* Note options on Page 23.

Indonesia----------L.I.P.I.
Malaysia----------Ministry of Science, Technology and Environment
Philippines----------Ministry of Energy
Singapore----------University of Singapore (Min. of Ed.)
Thailand----------National Research Council

All e[illegible]tive materials, demonstrations and symposiums will be coordinated through COST Chairman and the ASEAN Secretariat.

1. Coal Training

Since Indonesia was designated by COST to be the focal country for coal, the institution assuming responsibility for ASEAN participation will be L.I.P.I. Under the direction of its Director, L.I.P. I. will implement the coal component by circulating an overall curriculum of possible training topics to all 5 member countries, collect the specific curriculum desired by each country, and initiate the screening and selection of ASEAN participants. After screening by L.I.P.I., USAID and the Project Backstop officer will determine the final selection of participants.

After the AID and L.I.P.I. review has been completed, AID will finalize the course curriculum and notify participants of travel arrangements to the U.S.

2. Energy Conservation in Buildings

As the lead country for this component, the University of Singapore (Min. of Educ.) will coordinate ASEAN's participation in the development and refinement of the simulation model for energy conservation in buildings. Upon completion of this exercise, the University will submit to L.I.P.I. and the COST a plan for the final energy conservation symposium to wrap-up or disseminate lessons learned to other ASEAN member countries. That symposium will be held in Singapore.

3. Solar Water Pumping

Having accepted responsibility as the focal country for the water pumping component, Malaysia's Ministry of Science, Technology and Environment will be the lead agency. Within this Ministry, the Standards and Industrial Research Institute (SIRIM) will play a lead role in coordinating the solar training and demonstration phases of the water pumping component. Planning for the ASEAN-US Solar Water Pumping Conference will be coordinated with the ASEAN Secretariat and the COST Chairman.

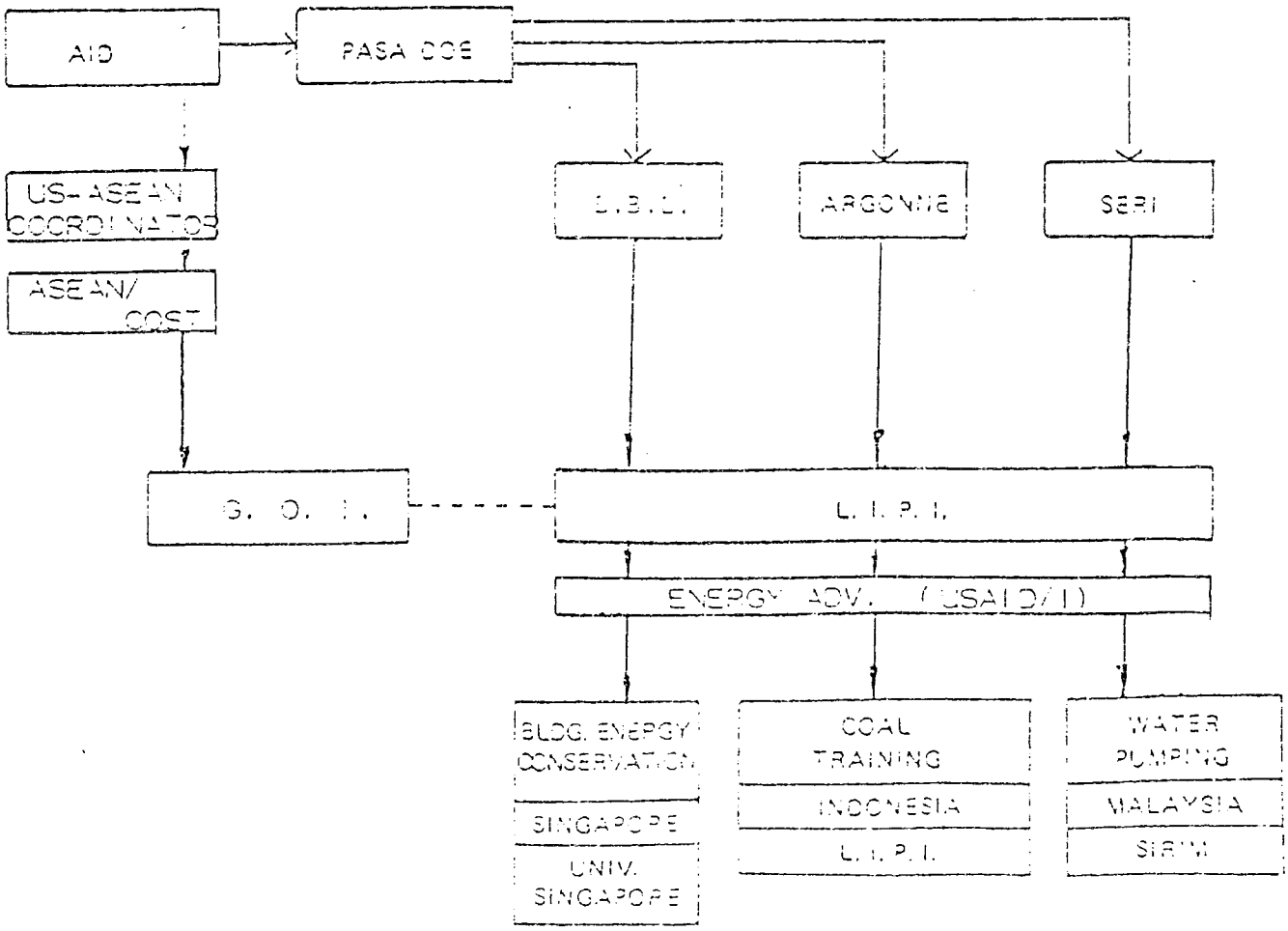
The Ministry of Science will coordinate in-country demonstrations with..:

National Energy Authority ----- Thailand
The Ministry of Mines &
Energy ---------- Indonesia
Minister of Education ---------- Singapore
Ministry of Energy ---------- Philippines

All evaluative materials, demonstrations and symposiums will be coordinated through the Chairperson of COST, ASEAN Secretariat.

From the USAID viewpoint, a PASA via DOE will in turn select and contract the respective implementing agencies. The agencies anticipated under this contract as aforementioned are Argonne Labs, Chicago, Ill., Lawrence Berkeley Lab., Berkeley, California, and Solar Energy Research Institute, Golden, Colorado.

Overall, an Energy Advisor located in Jakarta will assume the implementation and project verfication with backstopping through ASIA/PD or ASIA/TR/FE. In short, the implementation activity will flow as illustrated below.



V PROJECT ANALYSIS

A. Project Elements

1.Coal

a. Coal Training

The ASEAN Committee on Science and Technology (COST) has designated Indonesia as the lead ASEAN country or "focal point" for the coal training component. Because it deals with scientific and R&D-type issues, COST has selected three areas of coal combustion and conversion to be emphasized in the coal training course. These areas are coal gasification and liquefaction and fluidized bed combustion. However, since the development of ASEAN coal and lignite resources is still at an early stage, several countries expressed great interest in "upstream activities" such as coal resource assessment, mining, transportation, the international coal market, and coal port facilities.

Because of this wide range of interests, the Project took a flexible approach toward selecting an overall curriculum. At the project's initial stage, ASEAN will circulate training topics which the individual countries will rank-order including on-the-job training.

b. Purpose

The purpose of this component is to enhance ASEAN countries' capabilities to assess and develop their indigenous coal resources in an orderly and economic manner to reduce their dependence upon oil. As part of his effort, the comparative evaluation of coal combustion technologies in terms of their technical, economic and enviromental feasibility for the ASEAN region will be emphasized in order to maximize their utilization of coal. In addition, prospects for the introduction of coal conversion technologies in the ASEAN area to replace dwindling resources of oil and gas will be stressed.

This component will complement other ASEAN activities in the coal area, including the Australian-sponsored Coal Utilization Workshop held in May 1981. ASEAN's Committee on Industry, Mining, and Energy (COIME) coordinated the workshop for ASEAN, which included participants from the World Bank, Asian Development Bank, UN, and ESCAP.

The training will consist of a 5-week training course and a 4-week on-the-job training period for 6 participants from each of the ASEAN countries or a total of 30 participants in all from ASEAN. It is presumed that the 6 individuals attending the training course will be the same as the 6 individuals participating in the on-the-job training phase. If a country does not nominate 6 individuals for the training then it will be possible to fill the vacant slots with candidates from other countries, as selected jointly by AID and ASEAN.

2. Solar Energy for Water Pumping

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a. Demonstration

Three small-scale (2-5 HP) water pumps, powered by photovoltaic cells, anaerobic digesters, biomass gasifiers, and possibly solar thermal single-axis solar thermal concentrating collectors will be installed in Malaysia. These hardware testing, monitoring, and adaptation activities will compare technological alternatives in a manner complementary to, and not duplicative of, similar AID bilateral projects with Thailand and the Philippines, so as to allow detailed analysis of system and component performance, durability, operation and maintenance costs, and suitability for local manufacture. This activity will emphasize the sizing and matching of system performance to local energy needs, solar energy collection and conversion, biomass processing and conversion, and the adaptation of existing hardware to local environmental, social, and economic conditions. SERI engineering and planning staff, in conjunction with ASEAN lead country officials and counterpart scientists throughout the ASEAN region, will modify off-the-shelf items, test new materials and configurations, install the equipment at SERI and in Malaysian field test sites, monitor its operation, and suggest subsequent modifications. Monitoring and drafting of the final report will be carried out by the ASEAN side.

b. Training

Training would consist of a two and a half week course in the United States, two to three days of meetings with U.S. solar and biomass pumping component manufacturers and marketing representatives, and a week-long tour in the Southwestern United States of solar, wind, and biomass installations for water pumping, pump manufacturers, and solar production facilities. Up to three officials from each ASEAN country would participate. (See Annex V for full training circular).

Note: For each of the subject divisions, there will be hands-on demonstrations of individual components, working models in the SERI laboratories or at nearby commercial installations. The emphasis will be on practical information, rules of thumb, proven technologies, and cost minimization.

c. Conference on Alternative Energy Systems for Pumping

A three-day conference will be convened by ASEAN on solar alternative systems biomass technologies for powering water pumping. This meeting will include participants drawn from both the U.S. and the participating ASEAN countries, with the private and public sectors, including national laboratories and academic officials from the participating universities. The purpose of this conference will be to present the results of the comparative water pumping demonstration project, the training course, and the evaluations of both project sub-components. It will also identify areas for future basic and applied research, and for U.S.-ASEAN cooperation. There will be presentations of alternative pump configurations, research designs, and materials advances. There will be a concurrent trade show, featuring exhibitions by ASEAN and U.S. firms producing solar and biomass systems as well and pumps and controllers.

Panels will be established to discuss papers prepared by solar and biomass energy experts, as well as water pumping specialists from the U.S. and the ASEAN countries.

U.S. contribution to the overall cost of the three sub-components outlined above is estimated to be $353,000 (see Financial Analysis).

COST has designated Malaysia as the lead ASEAN country or "focal point" for the "RD&D on New and Renewable Energy Technologies" component of the second ASEAN-US Energy Cooperative Program. However, this component incorporates the interests of all five ASEAN nations, and not just Malaysia as reflected in the decisions of COST and the deliberations of its Energy Expert Working Group. On June 26, 1981, the Project Design Team met informally with the ASEAN Energy Expert Working Group in Jakarta at which time the Malaysian representative made a formal presentation of a proposed cooperative program in alternative energy for water pumping. Although this presentation adhered closely to the original U.S. proposal as approved by COST, the Project Design Team noted that delays in officially establishing the program's specifics made it unlikely that all the necessary project design work could be completed before the deadline for obligating the funds. Moreover, funding priorities were being adjusted such that the monies allocated toward the water pumping component would be more equal to the funding levels of the other two components. Therefore, it was suggested that there be some flexibility in the planning for this component. The Working Group explained that they were not in a position to alter COSTapproved decisions but that a letter from the U.S. to the COST Chairman explaining the situation and proposing a new program and budget could resolve the situation.

Subsequent discussions in all five countries including Malaysia in particular ended with an agreement on a program composed of training in the U.S., solar pumping demonstration in Malaysia, and on ASEANUS Conference on Solar Pumping to be held in the ASEAN region.

D. Purpose

This component is designed to enhance the capability of ASEAN country scientists, engineers, and rural development specialists to design, operate, maintain, and possibly manufacture solar water pumping units. The main vehicle for this work will be a comparative water pump testing and demonstration project in Malaysia, as well as a three to four week training course in the United States. An ASEAN-U.S. Conference on Alternative Energy Systems for Water Pumping will be held in the ASEAN region as a final event to review the results of the pumping installations and the lessons learned throughout the project, to identify areas for future research and cooperation, to discuss opportunities for the production and marketing of solar and other alternative pumping components within the ASEAN region. Dissemination of information would be emphasized in all three aspects of the project in order to strengthen ASEAN's ability to design and manufacture solar pumps locally for use in the region. For this reason, the participation of U.S. private sector, including firms involved in the manufacture and distribution of solar and biomass energy conversion components, electronic controllers, and small-scale AC and DC pumps will be invited. For example, representatives of leading U.S. firms will be invited to meet with ASEAN public and private sector counterparts in order to discuss cooperative testing and manufacturing projects, and other items of mutual interest. In addition, ASEAN participants will visit U.S. factories manufacturing the components for solar, biomass, wind and biogas-powered water pumps.

Given the increasing cost of diesel fuel and centrally generated electricity, the use of alternative energy source/technologies for water pumping in rural areas is becoming an important priority in the ASEAN countries. In some cases these technologies can provide electricity to areas not serviced by the national electricity system. Solar, wind, and biomass powered pumps have already been installed in several ASEAN countries and these countries are benefiting from bilateral programs with France and Japan, and multilateral programs with the EC.

This component is consistent with point three of the Asia Bureau's Five-Year Energy Program (FY82-86) which includes "Technical and Limited Capital assistance in the demonstration of the technical, economic, and social feasibility of solar, wind, biomass, and hydro technologies for rural or market town use." It is also consistent with the broad purposes of AID's Energy Office as contained in its Energy Assistance Policy paper.

3. ENERGY EFFICIENT BUILDINGS PROGRAM

a. Energy Consumption in Buildings

The combination of increasing economic activity in the commercial sector along with the burgeoning urban population in the ASEAN Region provides the impetus for an ever increasing share of total energy use to be spent in buildings. However, much of the information, procedures and administrative process that could ameliorate this trend has been developed in the U.S. and Europe during the past few years and can form the basis for application in ASEAN circumstances.

Because of the longevity of buildings and the natural inertia of the building services community (architects, planners, builders, code officials, etc.) there is a failure of pure market mechanisms to provide an efficient response to the rapidly rising costs of fuels.

The need to accelerate a more efficient allocation process and consumptive pattern is especially important in ASEAN where the energy economy is essentially totally dependent on imported oil subject to uncontrolled world market prices.

Modifications of the experiences gathered in the U.S. in energy end use analyses, data base compilation, computer energy use programs, technologies and design for energy efficient retrofit as well as new building application can form the basis of an assistance program which would be of benefit to all the ASEAN countries.

At the present time, efforts to improve the energy performance of buildings is primarily concerned with air conditioned buildings where the greatest amounts of energy are being used. A prescription for the Overall Thermal Transfer Value (OTTV) has been derived to initiate a building control program aimed at implementing more energy efficient buildings.

Although this requirement in Singapore is an OTTV of 45 watts per sq. meter and is expected to improve the energy efficiency of airconditioned buildings, it is only the very beginning of a full program to achieve obtainable and desirable energy performance. This point is exemplified by comparing two buildings, one with the stipulated value of 45 w/m^2 and another with a value some 50% larger. It is quite possible that the second building with the higher OTTV would actually consume less energy per square meter of floor than the first building with the regulation value of the OTTV.

This situation could happen if the two buildings had very different systems for providing air conditioning, ventilation, dehumidification and lighting controls. The building with the higher OTTV could have a variable fan speed system, a variable air volume distribution system, a lighting control system with photosensitive devices for taking advantage of daylighting as well as devices for sensing occupant presence and schedules. Such equipment coupled with a computer system for demand limitation and control when compared to the standard building without these energy efficiency technologies and with perhaps a terminal reheat system would allow the higher OTTV building to provide the same internal environmental specifications at a much lower total use in energy. Thus, both the loads in terms of climate and occupants as well as the building systems need to be considered together if the goal of improving the energy performance is to be actualized.

b. Program Elements

The elements of a comprehensive program which would lead to an effective policy to provide energy efficient buildings are as follows:

1. The development of practical analytic tools such as building energy performance computer codes which can accept information on local climate, building and equipment characteristics as well as occupant schedules and subsequently provide statements on energy use.

2. The provision of prescriptions for the necessary building materials, equipment and control systems which can form the design basis for meeting an overall required energy performance.

3. The in situ measurements of the actual energy performance of enough buildings to provide an experimental verification of the accuracy and consistency of the analytic tools and calculational procedures developed.

4. The physical demonstration in both new and existing buildings of the most recent technologies, design procedures and strategies that will provide dynamic examples of how buildings can be made more energy efficient.

The time schedule for both elements 1 and 2 is expected to be approximately one year each.

From the technical point of view both these elements could be undertaken concurrently if sufficient support is available. Elements 3 and 4 are expected to take approximately 2 to 3 years for completion and can also be undertaken concurrently but subsequent to elements 1 and 2. The accomplishment of elements

3 and 4 would require major assistance from both the public and private sectors in terms of building equipment along with some specialized personnel.

c. Singapore as the Focal Point

Preliminary examination of data gathering, administrative process along with existing technical and economic expertise among the ASEAN countries indicates that Singapore with its already demonstrated concern for improving the energy performance of its building sector would be the most natural country to undertake such a comprehensive program.

Moreover, the situation for building energy use is especially acute for Singapore since it now accounts for nearly half of its total national energy consumption, aggravated further by the large growth in commercial floor space expected during the next decade. Accelerating the implementation of more energy efficient buildings is a recognized policy by Singapore and thus assistance in this area has the opportunity for further augmentation beyond that of USAID.

In addition to the principal activities being developed in Singapore the participating ASEAN countries will contribute at a level that would make each of the program elements sufficiently exemplar so that the results could be readily applied to the local building conditions in their respective countries.

d. Program Implementation

In order to initiate this process USAID would propose an assistance program beginning with partial support for element 1 above. Full implementation of elements as described (in Annex II) and below will require support on a cost sharing basis beyond that of USAID contribution.

A brief description of the initial tasks necessary to carry out element 1 are as follows:

Task 1. Overall Management:

The purpose of Task 1 is to develop and emplace the study management system in conjunction with the University of Singapore allowing for an effective cooperative program. This task will also define:

Roles of ASEAN, University of Singapore and USAID management interaction.

Selection of steering committee which will guide and review program activities. Selection of chairperson and duties of the committee.

Selection of technical experts outside of ASEAN who would help in the tasks described in Annex II.

Other management procedures involving scheduling of major milestones.

Task 2. Review and study of existing analytic tools: The purpose of Task 2 is to provide familiarity with existing programs, the kind of information needed as inputs and the nature of the analysis provided by the outputs.

Principal Subtasks:

2A. Tutorial review with building and computer experts familiar with existing information.

2B. Defining data relevant for Singapore that is required for inputs such as meteorological information, building materials, as well as occupant preferences and tolerances.

2C. Defining the kind of output that will be useful to code officials and other perceived users of the analytic tools.

Task 3. Procedures surrounding data either not available or obtainable during the program course: The purpose of Task 3 is to find the measures that allow a useful output when the input data is not sufficiently accurate or comprehensive.

Task 4. Development of specialized algorithms for application of computer programs to Singapore: The purpose of Task 4 is to consider the various energy consuming systems and components as specified in the existing programs and to provide the parameters that are relevant for the Singapore application.

See Annex II for additional tasks.

B. Economic Analysis

The ASEAN-US Energy Program does not lend itself to traditional cost/benefit or cost/effectiveness analyses. The project is essentially a training effort, with the exception of the solar water pumping demonstration, and its outputs therefore will emerge in the form of increasing the technical skills of ASEAN's human resources. The solar pumping demonstration and building conservation computer program aspects of the program have research and development components from which the specific outputs will be in the form of completed research relating to solar energy fabrication and application, and energy demand management. Lastly, the information dissemination outputs of the Solar Pumping Conference and Energy Conservation Symposium will ensure that the knowledge gleaned from the project will be available for application by the respective governments in such areas as the selection of the most cost effective solar technology for application in rural areas and the development of Conservation Standards for buildings that will result in more economic and efficient utilization of electricity.

Although economic analysis of the proposed activities cannot in every case provide quantification of costs and benefits, it is possible to make some general order of magnitude estimates. In the short run, these programs, consisting primarily of training, will save ASEAN research costs and have the effect of subsidizing their existing educational and technical training programs. ASEAN personnel will have access to training and research opportunities that would not otherwise be available.

In the medium term, the results of the coal training, solar training and demonstration, and conservation programs will provide much of the information required by national decision makers to select appropriate coal combustion technologies, develop building energy consumption standards and regulations, and identify appropriate technologies for solar pumping. The introduction of solar pumps, construction of coal fired power plants, and the implementation of building regulations will accelerate the process of oil substitution.

It will not be until the long run, however, that actual savings from oil substitution will be realized. Every barrel of oil conserved or substituted for will save foreign exchange (either as an import cost or export earning) which could be applied toward other purposes of national economic development. ASEAN's energy needs are now being supplied almost wholly by oil, most of it imported. As noted earlier, ASCOPE has estimated that by the year 2000 ASEAN will be a net importer of 7 million barrels per day. At today's prices the import bill would equal approximately $250 million per day or more than $91 billion per year. In order for ASEAN to reverse its dependence upon imported oil as its primary energy source, the ASEAN governments are looking into the development of indigenous alternative energy sources, coal, and maximizing the efficiency of their energy use. To the extent that this program supports these efforts, the value of the costs saved by using non-oil energy sources can serve as a measure of the project's economic impact. Taking a conservative estimate that substitution efforts will result in a 1% savings in oil use, this would amount to $900 million per year.

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However, the economic value of nonconventional energy sources and conservation cannot be measured in energy equivalents alone as there are additional economic benefits of an indirect nature. For example, the beneficiaries of the training programs will have had the opportunity to pass their knowledge on to others. Another general benefit or goal of the project is to increase the availability of useful energy. Much of these savings will accrue to the small landholder and, in the case of solar pumping in particular, there will be a direct impact at the demonstration site in terms of increased water supplies for irrigation, savings for energy that can be applied towards other rural agricultural uses, and economic savings. These savings will spill over into other areas such as solar drying of crops lighting, heating, and mechanization due to the work in solar energy collection technology, energy stotrage and inverter technology. Moreover, the introduction of solar power will not require sophisticated power transmission systems--in terms of roads or electrical cable--hence, there will be a savings over traditional power sources. More importantly, the basic energy resource is non-depletable, thereby eliminating the need to make a choice between present consumption and future need. By stressing local manufacture of solar components, there will be secondary economic benefits that would otherwise not be realized. Lastly, to the extent that the research component of the solar is successful in reducing costs, the feasibility of all economic classes utilizing the technology will increase as R&D continues.

The selection of coal combustion or conversion technologies will accompany the development of a domestic coal using infrastructure that will provide new jobs and other economic benefits. Energy savings realized from improvements in the efficiency of building energy use will help delay the time when new power generating plants have to be financed and built due to a reduction of the projected peak load for electricity.

c. Institutional Capability

Under the three part approach, three Department of Energy (DOE) sponsored labs. have been identified to conduct the training and systems research. They are:

Argonne Lab., Chicago ---------- Coal Training

Solar Energy Research Inst.,
Golden, Colorado ---------- Solar Research

Lawrence Berkeley Labs.,
Berkeley, California ---------- Energy Conservation in Buildings

With respect to coal training, AID/W recognizes the very large resource for this purpose which has developed in the U.S. over many years, especially in the university sector. Accordingly, the illustrative description of Argonne National Laboratory is cognizant of both the projects adminstrative requirements as well as the full participation of other potential training institutions. For instance, Pennsylvania State University, University of Pittsburgh, University of West Virginia, and the School of Mines of the University of Colorado have been considered as instructors,each which have some very specialized expertise within the coal sector. The final objective will be a combination of institutions assuring effective training in the diverse coal topics identified by the ASEAN countries.

Argonne Labs.

Argonne National Laboratory (ANL) is one of the nation's largest federally funded research and development centers. The mission of the Laboratory is to apply broad-based scientific and technological resources to the solution of problems of energy supply, energy utilization and environmental protection. ANL's programs include numerous energy research and development efforts, as well as basic and applied research in the physical, environmental, and biological sciences.

Since Argonne National Laboratory was founded in 1946, educational endeavors and related interactions with institutions of higher learning have become increasingly prominent at the Laboratory. In 1968, the Argonne Center for Educational Affairs was formed.

In 1980, the Center for Educational Affairs was renamed the Division of Educational Programs to emphasize ANL's commitment to fulfill its responsibilities for conducting and administering energy related manpower development programs at Argonne, as well as at DOE headquarters, in industrial laboratories and in several developing countries.

If selected, the Argonne Division of Educational Programs would be assigned administrative responsibility for ANL programs funded as educational and training efforts by DOE and other agencies at both domestic and international levels. This would provide a wide range of programs for college and university participation under a Department of Energy program aimed at stimulating faculty and student development.

The Division's research participation programs involve university faculty members and students from a variety of scientific disciplines in energy-related research under the guidance of Argonne scientists and engineers.

Its training programs consist of faculty institutes, workshops and faculty-student science experiments. The division also conducts conference students.

Under the auspices of the International Atomic Energy Agency, the U.S. Agency for International Development and the U.S. Department of Energy, the division has become increasingly active in the development and administration of training courses for engineers, scientists, and technical managers from developing nations.

Participants During FY 1980

Faculty and Student Research Participation	778
Conferences	651
University-Oriented Training	589
International Training	109
TOTAL	2127

Solar Energy Research Institute

The Solar Energy Research Institute (SERI) was created out of the Solar Energy Research, Development and Demonstration Act of 1974 to take the lead in supporting the National Solar Energy Program and to assist in the establishment of the industrial base necessary for the widespread, early utilization of solar energy. In March 1977 the Energy Research and Development Administration (now part of DOE) evaluated many proposals for SERI and announced that SERI would be managed and operated at Golden, Colorado, by the Mid-West Research Institute, an independent, non-profit organization. SERI formally began operations on July 5, 1977, and saw its budget double from $12.7 million in fiscal year 1978 to about $25 million in fiscal year 1979.

SERI's responsibilities through 1985 have evolved to include:

- conducting solar research, development, and related activities;
- supporting DOE in the management of domestic and international programs in solar research, development, and demonstration;
- assisting the Federal Government in the formulation of national solar energy policies, plans, and strategies;
- contributing to the establishment of a solar energy industrial base that will foster the widespread use of solar technologies; and
- operating as the lead center for research in the National Photovoltaic Program (the Jet Propulsion Laboratory in Pasadena, California, is the lead center for applications).

To achieve these goals SERI has embarked on a wide range of research, training and information dissemination programs in photovoltaics, bio-mass, wind, active solar heating and cooling, passive solar technology, industrial process heat, solar thermal technology, ocean systems, and solar energy storage. In addition, SERI has established Solar Energy Information Data Bank, Solar Education Data Base, a state Solar Incentives Study program, and a bi-monthly Solar Law Reporter. Cooperative solar programs with South Korea, Mali, Spain, France, Italy, Israel, Australia, Japan and Brazil are managed by SERI as well as the $100 million U.S.-Saudi Arabian SOLERAS program.

One of the most interesting projects at SERI is the development of a handbook of agriculture applications of solar energy. Aimed at the developing countries, this handbook analyzes state-of-the-art alternative energy sources in terms of their suitability for agricultural end uses such as pumping and drying. Another project at SERI entails the field testing of a new methodology for evaluating the solar potential of rural villages.

THE LAWRENCE BERKELEY LABORATORY (LBL)

LBL is a large physical laboratory facility and building complex located adjacent to the Berkeley Campus of the University of California. The laboratory is managed by the University of California and is a prime contractor to the U.S. Department of Energy. There are approximately 3,200 employees at the laboratory among them some of the most outstanding scientists and engineers in the world including seven Nobel Laureates.

LBL has been in existence for 50 years and has contributed extensively to the advancements in physics, chemistry, many branches of engineering, computer science, biology, medicine and economics.

During the past few years since 1975 LBL has undertaken to extend its scientific and technical expertise into the area of building science. This move was greatly accelerated due to the combined lack of in-depth knowledge, national institutional commitment and the pressing need for information occasioned by the very sharp use in energy costs during the 1970's.

At the present time LBL has developed a team of some 50 building experts in a wide variety of specialties covering both the technical and institutional aspects needed for a comprehensive energy efficient building program.

Besides physical facilities for measurement and data gathering LBL has applied its past experience in computer science to the problem of developing a computer program as an analytic tool with which detailed studies of the energy performance of buildings can be executed. This program known as DOE-I and its follow-up DOE-II was first used by the state government of California as its primary analytical capability to support its recently promulgated energy conservation building codes.

LBL has, in addition, experts dealing with specialized problems of the developing countries and is therefore an ideally suited institution to assist AID in its program of energy efficiency in buildings for the ASEAN region.

D. ASEAN Lead Agency

The lead institution for the overall ASEAN project implementation will be L.I.P.I. (an Indonesian acronym for the Indonesian Institute of Sciences).

Among other things, L.I.P.I. has developed a keen rapport with specific Ministries serving the energy and environmental science fields within the ASEAN country groups.

Organizationally, L.I.P.I. covers the wide range of energy interests including biological research to coal gasification, and several proto-type technologies for charcoal substitution. The various departures from petroleum use have included research to utilize Ipil-Ipil, a rapid maturing wood as a fuel source.

Their interest in fluidized bed combustion chambers is given highest priority both for utilization of low grade coals, lignites, as well as the environmental effects of de-sulfurization of gases that the limestone catalyst provides.

L.I.P.I. developed as a semi-autonomous agency reporting directly to the President. They are structured as follows:

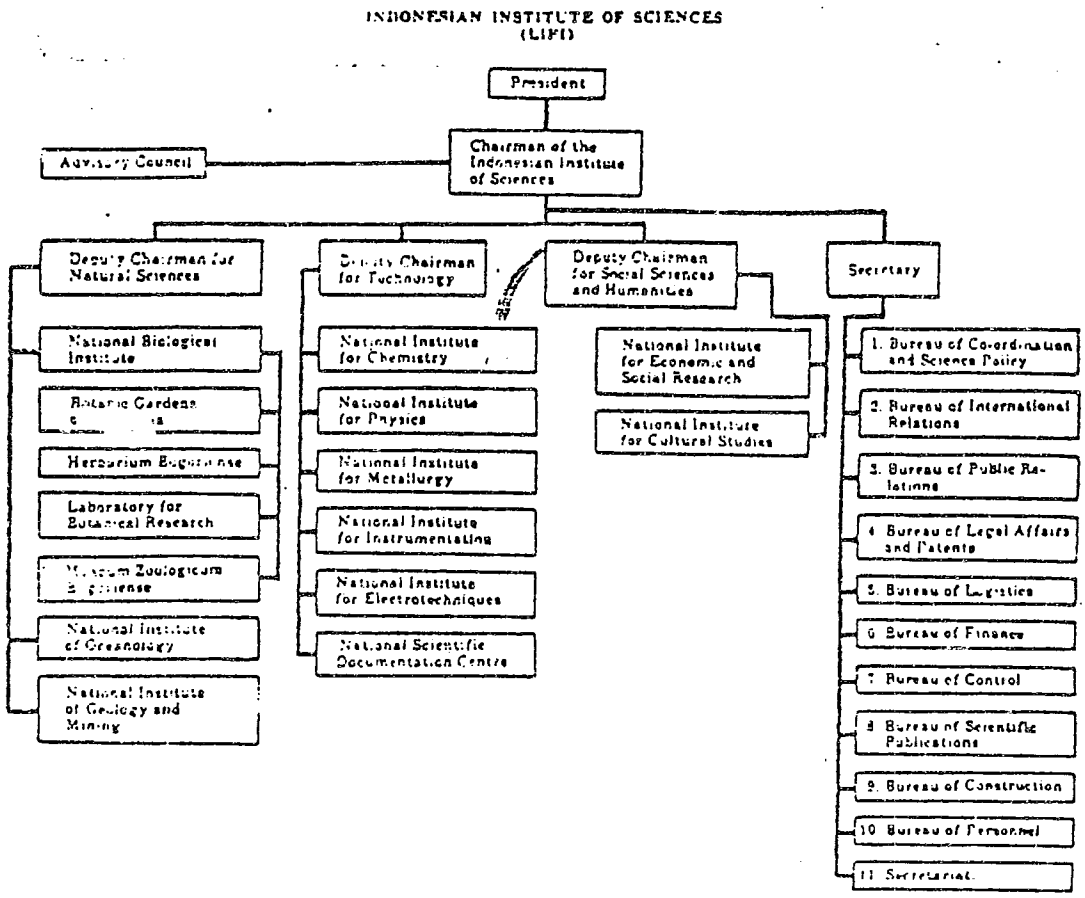

FIGURE II

E. Participant Training & Selection Process Coal Training

Attached in Annex I is a "Universe" of course material available to ASEAN coal training. It is the starting point for designing an effective coal training program.

The coal training will start during the spring semester 1982 and will be offered to 28-30 candidates, or approximately 6 candidates from each member country. In view of some difficulties to assemble 30 candidates during the spring semester, a fall course may be opened to provide additional flexibility. AID/ST/EY will provide a clearinghouse function and will evaluate courses. They will also participate or the Selection Committee, providing cross-referencing with other energy related training programs within AID.

Selection of Participants for SERI Solar and Biomass Technology/Water Pumping

Early in the implementation period, LIPI will notify the ASEAN Secretariat (and attending delegates from the ASEAN countries) that applications for participant training for the solar energy/water pumping short course will be accepted through the designated period.

Because of the short time period and the intensive nature of the program, it is expected that individuals selected will have substantial experience with the field supervision or management of water pumping and rural development projects. Practical experience with rural works, agricultural planning, and/or energy production and distribution will be preferred. The project coordinator will review the participant's applications along with a select committee composed of staff from SERI, AID, and Argonne.

Curriculum Identification and Course Material

The emphasis on this course will be on the rapid dissemination to irrigation and rural planning professional of practical design tools, information on low-cost durable system configurations, and the additional management information required to plan and execute renewable energy projects. The curriculum will be developed to meet these specific needs. An effort will be made to meet the specific needs of individual participants, through small-group discussions, trouble-shooting seminars, and visitsto a variety of demonstration and commercial installations.

The candidates will submit their applications to their specific employers and so on through the hierarchy of review procedures. All must be proficient in English. The selection will assure that women will not be excluded from participating. However, no quota for the attendance of women will be set.

F. Social Analysis

To generalize and attempt to lump the many cultural structures indirectly affected by change to shifting fuel sources is far beyond the reach of this project paper.

However, social and political structures within the ASEAN countries do not appear to pose great resistance to change within so-called traditional fuel resources. Thailand, Philippines and Malaysia are presently exploring alternatives to their rural fuel sources as well as developing a wide range of technologies which when fully tested will provide an array of fuels or energy sources for substitution.

The training and research demonstrations envisioned under this project incorporate technologies which directly benefit smallholders and have a great potential for direct application for agriculture use.

In this approach, given the wide selection of technical activities combined within the available resources, the alternative fuel sources suggested within the scope of training will most likely receive their final test at the farm-level. In no case does there appear to be a cultural or social barrier reluctant to the acceptance of the new technologies.

G. Technical Aspects

a. Solar Thermal Applications

Solar thermal technology entails using concentrating solar collectors to produce thermal energy, i.e., steam or other forms of heat. This heat can then be directly converted into electrical or mechanical energy, industrial process heat applications or advanced solar heating and cooling, utility or onsite electricity generation, irrigation pumping, respectively.

Three classes of systems are under development by the Solar Thermal Program at S.E.R.I. each oriented towards specific applications. These include: linear concentrators (parabolic trough and hemispherical bowls), parabolic dishes; and heliostat receiver systems. Applications for linear systems include solar heating and cooling, irrigation pumping, and midtemperature industrial process heat. Applications for the parabolic dish include small community and remote electric systems and small scale hightemperature process heat. The heliostat/central receiver concept is aimed towards onsite cogeneration, repowered and standalone bulk electric power generating systems, and solardriven fuels production processes.

The technical feasibility of solar thermal has been established since early in this century. For instance, a parabolic solar powered printing press was demonstrated at the 1878 Paris Exposition and a parabolic trough solar irrigation pump was operating in Egypt in 1913.

The barriers to the widespread utilization of solar thermal systems include: cost, reliability, durability, and performance. Studies give strong support to the belief that these barriers can be overcome. The Solar Thermal Program in this project will embark on a course of action which emphasizes research within the tropical environment and development to improve performance, laboratory subsystem testing to verify design adequacy, field tests to demonstrate systems-level reliability and durability, and the establishment of a viable manufacturing industry to produce low-cost concentrators and other sub-systems.

Presently, field experiments have been conducted by the University of Science, Penang with equipment donated by Japan or France.

b. Photovoltaic

With the advent of the space program and the use of photovoltaic for instant conversion of the sun's rays to electrical (direct current) energy, photovoltaics have become increasingly more attractive for lowhead pumping as production costs are reduced. Recent breakthroughs in photovoltaic (P.V.) manufacture and subsequent development of cheaper electrical storage systems (batteries) may soon provide LDCs with viable alternatives to small internal combustion engines. Photovoltaic solar cells, as opposed to conventional collectors which convert solar radiation into heat, produce electricity directly. This simple, solid state device holds the promise of long operating life with a minimum of maintenance.

Solar cells are connected and are often placed into a sealed glass or plastic modules. Any number of modules, each of which might deliver 12 watts, are positioned into a rigid frame to provide a specific power rating. The arrays are arranged at the specific site to form a field which meets the electrical requirements.

Since solar cells only deliver power during daylight hours, a photovoltaic system requires storage (usually a battery system) if power is to be supplied at night or during cloudy weather conditions. Also, the cells require power conversion by an inverter to change the DC to AC current.

Perhaps one of the most immediate applications for this particular technology is providing power to remote areas where there is no power grid or other electric sources are too costly. In the United States photovoltaics are finding wide applications for roadside telephones, ocean navigation buoys, and forest fire stations. The technology of photovoltaic conversion is well developed, but large-scale application is hampered by the high price of solar cells. In recent years, however, the price has been significantly reduced, and extensive R&D is underway to develop automated, efficient production processes which will reduce prices further still. This is the underlying solar arrays. Presently, many universities including the University of Science, Penang, Malaysia are engaged in silicion crystal experimentation; the heart of one type of photovoltaic and the major cost element.

Solar Thermal Systems (active systems)

Active systems generally use a collector, consisting of an absorption plate that transfers the sun's heat to a working fluid, and a translucent cover plate that prevents re-radiation of heat to the exterior. Insulation at the back of the collector retards energy losses there. Collectors are available for less than $10/sq. ft., but installation costs may increase this to $35 to $50/sq. ft. A typical home in the U.S. of 2,000 sq. ft. requires 500 to 700 sq. ft. of collector.

Storage is required if the thermal energy collected during sunlight hours is to be used at night and in times of overcast conditions. Water is generally used as the storage medium for liquid systems, and rock beds store heat for air systems. Cooling can be handled by absorption chillers similar to those in gas-fired refrigerators. The economics of these solar cooling devices generally are

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not currently competitive except in commercial sizes. The higher working temperatures they require call for more expensive components than those needed for space heating.

The utilization of solar energy for generating low-temperature heat is at the present time technically feasible and economically viable for producing hot water. Where electric resistance heating rates are high, thermal lowtemperature utilization is also economically attractive for cooling of buildings. All the active, passive, and hybrid systems hold high promise for the future when conventional fossil fuel pricing and availability are taken into account.

H. Financial Analysis

Financial Plan

The costs of this project will total $1.4 million of which $1.0 million will be provided by AID and approximately $400,000 will be provided by the ASEAN countries. The project expenditures will cover a three year period, but will be obligated through a project agreement between AID-ROI and will provide a PASA arrangement to the U.S. Department of Energy for implementation.

Table 4 reflects the projected budgets and costs by component and input. The local currency costs are those estimated to cover incidential costs, counterpart costs of research facilities, computer time and support costs for participant training.

Services of U.S. Laboratories will be provided through a AID-DOE PASA arrangement. These funds will cover the U.S. procurement of:

- Services and adaption of minor solar equipment;
- travel of participants for training, workshops and conferences;
- instructors, facilities and per diem costs of seminars and training.

TABLE 4

PROJECTED COSTS AND BUDGETS BY COMPONENT AND INPUT

	PROJECT COSTS		
	Source		Total
	AID	HC	
Project Component			
Coal Training			
Formal Training	$ 166,750	$ 60,000	$ 206,750
On-the-Job	98,400	40,000	138,400
Travel & Support Serv.	81,000	40,000	121,000
TOTAL	$ 336,150	$ 130,000	$ 466,150
Energy Conservation			
Technical Assistance	$ 148,000	$ 207,500	$ 348,500
End of Proj. Confer.	10,000	10,375	20,375
TOTAL	$ 158,000	$ 217,875	$ 375,875
Water Pumping			
Training Costs	$ 108,100	$ 21,000	$ 129,100
Field Demonstrations	170,000	65,000	235,000
Followup Analysis & Evaluation	35,000	-0-	35,000
Conference Costs	40,000	10,000	50,000
TOTAL	$ 353,100	$ 96,000	$449,100
Evaluation	$ 15,000	$ -0-	$ 15,000
Contingency (15%)	$ 137,750	$ -0-	$ 137,750
TOTAL PROJECT COSTS	$1,000,000	$	$1,443,875

BEST AVAILABLE

WATER PUMPING

DETAILED FINANCIAL PLAN

1. Training

15 ASEAN participants at SERI

International travel ($2,500 each)		$37,500	
U.S. Air Travel		6,000	
SERI per diem ($54/day for 18 days)		14,580	
Per diem for field visits ($62/day for 7 days)		6,510	
SERI staff cost		40,000	
SERI workshop preparation, ground transport, publications, etc.		3,500	$108,090

2. Demonstration

Preliminary (Oct. 1981) SERI Site Selection and System Integration Consultancy (2 person, 3 weeks each to Malaysia, Indonesia, Thailand, and the Philippines)		24,000	
Baseline Energy Usage + Energy Resource Data Collection		20,000	
Energy System Hardware Purchases (3.5 kW @ 10,000/kW)			
2.5kW PV system	$40,000		
2.5KW Anaerobic Digestor System (includes modified internal combustion engine & pump but exclusive of local labor and feedstock handling facilities)	16,000		
2.5kW Biomass Gasifier (including electric generator alternator & AC pump but exclusive of fuel densifiers, and fuel handling facilities).	20,000		

. Demonstrations - Continued.

Hardware shipping and delivery	$ 10,000	
Hardware installation and troubleshooting	12,000	
Hardware performance data monitoring and logging systems	10,000	
Adaptive R&D at SERI	18,000	$170,000
3. SERI Follow-up Comparative Economic and Engineering Analysis of Alternative Pumping Configurations		15,000
4. Evaluation of Demonstration Project		20,000
5. ASEAN-U.S. Solar Conference (funds for private participants will be sought from non-AID U.S. government agencies)		
ASEAN participation	$ 10,000	
6 U.S. participants (airfare and per diems only)	18,000	
Conference costs	12,000	40,000
TOTAL		$353,090

Financial Analysis

Estimated Budget and Budget Options for Conduct of a Course and On-The-Job Training Program on the Coal Fuel Cycle

1. Course-Related Costs

	Course Length (weeks) 8	10	12
Direct Costs (@ $20,000/week)[a]	$160,000	$200,000	$240,000
Stipend Costs (@ $27/day)[b]			
25 participants	37,800	47,250	56,700
50 participants	75,600	94,500	113,400
TOTAL COURSE COSTS			
25 participants	197,800	247,250	296,700
50 participants	235,600	294,500	353,400

2. On-The-Job Trainee Costs

	Length of O-J-T (months) 2	6
Stipends (@ $33/day)[c]		
25 participants	49,500	148,500
50 participants	99,000	297,000
Books (@ $100/participant)		
25 participants	2,500	
50 participants	5,000	
Travel (@ $200/participant)[d]		
25 participants	5,000	
50 participants	10,000	
Training Fees (@ $200/mo)		
25 participants	60,000	———
50 participants	120,000	———
On-Job-Training Placement		
25 participants	6,000	24,000
50 participants	12,000	48,000
TOTAL O-J-T COSTS		
25 participants	123,000	180,000
50 participants	246,000	312,000

3. Total Cost Options

On-The-Job Training Period Months	Participants	Course Length (Weeks) 8	10	12
2	25	320,000	370,000	419,700
	50	481,000	540,500	599,400
6	25	377,000	477,250	476,000
	50	595,600	654,500	713,400

a Based on current costs for operating International Atomic Energy Agency (IAEA) courses at Argonne National Laboratory (ANL). This cost included staff and administrative effort for course development and implementation, money for lecturers, and site visit costs.

b Based on current stipend paid to course participants by IAEA.

c Based on current stpend paid to O-J-T Fellows by National Research Council.

d Average one-way airplane ticket from ANL to O-J-T location.

FINANCIAL PLAN

ENERGY CONSERVATION IN BUILDINGS

A. TWO YEAR PROGRAM

Personnel

I. U.S. Experts: Scientist/Engineer, Program Leader, Buildings Computer Specialist

54 Person Weeks at $2,000/week*

$108,000

II. Singapore Experts: Engineer, Architect, Code Official Computer Specialist, Economist, Program Leader

125 Person Weeks at $1,100/week

$137,500

B. COMPUTER FACILITY

$70,000

C. MEASUREMENTS AND DATA REDUCTION SYSTEM

$8,000

D. TRAVEL

I. U.S.: 6 Person RoundTrips - U.S. to Singapore

$20,000

II. Singapore: 2 Person Trips and 3 person months per diem

$12,000

E. ASEAN CONFERENCE

I. Travel : $10,000

II. Facilities : $10,375

*All expensing is fully overheaded

Personnel (U.S.)	$108,000
Travel U.S. Experts	20,000
Travel Singapore Experts	12,000
Measurements/Data Reduction	8,000
Conference	10,000
	$158,000

Singapore

Personnel	$137,500
Computer Facility	70,000
Conference	10,375
	$217,875

VI IMPLEMENTATION

Coal Training Implementation Schedule

The implementation for the proposed project follows:

Circulation of Training Curriculum in ASEAN	October 1, 1981
ASEAN Selection of Specific Course Topics	November 15, 1981
Country Nomination of Training Participants	December 1, 1981
U.S. Review of Nominees	January 15, 1982
Finalization of Participant Selection	February 1, 1982
Participants Depart ASEAN for Training Course	March 1, 1982
Training Course Ends and OJT begins	April 7, 1982
OJT ends and participants return to ASEAN	May 7, 1982

WATER PUMPING IMPLEMENTATION SCHEDULE

The implementation schedule for the proposed project follows:

Solar Pumping Phase	
Prepare draft training curriculum	October 1, 1981
SERI Site Selection Consultancy	October 25-Nov. 7, 198
AID presents curriculum to ASEAN at US-ASEAN Energy Conference	October 19-30, 1981
Nomination of ASEAN Participants	January 30, 1982
Final training preparations completed	April 15, 1982
ASEAN Participants complete course	June 1, 1982
Solar Demonstration Phase	
Site selection (country)	January 30, 1982
Install resource monitoring equipment	February 15, 1982
Finalization of technologies and size to be tested	April 30, 1982
Finalize research objectives and methodology	April 30, 1982
Finalize institutional user arrangements and specific site	June 1, 1982
Receive preliminary resource monitoring data	July 15, 1982
Complete engineering design	August 30, 1982
Initiate procurement for solar equipment	August 30, 1982
Complete SERI adaptive R&D	January 30, 1983
Complete procurement (equipment dispatched to ASEAN region)	March 30, 1983
Complete equipment installation and commence operations	June 1, 1983
Complete initial phase of demonstration, testing and data collections	October 30, 1983
Assemble and analyze operational data and prepare interim report	November 30, 1983
Seminar for U.S. firms on test results and on ASEAN interest in future U.S. private sector involvement	March 30, 1984

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ASEAN-U.S. SOLAR CONFERENCE

Identify conference location and select conference date	February 1, 1982
Prepare preliminary conference schedule and topics	April 15, 1982 (See course)
Finalize conference schedule and topics	July 15, 1982
Identify private sector participants	December 31, 1982
Select U.S. and ASEAN panelists to prepare papers for presentation	January 30, 1983
Arrange financing for private sector participants	June 30, 1983
Papers due to conference coordinator	October 30, 1983
Interim report on demonstration project due	November 30, 1983
Conference	2nd week, December 1983
Follow-up meeting for U.S. private sector representatives with ASEAN counterparts	June 30, 1984

IMPLEMENTATION PLAN	TASK I	TASK II	TASK III	TASK IV	TASK V	TASK VI	TASK VII	TASK VIII	TASK IX	TASK X	TASK XI
Expected Time for Completion	4 weeks	24 weeks	12 weeks	24 weeks	16 weeks	24 weeks	4 weeks	4 weeks	4 weeks	4 weeks	4 weeks
Personnel Technical Qualifications and Number of Person weeks (PW)											
PL Program Leaders	PL-6 PW	PL-2 PW	PL-2 PW	CO-24 PW	PL-2 PW	CO-2 PW	PL-1 PW	PL-1 PW	CF-2 PW	PL-1 PW	PL-2 PW
CO Computer Expert	EN-1 PW	EN-10 PW	EN-1 PW	EN-24 PW	AR-5 PW	AR-2 PW	EN-4 PW	AR-1 PW	EC-2 PW	EN-2 PW	CF-2 PW
EN Engineer/Scientist		CO-12 PW	AR-4 PW	AR-6 PW	EN-8 PW	EC-1 PW	AR-2 PW	EN-1 PW	AR-2 PW	CF-1 PW	AR-2 PW
EC Economist/Engineer	2-US	CF-5 PW		PL-8 PW	CO-8 PW			EC-4 PW		AR-2 PW	EN-2 PW
CF Building Code Official	5-Sing	AR-1 PW	3-US	14 US						EC-1 PW	
AR Architect/ Analyst		14 US	9-Sing	50 Sing	8-US	1-US	2-US	3-US	1-US		3-US
		18 Sing			10-Sing	4-Sing	5-Sing	4-Sing	5-Sing	3-US	5-Sing
										4-Sing	7-ASEAN*
Facility Support Required COMP-Computer Required MEAS-Measurement Instrumentation Data Reduction System-DATA	None	COMP	COMP MEAS Possibility	COMP	COMP DATA	COMP	COMP	COMP	None	None	COMP Site Needed
Overseas Travel Required	1 PL-5 Working Days LBL--Sing	1 CO-2 Mo. 1 EN-1 Mo. Sing--LBL	None	1 EN LBL--Sing	None	None	None	None	None	1 PL LBL--Sing	1 PL LBL 1 EN--Sin 1 AR

*Included in conferenc costs.

BEST AVAILABLE

VII Monitoring and Evaluation

Implementation of this project will be monitored by the Chief, Energy Development Division, USAID/Jakarta and the Coodinator, ASEAN Programs, USAID/Manila.

The Project will be backstopped in AID/W, Program Coordination and Support, ASIA/PD with assistance from the Energy Advisor, ASIA/TR and the Development Support Bureau's Office of Energy (DS/EY).

Since the life of project is only three years, with major scheduled activities to be undertaken in the last two years, only one evaluation is scheduled for this project. An end of project evaluation will take place during the last quarter of FY 1984. That evaluation will assess the adequacy of project inputs, achievement of project outputs, and measure the degree to which the project purpose and end-of-project-status have been realized. That evaluation will also examine the degree to which the information generated by the project is influencing energy consumption patterns of the countries involved, and will make recommendations concerning additional or alternative uses of the information and/or the generation of additional information/activities for possible future applications.

The evaluation team will be comprised of one or two persons familar with energy consumption and utilization (possibly from AID/W), and a representative of ASEAN. Other members may be added as deemed necessary. The scope of work and tentative budget for the evaluation are as follows:

1. Coal Training:

   a. Evaluate quality of participants, adequacy of training, and potential impact based on jobs of returning trainees.

   b. Evaluate contribution of program to defining follow-up of technical assistance and training.

2. Conservation

   a. Evaluate contribution to policy making on energy demand management.

   b. Evaluate usefulness of computer model in Singapore and whether other ASEAN countries are adapting it.

3. Water Pumping

   a. Evaluate performance of systems installed
   b. effectiveness in accelerating RD&D efforts
   c. Success in stimulating interest in domestic and U.S. manufacturing

4. Implementation

   a. Assess role of Secretariat
   b. Assess feasibility of multi country/component project
   c. Assess linkages with AID bilateral programs

Cost Estimate

Energy Expert	$ 12,000
ASEAN Rep. (exclude Salary)	2,500
Misc. other costs	500
TOTAL	$ 15,000

ANNEX I

PRELIMINARY COURSE OUTLINE

Module C.4 Non-Electricity Related Coal Consumption (19 lectures)

4.1 Residential and Commercial Sector
- 4.1.1 Technologies - Space Heating
- 4.1.2 Technologies - Water Heating and Cooking
- 4.1.3 Environmental Considerations
- 4.1.4 Economic Considerations
- 4.1.5 Energy Efficiencies
- 4.1.6 Conservation Practices

4.2 Industrial Sector
- 4.2.1 Technologies - Primary Metals
- 4.2.2 Technologies - Chemical
- 4.2.3 Technologies - Glass and Concrete
- 4.2.4 Technologies - Other
- 4.2.5 Environmental Considerations
- 4.2.6 Economic Considerations
- 4.2.7 Energy Efficiencies
- 4.2.8 Conservation Practices

4.3 Transportation Sector
- 4.3.1 Technologies and Energy Efficiencies
- 4.3.2 Environmental Considerations
- 4.3.3 Economic Considerations
- 4.3.4 Conservation Practices

4.5 Manpower and Training Needs

Module C.5 Coal Consumption for Electrical Generation (24 lectures)

5.1 Boiler-Fired Power Plants
- 5.1.1 Technologies - Boilers
- 5.1.2 Technologies - Turbines and Generators
- 5.1.3 Technologies - Stack Gas Cleaning
- 5.1.4 Technologies - Heat Dissipation Systems
- 5.1.5 Environmental Considerations - Air
- 5.1.6 Environmental Considerations - Land
- 5.1.7 Environmental Considerations - Water
- 5.1.8 Economic Considerations - Air
- 5.1.9 Economic Considerations - Land
- 5.1.10 Economic Considerations - Water
- 5.1.11 Energy Efficiencies

5.2 Combined Cycle Power Plants
- 5.2.1 Technologies
- 5.2.2 Environmental Considerations
- 5.2.3 Economic Considerations
- 5.2.4 Energy Efficiencies

5.3 Fuel Cell and MHD Power Plants
- 5.2.1 Technologies
- 5.2.2 Environmental Considerations
- 5.2.3 Economic Considerations
- 5.2.4 Energy Efficiencies

5.4 Electricity Transmission and Distribution
- 5.4.1 Technologies
- 5.4.2 Environmental Considerations
- 5.4.3 Economic Considerations

5.5 Conservation Practices
5.6 Manpower and Training Needs

Module C.6 Coal Conversion Processes (11 lectures)

6.1 Technologies - Gaseous Fuels
6.2 Technologies - Liquid Fuels
6.3 Technologies - Solvent Refined Fuels
6.4 Environmental Considerations - Air
6.5 Environmental Considerations - Land
6.6 Environmental Considerations - Water
6.7 Economic Considerations - Air
6.8 Economic Considerations - Land
6.9 Economic Considerations - Water
6.10 Energy Efficiencies
6.11 Manpower and Training Needs

Module C.7 Siting Considerations for Coal Consumption and Conversion Facilities (8 lectures)

7.1 Air Use Considerations
7.2 Land Use Considerations
7.3 Water Use Considerations
7.4 Socio-economic Considerations
7.5 Atmospheric Dispersion Models
7.6 Thermal Plume Models
7.7 Alternative Site Analysis-I
7.8 Alternative Site Analysis-II

Module C.8 Benefit-Cost Analyses (9 lectures)

8.1 Purpose and Overview
8.2 Obtaining and Quantifying Technological Data Impacts
8.3 Obtaining and Quantifying Environmental Data Impacts
8.4 Obtaining and Quantifying Economic Data Impacts
8.5 Obtaining and Quantifying Manpower and Training Data Impacts
8.6 Obtaining and Quantifying Energy Efficiency Data Impacts
8.7 Integration nd Comparison of Benefit and Cost Impacts-I
8.8 Integration and Comparison of Benefit and Cost Impacts-II
8.9 Benefit-Cost Analyses as a Near-term and Long-term Planning Tool

Module C.9 Organization Roles and Staffing Requirements (9 lectures)

9.1 Governmental Role
- 9.1.1 Research and Development
- 9.1.2 Regulation
- 9.1.3 Staffing Requirements

9.2 Industries' Role
- 9.2.1 Production
- 9.2.2 Research and Development
- 9.2.3 Staffing Requirements

9.3 Utilities' Role
- 9.3.1 Production
- 9.3.2 Research and Development
- 9.3.3 Staffing Requirements

B. Work Sessions

Module C.1 Introduction and Background (5 work sessions)

1.a Review of Energy Supply and Demand Scenarios for World and Each ASEAN Country
1.b Review of Coal Resources for the World and Each ASEAN Country
1.c Projections of Needs Versus Availability for Each ASEAN Country and Calculations of Impact Sources and Levels

Module C.2 Coal Exploration and Extraction (6 work sessions)

2.a Review of Technologies
2.b Country-Specific Presentations on Feasible Technologies
2.c Continuation of 2.b
2.d Review of Economic and Environmental Considerations
2.e Country-Specific Presentations on Significant Economic and Environmental Considerations
2.f Continuation of 2.e

Module C.3 Coal Transportation and Benefication (6 work sessions)

3.a Review of Technologies
3.b Country-Specific Presentations on Feasible Technologies
3.c Continuation of 3.b
3.d Review of Economic and Environmental Considerations
3.e Country-Specific Presentations on Significant Economic and Environmental Considerations
3.f Continuation of 3.e

Module C.4 Non-Electricity Related Coal Comsumption (9 work sessions)

4.a Review of Residential and Commercial Sector Technologies
4.b Country-Specific Presentations on Feasible Technologies
4.c Continuation of 4.b
4.d Review of Industrial Sector Technologies
4.e Country-Specific Presentations on Feasible Technologies
4.f Continuation of 4.e
4.g Review of Economic and Environmental Considerations
4.h Country-Specific Presentations on Significant Economic and Environmental Considerations
4.i Continuation of 4.h

Module C.5 Coal Consumption for Electrical Generation (12 work sessions)

5.a Review of Boiler and Stack Gas Cleaning Technologies
5.b Country-Specific Presentations on Feasible Technologies

5.c Continuation of 5.b
5.d Review of Economic Considerations of Boiler and Stack Gas Cleaning Technologies
5.e Country-Specific Presentations on Significant Economic Considerations
5.f Continuation of 5.e
5.g Review of Environmental Considerations of Boiler and Stack Gas Cleaning Technologies
5.h Country-Specific Presentations on Significant Environmental Considerations
5.i Continuation of 5.h
5.j Review of Heat Dissipation System Economic and Environmental Considerations
5.k Country-Specific Presentations on Significant Heat Dissipation Economic and Environmental Considerations
5.l Continuation of 5.k

Module C.6 Coal Conversion Processes (6 work sessions)

6.a Review of Gaseous and Liquid Fuel Technologies
6.b Country-Specific Presentations of Feasible Technologies
6.c Continuation of 6.b
6.d Review of Economic and Environmental Considerations
6.e Country-Specific Presentations on Significant Economic and Environmental Considerations
6.f Continuation of 6.e

Module C.7 Siting Considerations for Coal Consuming and Conversion Facilities (5 work sessions)

7.a Review "Case Plant" and Identify Significant Air, Land, Water and Socioeconomic Considerations
7.b Team Presentations on Significant Air, Lane, Water and Socioeconomic Siting Considerations
7.c Continuation of 7.b
7.d Mock Computer Runs of a SO_2 Atmospheric Dispersion Model
7.e Mock Computer Runs of an Aquatic Thermal Plume Model

Module C.8 Benefit-Cost Analyses (4 work sessions)

8.a Quantification of Technological, Economic, and Environmental Data Inputs from "Case Plant"
8.b Continuation of 8.a
8.c Country-Specific Presentations on Benefit-Cost Analyses of "Case Plant"
8.d Continuation of 8.c

Module C.9 Organizational Roles and Staffing Requirements (3 work sessions)

9.a Review of Coal Use Scenarios for Each Country
9.b Country-Specific Presentations on Organizational and Staffing Requirements
9.c Continuation of 9.b

C. Discussions (By Panel of Experts)

Module C.1 Introduction and Background (1 session)

1.i Coal Utilization Scenarios for the World and ASEAN Countries

Module C.2 Coal Exploration and Extraction (2 sessions)

2.i Near-term and Far-term Technologies for ASEAN Countries
2.ii Near-term and Far-term Economic and Environmental Considerations for ASEAN Countries

Module C.3 Coal Transportation and Benefication (2 sessions)

3.i Near-term and Far-term Technologies for ASEAN Countries
3.ii Near-term and Far-term Economic and Environmental Considerations for ASEAN Countries

Module C.4 Non-Electricity Related Coal Consumption (3 sessions)

4.i Near-term and Far-term Technologies, by Sector, for ASEAN Countries
4.ii Near-term and Far-term Economic Considerations, by Sector, for ASEAN Countries
4.iii Near-term and Far-term Environmental Considerations, by Sector, for ASEAN Countries

Module C.5 Coal Consumption for Electrical Generation (3 sessions)

5.i Near-term and Far-term Technologies for ASEAN Countries
5.ii Near-term and Far-term Economic Considerations for ASEAN Countries
5.iii Near-term and Far-term Environmental Considerations for ASEAN Countries

Module C.6 Coal Conversion Processes (2 sessions)

6.i Near-term and Far-term Technologies for ASEAN Countries
6.ii Near-term and Far-term Economic Considerations for ASEAN Countries
6.iii Near-term and Far-term Considerations for ASEAN Countries

Module C.7 Siting Considerations for Coal Consumption and Conversion Facilities (2 sessions)

7.i Analysis of Country-Specific Results of "Case Plant" Presentations
7.ii Recommendations Related to Siting Methodologies

Module C.8 Benefit-Cost Analyses (2 sessions)

8.i Analysis of Country-Specific Results of "Case Plant" Presentations

8.ii Recommendations Related to Benefit-Cost Methodologies

Module C.9 Organizational Roles and Staffing Requirements (1 session)

9.i Near-term and Far-term Organization and Staffing Requirements for ASEAN Countries

D. Site Visits (Total of one week or equivalent to 20 sessions)

C.A Extraction and Beneficiation

A.1 Reclaimed and Unreclaimed Surface Mine
A.2 Underground Mine
A.3 Mine-Month Plant
A.4 Beneficiation Plant

C.B Coal-Fired Industrial and Electrical Generating Facilities

B.1 Steel Foundry
B.2 Concrete Manufacturing Plant
B.3 Coal Fired Plant with Flue-Gas Desulfurization

C.C Coal Conversion Facilities

C.1 HYGAS Facility
C.2 Exxon Donor Solvent Plant

ANNEX II

TASKS CONTINUED (Nos. 5-10)

ANNEX II - ADDITIONAL TASKS FOR ENERGY CONSERVATION IN BUILDINGS

Task 5. Application of analytic tools to prototypical Singapore buildings.

The purpose of Task 5 is to apply the computer program to a prototype building.

Task 6. Defining procedures for matching computer outputs with building code requirements.

The purpose of Task 6 is to assure that the outputs will be useful in both establishing and satisfying legal requirements.

Given the success of the above tasks the following tasks may be undertaken given time, resources and desirability.

Task 7. Determination of the potential reductions in energy use based on the introduction of energy efficient technologies and strategies (EETS).

The purpose of Task 7 is to examine what can be achieved if EETS are applied to both existing buildings as well as new buildings. The EETS are detailed according to the building type, building age occupant schedule, building materials, specialized micro-climate conditions and other engineering-architectural-physical conditions. (Economic and regulatory features are to be considered in Tasks VIII and IX).

7A. Modification of existing technologies and practices including housekeeping measures.

7B. New but existing technologies, policies and procedures for bringing about greater efficiency in energy use.

7C. Future energy profiles resulting from deployment of EETS designed in 7A and 7B.

Task 8. Economic Analysis.

The purpose of Task 8 is to examine the costs, paybacks, return on investment, tax incentives and other Pros and Cons on the economic side of introducing more EETS.

8A. Defining costs for retrofit of existing buildings as well as for new buildings according to subsection and the characterizations used in Task 7.

8B. Calculations of standard benefit/cost ratios are provided in terms of payback period and percentage rate of return on investment.

8C. Preliminary examination of involving public and private sources for capital generation.

8D. Financial barriers and incentives are examined.

Task 9. Developing the implementation plan.

The purpose of Task 9 is to develop a plan that could be used to implement the possible roads to more efficient use of energy buildings. Besides providing such possibilities for Singapore similarities and differences between the different ASEAN countries would be highlighted from the technical, economic, organizational and social view points.

9A. Examination of adequacy of existing public and private sector organizations and institutions for providing and promulgating information and implementing and enhanced energy conservation program.

9B. Suggestions for institutional and organizational innovations needed to accomplish EETS implementation including inter-ASEAN cooperation.

9C. Catalytic role of USAID and other international organizations such as the World Bank.

Task 10. Defining the precedents and establishing the demonstration concept.

The purpose of Task 10 is to present the justifications, conceptualization, expected benefits choice of building and equipment, measurement procedures, timetable for presentation of results, the overall costs and personnel requirements including both public and private sector involvements.

10A. Defining the need for hands on demonstration in both retrofit and new buildings.

10B. Factors for determining building site and demonstration EETS.

10C. Define costs, personnel and schedule of major milestones.

10D. Measurement procedures and condition with local officials, utilities and equipment manufacturers.

10E. Participation of other ASEAN countries in the actual on-site demonstration in terms of training and assistance.

Task 11. Transferring accomplishments of study and demonstration planning acquired in Singapore to other ASEAN participants.

The purpose of Task 11 is to set into place a useful information exchange process where the special problems of the different ASEAN participants can be assessed against Singapore study and demonstration plan.

11A. Defining how ASEAN participation can be optimized through the study and demonstration.

11B. Review of special problems resulting from different conditions, regulations, organizational infrastructure and engineering on the various ASEAN.

11C. Conference for ASEAN participants summarizing accomplishments.

ANNEX III

CHECKLIST OF STATUTORY REQUIREMENTS

CHECKLIST OF STATUTORY CRITERIA

PROJECT CHECKLIST

A. GENERAL CRITERIA FOR PROJECT	A. GENERAL CRITERIA FOR PROJECT
1. Country Resolution Unnumbered; FAA Sec. 653(b); Sec. 634A.	
(a) Describe how Committees on Appropriation of Senate and House have been or will be notifed concerning the project;	The project was included in AID's 1981 Congressional Presentation. Congressional notification of an FY 1981 authorization of the project will not be necessary.
(b) Is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than $1 million over that figure)?	Yes.
2. FAA Sec. 611(a)(1). Prior to obligation in excess of $100,000, will there be (a) engineering, financial, and other plans r cessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?	Yes. The project incorporates a component of training pilot and demonstration activities intended to test and adapt rural energy technologies as well as dissemination of techniques throughout the ASEAN countries.
3. FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?	No further legislative action is required.
4. FAA Sec. 611(b); Country Resolution Sec. 501. If for water or water-related land resource construction, has project met the standards and criteria as per the Principles and Standards for Planning Water and Related Land Resources dated October 25, 1973?	N/A.

5. FAA Sec. 611(e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed $1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability effectively to maintain and utilize the project?	N/A.
6. FAA Sec. 209. Is project susceptible of execution as part of regional or multilateral project? If so, why is project not so executed? Information and conclusion whether assistance will encourage regional development programs?	Yes. Under ASEAN, five countries will benefit from component specific information and experience in energy saving techniques.
7. FAA Sec. 601(a). Information and conclusions whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.	Since this is essentially a training and demonstration activity the project will not in and of itself affect international trade or strengthen free labor unions. However, planned conservation activities will improve
8. FAA Sec. 601(b). Information and conclusions on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).	All of the offshore procurement financed under this project is expected to be from the United States.
9. FAA Sec. 612(b); Sec. 636(h). Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized to meet the cost of contractual and other services.	ASEAN and Indonesia, the lead country will contribute to the costs of this project exceeding 25 percent. There are not U.S. owned local currencies available for this project.

10. FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?

No. N/A.

11. FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?

Yes.

12. Country Resolution Sec. 521. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar or competing commodity?

The project is not for this purpose. The remainder of the question is therefore not applicable.

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria.

a. FAA Sec. 102(b); 111; 113; 281a. Extent to which activity will (a) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production and the use of appropriate technology, spreading investment out from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using the appropriate U.S. institutions; (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions; (c) support the self-help efforts of developing countries; (d) promote the participation of women

B. FUNDING CRITERIA FOR PROJECT

(a) The research and training component of the project will indirectly involve or benefit the poor by increasing through an energy substitution effect and local resources to be redirected to the ASEAN nations' development. The water pumping component will involve the rural poor in testing and adapting technologies as well as in the means of disseminating them in order to improve each countries energy system and enhance prospects for rural development.

(b) This is essentially a project involving main ASEAN efforts toward better use of renewable energy.

(c) The technologies involved, if proven practicable, will help the role

in the national economies of developing countries and the improvement of women's status; and (e) utilize and encourage regional cooperation by developing countries?	of women through less labor requirements. (d) A successful renewable energy program should lead to emulation in this region.
b. <u>FAA Sec. 103, 103A, 104, 105, 106, 107</u>. Is assistance being made available: (include only applicable paragraph which corresponds to source of funds used. If more than one fund source is used for project, include relevant paragraph for each fund source).	
(4)(106) for technical assistance, energy, research, reconstruction, and selected development problems; if so, extent activity is:	Yes. See below.
(a) technical cooperation and development, especially with U.S. private and voluntary, or regional and international development, organizations;	(a) No.
(b) to help alleviate energy problem;	(b) The project specifically directed to the alternative uses of energy.
(c) research into, and evaluation of, economic development process and techniques;	(c) No.
(d) reconstruction after natural or manmade disaster;	(d) No.
(e) for special development problem, and to enable proper utilization of earlier U.S. infrastructure, etc., assistance;	(e) No.
(f) for program of urban development, especially small labor-intensive enterprises, marketing systems, and financial or other institutions to help urban poor participate in economic and social development.	(f) No.
(5)(107) Is appropriate effort placed on use of appropriate technology?	Yes. Development with application of appropriate technology and direct substitution of abundance resources for petroleum products is the essence.

c. FAA Sec. 110(a). Will the recipient country provide at least 25% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or has the latter cost-sharing requirement been waived for a "relatively least developed" country)?	Yes
d. FAA Sec. 110(b). Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to Congress been made, and efforts for other financing, or is the recipient country "relatively least developed"?	No. N/A
e. FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civil education and training in skills required for effective participation in governmental processes essential to self-government.	Insufficient renewable energy and the drain current fossil fuel imports placed on the ASEAN economies are serious constraints to rural development. The training and demonstration activities financed by this project will seek to alleviate this problem. All project components will be implemented by ASEAN through the selected lead countries in other local institutions, such as the universities.
f. FAA Sec. 122(b). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase of productive capacities and self-sustaining economic growth?	Yes

2. Development Assistance Project Criteria (Loans Only).

a. FAA Sec. 122(b). Information and conclusion on capacity of the country to repay the loan, at a reasonable rate of interest.	N/A

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

3. Project Criteria Solely for Economic Support Fund.

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

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

ANNEX IV

INITIAL ENVIROMENTAL EXAMINATION

INITIAL ENVIRONMENTAL EXAMINATION

Project Location: ASEAN - Regional

Project Title: ASEAN - Energy Cooperation

Funding: FY 81 Grant $1.0 million

Life of Project: 3 years

IEE Prepared by: Michael C. DeMetre July 7 '81
Michael C. DeMetre Date

Environmental Action Recommends:

Section 216.2(B) of AID Environmental Rules and Regulations (Regulation 16) specifically single out Research Projects as those that normally would not have a significant effect on the human environment. The following examination indicates that this project is no exception. A negative determination is therefore recommended.

Concurrence: _____ _____
DATE

Assistant Administrator, Bureau for Asia
(Approval/Disapproval of Negative Determination)

Approval : [signature]

Disapproval: _____

Date : 17 AUG 1981

Identification of Project

Project Description

The proposed project is a two year grant to begin in FY 81.

The purpose of the Project is to establish training in coal technology, solar and energy conservation in buildings and applied research capability within the ASEAN countries. All energy topics provide for substitution effects in conventional energy resources appropriate to the needs of the rural poor. This purpose is to be achieved thru technical assistance, training, seminars, commodity assistance, monitoring and evaluating the performance of the three project components. The Project will further assist the ASEAN nations by the creation of a conventional and non-conventional energy committees to develop a total ASEAN energy policy.

Identification and Evaluation of Environmental Impacts

As the attached impact evaluation schedule indicates, this Project does not have a forseeable, significant effect on the human environment. Direct impacts from the sub-projects and secondary impacts from the disemination of applied research findings to rural villagers are predictably insignificant. This Project will have a positive impact on the health environment by transfer of sound environmental consideration for coal mining, transportation and prevention of air pollutants. The environmental effects of activities carried out under this Project are negligible.

Recommendation for Environmental Action

Based on the above discussion and on inspecting the attached Input Identification and Evaluation Form and in accordance with AID's environmental rules and regulations this Project clearly merits a Negative Determination. Therefore, it is recommended that no further environmental analysis be carried out for this Project (i.e. environment assessment or impact statement) and that the threshold decision indicate a Negative Determination.

IMPACT IDENTIFICATION AND EVALUATION FORM

Impact Areas and Sub-areas[1/]	Impact Identification and Evaluation[2/]
A. LAND USE	
1. Changing the character of the land through:	
a. Increasing the population	N
b. Extracting natural resources	N
c. Land clearing	N
d. Changing soil character	N
2. Altering natural defenses	N
3. Foreclosing important uses	N
4. Jeopardizing man or his works	N
B. WATER QUALITY	
1. Physical state of water	N
2. Chemical and biological states	N
3. Ecological balance	N
C. ATMOSPHERIC	
1. Air additives	N
2. Air pollution	N
3. Noise pollution	N
D. NATURAL RESOURCES	
1. Diversion, altered use of water	N
2. Irreversible, inefficient commitments	N

1/ See Explanator Notes for this form

2/ Use the following symbols:
- N - No environmental impact
- L - Little environmental impac
- M - Moderate environmental impact
- H - High environmental impact
- U - Unknown environmental impact

IMPACT IDENTIFICATION AND EVALUATION FORM

E. CULTURAL

1. Altering physical symbols - - - - - - - - - - - N
2. Dilution of cultural traditions - - - - - - - - N

F. SOCIOECONOMIC

1. Changes in economic/employment patterns - - yes
2. Changes in population - - - - - - - - - - - - N
3. Changes in cultural patterns - - - - - - - - L

G. HEALTH

1. Changing a natural environment - - - - - - - N
2. Eliminating and ecosystem element - - - - - N

H. GENERAL

1. International impacts - - - - - - - - - - - - N
2. Controversial impacts - - - - - - - - - - - - N
3. Larger program impacts - - - - - - - - - - - N

ANNEX V

SOLAR & BIOMASS TECHNOLOGY/WATER PUMPING COURSE CURRICULUM

SOLAR AND BIOMASS TECHNOLOGY/WATER PUMPING COURSE CURRICULM

Part I

BACKGROUND INFORMATION

I. Survey of Energy Demand

A. Low-temperature needs
   1. Water heating
   2. Crop drying
   3. Pre-heating for industrial process air and liquids
   4. Space heating
   5. Desalinization

B. Middle and high-temperature applications
   1. Process steam
   2. Cottage industries (brick-firing, metal-working, etc.)
   3. Central industrial facilities (manufacturing, ore-reduction, smelting, etc.)
   4. Air Conditioning and refrigeration

C. Shaft Power
   1. Irrigation
   2. Grinding
   3. Oil-pressing

D. Electricity
   1. Lighting
   2. Refrigeration
   3. Motors for domestic and light industrial use
   4. Industrial processes

II. Survey of the Renewable Energy Resource Base and its Utilization

A. Solar Radiation

1. Forms and Availability

2. Energy Density and its application to different demands changing the energy density through concentration, storage,etc.

3. Measuring the Solar Insolation

a. measurement devices for constant or intermittent data collection

b. devices for recording, storing, and summing radiation data for system design and sizing.

B. Biomass Resources

1. Forms and Availability

a. Forest products wastes

b. ag residues

c. primary growth trees

d. dedicated fuelwood forests (especially fast-growing tropical species)

e. annual tree-crops

2. Energy Density and its Application to Different Demands and Heat Needs
Densifying low-BTUs fuels for higher applications

3. Measuring the Available Resource Base and its current rate of utilization

a. field surveys on energy usage for energy, soil enrichment, and small scale cottage industry

b. measuring controlled yields for tree-crops and biomass plantations

c. aerial survey and Landsat techniques for low-cost biomass estimation

C. Wind Energy

1. Availability, including seasonality of supply

2. Relationship of wind strength and available power for conversion to electrical or mechanical work

3. Measuring the Available Wind Resource

a. initial site survey techniques

b. specific data collection at likely sites

c. extrapolation from known data

III. <u>Technologies for Converting Renewable Resources into Useful Work</u>

A. Solar Insolation by Thermal Conversion

1. Flat-plate collectors

2. line-focusing concentration collectors (troughs)

3. point-focusing concentration collectors (dishs)

B. Solar Electric Conversion

1. Photovoltaic cells

a. single-cell silicon

b. polycrystalline and amorphorous silicon cells

c. ribbon and thin-film technologies

2. Photochemical conversion

C. Biomass Thermal Conversion

1. Direct combustion

2. Fluidized bed combustion

3. Biomass Gasification and Pyrolysis

D. Biomass Chemical Conversion

1. anaerobic digestion (biomass generators)

a. different designs--KVIC, Chinese, plug-flow, etc.

b. above and below ground reactor design and durability

c. chemistry of digestion and effects of change in feed-stock

d. conversion of gas to mechnical power through a modified internal combustion engine.

E. Wind Energy Conversion

1. horizontal axis machines

2. vertical axis units

3. mechnical vs. electrical power output--design considerations

PART II

APPLICATION OF RENEWABLE ENERGY TECHNOLOGIES TO WATER PUMPING

I. Design Considerations for System Sizing and Optimization

A. Water Resource Base

1. underlying aquifier (pumping head)

2. quality of water at various depths (ppm dissolved solids, salinity, etc.)

B. Water Demand

1. Irrigation of Crops

a. quantity per hectare/unit time

b. seasonal fluctuations in demand for alternative cropping patterns

c. time of day water demand patterns

d. seasonal fluctuations in precipitation and/or available ground water

2. Drinking Water for Local Residents and Livestock

a. time of day of demand

b. quantity demanded, including seasonal fluctuations

c. storage facilities available

3. Domestic and light industrial Usage

C. Renewable Energy Resource Base (including daily and seasonal fluctuations)

Solar

1. Insolation

2. Biomass

3. Wind Energy

D. Local Infrastructure for Technology Adaptation, Operation, and Maintenance

E. Local Capacity for Financing the Purchase, Operation, and Maintenance of Water Pumping Units

II. General Design Considerations for Using Renewable Energy Technologies to Power Water Pumping

A. The Intermittent Nature of the Power Source

B. The High Capital Cost of the Power Source, Coupled with Low or Non-existent Operating Costs

C. Coupling the Available Output (DC power or Shaft Power) with Commercial Pumps

D. Matching the Daily and Seasonal Pattern of Water Demand with the Output of the Renewable Energy Technology

III. Specific Design Considerations for Individual Renewable Energy Technologies to Power Water Pumping Units

A. Photovoltaic Cells

1. Sizing the Array

2. Calculating Average Daily Electrical Output for a Given Insolation Pattern

3. Extracting the Maximum Available Power from the Array

4. Alternative Design Configurations for Low-lift Appli.

5. Alternative Design Configurations for Deep-Well Sites

6. Battery Storage vs. Water Storage

7. Designing for multiple uses of the photovoltaic system when water pumping is not required

B. Solar Thermal Systems

1. Selecting the proper size of collectors

2. Alternative approaches to Tracking of Concentrating Collectors

3. Alternative Design Configurations for Converting Thermal Energy to Electrical Energy for Water Pumping

4. Alternative Configurations for Converting Thermal Energy into Mechanical Power for Water Pumping

5. Current Experience on the Reliability and Durability of Solar Thermal Powered Irrigation Systems and Generator Sets

C. Anaerobic Digestion

1. Feedstock requirements for Alternative Designs

2. Operation and Maintenance requirements for alternative designs

3. Maintaining maximum gas output

4. Coupling gas output to internal combustion engines to power water pumps

5. Current experience on the performance, reliability, and durability of Water pumps powered by biogas generators

D. Biomass Gasifiers

1. Selecting the feedstock

2. Advantages and costs of densification of feedstock

3. The output gases of alternative gasifier configurations

4. Converting the output producer gas to mechancial power for water pumping

5. Operation and maintenance of a small-scale gasifier

6. Recent design developments to increase efficiency and decrease required operation and maintenance

IV. <u>Economic Analysis of Alternative Water Pumping Technologies</u>

A. Capital costs of similar 2.5 - 5 HP units

B. Operating costs of alternative configurations

C. Reliability and Durability

D. Off-the shelf components vs. custom designed units

E. System design costs

F. Costs of setting up manufacturing facilities for alternative technologies

G. Estimates of costs of alternative configurations in 1985 and 1990

H. Costs of storing water vs. storing thermal or electrical energy

I. Maintenance in Remote sites

J. Training requirements for alternative designs

K. Planning the projects and developing legitimate costs estimates

L. Collecting data for the design of future units

V. Stand-Alone vs. Interconnected Pumping Systems

A. Design Problems

B. Economic considerations

C. Calculating the importance of system reliability

VI. Trends in Current Research and Installations for Small-Scale Water Pumping Installations

A. Minimizing resistence to water flow

B. Minimizing start-up demands on the energy source

C. Accommodating fluctuations in the output of the power source

D. Extracting maximum power from an intermittent energy source

ANNEX VI

ARGONNE NATIONAL LABORATORY: SURVEY OF ON-THE-JOB TRAINING

A PRELIMINARY DRAFT PROPOSAL FOR

A TRAINING PROGRAM IN COAL FOR

ASEAN TECHNICAL MANAGERS

AT

ARGONNE NATIONAL LABORATORY

ARGONNE NATIONAL LABORATORY

DIVISION OF EDUCATIONAL PROGRAMS

6/11/81 Draft
W. K. Derickson
M. A. Kanter

WKD-MAK
Draft 6/11/81

SUMMARY

A training program in coal for ASEAN technical managers to be presented at Argonne has been prepared. The outline for a formal training course is given in Appendix A. It is ten weeks long. It consists of 50% lectures, 30% work sessions, 10% discussion periods, and 10% site visits. Typically 70% of the course input would come from the private sector and the remaining 30% from the public sector and academia. Costs have been developed for 8, 10 and 12 week courses, on-the-job training options of two to six months, and for 25 to 50 participants. The cost ranges from $320,000 to $713,000.

However, the recommended option is a ten week course for 30 to 32 participants, a convenient number for Argonne's training and housing facilities. A six month on-the-job training period is recommended for approximately one-half of the participants. Under this recommendation the cost is estimated at $365,000. A variant on this recommendation is an extension of two weeks for detailed site visits to provide for those participants who would not go on to on-the-job training. The cost for that variant is estimated at $416,000.

WKD-MAK
Draft 6/11/81

INTRODUCTION

The decoupling of oil prices from their production costs and linking prices to the estimated costs of synthetic substitutes, by OPEC, in 1973-1974 has had a dramatic impact on the economies of all countries dependent on this oil. The Association of Southeast Asian Nations (ASEAN) has not been impacted by the OPEC oil action as most other countries because of indigenous oil and natural gas resources. However, in order to more efficiently and effectively utilize these limited resources, these nations intend to increase their use of indigenous coal resources, thereby freeing oil and natural gas resources for use by the transportation and industrial sectors and for exporting in order to achieve a more favorable balance-of-trade. However, these countries will require transfer of information to enable them to formulate optimal strategies for utilizing coal, and to then implement those strategies. An appropriate model for the transfer of such knowledge is the on-going technical assistance program in nuclear manpower development carried out under an Agreement for Cooperation between the Government of the United States and the International Atomic Energy Agency Training Program.

As a starting point, a training course, such as described in Appendix A, on the economic, environmental and technological aspects of the entire coal fuel cycle is proposed for mid and senior level technical managers from utilities, industries, research institutes and governmental agencies working with coal technologies. The purpose of this initial course would

be to familiarize these lead technical people with the major economic, environmental and technological issues for each of the coal fuel cycle technologies: exploration, extraction, processing, transportation, consumption and conversion. Country-specific issues would be identified and discussed in order to tailor the course to the specific needs of ASCEAN members.

Although this training course will provide an excellent foundation for transferring knowledge relevant to the coal fuel cycle, on-the-job training programs should follow the courses so that the participants can obtain practical experience applying this knowledge to particular relevant problems, techniques or methodologies under expert supervision. In addition, more specialized training courses might be required.

THE INITIAL COURSE

A proposed outline for an initial course can be found in Appendix A. This course is designed to give mid to senior level managers of scientists and engineers a broad exposure to the economic, environmental and technological considerations of the coal fuel cycle. In addition to addressing issues relevant to exploration, extraction, processing, transportation, consumption and conversion, the course also covers methodologies relevant to siting of coal burning and conversion facilities and benefit-cost analysis for factoring in and weighing the various considerations.

The course will consist of roughly 50% lectures, 30% work sessions, 10% discussion sessions and 10% site visits. The lectures will be given

primarily by U.S. experts from the private and public sector. Typically, about 70% of the lectures would come from mining companies (Peabody Coal), utilities (Commonwealth Edison), energy companies (Conoco, Exxon), transportation companies (Illinois Central-GUAC), engineering consultants (Bechtel, Gibbson-Hill), national coal and gas associations, industry sponsored research organizations (Electric Power Research Institute of Gas Technology) and industries (U.S. Steel, Allis Chalmers, Foster Wheeler and Dow Chemical). The remaining 30% of the lecturers would come from energy R&D laboratories (Argonne National Laboratory, Pittsburgh Mining Center and Pittsburgh Energy Technology Center), the government (Departments of Energy, Commerce and Interior) and academia (University of Southern Illinois, Massachusetts Institute of Technology, and University of Pittsburgh).

The work sessions are designed to provide an opportunity for the participants to assimilate and apply knowledge gained from the lectures to reference cases. Whenever possible, the reference cases will be designed to allow the participants to focus on issues specific to their own countries. Team presentations of the findings from specific reference case problems will also be a part of the work sessions. Such presentations will be followed with discussion sessions led by experts to provide feedback on the conclusions reached by the various teams in order to provide a more long lasting understanding of country-specific issues and methods for dealing with these issues.

Finally, there will be several site visits to mines, coal conversion facilities, and coal consumption facilities. This will allow the participants to actually see the various technologies in operation and the associated problems. These site visits will also provide the opportunity to ask specific questions of people working with the various technologies.

Argonne would provide a course leader with experience in international energy training who would be responsible for development of the course content, selection of outside resource persons, and the daily administration of the program. It would also provide leaders for each section of 13-16 participants who would provide individualized technical counseling, conduct work sessions, and otherwise assist the course leader. They would be supported by a clerical staff which is experienced in support of international energy training and which is attuned to working with persons from varying cultural backgrounds.

Argonne has housing on-site available for international training. The facilities consist of four room apartments of three bedrooms, two bathrooms, and a living-dining-kitchen room for 3-6 participants. Recreation and meal service is available on-site. Bus transportation off-site would be provided. In 1982, the housing is available from March to June.

COURSE LENGTH

Depending upon the background and level of the course participants, the course can vary from 8-12 weeks. The outline presented in Appendix A is

based on ten weeks; however, this can be altered to the decrease or increase the depth of coverage of each of the coal technologies. The background and experience of the participants and the strength of the countries' present coal utilization program should be the determining factors in selecting the course length. Generally, the greater the experience and the more active the coal utilization program, the longer the course length should be since the need for specific information will increase accordingly. For those countries that do not have active coal utilization programs perhaps a shorter course length of four weeks would be appropriate. The outline in Appendix A could be revised to have the first four weeks as overview for participants from these latter countries, followed by eight weeks of more detailed discussion of each technology area for those participants from countries with active coal utilization programs.

FOLLOW-UP TRAINING

The general purpose and intent of the proposed follow-up training must be better defined. If the purpose is to generally expose the trainee to the broad aspects of a few relevant areas of the subject field, then a one to two month assignment at a representative facility should be adequate. Difficulty in placing the trainees is anticipated since accommodation of the trainee for such a short time will be considered by the training organization as an uncompensated expense. Direct financial reimbursement to the receiving organization for that added expense will add significant

costs to the follow-up training placement activities. For a one to two month on-the-job training activity, subsistance costs can also be anticipated to be higher than those of the training course period since individualized, short-term accommodations for lodging and meals would probably necessitate motel/hotel accommodations and restaurant meal subsistance rates which would undoubtedly be higher.

If the purpose of the follow-up training is to provide the trainee with in-depth practical experience in a relevant area of the subject field, then follow-up training periods of approximately six months would be more appropriate. Although the total cost per trainee would be greater, certain economies could be realized. First, the training organization could place the trainee into a working group and could expect to get some benefit from the efforts of the trainee. The expected return in six months in all likelihood should be sufficient to induce the training organization to eliminate any requirement for financial compensation. Second, due to the longer assignment period, the trainee could probably find lodging in a modest furnished apartment or rooming house and would be better able to make boarding arrangements or secure lodging with cooking facilities. Thus, the monthly subsistance rates for the follow-up training period would probably be of the same order as those of the training course period.

Similar travel costs from the training course location to the follow-up training location and from there to the point of departure from the country would be experienced in either case.

An alternative to the arbitrary assignment of all trainees for follow-up training is to reduce the number of such assignments to selected individuals who are nominated by the sending country based on the specified real need and who are approved by a selection committee and the receiving organization based on their judgement of the trainee's qualifications and ability to assimilate the training. This approach has several advantages. First, it should decrease the number of training requests from individuals with no technical need who have managed to get an approval for the long stay in the United States. Second, it reduces the exposure of the U.S. government and the placement organization to claims of inept placement of inadequate trainees into working organizations when true benefits to the sending country will not be derived and unjustified disruption to the training organization could occur. Since many of the organizations that will be solicited for such placement will be privately owned, poor quality trainees would certainly be unwelcome.

PARTICIPANT SELECTION

The course would be designed to handle a minimum of twenty and a maximum of fifty participants. The participants should be selected on the basis of position, background, experience and English comprehension. Applications should be designed to include the following information:

1. Vital statistics -- name, age, sex, marital status, date of birth, place of birth, home address, work address, nationality, contact in case of emergency.

2. Educational background -- institutions, locations, major fields, degrees, years attended.
3. Employment history -- name and addresses of employers, titles of positions held, years of service.
4. Description of relevant work experience.
5. List of publications.
6. Statement of objectives in taking the training course.
7. Description of any follow-up training desired -- including definition of primary objective to be achieved and explanation of how training will be applied in future career and/or country's benefit.
8. Statement certifying adequate English language proficiency.
9. Certified statement of good health.
10. Certification by authorized Government official as to accuracy of statements on application and approval of planned activities.

Minimal standards for participant acceptance to the training course should be established and adhered to for course design to be effective. Unless this is done, serious mis-matches of course content and trainee capability may result. Therefore, the course designers should be included on the selection committee to identify technically appropriate candidates. Those who will have the greatest likelihood of employing their knowledge when they return to their country should be selected. Selection of candidates should occur about two months before start of course so a final iteration of course design can be made to better the match of participant capability and course content. Certified statements of good health must accompany applications to protect the U.S. Government, sponsoring institution, and cooperating organizations from undue liability. A major medical insurance policy should be supplied for each participant for the same reason.

BUDGET

Appendix B contains budget considerations and funding requirements for various course and follow-up training scenarios. Course presentation costs are estimated to be about $20,000/week of presentation. This cost includes course design, development, presentation, graphic art work, lecture art reproduction, amenities, secretarial support, and laboratory overhead. The participant subsistance of $27/day is based on double occupancy at ANL lodging facilities. A higher subsistance can be anticipated if the participants are housed off-site and low-cost eating facilities are unavailable.

RECOMMENDATIONS

Our recommended option is a ten week course for 30 to 32 participants, a convenient number for Argonne's training and housing facilities. A six month on-the-job training period is recommended for approximately one-half of the participants. Under this recommendation, the cost is estimated at $365,000. A variant on this recommendation is two weeks extension for detailed site visits to provide for those participants who would not go on to on-the-job training. The cost for that variant is estimated at $416,000.

APPENDIX A

PRELIMINARY COURSE OUTLINE
Economic, Environmental and Technological Aspects of the Coal Fuel Cycle

A. Lectures

Module C.1 Introduction and General Background (7 lectures)

1.1 Introduction and Overview of Course
1.2 Role and Mission of U.S. Agency for International Development
1.3 Types and Characteristics of Coal
1.4 Geological Considerations and Distribution of Coal Resources
1.5 Patterns of Energy Supply and Demand in ASEAN Countries
1.6 ASEAN Coal Resources
1.7 Legal Considerations of Coal Acquisition

Module C.2 Coal Exploration, Extraction and Beneficiation (11 lectures)

2.1 Exploration Technologies and Energy Efficiencies
2.2 Exploration Environmental and Economic Considerations
2.3 Extraction Technologies and Energy Efficiencies
  2.3.1 Surface Mining
  2.3.2 Underground Mining
  2.3.3 Reclamation
  2.3.4 Mine Safety
2.4 Environmental Considerations
  2.4.1 Surface Mining and Reclamation
  2.4.2 Underground Mining and Reclamation
2.5 Economic Considerations
  2.5.1 Surface Mining and Reclamation
  2.5.2 Underground Mining and Reclamation
2.6 Beneficiation Technologies
2.7 Manpower and Training Needs

Module C.3 Coal Transporation (10 lectures)

3.1 Within and Near Mine Transportation
  3.1.1 Technologies and Energy Efficiencies
  3.1.2 Environmental Considerations
  3.1.3 Economic Considerations
3.2 Away from Mine Transportation
  3.2.1 Technologies and Energy Efficiencies
  3.2.2 Environmental Considerations
  3.2.3 Economic Considerations
3.3 Management of Transportation
3.4 Manpower and Training Needs

Module C.4 Non-Electricity Related Coal Consumption (19 lectures)

4.1 Residential and Commercial Sector
- 4.1.1 Technologies - Space Heating
- 4.1.2 Technologies - Water Heating and Cooking
- 4.1.3 Environmental Considerations
- 4.1.4 Economic Considerations
- 4.1.5 Energy Efficiencies
- 4.1.6 Conservation Practices

4.2 Industrial Sector
- 4.2.1 Technologies - Primary Metals
- 4.2.2 Technologies - Chemical
- 4.2.3 Technologies - Glass and Concrete
- 4.2.4 Technologies - Other
- 4.2.5 Environmental Considerations
- 4.2.6 Economic Considerations
- 4.2.7 Energy Efficiencies
- 4.2.8 Conservation Practices

4.3 Transportation Sector
- 4.3.1 Technologies and Energy Efficiencies
- 4.3.2 Environmental Considerations
- 4.3.3 Economic Considerations
- 4.3.4 Conservation Practices

4.5 Manpower and Training Needs

Module C.5 Coal Consumption for Electrical Generation (24 lectures)

5.1 Boiler-Fired Power Plants
- 5.1.1 Technologies - Boilers
- 5.1.2 Technologies - Turbines and Generators
- 5.1.3 Technologies - Stack Gas Cleaning
- 5.1.4 Technologies - Heat Dissipation Systems
- 5.1.5 Environmental Considerations - Air
- 5.1.6 Environmental Considerations - Land
- 5.1.7 Environmental Considerations - Water
- 5.1.8 Economic Considerations - Air
- 5.1.9 Economic Considerations - Land
- 5.1.10 Economic Considerations - Water
- 5.1.11 Energy Efficiencies

5.2 Combined Cycle Power Plants
- 5.2.1 Technologies
- 5.2.2 Environmental Considerations
- 5.2.3 Economic Considerations
- 5.2.4 Energy Efficiencies

5.3 Fuel Cell and MHD Power Plants
- 5.2.1 Technologies
- 5.2.2 Environmental Considerations
- 5.2.3 Economic Considerations
- 5.2.4 Energy Efficiencies

5.4 Electricity Transmission and Distribution
- 5.4.1 Technologies
- 5.4.2 Environmental Considerations
- 5.4.3 Economic Considerations

5.5 Conservation Practices
5.6 Manpower and Training Needs

Module C.6 Coal Conversion Processes (11 lectures)

6.1 Technologies - Gaseous Fuels
6.2 Technologies - Liquid Fuels
6.3 Technologies - Solvent Refined Fuels
6.4 Environmental Considerations - Air
6.5 Environmental Considerations - Land
6.6 Environmental Considerations - Water
6.7 Economic Considerations - Air
6.8 Economic Considerations - Land
6.9 Economic Considerations - Water
6.10 Energy Efficiencies
6.11 Manpower and Training Needs

Module C.7 Siting Considerations for Coal Consumption and Conversion Facilities (8 lectures)

7.1 Air Use Considerations
7.2 Land Use Considerations
7.3 Water Use Considerations
7.4 Socio-economic Considerations
7.5 Atmospheric Dispersion Models
7.6 Thermal Plume Models
7.7 Alternative Site Analysis-I
7.8 Alternative Site Analysis-II

Module C.8 Benefit-Cost Analyses (9 lectures)

8.1 Purpose and Overview
8.2 Obtaining and Quantifying Technological Data Impacts
8.3 Obtaining and Quantifying Environmental Data Impacts
8.4 Obtaining and Quantifying Economic Data Impacts
8.5 Obtaining and Quantifying Manpower and Training Data Impacts
8.6 Obtaining and Quantifying Energy Efficiency Data Impacts
8.7 Integration nd Comparison of Benefit and Cost Impacts-I
8.8 Integration and Comparison of Benefit and Cost Impacts-II
8.9 Benefit-Cost Analyses as a Near-term and Long-term Planning Tool

Module C.9 Organization Roles and Staffing Requirements (9 lectures)

9.1 Governmental Role
- 9.1.1 Research and Development
- 9.1.2 Regulation
- 9.1.3 Staffing Requirements

9.2 Industries' Role
- 9.2.1 Production
- 9.2.2 Research and Development
- 9.2.3 Staffing Requirements

9.3 Utilities' Role
- 9.3.1 Production
- 9.3.2 Research and Development
- 9.3.3 Staffing Requirements

B. Work Sessions

Module C.1 Introduction and Background (5 work sessions)

1.a Review of Energy Supply and Demand Scenarios for World and Each ASEAN Country
1.b Review of Coal Resources for the World and Each ASEAN Country
1.c Projections of Needs Versus Availability for Each ASEAN Country and Calculations of Impact Sources and Levels

Module C.2 Coal Exploration and Extraction (6 work sessions)

2.a Review of Technologies
2.b Country-Specific Presentations on Feasible Technologies
2.c Continuation of 2.b
2.d Review of Economic and Environmental Considerations
2.e Country-Specific Presentations on Significant Economic and Environmental Considerations
2.f Continuation of 2.e

Module C.3 Coal Transportation and Benefication (6 work sessions)

3.a Review of Technologies
3.b Country-Specific Presentations on Feasible Technologies
3.c Continuation of 3.b
3.d Review of Economic and Environmental Considerations
3.e Country-Specific Presentations on Significant Economic and Environmental Considerations
3.f Continuation of 3.e

Module C.4 Non-Electricity Related Coal Comsumption (9 work sessions)

4.a Review of Residential and Commercial Sector Technologies
4.b Country-Specific Presentations on Feasible Technologies
4.c Continuation of 4.b
4.d Review of Industrial Sector Technologies
4.e Country-Specific Presentations on Feasible Technologies
4.f Continuation of 4.e
4.g Review of Economic and Environmental Considerations
4.h Country-Specific Presentations on Significant Economic and Environmental Considerations
4.i Continuation of 4.h

Module C.5 Coal Consumption for Electrical Generation (12 work sessions)

5.a Review of Boiler and Stack Gas Cleaning Technologies
5.b Country-Specific Presentations on Feasible Technologies

5.c Continuation of 5.b
5.d Review of Economic Considerations of Boiler and Stack Gas Cleaning Technologies
5.e Country-Specific Presentations on Significant Economic Considerations
5.f Continuation of 5.e
5.g Review of Environmental Considerations of Boiler and Stack Gas Cleaning Technologies
5.h Country-Specific Presentations on Significant Environmental Considerations
5.i Continuation of 5.h
5.j Review of Heat Dissipation System Economic and Environmental Considerations
5.k Country-Specific Presentations on Significant Heat Dissipation Economic and Environmental Considerations
5.l Continuation of 5.k

Module C.6 Coal Conversion Processes (6 work sessions)

6.a Review of Gaseous and Liquid Fuel Technologies
6.b Country-Specific Presentations of Feasible Technologies
6.c Continuation of 6.b
6.d Review of Economic and Environmental Considerations
6.e Country-Specific Presentations on Significant Economic and Environmental Considerations
6.f Continuation of 6.e

Module C.7 Siting Considerations for Coal Consuming and Conversion Facilities (5 work sessions)

7.a Review "Case Plant" and Identify Significant Air, Land, Water and Socioeconomic Considerations
7.b Team Presentations on Significant Air, Lane, Water and Socioeconomic Siting Considerations
7.c Continuation of 7.b
7.d Mock Computer Runs of a SO_2 Atmospheric Dispersion Model
7.e Mock Computer Runs of an Aquatic Thermal Plume Model

Module C.8 Benefit-Cost Analyses (4 work sessions)

8.a Quantification of Technological, Economic, and Environmental Data Inputs from "Case Plant"
8.b Continuation of 8.a
8.c Country-Specific Presentations on Benefit-Cost Analyses of "Case Plant"
8.d Continuation of 8.c

Module C.9 Organizational Roles and Staffing Requirements (3 work sessions)

9.a Review of Coal Use Scenarios for Each Country
9.b Country-Specific Presentations on Organizational and Staffing Requirements
9.c Continuation of 9.b

C. Discussions (By Panel of Experts)

Module C.1 Introduction and Background (1 session)

1.i Coal Utilization Scenarios for the World and ASEAN Countries

Module C.2 Coal Exploration and Extraction (2 sessions)

2.i Near-term and Far-term Technologies for ASEAN Countries
2.ii Near-term and Far-term Economic and Environmental Considerations for ASEAN Countries

Module C.3 Coal Transportation and Benefication (2 sessions)

3.i Near-term and Far-term Technologies for ASEAN Countries
3.ii Near-term and Far-term Economic and Environmental Considerations for ASEAN Countries

Module C.4 Non-Electricity Related Coal Consumption (3 sessions)

4.i Near-term and Far-term Technologies, by Sector, for ASEAN Countries
4.ii Near-term and Far-term Economic Considerations, by Sector, for ASEAN Countries
4.iii Near-term and Far-term Environmental Considerations, by Sector, for ASEAN Countries

Module C.5 Coal Consumption for Electrical Generation (3 sessions)

5.i Near-term and Far-term Technologies for ASEAN Countries
5.ii Near-term and Far-term Economic Considerations for ASEAN Countries
5.iii Near-term and Far-term Environmental Considerations for ASEAN Countries

Module C.6 Coal Conversion Processes (3 sessions)

6.i Near-term and Far-term Technologies for ASEAN Countries
6.ii Near-term and Far-term Economic Considerations for ASEAN Countries
6.iii Near-term and Far-term Considerations for ASEAN Countries

Module C.7 Siting Considerations for Coal Consumption and Conversion Facilities (2 sessions)

7.i Analysis of Country-Specific Results of "Case Plant" Presentations
7.ii Recommendations Related to Siting Methodologies

Module C.8 Benefit-Cost Analyses (2 sessions)

8.i Analysis of Country-Specific Results of "Case Plant" Presentations

8.ii Recommendations Related to Benefit-Cost Methodologies

Module C.9 Organizational Roles and Staffing Requirements (1 session)

9.i Near-term and Far-term Organization and Staffing Requirements for ASEAN Countries

D. Site Visits (Total of one week or equivalent to 20 sessions)

C.A Extraction and Beneficiation

A.1 Reclaimed and Unreclaimed Surface Mine
A.2 Underground Mine
A.3 Mine-Month Plant
A.4 Beneficiation Plant

C.B Coal-Fired Industrial and Electrical Generating Facilities

B.1 Steel Foundry
B.2 Concrete Manufacturing Plant
B.3 Coal Fired Plant with Flue-Gas Desulfurization

C.C Coal Conversion Facilities

C.1 HYGAS Facility
C.2 Exxon Donor Solvent Plant

APPENDIX B

Estimated Budget and Budget Options for Conduct of a Course and On-The-Job Training Program on the Coal Fuel Cycle

1. Course-Related Costs

	Course Length (weeks) 8	10	12
Direct Costs (@ $20,000/week)[a]	$160,000	$200,000	$240,000
Stipend Costs (@ $27/day)[b]			
25 participants	37,800	47,250	56,700
50 participants	75,600	94,500	113,400
TOTAL COURSE COSTS			
25 participants	197,800	247,250	296,700
50 participants	235,600	294,500	353,400

2. On-The-Job Trainee Costs

	Length of O-J-T (months) 2	6
Stipends (@ $33/day)[c]		
25 participants	49,500	148,500
50 participants	99,000	297,000
Books (@ $100/participant)		
25 participants	2,500	
50 participants	5,000	
Travel (@ $200/participant)[d]		
25 participants	5,000	
50 participants	10,000	
Training Fees (@ $200/mo)		
25 participants	60,000	———
50 participants	120,000	———
On-Job-Training Placement		
25 participants	6,000	24,000
50 participants	12,000	48,000
TOTAL O-J-T COSTS		
25 participants	123,000	180,000
50 participants	246,000	312,000

3. Total Cost Options

On-The-Job Training Period Months	Participants	Course Length (Weeks) 8	10	12
2	25	320,000	370,000	419,700
	50	481,000	540,500	599,400
6	25	377,000	477,250	476,000
	50	595,600	654,500	713,400

a Based on current costs for operating International Atomic Energy Agency (IAEA) courses at Argonne National Laboratory (ANL). This cost included staff and administrative effort for course development and implementation, money for lecturers, and site visit costs.

b Based on current stipend paid to course participants by IAEA.

c Based on current stpend paid to O-J-T Fellows by National Research Council.

d Average one-way airplane ticket from ANL to O-J-T location.

ANNEX VII

INDONESIA - ENERGY PROFILE

ENERGY

INDONESIA

Summary

Indonesia, as the principal oil/LNG exporting country east of the Persian Gulf, is a chief source of hydrocarbon energy in Asia and the Pacific Basin. During the past year, Indonesia continued to be a major supplier of crude oil and refined products to the U.S. Although the amount declined, its share of total U.S. oil imports increased. About six percent of U.S. crude imports come from Indonesia. For the U.S. West Coast, this percentage is much higher. Indonesian low sulfur crude is preferred for pollution and stability of supply reasons. Indonesian exports of crude to refineries in Trinidad also make their way to U.S. customers along with substantial quantities of low sulfur waxy residual fuel oil. As shown in Table 1, oil exports earn considerable amounts of foreign exchange.

Indonesia may also become a supplier of LNG to the U.S. Plans still call for a significant amount of gas to be delivered to Southern California by the Pacific Lighting Corporation. Indonesia's interest in maximizing oil and gas production and developing alternate markets for LNG is consistent with U.S. interests of seeking new forms and stable sources of energy at competitive prices.

TABLE #1

NET FOREIGN EXCHANGE EARNINGS FROM OIL
(in BILLION $)

	1977/78	1978/79	1979/80	1980/81	1981/82 (est)
Oil net	4.4	4.1	6.7	11.0	12.4

Oil Production and Trade

In 1980, based on production of almost 1.6 MMBD, Indonesia exported 378,756,600 barrels of crude oil and condensate or an average of 1.035 million barrels per day. This is 7.8% below 1979 exports.

Japan and the United States remain by far the largest markets for Indonesian crude oil in 1980, purchasing 55% and 30% respectively. In 1980 Indonesia accounted for over 14% of Japan's petroleum imports and about 6% of U.S. imports. Table #14 shows the destination of Indonesia's crude and condensate exports.

TABLE 2
INDONESIAN CRUDE PRODUCTION
(Million Barrels)

	1975	1976	1977	1978	1979	1980
Annual Total	476.9	550.4	615.1	596.7	580.4	577.0
Daily Average	1.307	1.504	1.685	1.635	1.590	1.577

TABLE 3
INDONESIAN EXPORTS OF CRUDE AND CONDENSATE 1972-1980
(Million Barrels)

1972	1973	1974	1975	1976	1977	1978	1979	1980
229	370	379	363	450	484	462	411	379

TABLE 4
INDONESIAN EXPORTS OF CRUDE
('000 Barrels of Oil)

Japan	206,535.0	54.5
U.S.A.	114,313.8	30.2
Trinidad	25,112.1	6.6
Australia	9,427.5	2.5
Philippines	6,689.4	1.8
Brazil	4,196.6	1.1
Singapore	4,172.0	1.1
Taiwan	2,696.1	.7
Caribbean	2,613.9	.7
New Zealand	909.8	.2
Italy	899.4	.2
France	773.8	.2
Thailand	299.9	.1
Korea	116.3	.1
TOTAL	378,756.6	100.0

Oil Imports

Indonesia imported 32.9 million barrels of crude oil from Saudi Arabia at a cost of $939 million in 1980. This was refined at Cilacap. Indonesia also imported petroleum products largely from Kuwait and Singapore. Product imports in 1980 are listed in Table 5.

TABLE 5
1980 INDONESIAN IMPORTS OF PETROLEUM PRODUCTS

	Amount (barrels)	Value (Million $)
Jetfuel	2,059,351	89.9
Kerosene	7,459,893	320.8
Gas Oil	11,087,733	458.7
Diesel	372,364	11.1
Fuel Oil	426,940	13.9
Total	21,406,281	894.4

Gas Production

Indonesia's gas production increased by 6.6% in 1980 and surpassed one trillion cubic feet (about 30 billion cubic meters) for the first time. This is the energy equivalent of about 120 million barrels of oil. The following table shows the rapid growth of natural gas production in recent years.

TABLE 6
NATURAL GAS PRODUCTION
(billion cubic feet)

1975	1976	1977	1978	1979	1980
222	312	543	820	981	1046

The government continues to stress the importance of utilizing all gas produced. In 1980 78% of produced gas was utilized, up from the near two-thirds flared in the mid-1970s. The two producers of Liquified Natural Gas (LNG), Mobil and Huffco, are by far the largest producers of natural gas.

Gas Exports-Liquified Natural Gas (NLG)

In 1980 Indonesia took over from Algeria as the world's largest exporter of liquified Natural Gas (LNG). This is a position Indonesia may well maintain. In 1981 Indonesia signed two contracts which will increase Indonesia's LNG capacity by 80% in the next three years. LNG export volumes continued to rise in 1980, up more than one-third over 1979. Export earnings rose even faster to $2.3 billion. The following table charts the rapid increase in LNG shipments.

National Energy and Petroleum Policy

Until recently Indonesia's energy policy and petroleum policy were nearly synonymous. Oil had the dual role of being the nation's prime source of commercial energy and of providing foreign exchange to finance development. As domestic consumption of petroleum products has steadily increased, this policy has evolved.

-- The government has embarked on an ambitious program to diversify domestic energy sources away from petroleum to make available more of Indonesia's future oil production for export.

-- Natural gas--in the form of liquified natural gas (LNG) exports--has emerged as a substantial foreign exchange earner. LNG is expected to make an ever increasing foreign exchange contribution, perhaps approaching that of oil exports by the beginning of the 1990s.

Oil will remain at the base of Indonesia's energy policy, however, and the following are important elements of the energy strategy.

-- Exploration and development of Indonesia's oil resources is encouraged to increase oil production. The government welcomes foreign investment to explore and develop offshore and more remote onshore acreage.

-- The government is taking steps, including the expansion of refining capacity, to insure that needed petroleum supplies are available domestically.

To better coordinate energy planning, a National Energy Coordination Board (BAKOREN) was established in August, 1980. In addition to the Minister of Mines and Energy, who is Chairman, the Board includes the Ministers of Public Works, Industry, Defense, Communication, Agriculture, the State Ministers of Research and Technology, Development Supervision and the Environment, State Apparatus Reform and the Directors General of MIGAS and Power from the Ministry of Mines and Energy.

Migas

The Ministry of Mines and Energy, which includes the Directorate General for Oil and Gas (MIGAS), has primary responsibility for petroleum and energy for the government. MIGAS oversees the basic operations of the Contract of Work holders--Caltex and Stanvac--and Pertamina. It licenses companies to operate in the petroleum sector, enforces safety and environmental regulations, and maintains statistics. It has a say in all major issues related to petroleum, including pricing, manpower and production. MIGAS also supervises the Indonesian Petroleum Institute (Lemigas). Lemigas checks specifications on crudes and products and runs the Indonesian Oil and Gas Academy at Cepu in East Java.

Pertamina

The nucleus of the Indonesian petroleum sector is Pertamina, the State oil and gas company. Created out of the merging of two smaller national companies, Pertamin and Permina, in 1969, Pertamina has become one of the largest state oil companies in the world. The company's basic charter was revised and strengthened by Law No. 8 of 1971 ("The Pertamina Law"), which made the company responsible for all petroleum activities in Indonesia, including exploration, production, refining, transportation and marketing. It owns and operates all of Indonesia's refineries, domestic distribution facilities, a fleet of tankers and other vessels and an aviation service. It employs more workers, over 45,000, than any other Indonesian industrial enterprise. Pertamina exercises supervisory control over the operations of the 31 foreign oil contractors and over 200 service companies.

INDONESIA'S NATIONAL ENERGY PLAN

Indonesia's first National Energy Plan was formulated in mid-1977 and incorporated in the government's overall third Five Year Plan 1979-1984 (Repelita III). With the establishment of the National Energy Coordination Board (BAKOREN) in August 1980 a formal group which represents all sectors of the economy is working to agree on revisions to the plan. The basic goals of the earlier and current plans are to:

- guarantee domestic energy supplies at an affordable price in accordance with demand
- export energy to provide foreign exchange
- develop alternative energy sources to fuel domestic economic development and to free oil and gas for export
- conserve energy, particularly that from oil, protect the environment and promote national resiliance

With oil exploration taking place at a rapid pace and LNG plans moving ahead, the emphasis of current planning is on diversification of energy resources and to a lesser extent conservation. The original plan predicted an increase in overall commercial energy demand from FY 1978/79 to FY 1983/84 of about 10 percent per year. During that period energy planners hoped to decrease the role of oil as a domestic source of energy from 82.2 percent to 77.7 percent. Table 7 shows the original plan and calendar year 1980 performance for comparison.

TABLE 7
COMMERCIAL ENERGY CONSUMPTION
% Million Barrels of Oil Equivalent (BOE)

	1978/79	%	1980	%	(Plan) 1983/84	%
Natural gas	23.804	15.8	23.302	13.1	42.743	17.6
Coal	1.041	.7	951	.5	6.016	2.5
Hydro	1.982	1.3	4.432	2.5	5.399	2.2
Geothermal	-	-	-	-	-	-
Oil	123.824	82.2	149.156	83.9	189.423	77.7
Total	150.651	100.00	177.841	100.0	243.656	100.00

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DOMESTIC CONSUMPTION AND DISTRIBUTION

Petroleum Products

In recent years domestic consumption of petroleum products has been increasing at rates in excess of 12% annually. Despite increases in domestic fuel prices in May 1979 and May 1980, demand rose by 11.8% in 1980. Domestic sales of petroleum products reached 139 million barrels (22,047,964 kiloliters) or 24% of total production. This number does not include oil used by the petroleum industry for refining or production. Sales of international bunker and aviation fuel added another 2.3 million barrels. In fiscal year 1981/82 the government estimates that consumption will grow to 158 million barrels (433,000 b/d) or 25.1 million kiloliters and that it will require at least 500,000 b/d of crude to satisfy this demand for products. Kerosene accounts for more than one-third of all petroleum products sold, but use of fuel oil and diesel oil is increasing at a faster rate. Table 8 shows consumption in recent years.

TABLE 8
DOMESTIC CONSUMPTION OF PETROLEUM PRODUCTS
(Excluding Use by the Oil Industry)
(Millions Barrels)

Millions	1977	1978	1979	1980
Avgas	0.12	0.12	0.12	0.12
Avtur	2.24	2.52	2.74	3.27
Super 98/ Premium	17.99	20.31	21.91	23.79
Kerosene	36.73	41.70	45.46	48.97
Automotive Diesel	26.85	31.62	34.54	40.06
Industrial Diesel	5.95	6.52	7.33	7.64
Fuel Oil	7.89	9.44	11.89	14.81
	97.77	112.23	123.99	138.66

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while households remain the largest consumers of petroleum products, use by other sectors of the economy has risen more rapidly, as the tables 9 and 10 show.

TABLE 9
GROWTH OF OIL USE BY SECTOR

Sector	% Increase 1970-1980	% Increase 1979-1980
Households	185	7.6
Transportation	220	12.7
Industry	237	13.4
Electric Power	487	21.4

TABLE 10
CONSUMPTION OF OIL BY SECTOR
1979 - 1980
(in 1,000 kiloliter)

YEAR	HOUSEHOLD	TRANSPORTATION	ELECTRIC POWER	INDUSTRY
1970	2,732.10	2,247.58	312.0	1,551.28
1971	2.817.54	2,386.39	334.1	2,010.47
1972	3,306.58	2,727.54	437.7	2,193.51
1973	3,681.97	3,317.76	478.1	2,614.19
1974	4,258.05	3,954.34	513.1	2,885.51
1975	4,882.66	4,029.58	628.49	3,394.19
1976	5,280.04	4,765.09	853.33	2,906.87
1977	5,863.47	5,258.12	1,035.49	3,442.80
1978	6,559.04	5,880.93	1,311.43	4,054.53
1979	7,230.32	6,388.15	1,508.19	4,613.92
1980	7,783.37	7,199.44	1,831.71	5,232.63

Domestic sale of kerosene, diesel oil and fuel oil are heavily subsidized in Indonesia. Current prices which have been in effect since May 1, 1980 are listed in Table #25.

These problems are well recognized by the government. While various observers have predicted that Indonesian petroleum consumption will continue to grow until it consumes all oil production in the early 1990s, the seriousness of that development make it more likely that the government will have to take steps, including price increases, before the mid-1980s to curb the growth of petroleum consumption. A slower growth in petroleum consumption would give Indonesia more time to develop its non-oil sectors. For example, at a 12% rate of increase, consumption reaches present production levels in late 1992. At an 8% growth rate, consumption would not reach present production levels until 1999. The earlier the growth in oil consumption slows to a more sustainable pattern, of course, the longer Indonesia's export horizon will be.

It should be recognized that Indonesia's consumption of petroleum is still low, about one barrel per person per year. This compares with per capita consumption of 2 barrels in the Philippines, 4 barrels in Malaysia, 16 barrels in Japan and 28 barrels in the U.S. Invariably, total energy consumption will increase as the Indonesian economy grows. Government energy planning focuses on how to substitute other energy sources to slow the growth of petroleum product consumption. For example, Minister of Mines and Energy Subroto recently stated that the government has revised the target for oil's share of the enrgy supply in 1983/84 to 73.9 percent.

To accomplish this goal of reducing oil's share, Indonesia is embarking on a massive program to develop other sources of energy. Fortunately, it is blessed with large reserves of coal and gas and potential for hydro, geothermal and solar. The following is a brief description of these alternatives and the plans for their development. The following table gives rough government estimates of ultimately recoverable reserves.

TABLE #31

POTENTIAL ESTIMATES OF ENERGY RESOURCES

Oil	50 billion barrels	50 billion BOE
Natural Gas	122 trillion SCF	22 billion BOE
Coal	18 billion tons	90 billion BOE
Geothermal	8 - 10,000MW	---
Hydroelectric	31,000 MW	---

Coal

Indonesia has sizeable coal deposits. The Ministry of Mines and Energy estimates potential reserves of up to 18 billion tons, mainly in Sumatra and Kalimantan. Production was only 268,000 tons in 1980, however. The government has extensive plans to develop these resources. As part of the National Energy Policy the government seeks to use coal as a substitute for fuel oil in the generation of electricity and for fueling large industries, such as cement. In addition, coal is to be used as a fuel for village and rural households. Studies done for the government mention coal briquettes as a potential fuel for home cooking.

With loans from the World Bank and elsewhere, the government has begun the rehabilitation and expansion of the Bukit Asam mine in South Sumatra. Reserves are estimated to exceed 200 million tons with larger reserves in surrounding areas. Beginning in 1984 coal from the mine is to be shipped by train and barge to West Java where it will fuel the Suralaya power project. Two generating plants of 600 MW each are to begin operation in 1984/85 with two more plants planned to start in 1988. To meet this demand and that from planned cement factories and electrical generation from the mine mouth, production increase from about 200,000 tons per year in 1980 to 850,000

tons per year in 1984 and nearly 3 millions tons per year in 1985. The World Bank estimates that the project with related infrastructure will cost $862 million. By 1990 the government would like production to grow to 12.5 million tons per year.

The government is also expanding the Ombilan mine in Central Sumatra. Reserves there are estimated at over 100 million tons. Current production is under 100,000 tons per year. Production is used largely to fuel the Indarung cement plant and at the mine. The government estimates that demand for Ombilan coal from cement plants, the state railroad and for electricity generation from the mine site will grow to nearly one million tons per year by 1985. To satisfy this demand the government plans to increase coal production in two stages. In 1981/82 the government has budgeted $52 million for infrastructure improvements to boost the mine's capacity to 425,000 tons per year in 1983. Further investments are then planned for 1983 to meet 1985 demands.

The government is also moving toward agreement with foreign firms for the exploration and production of coal in East Kalimantan. In April the government intialled the first foreign investment proposal for coal in Kalimantan. Several other agreements are expected soon. This coal would be both for export and domestic use.

Natural Gas

Indonesia has large natural gas reserves and good prospects for discovering more. The government intends to use gas to fuel industrial development and as a feedstock for fertilizer and petrochemical industries in addition to LNG for export. New industrial zones in Aceh, Sumatra and on Bunyu island off Kalimantan are near sizeable gas deposits. Natural gas in the form of LPG also has a large potential market for household use. To further develop this resource the government realizes that it must establish a gas pricing policy which encourages the development of new gas fields near populated areas. PERTAMINA is presently studying a report prepared by outside consultants which recommends higher wellhead and end-use prices for natural gas.

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TABLE #28
1980 GAS UTILIZATION
(thousand standard cubic feet)

Fuel Gas for oil industry	48,010,478.
Gas Lift	42,134,142.
Gas Injection	114,864,908.
LPG	23,192,480.
LNG	472,275,223.
PGN Jakarta	444,721.
PGN Cirebon	1,126,802.
Refinery	10,583,657.
PUSRI (fertilizer)	51,070,225.
Cilamaya (steel, fertilizer cement)	47,075,914.
Total	810,778,568.
Percent of Production	77.5%

For the future the government has plans to use gas as the feedstock for a large olefins project to be based near Arun, Sumatra and for a methanol plant on Bunyu Island off East Kalimantan. Construction of a pipeline to connect the Poleng field off Madura Island with Surabaya is planned. To encourage the development of additional gas reserves near populated areas, the government is currently studying its gas pricing policy. Current prices for industrial users range from $.33 to $1.27 for million BTU for domestic gas.

Geothermal:

Indonesia has substantial geothermal potential and unlike other forms of energy some of the prospective sites are near the areas of largest demand in Java. The government opened a small 2 MW pilot plant on the Dieng plateau in early 1981. Pertamina is cooperating with the government of New Zealand in the construction of a 30 MW plant in Kamojang. In August 1980 Pertamina invited foreign firms to participate in the development of geothermal steam power and electricity. Some eighteen firms showed initial interest. The first contract for foreign participation in geothermal development was intialled in April with Union Oil for development of geothermal resources on Mount Salak.

Hydropower:

Indonesia has so far tapped about 500 MW of hydroelectric power. Development of the Asahan project in Sumatra will add an additional 1200 MW in late 1982. Unfortunately, most hydroelectric potential is located off Java, which consumes the bulk of electric power in Indonesia. A number of small hydro plants are either under study or have already been judged feasible for construction on Java. This construction program should be moving ahead in the next few years.

The Budget and Subsidies

The domestic sale of petroleum products is highly subsidized in Indonesia. Kerosene, which is widely used for lighting and cooking, is priced at 6¢ per liter (23¢ per gallon). Fuel oil and diesel are only slightly more expensive. Indonesia increased domestic fuel prices in May 1979 and May 1980, but the international price of oil outstripped these increases and the level of subsidy has increased rapidly. Sensitive to the impact of a change in fuel prices particularly on the urban poor, President Suharto in his January 1981 budget speech promised that prices would not be raised in FY 1981/82. As a result, the 1981/82 budget anticipates an 47% jump in the petroleum product subsidy to $2.4 billion or almost 11% of the total budget. Finance Minister Ali Wardhana recently estimated that the subsidy might be higher. With legislative elections in April 1982, followed by a Presidential election a year later, it is not clear when the next price increases will take place. Without domestic price increases, the subsidy can be expected to increase along with domestic consumption. If international oil prices rise again, the subsidy would grow even faster.

The oil product subsidy spreads a part of the benefit of Indonesia's oil revenue among the Indonesian people but by doing so in relation to the amount of fuel purchased, the subsidy does not necessarily target areas of development emphasis. The low fuel prices also encourage domestic consumption thus reducing the amount of oil available for export. It should be noted that the budgeted subsidy is only about one half of the total economic subsidy, since a considerable amount of crude is obtained from contractors at well below market price.

Refining

In April and May, 1981 Pertamina signed contracts to more than double Indonesia's effective refinery capacity and bring refinery output more in line with domestic consumption patterns. At present Indonesia has the capacity to refine about 400,000 barrels per day, with little capacity to crack fuel oil into the middle distillates which are needed locally. Current refinery capacity is detailed in Table #26.

In 1980 Indonesia's refineries processed an average of 354,200 barrels per day. About 220,000 b/d was kerosene, diesel, gasoline and other fuel needed in the domestic market (abbreviated BBM in Indonesia). This compares with 1980 BBM consumption of 387,000 b/d. To cover the gap, Pertamina sent about 150,000 b/d of crude to Singapore refineries last year. The refineries returned products in exchange for a processing fee. Pertamina reached a similar agreement with the Philippine National Oil Company to refine 20,000 b/d of Indonesian crude beginning in March 1981 and return the products to Eastern Indonesia. Pertamina also imports products directly from Singapore and Kuwait. These imports averaged 58,500 b/d in 1980. Finally, Pertamina has exchange agreements with several major petroleum companies and some small oil trading companies that return about .8 barrels of product for each barrel of crude.

ANNEX VIII

THAILAND - ENERGY PROFILE

Thailand

Overview

Thailand has not been immune from the disruptive effects of the energy price increase in 1973/74, although the direct impact on growth has been less than in many oil-importing developing countries. Most of the impact of rising energy prices has been absorbed in the growing current account and public sector deficits. Thailand has delayed adjusting domestic energy prices to changes in the cost of energy imports on the grounds that higher energy prices would adversely affect growth and inflation. As a result of these policies the direct contribution of energy price increases to the overall inflation has been relatively modest on the basis of computed indices.

After initial increases in 1974, energy prices remained roughly constant until 1977 and rose sharply only in 1979. This has retarded conservation and reduction of the energy intensity of the Thai economic structure. The combination of continued rapid growth, modernization, and a heavy dependence on energy imports has resulted in a large oil import burden on the balance of payments, particularly after the doubling of oil import prices in 1979/80. The exceptionally low GDP elasticity energy consumption in 1978 (the last year for which data are available) is apprently due to transitory factors of very high agriculture led GDP growth and supply shortages of hydroelectricity and some petroleum products. The longer-term trends for higher energy consumption growth are likely to continue unless further price adjustments are made. Maintaining low energy prices has also contributed to the fiscal deficit. Adjustments in energy price policy will be essential to any satisfactory adjustment program.

Recent discoveries of natural gas, which will be available in 1982, and expanded production capacity of lignite beginning in 1984 will reduce the

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the use of imported energy for power generation through the 1980's and will lower the economy's dependence on imported energy. However, even with this substitution, the development of remaining domestic hydro potential, and the possible production of alcohol from sugarcane and cassava, some 50% of total energy requirements would still have to be imported by 1990. Without significant increases in domestic energy reserves, a large portion of incremental demand after 1990 will have to be satisfied by imports bill could accelerate sharply in comparison to its slow growth in the 1980's. Thailand will not be able to break its dependence on imported energy in the foreseeable future, and thus will have to adjust its domestic energy policies to external developments in energy markets, including both expected price increases and possible supply shortages.

Total energy consumption in Thailand has increased from 7.4 million tons of oil equivalent (T.o.e.) in 1970 to over 15.6 million T.o.e. in 1979, an average annual growth rate of 8.6 percent. In 1979, petroleum products accounted for almost 69% of total energy; hydro and lignite (low-grade coal) for about 6% and 3.5% respectively; and charcoal, firewood, paddy husk and bagasse for the remaining 21.5%. The price of oil products has increased almost six-fold since 1972 and has become a heavy burden on the Thai economy. In 1979, oil imports, which were about $1,150 million in value, absorbed 29% of export earnings, leaving Thailand with a substantial current account deficit. The impact of oil prices were even greater following the 1979-80 increases. It has been estimated that in 1980, Thailand's oil import bill increased to about $2.7 billion, absorbing over 42% of total export earnings and contributing to a current account deficit of more than $2 billion. Preliminary estimates by NEA for 1981 indicate that oil will account for 76% of total energy consumption, and the import bill will equal 37% of total export

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Table 1: ENERGY CONSUMPTION

	1960-69	1970-74	1975-78	1979
Growth of commercial energy consumption (% p.a.)	15.6	10.6	9.2	
Elasticity of energy consumption with respect to GDP	1.8	1.9	1.0	
Share of total commercial energy imported (% of energy equivalent)	86.2	88.2	81.1	
Value of energy imports (B, billion)	1.5	5.1	18.0	32.6
Energy imports share of total imports (%)	9	13.4	21.1	21.3

A Ministry of Science, Technology and Energy was created recently for the development of nonconventional energy and new uses of existing energy sources, but, so far, it has played a minor role in the larger sector issues. The National Energy Administration (NEA) within the Prime Minister's Office, while responsible for overall energy policy, has concentrated mainly on collecting energy data. NEA is currently planning to carry out an Energy Master Plan Study, with the assistance of Asian Development Bank (ADB) and UNDP financing, to define a program to meet Thailand's energy requirements up to the year 2000. The Petroleum Authority of Thailand (PTT) was established in December 1978 to undertake all petroleum business and develop related energy policies. Under the Second Natural Gas Development Project of the World Bank, PTT will receive technical assistance to undertake: (a) a refinery expansion study; (b) a gas utilization study; and (c) energy conservation studies. These efforts, in addition to NEA's program, should provide an initial framework for the development of a comprehensive energy strategy for the country.

Source: NESDB, Bank of Thailand Statistical Bulletin, NEA

Energy Resources

Oil

Thailand's proven petroleum reserves total about 1.1 million barrels in the Fang province of Northern Thailand. Production at present is less than 100,000 barrels a year, about 0.1% of total domestic consumption. Intensive exploration is currently being undertaken in the northeast region of the country and offshore in the Gulf of Thailand where natural gas has already been found (see para. 1.08). There are extensive oil shale reserves (about 2,500 million mt), mainly in the remote areas of Tak province but oil production from shale is still uneconomic. The Government is considering the establishment of a pilot shale oil extraction plant under a technical cooperation agreement with countries possessing such technologies.

Thailand has large areas of sugar plantations and has initiated studies of the feasibility of making ethanol by using the alcohol that can be produced from sugar cane. The studies are at an early stage but will be followed with interest by the Bank.

Coal

Lignite (low-grade coal) reserves are currently estimated at around 770 million mt located at Mae Moh (650 million mt), Krabe (100 million mt), and Li (20 million mt). Of the lignite reserves at the Mae Moh site, 350 million mt are proven and probable reserves which are sufficient to sustain a total generating capacity of about 1,500 MW for about 25 years to be developed during the 1980's. EGAT is constructing units 4 and 5 of 150 MW each at Mae Moh (150 MW are currently installed) which the Asian Development Bank (ADB) is helping finance and the World Bank has recently made a loan of US$72 million for the complementary lignite development. The Department of Mineral Resources is undertaking a drilling program for all the lignite

bearing basins in the country with the exception of Mae Moh, which are still under the responsibility of EGAT. Preliminary indications are that the reserve potential at Mae Marat in the province of TAK could be substantial but possibly at a considerable depth underground.

Lignite is the lowest quality coal with a heating value of about 3,880 kcal/kg, or lower (2,700 kcal/kg at Thailand's Mae Moh mine). Lignite is uneconomical to transport due to its high moisture and ash content, and unsafe to store due to its tendency to decompose and self-ignite in open air. Hence, lignite is not traded and is used almost exclusively in Thailand, as elsewhere, for large-scale power generation at mine-mouth sites.

The proven and probable lignite reserves at Mae Moh are capable of supporting a generating capacity of about 1,500 MW during the 1980s which, together with the presently installed 60 MW capacity at Krabi, would constitute approximately 22% of EGAT's total energy generation in 1990. Under EGAT's development plan (1979-1990) annual production at Mae Moh mine would expand from 1 million Mt of lignite in 1979 to 9.8 million Mt in 1988 thus maintaining the share of lignite among its primary energy sources.

Natural Gas. Significant reserves of natural gas have been discovered in the Gulf of Thailand which are projected to come on stream in mid-1982. The proven recoverable gas reserves are 1.6 trillion cubic feet (tcf) of good quality gas and 1.3 tcf of lower quality gas. Probable recoverable reserves are estimated at a further 4.7 tcf. Two overseas groups, Union Oil Company and Texas Pacific Oil Company, will undertake the development of gas reserves, and the Petroleum Authority of Thailand (PTT) will take delivery at the offshore production platforms. In the initial years much of the gas output will be contracted to the Electricity Generating Authority of Thailand (EGAT), while a small proportion will be available to industries. The Bank made a loan of $107 million (Loan -

1773-TH) in FY80 for the first phase of development of the natural gas pipeline.

The substitution of natural gas for imported oil would considerably reduce the demand for fuel oil for power generation. EGAT has in its development program 2,700 MW of generating capacity to be converted or newly installed in the next few years. It is expected that by 1991 about 37% of EGAT's total generation would be from thermal stations using natural gas.

Sponge iron smelting and petro-chemical plants are in the feasibility study stage with a view to using the natural gas more economically than for power generation. However, it is anticipated that substantial quantities of gas will always be available for power plants.

Hydro Potential. Thailand's domestic hydroelectric potential is about 9,300 MW, of which about 1,270 MW are in operation and another 2,100 MW will be installed by 1991. Hydropower would increase from 14% of EGAT's total generation in 1981 to about 19% in 1991. The Mekong river which forms the border between Thailand and Laos and then flows through Kampuchea and Viet Nam has an estimated hydro potential , in even projects, of about 19,000 MW with an annual energy output of 110,000 GWh. This represents about 9 times Thailand's electricity consumption in 1979 and 3 times the forecast electricity requirement in 1990. The Mekong's development is governed jointly by Laos, Kampuchea, Thailand and construction is likely to await the resolution of the current political problems in the region. Substantial resettlement requirements will arise from the development of the first major hydro site at Pa Mong on the Mekong, about 60 km west of Vientiane. An organizational and financial study of the Pa Mong is being carried out by consultants. In addition, the numerous tributaries of the Mekong River in Laos are tentatively estimated to provide another 18,000

MW of hydro potential to the region. Based on a desk study made by the National Energy Administration (NEA), a dam site on the Salween river at the annual energy output of about 47,000 GWh. Following recent ministerial level exchanges, the two Governments agreed in principle to cooperate on the development of the Salween river.

Other Energy Resources. Thailand's other energy resources include oil shale, fuelwood and possibly geothermal. Estimates of oil shale reserves at Mae Sot range from 2,500 to 18,500 million tons, enough to generate fuel at the rate of 60,000 b/d, 2,500 million mt but these are uneconomic to develop at present prices. The Government is considering establishment of a pilot oil shale extraction plant and refinery using the Lurgi process under a technical cooperation agreement with countries possessing such technologies. Fuelwood resources, once plentiful, are rapidly depleting and deforestation is becoming a serious problem. The World Bank has been requested to help finance a project to improve forestry and wood production. Geothermal exploration is being carried out by EGAT in the northern part of Thailand near Chiangmai.

Energy Supply Alternatives. Prospects to reduce Thailand's dependence on imported energy are good, at least for its electricity sector in the 1980s. Based on the development of natural gas and lignite resources proven to date and on the continued expansion of its hydro potential, Thailand should be able to reduce its share of imported energy for the electricity sector from about 72% in FY81 to 11% in FY86. However, without a substantial increase in the natural gas and lignite reserve position or the development of international hydro potential, Thailand will re-emerge in the 1990s as a major importer of energy for its power sector. In the other large energy consuming sectors, i.e., transportation and industry, the prospects

for converting to other forms of energy are rather limited in the near term. Thus, there is a need to focus on curtailing energy demands and encouraging greater energy conservation.

Energy Investment Program. The Government's policy is to reduce Thailand's dependence on imported energy by developing indigenous energy resources such as natural gas, lignite and hydro potential. Large investments are required to meet Thailand's energy demand in the 1980s. The annual cost of the energy investment program will be in excess of $300 million for oil and gas, $100 million for refineries and $50 million for lignite development. Other investments in energy production and conservation will be needed to reduce the country's dependence on imported energy in the future. For the power sector, capital expenditure to meet increased demand is estimated at $6,700 million during the period FY82-86 of which 83% is accounted for by EGAT.

ANNEX IX

MALAYSIAN - ENERGY PROFILE

Malaysian Energy Situation

Malaysia is among a small group of countries that can still increase their energy consumption slightly without risking economic chaos, compared with the prospect for declines in most other countries. Malaysia's energy consumption will increase an estimated 13 percent annually through the mid-1980s, reaching a level of 350,000 b/d oil equivalent by 1985. By 1985, requirements for imported oil are expected to rise to 265 MB/D but these imports will not be a net drain on foreign exchange reserves, because Malaysian oil exports should be about 500 MB/D. By the mid-1980s energy demand growth may moderate because the pace of Malaysian energy-intensive investment will probably slow, and the small but growing conservation faction within the state oil company will likely become more effective. By then we expect that increased exploitation of gas reserves will help temper oil import needs, and LNG exports will begin to generate export earnings.

Nevertheless, the need to develop alternative energy source and to broaden energy base in Malaysia is being given urgent attention by the government. At the recent Second Meeting of ASEAN Economic Ministers on Energy Cooperation on 27th April 1981, Malaysia's Deputy Prime Minister pointed out that:

> "the current insecurity of world oil supply and the drastic rise in crude oil prices are compelling reasons for ASEAN countries not only to lower their dependence on oil but also to diversity their energy base, giving prominence to the development and utilization of alternative energy sources.....
> .....The man is the street puts his eggs in more than one basket, and we must in our turn keep

energy options open whenever we can, so that risks can be spread over a wide front."

Energy Demand

There is no adequate data available on a current basis for Malaysia's energy situation but its consumption of oil for 1980 on a sectoral basis is shown in the table below:

Sector	Million Barrels	'000 b/d	%
1. Electricity	18	48	30
2. Transport*	16	44	27
3. Manufacturing	9	23	14
4. Agricultural	5	13	8
5. Commercial	5	13	8
6. Residential	4	12	8
7. Mining/Quarrying	3	8	5
TOTAL	60	161	100

*Includes private vehicles

SOURCE: SIRIM

The power and transport sector account for over half of Malaysia's energy consumption. Due to their relatively high income elasticity of demand, these sectors are likely to increase their energy requirements as the economy expands.

Malaysia is dependent upon oil for almost 95% of its commercial energy requirements, while hydro accounts for about 3% and the remaining 2%

comes from charcoal and firewood. According to Petronas, the national oil company, domestic oil consumption has more than doubled from 98.9 MBD in 1975 to more than 150 MBD in 1980. The highest growth rates by specific petroleum products during this period were registered by premium mogas, LPG, and fuel oil which grew in excess of 10% per annum. The government has raised domestic retail prices three times since 1975 -- once in 1976 and twice in 1979 -- but demand has continued to grow nevertheless.

A recent study by a SIRIM staff member projects that through the year 2000 Malaysia will be heavily dependent upon oil as a source of energy. These projects, shown in Table 1, assume that Malaysia's economy grows at an annual rate of 8% between 1980 and 1990 and then at 5% up to the year 2000. It also shows that the power sector's demand for energy will increase from 12% to 18% by 2000. At the same time, as shown in Table 2, the power sector's demand for oil will increase at an annual rate of 10% but (see Table 3) will still only account for about 1/3 of the sector's demand for energy. This same study also estimates that without the development of alternative energy sources and increased conservation, Malaysia will become a net importer of oil by 1990.

The other energy options that are available to Malaysia which could be considered as indigenous resources are hydro power and natural gas. Gas reserves in Malaysia are about three times the oil reserve in equivalent energy term and hydro potential is enormous, especially if this form of energy could economically and feasibly be transferred from the vast potential in Sarawak to the high consuming areas of the Peninsular of Malaysia. However, this energy option requires heavy capital investment as well as long lead time for development. Other energy options are also being pursued and looked into.

Malaysia's proven oil reserves according to Petronas stands at approximately one billion barrels. At the current rate of production it has been estimated that these reserves will be exhausted in ten to eleven years. For this reason, Petronas official policy regards oil as a depleting and non-renewable resource and, therefore, requires that a "cautious approach" be taken to the development of the country's energy resources. Therefore, since Malaysia will never become a major oil exporter, energy development and not export activities are central to Malaysia's long term planning.

For this reason, Malaysia's energy policy evolves around 2 strategies:

* Conservation of existing oil reserves; and
* Development of gas deposits for the rapidly growing domestic needs

Malaysia's petroleum fields contain 4 times as much gas as crude oil. It follows that in its energy policy, the best course for Malaysia to follow would be to develop these gas fields and diversity energy consumption so as to use more and more gas in place of oil.

Oil Production

For historic, financial, and technical reasons, Malaysia has found it advantageous to market an estimated 85% of its production abroad and purchase less costly high sulpher heavy crude from the Middle East at cost differential of approximately $4 per barrel.

Exports are shipped directly from the wellhead to ships for transport to the foreign markets since Malaysia does not refine any crude for the foreign market. Three major refineries in Malaysia (118 KBD) and one in Singapore (16 KBD) supply the domestic demand for petroleum.

Although Malaysian production of crude oil has increased dramatically since 1975 (as shown in Table 4), the government has adopted a conservative strategy for further exploitation of its limited resources. Currently the sale of crude oil abroad not only finances the purchase of heavy high sulpher (and less costly than the Malaysian crude) petroleum from the Middle East but also provides a net positive contribution to the balance of trade. Economic planners and decision makers clearly wish to postpone the day when the oil resources become depleted and the economy must finance the import of crude oil.

At the moment, crude exports take second place only to natural rubber among the country's exports and are set to overtake it in 1980. Crude sales have risen rapidly from 7.35 million tones in 1977 to 9.15 million in 1978 and an estimated 12.11 million last year (see Table 5). Their value reached a provisional MS$4127 million in 1979, netting 17 .% of all export earnings, compared to 13.1% a year earlier. The main customers are Japan and the US West Coast. Malaysia also exported some 342,000 tons of petroleum products in 1979, though it stopped re-exporting crude and partly-refined petroleum from Brunei in 1977.

The future of crude exports depends, of course, on production limits and o- the level of domestic demand. Currently most estimates place the latter at around 150,000 b/d and project average annual growth rates of 9-10% between now and 1985, compared to 7-8% through the 1970s. Petronas has repeatedly declared that local needs have priority over exports, though the first indication of this policy having a substantial impact came only recently when the corporation announced that it would neither accept new clients for its contract sales for this year nor raise supplies to its 15 existing contract customers above the present 135,000 b/d level.

According to one report, Petronas has even talked of cutting its term contract sales to Japanese buyers in 1980 by 10%.

Any shrinkage in crude export levels would be accentuated by a growing demand for imported crudes. Only Shell's 17,000 b/d refinery at Lutong was designed to process the light, low-sulphur Malaysian crude. The other two plants at Port Dickson (Shell 90,000 b/d, and Esso 33,000 b/d) depend primarily on imports of heavier Middle Eastern crudes, which meet the local demand for middle distillates rather than light ends. Imports have grown from 3.77 million tons in 1977 and 4.22 million in 1978 to an estimated 4.4 million in 197-, when they cost the country M$1222 million, or 7.2% of all import values. Malaysia also buys in some 400,000 t/yr of products from overseas, though as the three refineries gradually raise their crude throughput -- up 5.3% to 6 million tons in 1979 -- this figure is dropping.

In 1979, the export volume of crude petroleum amounted to 82.64 million barrels or a daily average of 226,400 barrels. When compared to the average daily export of 129,000 barrels in 1976, there was an increase of 75%.

The export volume by destination in 1979, as indicated in Table 6, shows that major portion of Malaysia's petroleum exports went to Japan.

However, one striking feature is the significant jump in the exports to ASEAN countries from about 15% of total exports 1977 and 1978 to 22% of total exports in 1979 (also in Table 6)

In 1980, exports of crude and partly refined petroleum are expected to reach M$5,400 million accounting for about 22% of total export receipts compared with M$861 million or 9% of total export receipts in 1975

Therefore, in terms of ranking, the export of crude and partly refined petroleum has been elevated from the fifth position in importance in 1975 to the second position in 1980, next only to manufactures.

Most observers agree that Malaysia could easily produce up to 500,000 b/d, and given the rate of growth of recent years that would not have seemed an unrealistic short-term target. But over the past year, the government through Petronas, has begun applying noticeable pressure to limit output. In part, the authorities explain this by recalling their officially "conservationist" approach, which received much publicity in the mid-1970s. This states that the continued export strength of Malaysia's four other major commodities -- rubber, tin, plam oil and timber -- makes oil production a luxury rather than a pressing need, and that the oil would be better left under the seabed. The sincerity of this policy has been questioned, however, in the light of the extremely rapid exploitation of crude that has taken place. Petronas now says that his was to allow the foreign companies to recover their costs in a short time, and that the long-term development needs of the local population must now take precedence. This is now being promoted as a "depletion policy".

It is clear that officials have been struck by the uncomfortably slow rise in the country's recoverable crude reserves and the prospect of almost complete exhaustion of those reserves by the end of this decade. According to Rastam Hadi, Managing Director of Petronas, in an interview with Petroleum Economist, remaining proven recoverable reserves (using primary recovery) now total only 1.4 billion barrels, while it has been estimated that enhanced recovery methods could bring the figure up to some 3 billion. The former compares well, though, with the 1.04 billion barrels given for third-quarter 1979, and the 0.9-1 billion barrel-figure current for some years before then.

The total has been bolstered in the interviewing period by recent discoveries, mainly off Trengganu, but it is difficult to get an accurate field-by-field picture of reserves. Partly this is a question of confidentiality, and partly a question of a lack of verification. All reserves est-mates to date are company figures, checked b- Petronas, though in future the corporation aims to bring in independent consultants to provide their own figures for the important fields. The following, though, are accepted estimates revealed by the authorities (in million barrels): Tapis 300, Pulai 70; Bekok 70; Samarang 85; South Furious 40; Baronia 80; Takau 30 and Temana 30. There was controversy of 50 million barrels but the company countering with 20 million. The remaining 645-675 million barrels are assumed to be widely distributed over the 14 other structures either in production or declared commercial, and the many non-commercial finds.

The overall total could support production at the current rate for only some 12-13 years, and while Rastam Hadi and Petronas' chairman, Tan Sri Abdullah Salleh, remain hopeful that exploration will unearth at least moderate-sized new deposits in future, long-term thinking is turning steadily towards the development of natural gas as a major alternative and supplement to crude. The gas option has been available since the early 1970s, when the huge non-associated gas reserves north of Sarawak were discovered and proposed as the source for an LNG project, but it is only in the last two years -- when gas policies have begun the climb towards parity with crude and external pressures to restrict oil production have appeared -- that the exploitation of smaller gasfields and the currently wasted associated gas has become a priority in Malaysia.

And it is the recently imposed control on the flaring of that associated gas -- as proposed in C. Itoh's "master plan" for Petronas, drawn up in 1978 -- that has done the most to curb crude output in the past year.

The exact scale and spread of natural gas reserves is, as with oil, to some extent a matter for conjecture. Rastam Hadi confirmed the estimate made in 1979 by the head of Petronas' research department of 27 trillion cu. ft. recoverable -- which included both non-associated and an unspecified, though small, amount of associated gas. Shell and the banks involved in financing the LNG scheme, however, have a figure of 23.4 tcf non-associated only, and as early as 1978 -- before recent discoveries -- the level of associated gas reserves was put at 6 tcf, which makes Malaysia's gas resources almost four times as great in energy terms as its oil.

Only a tiny proportion of the gas currently flowing is commercially utilized. Most, of course, is flared, though the companies and Petronas will not release figures on the extent of flaring and other wastage. According to Petronas, about 5% of the gas is used on the platforms for power generation purposes -- some 16 MMcf/d -- and United Nations statistics indicate an average of 9.5 MMcf/d used commercially in the first eight months of last year. The remainer -- over 300 MMcf/d -- is assumed to have been flared off.

The small amount utilized -- which has stayed at the 8-9 MMcf/d level throughout the 1970s -- is all from Sarawak fields situated close to the shore. The biggest user is believed to be Brunei LNG, over the border at Seria, which takes less than 4 MMcf/d from the Fairley-Baram field straddling the boundary between the two countries. This is fed into the BLNG gas collection pipeline grid. Other customers include a small Sarawak Electricity Council power station at Miri (the country's only gas-fired unit), the Shell

refinery at Lutong, a brickworks at Miri and some factories in the area.

TABLE 1

PROJECTIONS OF MALAYSIAN ENERGY CONSUMPTION ('000 TJ)

Type	1980	1985	1990	1995	2000
Petroleum	225 (88%)[1/]	350 (80%)	558 (85%)	768 (84%)	1030 (82%)
Electricity	30 (12%)	58 (10%)	100 (15%)	149 (16%)	223 (18%)

1/ Figures in the parenthesis are the percentage share of the energy type.

TABLE 2

Projections of Petroleum Products Demanded by the Power Operating Sector ('000 TJ)

	1980	1985	1990	1995	2000
Electricity Demand	30	56	100	149	223
Hydro Supply[1/]	4	7	12	17	25
Balance of Electricity to be provided by petroleum products	26	49	89	132	198
Power Generation petroleum demand	106	163	244	318	419

1/ National Electricity Board's projections

TABLE 3

Projections of Total Petroleum Demand in Malaysia ('000 TJ)

Type	1980	1985	1990	1995	2000
Non-electric Petroleum	225	357	558	768	1030
Electric Petroleum	106	163	244	318	419
TOTAL	331	520	802	1086	1449

TABLE 4

Oil Production (BPD)

	Volume	% Growth
1975	98,027	-
1976	165,390	69%
1977	183,600	11%
1978	216,900	18%
1979	283,000	30%
1980	266,000	-6%

SOURCE: PETRONAS

TABLE 5

MALAYSIA: OIL TRADE 1977-79
Thousand Tons

Crude Oil	1977	1978	January-September 1978	January-September 1979
Imports				
Kuwait	804.7	1016.5	484.3	1746.7
Saudi Arabia	2106.7	2472.3	1962.4	1201.0
Iran	812.3	714.6	618.4	173.1
Brunei	47.8	-	-	-
Others	-	21.3	21.3	-
TOTAL	3771.5	4224.7	3086.4	3120.8
Exports				
Japan	3386.2	4848.5	3480.3	3893.0
USA	2768.6	2790.9	1900.2	2516.7
Singapore	205.5	606.1	336.1	1373.9
Thailand	478.5	491.0	317.0	328.0
Philippines	390.6	195.2	168.6	333.1
Others	124.8	291.1	218.8	239.6
TOTAL	7354.2	9152.8	6421.0	8684.3
Petroleum Products				
Imports	1578.4 a)	1000*	750*	400*
Exports	638.2 b)	292.5	184.5	258.5

*Estimate

a) Includes 236,000 tons partly refined petroleum.

b) Includes 368,100 tons partly refined petroleum.

SOURCE: Dept. of Statistics

TABLE 6

Destination of Exports 1977-79

Units: Barrels Per Day

Destination	1977 Volume	1977 % of Total	1978 Volume	1978 % of Total	1979 Volume	1979 % of Total
Japan	68,400	46	98,220	53	108,027	48
United States	56,470	38	52,750	28	63,808	28
ASEAN Countries	22,130	15	29,350	16	49,726	22
Others	2,670	1	6,050	3	4,849	2
TOTAL	149,670	100	186,370	100	226,410	100

SOURCE: Petronas

TABLE 7

Export Volume & Value 1976-1979

EXPORTS

Year	Volume (Million Barrels)	Value (Million US$)	Average Unit Value (US$/Bbl)
1976	47.1	596.5	12.66
1977	54.63	769.8	14.12
1978	68.0	967.7	14.23
1979	82.64	1,755.0	21.4

SOURCE: Petronas

ANNEX X

SINGAPORE - ENERGY PROFILE

Singapore - Energy

Singapore, has no natural energy resources, and depends entirely on imported fuel. As a result of its vigorous industralization programme since Independence, the consumption of electricity, gasoline, and burning oil has been on the increase, The per capita consumption of petroleum products in Singapore has risen from 476.6 kg in 1966 to 1,102.2 kg in 1977 - an increase of more than 2.3 times in 12 years. The percentage of petroleum products used for electricity generation and gas production has risen from 44.3% in 1966 to 52.5% in 1977.

The need to increase domestic productivity and the improvement of the standards of living are the two main contributing factors to the high demand of energy. The increase of demand in electricity is at the average of 15.7% in eight years up to 1973, with 24.9% in 1972. It dropped to 3.1% in 1974 as a result of the oil crisis in 1973. Since then the demand continues to rise to 14.1% in 1978.

The GDP growth rate on the other hand, increase more than the rate of per capita consumption of electricity. This indicates that the demand is not only to meet the target of productivity, but also to increase the standard of living.

The authority in charge of the production and distribution of electricity, gas and water in Singapore is the Public Utilities Board (PUB). In 1978, the PUB consumed 1,480,000 tons of fuel oil and 6700 tons of diesel oil for the generation of electricity. To produce gas, 38,600 tonnes of naphtha were used. 4,000 tons of liquefied petroleum gas (LPG) were purchased. The total primary energy consumption in Singapore for that year and the consumption by the PUB is as follows:

Products	Total Primary Energy Consumption tonnes	PUB Consumption tonnes	%	Fuel bill for PUB million
Fuel oil	1,500,000	1,480,000	78.9[illegible]	S$273.83
Diesel oil	[illegible],000	[illegible],700	1[illegible]	-
Naphtha	[illegible],000	35,600	59.5[illegible]	S$ 12.41
LPG	[illegible],000	4,000	6.8[illegible]	S$ 1.49
Total	[illegible],000	1,[illegible],300 (97.5[illegible])		

BEST AVAILABLE

The consumption of energy to generate electricity is therefore high. A substantial amount of funds is therefore required to finance the expenditure including transmission and distribution cable network, load dispatch centers and substations. It is also obvious that considerable saving of foreign exchange would result if the electricity consumption is reduced, not only in fuel oil but also in the purchase of equipment. The utilization of gas in 1978 is as follows:

The utilization of gas in 1978 is as follows:

Domestic	[illegible] million units	[illegible]
Commercial	[illegible].1 million units	31.0%
Industrial	[illegible] million units	10.0%
		100%

Source: University of Singapore

In the industrial sector, petroleum refineries and products industries account for about a quarter of the total consumption of electricity followed by the electronics and other metal products industries such as the steel mills and the chemical, rubber, and plastics industries. While the industrial sector consumes most electricity, it is not always easy to conserve energy without replacement of plants and equipment. It is reported that two local oil refineries will be investing S $17 million (US$7.7 Million) on energy saving equipment and expect to save over half a million barrels of oil a year.

In the domestic sector, the total consumption appears to be less significant. However, with rising affluence there is a tendency of using more electricity than absolutely necessary. Many private homes are full air conditioned. As a result private housing, on an average may use 3 times the electricity of a public 2-room unit built by the Housing and Development Board (HDB), and more than 1 1/2 times in gas consumption.

BEST AVAILABLE

Unfortunately the options for alternative sources of energy are not apparent in Singapore. The maritime climate limits the availability of solar energy. The average direct sunshine hours is about 5.6 hour per day. The annual mean daily total radiation is about 4.46 kwh/m2 for about 66.5% of the days in a typical year. This is not unlike certain parts of the temperate zone. However, there is no seasonal change in Singapore, and during partially cloudy and overcast days there is a substantial amount of diffuse radiation present. These conditions render it possible for solar hot water appliances to function reasonably well. At present there are several companies assembling solar hot water appliances for domestic and commercial projects which include hotels, clubs and hospitals. There is no work at present on solar water pumping.

Solarvoltaic cells are applied to a telephone in a remote island which is not served directly by the PUB network. No solar air conditioning installation is made, though the University of Singapore is to set up an experimental building to test the efficiency of a unit which is commercially available. No biogas work is done, though the local pig farms could supply sufficient waste to generate biogas. Wind energy is not considered viable at this stage, as the calm period in Singapore is about 30% of the days in a year. It may be possible to use wind energy on the smaller islands, south of the main island of Singapore where winds are expected to be stronger.

Singapore does not consume coal at present although the feasibility of introducing coal-fired power plants is presently under consideration. If environmental concerns can be arranged, then it is possible that coal use will begin in 1987 as shown in table 1, for this reason, Singapore is interested in fluidized bed combustion for its potential power plants.

Table 1 Proposed Coal-Fired Projects (1980-2000) in Singapore

Coal-Fired Power Plant	1980 - 1986	1987	1988	1989	1990	1991	1992	2000
PULAN SERAYA Phase 1 (MW)	-	700	-	-	-	-	-	-
PULAN SERAYA Phase 2 (MW)	-	-	-	-	700	-	-	-
PULAN SERAYA Phase 3 (MW)	-	-	-	-	-	-	-	700
Total (MW)	-	700	-	-	700	-	-	700
Coal-fired Accumulated Total (MW)	-	700	700	700	1,400	1,400	1,400	2,100
Coal Requirement for Electricity (1,000 tce)	-	1,600	1,600	1,600	3,200	3,200	3,200	4,800

Singapore - Conservation

Because it has no indigenous energy resources, Singapore places a high priority on energy conservation. Because much of the energy consumed is in the form of electricity efforts have focused on increasing the efficiency of electrical use.

The utilization of electricity in Singapore in 1978 is as follows:

Public lighting	52 GWh	1%
Domestic	888 GWh	17%
Commercial and Entertainment	1667 GWh	32%
Industries	2607 GWh	50%
		100%

Source: University of Singapore

Electricity consumption

In the commercial and entertainment sector, mainly due to lighting and air conditioning. While the illuminance levels in offices are generally not excessive, there is a tendency to over-light supermarkets and departmental stores with the hope that higher illuminance levels would attract more customers. Commercial buildings such as highrise offices and places of public resort including cinemas, restaurants and theatres are normally air conditioned, and consume much electricity. In a typical high-rise office building, for example, the following percentages are often found:

Airconditioning	40 W/m^2	55%
Lighting	18 W/m^2	25%
Others (lifts, electrical appliances, etc)	15 W/m^2	20%
	73 W/m^2	100%

University of Singapore

It is obviously that the electricity used for air conditioning is high and conservation is necessary.

"Save Energy" Campaigns

The energy crisis in 1973 prompted the authorities to organize a nation-wide "Save Energy" campaign. The electricity consumption was reduced to 3.9% in 1974 from an annual growth rate of more than 15% from 1966. However, the consumption rate increased to 8.1% in 1975, and had risen steadily to 15.3% in 1978. This naturally caused concern and in 1979 a second "Save Energy" campaign was launched. In addition to using the mass media such as newpapers,

TV and radio, conferences, seminars and talks were organized by the PUB officers and other professionals in energy conservation. Leaflets were published to advise households how they may conserve energy in lighting, cooking, and the use of electrical appliances such as refrigerators and air conditioners. The public was also encouraged to report to the PUB any misuse of lighting, and the PUB officers would investigate. The three-month long campaign in April, May and June of 1979 generated much public interest and response. It was estimated that the saving of electricity consumption of all sectors over these three months was about 5%.

In 1981, the PUB's conservation campaign included the establishment of an Energy Conservation Center to provide free advice to the public (domestic and small consumers) on how to save energy. This effort involves also the Ministry of Trade and Industry, Consumers Association of Singapore, the Building Central Division, Registry of Vehicles, and the Economis Development Board. However, the PUB has set an example for buildings by achieving its 10% target in energy reduction by cutting energy waste. For instance, the air conditioning system is switched off for half an hour during lunch time. Fewer elevators are used during off-peak hours and lighting is reduced by installing individual switches instead of a central one.

Building Design and Regulations

The first major nation-wide conference in energy conservation in buildings was held in September 1976. Several recommendations to amend the existing building regulations have been made, including building fabric, air conditioning natural ventilation and artificial illumination, in order to reduce energy consumption in buildings. At this conference it was announced that a research grant donated by the Board of Architects and the Professional Engineers Board, the registering bodies for the two professions, for research on energy conservation to be done. The Building Control Division(BCD) of the Public Works Department, the relevant authority in building approval, was requested to take upon this task.

Accordingly a BCD Committee on energy conservation was set up under the Chairmanship of the Assistant Director (Building Control), with representatives from the University of Singapore, Singapore Institute of Architects, Institute of Engineers Singapore, Association of Consulting Engineers, Public Utilities Board, and the Public Works Department. A Research Committee was also established within the Committee (under the Chairmanship of the author) to conduct research work.

The 2-year research project was completed in 1979, and the recommendations of the Committee were accepted by the authorities and incorporated into the Building Control (Space, Light and Ventilation) Regulations, and were published as a Handbook on Energy Conservation in Buildings and Building Services (PWD, Singapore 1979).

In lighting, the most significant addition to the regulation is that maximum

permissible lighting loads were stipulated for various building types as shown in Table 2.

TABLE 2 Table on Maximum Permissible Lighting Load

Type of Building	Maximum Lighting Load W/m^2
Offices	20
Classrooms	20
Lecture Theatres/auditorium	25
Shops/Supermarkets/ Departmental Stores	30
Restaurants	25
Lobbies	10
Stairs	10
Car Park	5

Source: University of Singapore

The designer is permitted to use any system he wishes, provided that the total load does not exceed the maximum permissive consumption. Good lighting practice such as choice of lamps and luminaires, use of localized lighting, switching, control and maintenance, are advocated. However, no Singapore Code of Practice in lighting is available for the time being.

In air conditioning, the American Society of Heating, Refrigeration and Air conditioning Engineering (ASHRAE) concept of Overall Thermal Transfer Value (OTTV) forms the basis of the regulation. The OTTV is a hypothetical value of the thermal performance of the enclosing walls of air conditioned buildings. It depends on the amount of sun received on the walls, the heat transfer between indoors and outdoors, the weight per unit area of the walls, and the thermal transmittance coefficience ('U'Values) of the walls. The constants of the concept such as solar factor, equivalent temperature difference, indoor-outdoor temperature difference, have been determined by the research team. Variables such as shade coefficients of sum-breakers over clear glass are also calculated, and 'U' values are obtained from standard thermal conductivities of building materials.

The maximum permissible OTTV depends on the desirable reduction of electricity consumption and the practicality of insulating the building fabrics from the sun and external heat. Investigation by the research team has indicated that according to the constants derived from measurements, the OTTV of an average high-rise commercial building is about 65 W/m2, and a reduction of electricity consumption of 10% is possible if the OTTV is reduced to 45W/m2.

All proposed buildings to be air conditioned in Singapore are now required to be designed for an OTTV of 45 W/m2.

Fig 4 shows a survey of six major buildings in Singapore. Though the results are rather scattered, it may be seen that , in general, the average monthly energy consumption and the percentage of fenestration are proportional to the OTTV.

Fig 5 shows the theoretical electricity saving in air conditioning if the OTTV is reduced, as compared with an existing building.

Fig 6 shows the expected saving of a building if the shade coefficients and insulation of spandrel walls are improved. The working of the OTTV is outlined in this paper as Appendix 1.

For roofs of all Buildings maximum 'U' values are regulated according to the unit weight of the roof as follows:

Weight Group	Weight Range (kg/m^2)	Max Thermal Transmittance ($W/m^2\ ^oK$)	
		Airconditioned Building	Non-airconditioned Building
Light	Under 50	0.5	0.8
Medium	50 to 230	0.8	1.1
Heavy	Over 230	1.2	1.5

Source: University of Singapore

The purpose of insulating the roof is to reduce the cooling load of air co-ditioned buildings and to improve the thermal comfort in non-airconditioned buildings so that there may be no need to introduce air conditioning later.

In air conditioning systems, more precise analyses instead of rule-of-thumb methods are required, Minimum fresh air supply is stipulated according to the use of the building, and the ventilation rate is not to exceed 30% of the minimum fresh air supply. Zoning and control is required for each air conditioned space. Insulation of chilled water pipe is also regulated and the indoor conditions are limited to the following:

Maximum dry bulb temperature	27°C
Minimum dry bulb temperature	23°C
Maximum relative humidity	75%
Maximum air movement	75 m/min

It may be seen from the above that there is a definite attempt in energy conservation. However, the minimum dry bulb temperature could be raised for certain buildings such as offices where such low temperature is not necessary. Advantage could also be taken in air movement for local relief.

For non-airconditioned buildings, window openings are increased from 5% of the floor area of an occupied space to 7.5%, while the overall window area

including openings is increased from 10% to 15%. This is to encourage the use of natural lighting and ventilation. Use of cross ventilation and sun-breakers are also encouraged.

For industrial buildings, roof ventilators or jack roofs are to be used. Spacing of the jack roofs is reducing from 13 m to 9 m, and the spacing of the jack roof is to be 1.2 m per metre run.

Upgrading of existing buildings

While the building regulations are expected to reduce the energy consumption of new buildings, existing buildings continue to consume energy. This is not satisfactory. It has been announced that existing air conditioned buildings will be required to pay 20% surcharge of electricity if the building fabric is not improved to the OTTV of 45 W/m2. This means that the external walls of existing air conditioned buildings are required to be further applying insulating materials on the opaque sections, double-glazing, or adding external sun-shading devices. Obviously there will be capital cost, but in the long run, particularly in view of national interest, the saving of energy would compensate the initial expenditure.

Other measures being considered as follows:

(1) Replacement of existing equipment - Existing equipment which have low coefficient of performance could be replaced by efficient type.

(2) Installation of control - Some existing systems have insufficient control and do not respond to climate conditions or internal heat gain. Better control would reduce energy consumption.

(3) Artificial lighting - Some existing installations have higher lighting load than that prescribed by the revised building regulations. The excessive illuminance is wasteful.

(4) Reduction of infiltration - Air leakage through windows which are not properly sealed and openings without doors or air curtains are sources of wastage. Considerable saving could result if the infiltration could be minimized by weatherstripping of windows and enclosure openings.

The implementation of these measures, however, is not going to be easy. Building owners are unlikely to upgrade their buildings unless some incentives are being given. They may be in the form of tax concession such as shorter write-off periods. However, the methods of computation, the actual amount deductable and the depreciable capitalized costs to be exercised by the authorities, are expected to be complicated. To-date no definite decisions have been made.

ORIGIN OF OTTV

The OTTV is derived by ASHRAE (The American Society of Heating, Refrigeration, and Air-Conditioning Engineers, Inc.). It is contained in the ASHRAE Standard 90/75 "Energy Conservation in New Building Design". The Singapore guidelines are based on section 4.4 "Criteria for Type 'B' Buildings" which include all non-residential buildings. Under 4.4.3 "Cooling Criteria", the OTTV's are stipulated according to the latitude of the location, and varying from 38 BTU/H.FT² (121 W/m²) at 56°N to 29 BTU/H.FT² (92 W/m²) at 24°N on a linear graph. The expression of OTTV is given as follows:

$$OTTV = \frac{(U_w \times A_w \times TD_{eq}) + (A_f \times SF \times SC) + (U_f \times A_f \times \Delta T)}{A_w}$$

(see note below)

OTTV = overall thermal transfer value

where

U_w = the thermal transmittance of all elements of the opaque wall area Btu/h.ft².F (W/m²K)

A_w = opaque wall area, ft² (m²)

U_f = the thermal transmittance of the fenestration area Btu/h.ft².F (W/m²K)

A_f = fenestration area, ft² (m²)

TD_{eq} = equivalent temperature difference F° (C°)

SC = shading coefficient of the fenestration

ΔT = temperature difference between exterior and interior design conditions

SF = solar factor value given Btu/h.ft² (W/m²)

A_w = gross area of exterior walls, ft² (m²)

NOTE: Where more than one type of wall and/or fenestration is used, the respective term or terms shall be expanded into sub-elements, as:

$$(U_{w1} \times A_{w1} \times TD_{eq1}) + (U_{w2} \times A_{w2} \times TD_{eq2}), \text{ etc.}$$

THE OTTV CONCEPT

The first expression of the equation, $(U_w \times A_w \times TD_{eq})$, involves the U-values, the area, and the equivalent temperature difference of the opaque wall area. The TD_{eq} is a term developed by the ASHRAE. It embodies the heat capacity, solar radiation on the wall, and temperature difference between indoors and outdoors. This caters for the static and non-static heat flow across the opaque wall. The U-value of the opaque wall includes the air film of the surfaces, air cavity in the construction, if any, and the thermal resistances of the materials used. This expression thus determines the heat gain through the opaque wall.

The second expression, $(A_f \times SF \times SC)$ includes the area of the window, the solar factor, and the shade coefficient of the glass. The solar factor is the average solar radiation on vertical surfaces of the four orientations, and is measured to be 130 W/m². The shade coefficient of the glass depends on the type of glass to be used, and the external sun shading devices installed. Thus this expression gives the heat gain due to the sun on the window.

The third expression $(U_f \times A_f \times \Delta T)$ has to do with the gain of the glass, not due to the sun, but due to the indoor and outdoor temperature difference, ΔT, which is to be 5°C for Singapore. The U-value of the glass, U_f, varies a little with the thickness of the glass, and is reduced by the use of double glazing.

The sum of these three expressions gives an indication of the thermal performance of the total wall. To convert to unit area, it is divided by the total area of the wall, and the quotient is the OTTV.

SINGAPORE MODIFICATION

The ASHRAE standards are for American conditions, and modification for Singapore conditions are necessary. The following are the changes made:

1 **Design Temperature**
Temperature difference between exterior and interior design condition for Singapore is 5°K (5°C). This is based on the average maximum daily temperature at noon of 30°C and the average indoor temperature of 25°C.

2 **Solar Factor**
The solar factor used by ASHRAE is substantially higher than that of Singapore. The American standards vary from 145 BTU/H.FT² (462 W/m²) at 56°N to 127 BTU/H.FT² (404W/m²) at 40°N, then to 117 BTU/H.FT² (373 W/m²) at 24°N. No data are shown below 24°N. Measurements made locally indicate that, for vertical surfaces, the annual average of all orientation is about 130 W/m², which is now used as the standard solar factor for Singapore. For the actual orientation of a wall for which OTTV is to be calculated, the following is to be used:

$$SF = 130 \times CF \text{ (W/m}^2\text{)}$$

where CF is the correction factor with reference to the orientation of the wall in question as follows:

Orientation	N	NE	E	SE	S	SW	W	NW
Correction Factor CF	0.72	1.00	1.25	1.02	0.74	1.02	1.25	1.00

(The correction factor for other orientations may be found by interpolation)

3 **Equivalent Temperature Differences (TD_{eq})**
As the solar factor in Singapore is substantially less than that used by ASHRAE, these differences are accordingly reduced as follows:

Singapore

Wall Construction — Mass/Unit Area	TD_{eq}
0-125 kg/m²	16°K
126-195 kg/m²	12°K
over 196 kg/m²	10°K

ASHRAE

Wall Construction — Mass/Unit Area	TD_{eq}
0-125kg/m²	24.5°C
126-195 kg/m²	21.0°C
196-345 Kg/m²	17.0°C

4 **Gross area of external walls**
According to ASHRAE Standard 90/75 (item 4.2.2), the gross area of exterior walls consists of all opaque wall areas (including foundation walls, between floor spandrels, peripheral edges of floors, etc), window areas (including sash), and door areas, where such surfaces are exposed to outdoor air and enclose a heated and/or mechanically cooled space (including interstitial area between two such spaces).

The Singapore definition of gross area of external walls does not include the notes in the brackets. The following is added, "the fenestration area shall include glazing, glazing bars, mullions, joints, transoms, heads, and sills of window construction, and shall be measured from the extreme surface of the window construction".

The practice implication of the above is that the walls of an air-conditioned space, if not directly exposed to outside area, will not be included in the calculation. This is reasonable as the OTTV concept applies specifically to exposed external walls only. Also the conductivities of window frames and sashes are assumed to be the same as that of the glazing.

5 **Wall-by-wall Calculation**

The ASHRAE Standard does not make reference to orientation of the walls. In the Singapore guidelines the OTTV of each wall is to be calculated first. If there are more than one type of material and/or fenestration is used, the respective term or terms shall be expanded into sub-elements, such as

$$(A_{w1} \times U_{w1} \times TD_{eq1}) + (A_{w2} \times U_{w2} \times TD_{eq2}), \text{ etc.}$$

The OTTV's of the walls of which enclose the same space are then combined to form the final OTTV as follows:

$$OTTV_w = \frac{A_{w1} \times OTTV_1 + A_{w2} \times OTTV_2 + \ldots + A_{wn} \times OTTV_n}{A_{w1} + A_{w2} + A_{w3} + \ldots + A_{wn}}$$

6 **Maximum Permissible OTTV**

The Singapore guidelines set the maximum permissible OTTV of an air-conditioned space at 45 W/m².

ANNEX XI

PHILIPPINE - ENERGY PROFILE

Philippine Energy Situation

Oil, most of it imported accounts for over 3/4 of Philippine energy as shown in Table 1. Thus, energy demand poses a major economic problem for the government. Since the cost of imported fuel in 1979 for example equalled 97% of the country's trade deficit. The overriding goal of the Philippine energy program, therefore, is to substitute domestic energy sources for imported oil and to promote conservation and more efficient use of energy without constricting economic development. Recent declines in production from the NIDO oil field, the Philippines only source of domestic oil, after previous expectations of an increase production, have made oil substitution efforts even more critical to the nation's energy future.

The origins of the Philippine energy program stem from the difficult situation of 1973-1974. Although 94% dependent on imported oil, the Philippines found it had no control over the supply sourcing, or transportation of the oil it needed for energy. The government acted quickly to create the Philippine National Oil Company (PNOC), which today controls 60% of the islands' imports and has full transport capability. PNOC has reduced reliance on Middle Eastern oil and has assumed an active role in promoting other domestic energy-related projects.

In 1977, the government went a step further, establishing the Ministry of Energy which subsumes both PNOC and the Philippines' National Power Corporation. Its mandate was to forumulate and execute a ten-year comprehensive program that would supply energy needed for continued growth as determined by NEDA. To ensure the Ministry's plans and NEDA's projections, the entire package is re-evaluated each year.

Thus the Philippines has, in effect, fashioned a rolling ten-year energy development program, sufficiently flexible to respond to the country's changing energy conditions and requirements. During the '70s the country spent more than $500 million on energy development -- about three-fourths of which went to oil and gas exploration. For the '80s the national program calls for expenditures totalling just under $14 billion in 1979 prices. The program will bring complete electrification of the country by 1987. It will reduce dependence on imported oil from 81% in 1979 to 25.5% in 1989, and will create an estimated 470,000 jobs.

The Ministry of Energy's five-year program for 1981-85 (issued July 1980) includes plans for development of geothermal and the following "non-conventional" energy sources: fuel alcohol (alcogas - 20 percent alcohol, 80 percent gasoline); bagasse (primarily to fuel alcohol distilleries); dendrothermal; biogas; wind; "small hydroelectric resources" (mini-hydroelectric and small water-impounding projects); direct solar energy (water heating, drying); "integrated energy systems" (combination of solar, biogas and windmill plants); hot springs, marsh gas; agri-forestry waste; washeat.

The five-year plan sets the following goals for energy contribution of nonconventional systems by the end of 1985, in thousand barrels of oil equivalent (MBOE) as shown in Table 2.

The plan calls for expenditure of $569 million over the five-year period on the non-conventional energy development program, distributed as follows: mini-hydroelectric, 32 percent; alcogas, 26 percent; dendrothermal, 18 percent; windmill water-pumping, 15 percent; other technologies, 9 percent.

Geothermal. As of June 1980, the Philippines had a proven total geothermal field power capability of 986 megawatts. This figure is expected to reach 1,200 megawatts by the end of 1980. Total installed capacity is 443 megawatts. The five year plan calls for drilling of 395 wells, which at the present success ratio should establish a cumulative steam availability of 3,480 megawatts. The planned installed geothermal generating capacity by the end of 1985 is 1,726 megawatts. The plan estimates expenditure of $679.42 million on the geothermal development program during the period.

In general, 1980 was a downbeat year for the Philippine energy program. Price increases continue, and the flow rate for the Nido field, the country's one production field fell from 40,000 to 11,000 barrels per day. Philipps Oil drilled five dry wells in the Visayan Sea, dimming hopes for that area. Both Cities Service and AMOCO postponed development of their discovery fields, Matinloc and Cadlao, from 1980 to 1981. Finally, the Philippines' last independent field was discovered in November 1978 (Matinloc), over 2½ years ago.

The success story of the year is the geothermal program: geothermal plate generating capacity will be practically doubled this year, from 223 MW to 443 MW. This is the only generating capacity which will be added to the important Luzon Grid in 1980, and it is badly needed. The additional geothermal power delivered in 1980, will nevertheless, reduce estimated consumption of oil in the Philippines this year by less than two per cent.

In the medium-term, the current generation of investments in hydro, nuclear and coal should begin to contribute appreciably to the energy stream. There are no new oil discoveries or geothermal units as yet

scheduled for development during this period, but both energy sources will probably continue to make some new contributions.

The year 1983 looks particularly difficult. Although the National Power Corporation has claimed that the Magat Dam (360 MW), the Kalayaan pumped storage facility (300 MW) and the Batangas coal-fired thermal plant (300 MW) will be on-line in 1983, it seems highly unlikely that any of these units will be operating that early. All of these projects will feed into the Luzon Grid and by 1983, under conservative estimates of 6 per cent per year demand growth in the Grid, demand will overtake supply unless at least one of the three projects is ready for service.

If 1983 can be weathered, however, these generating facilities, along with the nuclear plant (assuming that construction goes forward) will make a major contribution to the energy flow in the mid-80's. By available current estimates, Magat will go on-line in 1984, and the coal-fired thermal plant, the nuclear plant and effectively, Kalayaan in 1985. (The Kalayaan pumped storage facility is designed to provide supplementary power during peak demand and depends on the nuclear plant for power to operate the pumps to store water during slack periods.) Thus, by sometime in 1985, approximately 1580 MW of additional power should be available for the Luzon Grid. (The Grid now requires, at daily peak, about 1800 MW.) The National Power Corporation plans to begin retiring oil-burning plants during this period.

Geothermal Energy

Geothermal-powered generation of electricity will take a bigger share of the Philippines energy mix by 1989, increasing to 7.2% of total demand in 1989 from 1.6% in 1979

The Philippines government's push to develop geothermal power generation is part of its $9.7 billion, 10-year energy program to cut oil imports to 47.9 million bbl/year in 1989 from 74.8 million bbl/year in 1979.

That will accompany an expected overall doubling of energy consumption, to 184.6 million bbl of oil equivalent in 1989 from 92.04 million in 1979.

It has earmarked $347 million of that budget for exploration and development of geothermal resources in hopes of increasing geothermal power generating capacity in the Philippines to 1.26 million kw in 1989 from 446,000 kw in 1980.

Plans call for an additional 714,000 kw equivalent of geothermal steam to be developed by 1989 for future power generation.

The balance of power generation's share in the Philippines' energy mix targeted in 1989 involves a switch to 6.2% from 22.5% for oil, 12.8% from 6.3% for hydroelectric power, 6.2% from 0.3% for coal, 3.5% from zero for nuclear, and 1.9% from zero for unconventional power sources.

Nonpower energy consumption would account for the remaining 62.2% of the total national energy mix in 1989.

That's a cut of 7% from 1979 in nonpower consumption's share of the nation's total energy mix.

But nonpower consumption will increase to 114.7 million bbl of oil equivalent in 1989 from 63.7 million in 1979.

Nuclear

The Philippines has one 620 MW light water reactor under construction on Bataan Peninsula. However, construction delays have pushed back its completion date until late 1984 at the earliest.

Philippines' Primary Energy Consumption

	1978	1979	1980	1st Quarter 1981
Oil				
Imported (MB)	81,071	74,896	73,718	18,012
% of total	93.5%	79.3%	79.6%	74.4%
Domestic (MB)	-	7,718	3,771	351.
% of total	-	8.2%	4.1%	1.4%
Total Oil	81,071	82,614	77,489	18,363
% of total	93.5%	87.5%	83.7%	75.8%
Coal				
MT	265,282	232,780	281,226	72,770
MBOE	947.4	768.2	928	242.3
% of total	1.1%	0.8%	1%	1%
Hydro				
MWH	2,787,125	2,878,906	3,553,700	817,894
MBOE	4,645.2	4,798.2	5,922.8	1,363.2
% of total	5.4%	5.1%	6.4%	5.6%
Geothermal				
MWH	3,200	638,244	2,049,224	691,565
MBOE	5.3	1,063.7	3,415.4	1,152.6
% of total	nil	1.1%	3.7%	4.8%
Bagasse				
MBOE	N/A	5,195.8	4,849.6	3,095.7
% of total	N/A	5.5%	5.2%	12.8%
Total Primary Energy (MBOE)	86,669.5	94,439.9	92,604.8	24,216.8
Total Indigenous Energy				
MBOE	5,598.5	19,543.9	18,886.8	6,204.8
% of total	6.5%	20.7%	20.4%	25.6%

Source: Ministry of Energy, Bureau of Energy Utilization Quarterly Review

NOTE:
1. Oil includes energy fuels only (avgas, avturbo, premium and regular gasoline diesel, fuel oil, kerosene, and LPG) and refinery fuel and loss.
2. MBOE: thousand barrels of oil equivalent; MT = metric tons; MB = thousand barrels.
3. Assume all NIDO crude converted to energy use.
4. One MBOE = 280 MT coal = 600 MWH electric energy.
5. Hydro and geothermal in terms of gross generation
6. 1 MT bagasse = 1.44 BOE

BEST AVAILABLE

Table 2

Philippine Energy Program, 1981-1985

Source	MBOE
Alcogas	
- Alcohol production	2,415.10
- Bagasse:	
- For alcohol production	1,430.30
- Excess	792.00
Dendrothermal	973.00
Mini-hydroelectric	1,610.00
Small Water-impounding Project	213.00
Solar Water Heating	12.00
Biogas	55.71
Solar Drying	1.20
Producer Gas	2.40
Windmill water-pumping	.60
Other projects (total)	1.19
TOTAL	7,506.50

Source: Ministry of Energy

ENERGY CONSERVATION

PHILIPPINES

Energy conservation has a high priority in the Philippine energy strategy. Although the most effective policy instrument has been pricing policies, several effective conservation programs, including some training courses, are administered by the Ministry of Energy's Bureau of Energy Utilization. These programs have increased public awareness of the need to conserve energy and enchanced industry's ability to cut production costs through increased effeciency of energy use.

As shown in Table 1, conservation programs have been successful over the last few years on reducing gasoline use and minimizing increased consumption of fuel oil. Table 2 indicates those industries where energy demand has been reduced or increases minimized.

The omnibus Energy Conservation Act (see attached) or "Batas Pambansa Blg. 73" provides the legal basis for energy conservation in buildings. However, due primarily to a lack of technical information, no consumption regulations have been established. Instead, the Bureau has provided training courses and seminars for those interested in reducing energy consumption. In several cases, notably the Holiday Inn of Manila and the Manila Hotel, energy conservation action teams have been formed by the building's owner to reduce energy waste.

Table 1

Petroleum Product Consumption
(Thousand barrels per day)

Products	1978	1979	1980	1st Quarter 1981
LPG	7.1	7.5	6.6	640
Av gas	0.4	0.3	0.2	15
Naphtha	1.9	2.3	2.1	201
Premium Gasoline	18.7	18.2	16.0	1428
Regular Gasoline	23.0	21.4	14.5	1124
Av Turbo	7.1	7.3	7.1	649
Kerosene	10.1	9.5	8.7	757
Diesels	42.7	46.5	47.7	4725
Fuel Oil	103.1	105.8	109.3	8358
Asphalts	1.1	1.2	0.9	111
Lubes & Greases	2.8	3.0	2.7	252
Other[1/]	1.6	1.7	1.5	131
TOTAL	219.6	224.7	217.3	19058

[1/] Includes process gas, solvents, propylene, wax and petroleum, 1981 data includes refinery fuel and loss.

Source: Ministry of Energy, Bureau of Energy Utilization Quarterly Review

Table 2

Petroleum Products Consumption by Industry
(MB)

SECTOR	1980	FULL YEAR 1979	% Change
Cement	3,363	3,441	(2.3)
Sugar	1,167	1,200	(2.8)
Coconut & Vegetable Oil	1,026	1,109	(7.5)
Mining	4,244	3,883	9.3
Power Generation	17,170	18,893	(9.1)
Fertilizer	495	487	1.6
Logging/Wood Products	1,397	1,655	(15.6)
Paper Processing	1,599	1,659	(3.6)
Lube Refinery	794	600	32.3
Textile Mills	940	1,101	(14.6)
Land Transport	1,548	1,582	(2.2)
Domestic Marine	2,076	2,171	(4.4)
Domestic Aviation	908	1,081	(16.0)
Fishing Trade	714	802	(11.0)
Glass Manufacturing	702	902	(22.2)
Steel/Metal/Nickel/Process	5,260	5,083	3.5
Contractors	1,439	1,475	(2.4)
Ceramics	204	223	(8.5)
Rubber & Tires	179	215	(16.7)
Chemicals	576	671	(14.2)
Tobacco	90	102	(11.8)
Food Processing	626	754	(17.0)
All Others	3,808	3,892	(2.2)
Refinery Fuel & Loss	3,283	3,569	(8.0)
TOTAL	53,608	56,550	(5.2)

Source: Ministry of Energy

BATAS PAMBANSA BLG. 73

AN ACT TO FURTHER PROMOTE ENERGY CONSERVATION AND FOR OTHER PURPOSES

Section 1. *Declaration of Policy.* In the face of the uncertainties of continuing world oil supplies, it is hereby declared the policy of the State to institutionalize energy conservation in order to enhance the availability of energy supplies required to support the country's economic, social and developmental goals.

Sec. 2. In order to carry out the policy declared in this Act, the heads of ministries, bureaus, and agencies of the Government, including those of political subdivisions and government-owned or controlled corporations, shall adopt and strictly enforce measures, particularly those that will facilitate and expedite official action on transactions involving the public, to promote the conservation of energy. They shall enjoin observance of such measures by their officers and employees through administrative sanctions.

Sec. 3. Towards the same end and to develop a more dynamic and effective program for the rational use of energy, the following acts are hereby prohibited:

(a) The importation, manufacture or assembling of gasoline-powered passenger motor cars with engine displacement of over 2,800 cubic centimeters of Kerbweight exceeding 1,500 kilograms, including accessories.

(b) The use of neon lights and electric lights for commercial advertising earlier than 6:00 o'clock P.M. and beyond 9:00 o'clock P.M.; and, except during the Christmas season and during the Ramadan, the deliberate use of unnecessary and excessive lighting in hotels, motels, shopping complexes, buildings, structures and similar commercial establishments as shall be determined by the Ministry of Energy in accordance with accepted electrical standards and practices.

(c) The use of government vehicles for purposes other than official business: *Provided,* That in every case, the trip ticket authorizing the use of the vehicle shall be displayed on the windshield or in another conspicuous place on the vehicle: *Provided, further,* That vehicles used by intelligence and investigative agencies of the Government shall not be covered by the foregoing proviso.

The use of government vehicles on Sundays, legal holidays, or outside regular office hours or outside the route of the officials of employees authorized to use them, or by any person other than such official or employee, shall, unless properly authorized, be *prima facie* evidence of the violation of this paragraph. For the purpose of this paragraph, vehicles owned by government-owned or controlled corporations are deemed government vehicles.

Sec. 4. Also towards the same end and to develop a more dynamic and effective program for the rational use of energy, the Ministry of Energy, after public hearings, is hereby empowered:

(a) To establish and administer a fuel allocation and rationing program during periods of tight supply, and to assure that dealers of fuel deliver the right quality and quantity of the product to their customers.

(b) To require, at reasonable profit levels, the distribution and sale of alcohol/gasoline or other energy blends in order to increase the use of domestic energy resources.

(c) To set standards of energy consumption for oil-powered or electric-driven machinery, equipment, appliances, devices, and vehicles imported into, manufactured, assembled or sold in the Philippines for domestic use, in consultation with the Ministry of Industry and the Ministry of Trade, taking into account the technical and economic limitations involved.

(d) To require industrial, commercial and transport entities or establishments to collect or cause the collection of waste oil for recycling as fuel or lubricating oil.

(e) To fix the oil refineries' production yields and product quality, especially during periods of oil shortage, taking into account the technical limitations involved.

(f) To require industrial, commercial and transport establishments consuming more than one million fuel oil equivalent liters of energy including liquid fuels and electricity annually to submit fuel and electric consumption as well as production and sale statistics, in order to properly monitor energy consumption and utilization efficiency.

(g) To set, in consultation with the Ministry of Industry, energy use standards for industrial, commercial and transport establishments, taking into account the technical and economic limitations involved: *Provided, however,* That in the case of sugar mills and refineries, the Philippine Sugar Commission shall be consulted.

(h) To require industrial, commercial and transport establishments consuming more than two million fuel oil equivalent liters of energy annually to employ qualified engineers to act as energy managers, and to submit energy conservation programs and energy audits.

(i) To regulate, in consultation with the Ministry of Public Works and the Ministry of Industry, the use of air-conditioners in offices and in commercial and industrial establishments, including but not limited to requiring the use of thermostats and setting them to certain temperatures that will conserve energy but still assure reasonable convenience to the users thereof. A permit issued by the Ministry shall be required for all new or additional air-conditioning equipment to be installed after January 1, 1981 in commercial and industrial establishments so as to ensure that capacity is not in excess of that which is reasonably required to cool the premises.

Sec. 5. The Ministry of Labor and Employment, in consultation with the Ministry of Industry and the Ministry of Trade, is hereby empowered to stagger the working hours in industrial and commercial establishments and in offices, or fix the number of working days per week in such establishments or offices, for the purpose of conserving energy and relieving traffic congestion: *Provided, further,* That in fixing working hours and working days in the Metro Manila Area, the Metro Manila Commission shall be consulted.

Sec. 6. The Ministry of Education and Culture is hereby empowered to fix the schedule of school hours in urban centers for the purpose of conserving energy and relieving traffic congestion, without, however, sacrificing educational standards; and also to prescribe the study of energy conservation in the appropriate grades or levels in schools.

Sec. 7. The Ministry of Trade, in consultation with the Ministry of Tourism and the Ministry of Labor and Employment, is hereby empowered to limit and fix the operating hours of business establishments which by their very nature have to operate on a twenty-four hour basis: *Provided,* That the Ministry of Trade shall require the manufacturers or dealers of oil and electric-consuming devices, equipment, appliances, and vehicles manufactured or sold in the Philippines to show their product's energy requirements and consumption efficiency.

Sec. 8. The Ministry of Human Settlements is hereby empowered to set standards in accordance with accepted engineering principles and practices in the use of building materials and the designs for private offices, commercial, and industrial buildings, which will promote the ends of energy conservation. The Ministry, with the assistance of the Ministries of Industry, Labor and Employment, and Education and Culture, shall also make plans and find ways to enable people to reside at a convenient distance from the place where they work and/or study.

Sec. 9. The Ministry of Transportation and Communications is hereby empowered to regulate the use of motor vehicles so as to conserve fuel and relieve traffic congestion, including but not limited to restricting the use of certain types of vehicles during peak hours of the day and during Sundays and legal holidays, or their use for certain destinations or over certain streets during Sundays and legal holidays, or their use for certain destinations or over certain streets during stated hours; or imposing carless days; or requiring the organization of car pools in specific areas or among residents of certain neighborhoods; or fixing a minimum number of passengers for certain types of motor vehicles with certain destinations; or fixing speed limits on certain highways or streets; or requiring certificates of road-worthiness before registration of motor vehicles; or denying registration to vehicles which do not meet the standards of energy consumption set pursuant to the provisions of this Act; or setting and enforcing yearly limits on the number of passenger cars that are sold and/or registered for the first time.

Sec. 10. The Ministers of the various ministries empowered to perform certain acts in the preceding sections shall conduct public hearings within sixty (60) days from the date of the approval of this Act, and thereafter issue such rules and regulations as may be necessary to implement its provisions. Such rules and regulations shall be subject to the approval of the President (Prime Minister) and shall take effect fifteen (15) days after their last publication in two (2) newspapers of general circulation in the Philippines once a week for two (2) consecutive weeks.

Sec. 11. Any person who wilfully violates any provision of Section three hereof or any rule or regulation promulgated pursuant to the authority granted in this Act shall, upon conviction, be punished by a fine of not less than one thousand pesos but not more than five thousand pesos, or by imprisonment of not less than one month nor more than

one year, or both, in the discretion of the court: *Provided*, That if the violation is committed by a juridical person, the penalty herein provided shall be imposed on the official and/or employee thereof responsible for the violation: *Provided, further*, That if the violation is committed by a government official or employee including those in government-owned or controlled corporations, he shall, in addition to the penalty provided above, be subject to disciplinary administrative proceedings and penalties: *Provided, finally*, That any passenger motor vehicle manufactured or assembled in violation of Section 3 (a) hereof shall, after proper proceedings, be confiscated and forfeited in favor of the Government.

Sec. 12. Any provision of law, presidential decree, executive order, or rules and regulations inconsistent with the provisions of this Act or with the rules and regulations issued pursuant thereto, is hereby repealed or modified accordingly.

Sec. 13. If for any reason or reasons, any part or provision of this Act shall be held unsconstitutional or invalid, no other part or provision hereof shall be affected thereby.

Sec. 14. This Act shall take effect upon its approval and shall remain in force for a period of five years thereafter.

Approved, June 11, 1980

ENERGY MANAGEMENT TRAINING COURSE
(Success Story)

I. INTRODUCTION

In support of its program to promote and encourage efficient utilization and judicious conservation of energy in all sectors, the Bureau of Energy Utilization has successfully conducted nationwide, eight (8) training courses on Energy Management in various key cities distributed as follows: four in Manila, and one each in the cities of Bacolod, Cebu, Davao and Cagayan de Oro. These training courses were implemented in cooperation with the Productivity and Development Center of the Development Academy of the Philippines (DAP). The remaining two (ninth and tenth) are scheduled to be held in February 1980 in Manila and Baguio City, respectively. A one-day post training evaluation conference to be participated in by selected graduates has been scheduled on February 27, 1980 to assess the effectivity of the program implementation.

II. OBJECTIVES

The ultimate objective of the training course is to institutionalize the energy management and conservation program at the firm level. Specifically, the training course is aimed at the following:

1. To provide the participants with a proper perspective of the government's efforts, thrusts, and goals concerning energy exploration, development and utilization.
2. To impart to the participants energy management tools and techniques to enable them to design, initiate and implement energy management and conservation program in their respective establishment.
3. To equip the participants with various operational measures and practices in achieving fuel economy in their respective plants.
4. To serve as "forum" for "idea transfer" and interaction on energy management practices.
5. Create a pool of Energy Management Specialists that will have a "multiplier effect" in disseminating effective energy conservation measures and awareness at plant level and ultimately on a national scale.

III. PROGRAM DESCRIPTION/METHODOLOGY

Each training course is designed for a specific target industry sector but generally, the course designs can be subdivided into three modules namely:

A. *Development and Energy Management Perspective Module:* This part is aimed at impressing on the participants the current energy statistics, the roles and responsibilities of high energy consuming sectors complementary to and for the attainment of societal goals, government policies/strategies to conserve energy and reduce dependency on oil.

B. *Management Development Module:* This part focuses on energy management theories, principles, philosophy and practices aimed at developing among the participants positive attitudes towards implementing energy management concerns in their respective establishments and highlights on the benefits that can be derived from such an undertaking. Topics covered among others are energy management: scope/objectives/requirements; energy survey; evaluation of energy saving opportunities; and energy monitoring.

C. *Technical Course Module:* This part deals with the fundamental and basic concepts related to energy utilization in the plant and in-plant energy conservation practices to achieve fuel economy of typical plants in the target industry mix.

Various training methodologies were utilized for effective implementation. These include lectures by competent speakers, small group discussions, plenary sessions, film showing, action planning exercises and plant visits.

The application of these various methodologies equipped the participants with the following:

- awareness of the country's long-term energy program as conceived and designed by the Ministry of Energy.
- capability to design short-term as well as long-term energy conservation and management program in their respective establishments.
- techniques to determine energy saving opportunities in their respective plants.
- management tools to evaluate these energy saving opportunities for recommendation to top management.
- management skills to implement, monitor and control energy conservation programs.

IV. TRAINING RESULTS AND EVALUATION

A. Profile of Participants

To date, a total of 304 "energy managers" have successfully completed the training courses. (See attachment for complete list of participants). They were composed of plant managers, senior engineers, supervisors and/or senior staff members. The position profiles of the participants are as follows:

Position	*Number*	*Percent*
President	1	0.4
Vice-President	11	3.6
Plant/Production Manager	55	18.1
Plant Superintendent	44	14.5
Division Head	7	2.3
Supervisor	84	27.6
Administrative Officer	5	1.6
Plant/Production/Staff Engineer	94	30.9
Others	3	1.0
TOTAL	304	100.0

A total of 141 establishments from the industrial and government sectors participated in the training courses. In 1979, the industrial sector accounted for about 40% of the country's total energy consumption. Breakdown of industry sectoral representation is as follows:

Industry Classification	*No. of Companies*
Appliance Manufacturing	1
Car Assemblers/Spare Parts Mfg./Dealers	9
Cement	6
Chemicals and Pharmaceuticals	18
Construction	1
Fertilizers	2
Food & Beverages	23
Glass & Ceramics	5
Lumber	4
Metal Working & Machine Shop	3
Mining	4
Oil Refineries	5
Power and Electric Generation	7
Pulp and Paper	2
Rubber & Rubber Products	3
Shipping	4
Sugar Millers and Sugar Centrals	18
Textile	10
Transport	11
Others (Ministries, Government Agencies)	5
TOTAL	141

B. Faculty Members

Following is the list of resource speakers for the training courses:

Vicente R. Abuyuan
Pilipinas Shell Petroleum Corporation
Arturo Alcaraz
Phil. National Oil Company
Antonio Anciano
Ministry of Energy
Llorente Bartolome
Engineering Development Corporation
Hermelando A. Bauza
Caltex (Phils.) Inc.
Rufo S. Bernardo
Petrophil Corporation
Ernesto G. Binag
National Power Corporation
Josie Blanco
Petrophil Corporation
Jaime R. Camacho
Manila Electric Company
Eduardo Q. Canela
U.P. Institute for Small Scale Industries
Col. Arturo Castro
Ministry of National Defense
Zoilo M. Cortes
Visayan Electric Company
Andrea D. Domingo
Dynetics, Inc.
Elsa T. Escano
Development Academy of the Phils.
Pablo Gabriel
Adamson University
Eduardo F. Gamboa
Philippine Sugar Commission
Prof. Ruben Garcia
U.P. College of Engineering
Antonio A. Gimenez
Delta Motors Corporation
Francisco P. Jover
Board of Investments
Francis M. Lorilla
PNOC-Energy Development Corp.
Gary S. Makasiar
Ministry of Energy
Mario M. Mencias
Manila Electric Company
Domingo S. Mendoza
Mapua Institute of Technology
Florecito S. Navarro
Bureau of Energy Utilization
Paciente R. Rebong
Phil. Cellophane Film Corporation
Maj. Eliseo Rio, Jr.
Project Sta. Barbara, Cavite
Tomas M. Rizo, Jr.
Petrophil Corporation
Fernando S. Serra
Ford Philippines, Inc.
P.R. Shrinivasan
Asian Productivity Organization
Marcelino Q. Soriano
PNOC – Energy Development Corp.
Lito Supangco
Board of Transportation
Dr. Ernesto N. Terrado
Bureau of Energy Development
Cesar Valbuena
National Econ. Dev. Authority
Efren Vargas
Mobil Oil Philippines, Inc.
Engr. Pedro Viray
National Pollution Control Commission

C. Energy Management Association of the Philippines

As a result of the successful impact of the training course on the participants, they organized and registered with the Securities and Exchange Commission, the Energy Management Association of the Philippines (ENMAP), a non-stock, non-profit body which aims to accomplish the following objectives:

- Disseminate energy conservation plans, information and techniques among its members.
- Serve as "forum" for "idea transfer" and interaction on the energy management practices.
- Institutionalize energy management and conservation practices in the industry sector.
- Provide members, in cooperation with the Bureau, adequate and updated techniques thru consultancy on effective energy management in their respective establishments.
- Invite in cooperation with the Bureau and the Development Academy of the Philippines (DAP), technical experts (local and foreign) to extend consultancy services on energy conservation techniques.

Nine members of the Board of Directors were voted from among whom the following officers were elected:

President	ALBERTO T. ABAYA VP Manufacturing Atlantic Gulf and Pacific Co. of Manila
Vice-President	PACIENTE R. REBONG Chief Engineer-Eng'g/Maint./Aux. Phil. Cellophane Film Corp.
Secretary	OSCAR O. BRUCE Energy Specialist San Miguel Corporation
Treasurer	BRUNO DE LA CRUZ Technical Assistant to VP Phil. Match Company
Auditor	VICTOR T. FRESNOZA, JR. Production Superintendent Planters Products, Inc.

The other four members of the Board of Directors are as follows:

ANTONIO A. GIMENEZ
AVP–Manufacturing
Delta Motors Corporation

CONSTANTINO DERECHO
Plant Manager
Evertex Industries, Inc.

JOSE C. CABURIAN
Asst. Manager and Engineer
Marsman and Company

CORNELIO F. CARLOS
VP Plant Manager
Ford Phils., Inc.

D. General Reactions/Comments:

To assess the effectivity of the training course in imparting knowledge and skills on energy management and conservation, two sets of training evaluation techniques were employed: firstly, the evaluation on subject matter and effectivity of the lecturer and secondly, the evaluation of the training as a whole. In addition, the evaluation further solicits suggestion for improvements of course design and its implementation.

The graduates of the training course emphasized the accomplishments generated by the 5-day training courses. A few comments were as follows:

- It is timely, appropriate, comprehensive, very interesting, informative, relevant, applicable, enlightening and motivating.
- A major thrust in the on-going concern for overall energy development, utilization and management.
- Acknowledgment is extended to the Bureau of Energy Utilization of the Ministry of Energy and the Productivity Development Center of the Development Academy of the Philippines for the successful implementation of the training course.
- The Bureau of Energy Utilization should gather successful energy-saving ideas, devices, literature, and inventions, for effective dissemination to industry as well as other users of energy.
- BEU should conduct advance courses to graduates of this program.
- The Energy Management Training Course should be an endless on-going program of the government.
- BEU should monitor the progress of the energy conservation program of companies that have participated in the seminar
- BEU should conduct a public information campaign on how to conserve energy.

V. PROGRAM FOR 1980

For 1980, in addition to the two training courses scheduled in February, the Bureau of Energy Utilization is scheduling another series of training courses which will include both basic and advanced courses.

On the part of the ENMAP, this association shares a great responsibility in giving support to the government program as far as efficient and judicious energy utilization is concerned. Thus, in view of this task, it plans to extend consultancy services to interested companies on energy management in cooperation with the Bureau of energy Utilization. Furthermore, it also plans to conduct advanced Energy Management Workshops/Conferences among the members.

LIST OF PARTICIPANTS

Renato B. Aban
Paper Ind. Corp. of the Phils.
Ricardo R. Abarro
Petrophil Corporation
Alberto T. Abaya
Atlantic Gulf & Pacific Co. of Manila
Cipriano L. Abesamis
National Power Corporation
Rogelio B. Abuloc
Vitarich Corporation
Antonio T. Acepcion
Fortune Cement Corporation
Danilo R. Africa
Mead Johnson Phils. Inc.
Marcial C. Aguirre
Phil. Sinter Corp.
Raulito T. Alcoseba
Pepsi-cola Bottling Co. of the Phils.
Pacifico D. Alesna
Phil. Match Co. Ltd.
Carmelo G. Aliermo
Holland Milk Products, Inc

COAL

Philippines

The Philippines has 150 million tons (mt) of proven coal reserves but the government believes that continued exploration can increase this figure to 550 mt as shown in Table 1.

The development of coal as an alternative energy source has been slow. As shown in Table 2, production for energy consumption fell in 1978 and 1979 after a high in 1977 of 284,500 tons.

Most of the coal is sub-bituminous or "brown coal" which averages only 6,000 BT per pound and is reportedly delivered "dirty" (with an appreciable percentage of rock or grit). The mines, principally located on Cebu Island in the Visayan Sea (85 per cent of 1979 production), are small, underground digs which must cope with fractured (split and broken seams) which ca-not be worked with the massive machinery associated with world-class coal mines.

It is believed that production in 1979 fell due to low demand. Indeed, in the near term, production will be limited by consumption and since consumption is almost entirely restricted to power plants, there is a direct relation to the growth in electricity demand. Industrial use of coal, in the cement industry, is not yet seen to be economical due to the long payback period in converting from oil.

Table 3 shows that coal plays a small role in the generation of electricity while Table 4 shows that industry is the largest consumer of power.

To maintain the use of coal, which is projected to increase from 285,000 tons in 1980 to 5.4 million tons in 1985 -- an increase that would be the

direct result of accelerated industrial conversions to coal -- the government has expanded its commitment to explore and produce coal through its corporate agencies. Imports would maintain the balance of supply and demand in the meantime. The main guideline in the government's priming of the coal-exploration sector would be to directly operate prospective coal areas whose infered reserve potential is relatively large and where the market is proximate and equally substantial. The move is meant to encourage the private sector to participate further.

By 1985 total power generating capacity of the National Power Corporation's coal plants is expected to reach 720 MW. The private sector, on the other hand, expects to increase its capacity from about 17.5 megawatts to 40 megawatts during that period. The resulting 760-megawatt capacity will require approximately 2.47 million tons of coal.

The biggest projected consumer of coal is the cement industry, whose plants are required to convert from oil to coal. Although investments in the conversion program are considerably high, the lower cost of coal will easily recover in the long run whatever load this process will put on the industry. By 1984 the rehabilitation program of the various companies will have been completed with a forecast total requirement of 1,240 metric tons. This is about 600 percent of the program's 1980 requirements. By 1985 the first one-million-ton-a-year cement plant is scheduled to start its operation which will require an additional 75,000 metric tons of coal, bringing the industry's total demand to 1.3 million metric tons of coal, or an eightfold increase within five years.

The total coal requirement by 1985 is 5.4 million metric tons, equivalent to approximately 17.82 million barrels of oil.

The upsurge of demand due to simultaneous conversion to coal-firing facilities is expected to place a heavy burden on supply. The projected coal production by 1985 is about 2.31 million metric tons.) A temporary structural imbalance would result, requiring a responsive importation program.

Local supply, however, is programed to increase yearly as supported by the country's total reserves which are now estimated at 1,150 million metric tons, categorized into proven (175 million metric tons), indicated (155 million metric tons) and potential (820 million metric tons). The accelerated pace of exploration and development, which would elevate the indicated and the potential reserves to proven reserves amounting to 550 million metric tons by 1985, will in the long run ease this lopsided supply situation. In sum, the Philippines is more interested in coal component's upstream topics such as coal development than in the combustion technologies. Specifically, their interests lie in coal exploration extraction, transportation and visiting U.S. coal sites.

Judging from the projects that the government is prepared to fully finance, it appears that the official approach in breaking the Catch-22 situation in coal supply-and-demand is to first tackle the demand side of the equation, that is to stimulate greater demand.

National Coal Authority (NCA), said that of the projects under the logistics program, the government will shoulder the full costs of the construction of the eight coal terminals and the purchase of the 12 marine vessels. He said the NCA envisages "a network of infrastructure for the transport, receiving, blending, storage and distribution of coal to meet the quality and quantity requirements of customers."

Construction of the mine loading ports for use by coal miners will have to be borne jointly by the government and the producers themselves.

The eight coal terminals, set to be operational by the end of 1982, are located near existing cement plants. Apart from serving as supply points, the terminals will also blend local and imported coal to meet the quality requirements of cement plants. Blending is a necessity as Philippine coal has lower heat-generating capacity, with an average of 8000 Btu to 10,000 Btu. It has to be blended with higher-grade, imported coal to suit the plants' heating needs.

Tiaoqui said that for 1982, the Philippines will import between 700,000 and 1 million tons of coal mainly for blending purposes and partly to make up for the expected shortfall in domestic coal production. The Bureau of Energy Development (BED) projects 1982 production at 515,000 tons. Demand is projected at 706,000 tons granting that the government's coal conversion program for the cement industry is fully implemented.

The government strategy of spending first for the downstream sector of the coal industry gives rise to the question of whether or not it is also good judgment to spend simultaneously for the upstream sector.

If exploration funds continue to be scarce, domestic supply of coal will also grow at a painfully slow pace. On the other hand, the ₱1-billion government spending for the logistics system will stimulate coal conversion and boost demand considerably. The coal terminals and the marine vessels envisioned by the system will therefore serve mainly imported coal. In such an event, it would seem that the country had merely shifted from imported oil to imported coal.

Table 1

Coal-Development Program

Year	Number of contracts (Cumulative)	Reserves (million MT)			Production (thousand MT)
		Proven	Indicated	Potential	
1980	43	175	155	820	300
1981	48	220	210	720	780
1982	-	285	260	605	1,380
1983	-	370	320	600++	1,710
1984	-	480	400	600++	1,950
1985	-	550	440	600++	2,310

++The coal program will initially intensify exploration and development activities to upgrade the category of potential and indicated reserves. accelerated exploration is expected to increase potential reserves a few years from now.

Table 2

Coal Production and Consumption for Energy Use
(Metric Tons)

	1978	1979	1980	1st Qtr. 1981
Production	254,515	263,126	328,346	94,776
Consumption	265,282	232,780	281,226	72,770

SOURCE: Ministry of Energy, Bureau of Energy Utilization Quarterly Review

Table 3

Philippine Electricity Generation by Power Source
(Million Kwh)

	1980		1st Qtr. 1981	
	Amount	% Share	Amount	% Share
Oil				
Thermal	9,134	50.7%	2,065	46.2%
Diesel	3,138	17.4%	865	19.4%
Coal Thermal	157	0.8%	26	0.6%
Hydro	3,554	19.7%	818	18.3%
Geothermal	2,049	11.4%	692	15.5%
TOTAL	18,032	100.0%	4,466	100.0%

Source: Ministry of Energy, Bureau of Energy Utilization
Quarterly Review

Table 4

Electric Energy Consumption by Sector
(Million Kwh)

Sector	1979		1979		1st Qtr. 1981	
	Amt.	% of total	Amt.	% of total	Amt.	% of total
Residential	3,081	23.7%	3,669	20.3%	1,027	22.9%
Commercial	3,168	24.3%	3,484	19.3%	819	18.3%
Industrial	4,713	36.2%	6,672	37.0%	1,502	33.6%
Utilities own use and losses	1,243	19.9%	3,026	16.8%	773	17.3%
Other	230	1.8%	1,181	6.6%	345	7.7%
TOTAL	13,014	100.0%	18,032	100.0%	4,466	100.0%

SOURCE: Ministry of Energy, Bureau of Energy Utilization Quarterly Review

SOLAR PUMPING

Philippines

The most promising sources of non-conventional energy in the Philippines are ALCOGAS, dendro-thermal plants, mini-hydro and photovoltaic cells. Full-scale or pilot projects are underway in all of these areas.

ALCOGAS: On October 29, 1979 a major planning document on the Alcogas Project in the Philippines was published. Entitled "Philippine Fuel Alcohol Program", the paper was the work of the PNOC's Energy Development Corporation. Most observers judge the plan over-ambitious but useful as a guideline. The Philippine Sugar Commission is moving ahead to grant contracts for the construction of three alcohol distilleries which will produce alcohol from sugar.

The most serious questions raised about the project revolve around the availability and cost of sugar cane for alcohol, the high cost of the alcohol and the net energy savings, given the energy content of the sugar. With a good market for Philippine sugar abroad, many observers believe both foreign exchange and domestic resources can be saved by buying petroleum and refining it.

Dendro-thermal and Mini-hydro: The National Electrification Administration (NEA) has 70 million dollar grant from the British and French Governments, to build a full-scale dendro-thermal plant. Before this grant materialized, the Center for Non-Conventional Energy of the Ministry of Energy had planned a pilot dendro-thermal plan supported by USAID grant-loan package, but this project is now being reconsidered.

NEA also has ambitious plans for mini-hydro projects (under 10 MW) which dovetail with the Administration's commitment to small rural electric cooperatives. Generally, mini-hydro plants are considered an expensive

energy source, but the reputation of the NEA for sound administration and the limited investment required that these projects be watched. Both dendro-thermal and mini-hydro will be marginal suppliers of energy over the next decade.

Photovoltaics: Solar cells are still too expensive to be practical energy sources on any scale, but it may already be cheaper to partially electrify small isolated villages with photovoltaic cells than to string expensive transmission lines. West German economic aid will finance a 10 KW pilot be located in Barrio Remedios Trinidad in Bulacan. The results of the pilot plant will bear watching.

The Volcanology Commission is also exploring the feasibility of PV for powering some of its remote monitoring stations. In sum, this component is of interest to the Philippines for end-uses other than and including water pumping.

ANNEX XII

PRELIMINARY PROJECT PROPOSAL
BY
DR. ROBERT ICHORD, AID

Manila, February 18, 1981

ASEAN - U.S. ENERGY COOPERATION

Preliminary Report On Possible Second Energy Project

by

Dr. Robert F. Ichord, Jr.
Energy Advisor, ASIA Bureau
U.S. Agency for International Development

This aide-memoire presents my preliminary conclusions on possible cooperative activities under a second ASEAN-U.S. energy project based on my discussions with officials from all five ASEAN countries and the Secretariat during the period January 19-February 18, 1981. I greatly appreciated the preparations made and courtesies extended by ASEAN governments and other institutions for and during my visit. I welcome ASEAN reactions to these ideas, which I shall be discussing with my colleagues in Washington and in the field.

Energy Policies and Programs in the ASEAN Countries

I found a number of common elements in the energy policies and programs in the ASEAN countries, although the energy positions of individual countries vary considerably. Among these common elements are the following:

(1) plans and programs to reduce fuel oil use in the power sector through the development and utilization of indigenous and imported coal/lignite;

(2) efforts to develop and implement policies and regulations for improving the efficiency of energy use in transportation, industry, and buildings;

(3) developing RD & D programs in new and renewable energy technologies with particular emphasis on distributed energy technologies for rural application.

ASEAN Cooperation In Energy

Within the framework of the ASEAN Economic Ministers on Energy and the Committees on Industry, Minerals, and Energy (COIME) and Science and Technology (COST), as well as ASCOPE, ASEAN is making significant progress toward a structure of regional energy cooperation. I appreciated the opportunity to review and discuss the proposal on energy research of the COST Subcommittee on Non-Conventional Energy. ASEAN cooperation and information exchange in the research areas covered in this proposal is particularly important at this early stage in the development and demonstration process. It can serve to accelerate research progress and avoid unnecessary duplication. I regret I was not able to arrive in time for the COIME meeting in Kuala Lumpur, but hope the following project concept will also respond to COIME interests.

Possible Concept for Second ASEAN-U.S. Energy Cooperation Project

During my discussions, many worthwhile suggestions were put forward for cooperative activities under a second project. Due to budget constraints, I have chosen to focus my suggestions on one activity within each of the three areas of common interest mentioned above.

(1) Coal/Lignite Substitution

National programs to assess, develop, and utilize coal/lignite resources are placing heavy demands on technical and managerial personnel in the ASEAN countries. A need exists for broadening analytical and emperical knowledge and practical experience with coal technologies and systems in exploration, development, transportation, conversion, and utilization of coal. Interest in this area was expressed by all five ASEAN countries. One possibility would be an intensive professional development program in coal for ASEAN technical managers, involving technical briefings and course work and field and in-plant experience tailored to country and individual needs and backgrounds. Such a program could involve four participants from each country and could run over a two-month period in the U.S.

(2) Energy Conservation

The process of urbanization is proceeding at a rapid pace in the ASEAN countries and construction of new office buildings, shopping centers, hotels, etc., continues unabated. It is important that these buildings are as energy efficient as possible, especially given the already substantial load for air conditioning in major ASEAN cities and the high costs of altering buildings after they are constructed. Singapore has taken a major step in promulgating Building Control Regulations that requires all new buildings to attain an "overall thermal transfer value" of less than 45 w/m^2 by January 1, 1982. It may be useful to develop a cooperative program among ASEAN countries that would focus on the costs/potential for energy savings in the building sector and the factors and options to consider in developing regulations. I suggest, therefore, an activity under this project which would analyze and compare experiences in this sector and would, with technical assistance from the United States, help develop a computer program for use by planners, architects, and builders in evaluating the costs/energy savings of new building designs and alterations. Thailand, Philippines, and Singapore expressed interest in this area.

(3) RD & D on New and Renewable Energy Technologies

The ASEAN Proposal on Non-Conventional Energy Research identifies a range of energy technologies for RD & D. Given the limited resources available, it would seem wise to focus our efforts on one important area, both to maximize impact and to test capabilities in this type of regional cooperation.

One initial area for rural development is water pumping. With rising diesel costs, our urgent need exists to fund cost-effective energy alternatives for powering pumps. Technologies exist for driving pumps from solar, wind, biogas, and biomass resources and ASEAN countries are developing programs to test specific systems. To help accelerate this process, this project could support the comparative selection, adaptation, testing and evaluation of different pumping systems, including an assessment of the potential for manufacturing systems/components in the ASEAN region. Interest was expressed in alternative pumping technology in Malaysia, Thailand, Indonesia, and the Philippines. Countries may decide to concentrate in a particular energy source (e.g. solar) and technology (e.g. photovoltaics) or develop a comparative demonstration of two or more approaches.

The U.S. Solar Energy Research Institute, which is currently assessing solar pumping systems/components and developing a test facility, is suggested as technical manager for this activity.

Projected Budget for Second Project

A.I.D.'s estimated resources for the second project are $1 million over two years. Below is a possible breakout of this amount for the above activities. Before this final approval, a more detailed budget, project description, implementation plan, and ASEAN counterpart budget must be prepared. In order to facilitate approval, it is suggested that the U.S. and ASEAN sign a memorandum of understanding s to activities to be carried out under the project. A.I.D. would then contract for the technical assistance, training, and equipment, etc., required for the activities, rather than signing individual agreements with all five countries. This approach would greatly simplify and speed-up contracting and implementation.

Possible Project Budget

1.	Coal Training	$ 200,000
2.	Energy Conservation in Buildings	150,000
3.	Demonstration of Water Pumping Technologies	500,000
4.	Miscellaneous	150,000
		$1,000,000

PROJECT DESIGN SUMMARY LOGICAL FRAMEWORK

From FY 81 to FY 84
Total U.S. Funding $1,000,000
Date Prepared: Aug. 12, 1981

Project Title & Number: Energy Cooperation in Development 498-0272

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes: To decrease the dependence of ASEAN countries on petroleum as an energy source.	Measures of Goal Achievement: A decrease in the current and projected growth in petroleum consumption.	National Government Statistics	Assumptions for achieving goal targets: That alternatives to petroleum can be identified and developed at a pace significant enough to impact on the rapidly growing demand for energy.
Project Purpose: To encourage substitution of coal for oil in the power sector, to increase the efficiency of energy use in building and to develop and apply alternative energy systems for pumping water.	Conditions that will indicate purpose has been achieved: End of project status. 1. A program to assess and develop indigeous coal resources in place in each country, and coal conversion techniques under active study. 2. Policies in place to promote energy use efficiency, and architects, builders, etc., aware of and responding to the need to conserve energy when they design and build new buildings. 3. Demonstrated ability to analyze system and component performance, durability, operation and maintenance costs, and suitability for local manufacture of alternative energy pumps.	1. Documents related to the establishment and/or implementation of such a program. 2. Policy papers, technical articles published statements, statistics, and conversation with industry representatives. 3. Government records or documents, conversation with gov't officials.	Assumptions for achieving purpose: That host country government officials are receptive to alternative energy/energy saving programs, and that these programs do not present significant financial/social/cultural burden on implementers/beneficiaries.
Outputs: 1. Increase expertise in coal/lignite development and utilization. 2. Programs and criteria to analyze the cost/energy saving potential of alternative policy/technical approaches designed to increase efficiency in energy use. 3. Adapt, test and evaluate alternatives to centrally generated electricity for rural areas.	Magnitude of Outputs: 1. Six participants from each of the five participating countries trained in the technical, economic, and environmental feasibility of coal combustion/substitution. 2. A computer program developed and tested to provide information to policy makers and the building services community on energy efficiency. 3. Three test sites powered by photovoltaic cells, anaerobic digestors, and biomass gasifiers.	1. Training records 2. Project records, observation 3. Project records, observation	Assumptions for achieving outputs: That appropriate individuals can be identified and released for training, counterparts and support facilities identified or established, and needed sites and/or services obtained.
Inputs: AID-Funded: ($000) Technical Assistance 847 Evaluation 15 Contingency 138 Host Country Funded Tech Assistance Support 434	Implementation Target (Type and Quantity) FY-82: Three TA contracts signed, one in each target area; training of coal substitution participate completed. FY-83: Solar demonstration sites constructed and operational; computer program to measure energy efficiency designed FY-84: Solar conference held; computer program tested and		Assumptions for providing inputs: That qualified organizations/individuals can be identified and contracts negotiated.