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JULY 1973 EDITION
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UNITED STATES GOVERNMENT

Memorandum

TO : AA/TA, Mr. Curtis Farrar DATE: May 21, 1976

FROM : TA/PPU, Carl Fritz

SUBJECT: Approval of OST Project "Studies of the Energy Needs in the Food System"

On Friday 7 May we received the final regional bureau concurrence on our proposed project. The following bureaus have now cleared this revised project paper: PPC, AFR, LA, ASIA, NENA and SER. The offices and individuals are indicated on the attachment to the PP facesheet. The concurrence of the other members of the R&DC has been assumed since they have not indicated otherwise.

Other appropriate clearances have been received from TA/AGR and TA/RD and are also included.

The PP calls for an obligation of $300,000 in FY 76. We will not be able to obligate this entire amount. However, through a "Sole Source" contract with Florida Institute of Technology for the Haitian field study and Project Agreements with Nepal and Upper Volta for the field studies in those countries, we could obligate up to $135,000. These two missions have been extremely interested in the several activities and OST assumes that they would be willing to process ProAgs although they have not been contacted on this matter.

As you are aware, the Deputy Administrator has expressed special interest in this project. (A copy of a memo from Bill Parks, Special Assistant to the Deputy Administrator, is attached.) But since Mr. Murphy has reviewed the previous draft, we will not resubmit the paper to him unless you direct us to do so. This approach has been cleared with Mr. Parks as explained on the PP clearance sheet.

Attachment:
a/s

APPROVED _____

DISAPPROVED _____

DATE May 21 '76

TA/OST:JBosken:5/21/76

9310234-(2)
PD-AAL-831-B1

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT PAPER FACESHEET

TO BE COMPLETED BY ORIGINATING OFFICE

1. TRANSACTION CODE (ENTER APPROPRIATE LETTER)
[X] ORIGINAL [ ] CHANGE [ ] ADD [ ] DELETE

PP 116p.

DOCUMENT CODE: 3

2. COUNTRY/REGIONAL ENTITY/GRANTEE
Interregional - GTS - KPA #20

3. DOCUMENT REVISION NUMBER

4. PROJECT NUMBER
931-11-995-234

5. BUREAU
A. SYMBOL: TAB
B. CODE:

6. ESTIMATED FY OF PROJECT COMPLETION
FY 79

7. PROJECT TITLE - SHORT (STAY WITHIN BRACKETS)
Studies of Energy Needs in Food System

8. ESTIMATED FY OF AUTHORIZATION/OBLIGATION
A. INITIAL MO. 6 YR. 76 B. FINAL FY 77

9. SECONDARY TECHNICAL CODES (MAXIMUM SIX CODES OF THREE POSITIONS EACH)

10. ESTIMATED TOTAL COST ($000 OR EQUIVALENT, $1 = ____)

A. PROGRAM FINANCING	FIRST YEAR 76 B. FX	C. L/C	D. TOTAL	ALL YEARS E. FX	F. L/C	G. TOTAL
AID APPROPRIATED TOTAL						
(GRANT)	(300)	( )	( )	(1100)	( )	(1100)
(LOAN)	( )	( )	( )	( )	( )	( )
OTHER 1.				To be determined		
U.S. 2.						
HOST GOVERNMENT				To be determined		
OTHER DONOR(S)						
TOTALS	300			1100		1100

11. ESTIMATED COSTS/AID APPROPRIATED FUNDS ($000)

A. APPROPRIATION (ALPHA CODE)	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE	FY 76 D. GRANT	E. LOAN	FY 77 F. GRANT	G. LOAN	FY 78 H. GRANT	I. LOAN	ALL YEARS J. GRANT	K. LOAN
			300		600		200		1100	
TOTALS			300		600		200		1100	
ESTIMATED EXPENDITURES			0		50		640			

12. PROJECT PURPOSE(S) (STAY WITHIN BRACKETS) [X] CHECK IF DIFFERENT FROM PID/PRP

(1) To identify steps to more efficient energy production and usage in food production, distribution and preparation.

(2) To indicate the most promising approaches to providing suitable energy increments in the rural areas.

14. WERE CHANGES MADE IN THE PID/PRP FACESHEET DATA NOT INCLUDED ABOVE? IF YES, ATTACH CHANGED PID AND/OR PRP FACESHEET.

[ ] YES [X] NO

15. ORIGINATING OFFICE CLEARANCE

SIGNATURE: John C. Ferguson

TITLE: Deputy Director

DATE SIGNED: MO. APR DAY 19 YR. 76

16. DATE RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION: MO. APR DAY 21 YR. 76

AID 1330-4 (5-75)

ROJECT: Studies of Energy Needs in the Food System

. Drafter: TA/OST, Jerome J. Bosken, 27977

. Clearance: TA/PPU, John Gumming, 28158

. Clearance: R&DC

A first draft of this paper was reviewed by the R&DC on 30 March 976. The revised version incorporating the comments made at that eeting was sent to Mr. William Parks, Special Assistant to the Deputy dministrator, who offered further observations. This final version as circulated to the R&DC members and bureau clearances were obtained s follows (by phone):

PPC:	John Shannon, PPC/DPRE	- 28 April
AFR:	Frank Moore, AFR/DP	- 30 April
LA:	William Feldman, LA/DR	- 30 April
ASIA:	Calvin Murphy, ASIA/TD	- 30 April
SER:	John Rixse, SER/ENGR	- 3 May
NENA:	James Dalton, NE/TECH	- 7 May

4. Clearance: TA/AGR

Whitney Hicks was a member of the working group which prepared the project paper.
William Merrill and Whitney Hicks represented TA/AGR at the R&DC review of 30 March.

Final clearance (phone): Whitney Hicks - 20 May

5. Clearance (phone): TA/RD, Ted Owens - 20 May

6. Clearance (phone): A/AID

Bill Parks, Mr. Murphy's Special Assistant, concurred with the submission of the PP to AA/TA for approval and AA/TA's decision as to the necessity of resubmission of the PP to Mr. Murphy - 20 May

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PROJECT PAPER

Country Studies of the Need for Energy in the Food System with Selected Field Studies

Short Title: Studies of Energy Needs in the Food System

Part I. SUMMARY and RECOMMENDATIONS

A. Face Sheet Data

The face sheet data is on the accompanying sheet.

B. Recommendations

Grant FY 76	$300,000.
TQ	600,000.
77	200,000.
Total	1,100,000.

C. Description of Project

The project will undertake to study the usage of energy to produce, distribute and prepare basic foods in four separate countries. The foods will depend upon the specific country under study but will include the relevant items from the following list of crops:

Rice, wheat, maize, sorghum, millet, rye, barley;
Cassava, sweet potato, potato, common mung bean, soybean,
Cowpea, Chick and pigeon pea, peanut.

These and the remaining crops listed on page 8 comprise over 90% of the food eaten throughout the world. The surveys will determine the amount, type, source of this energy; its costs and the benefits obtained from using the energy; how the energy usage can be improved so that greater food production is achieved; how supplies of energy in the rural areas can be increased, with a special focus on the potential of alternative energy sources for increasing the supply. Also included will be several field studies of specific aspects of energy usage in the food system. Items under consideration for such studies include a design for a solar cooker and an examination of its acceptability in Haiti, a determination of institutional and technical factors related to the diffusion of methane generators in Nepal and a study of the reallocation of time for women in rural villages in Upper Volta due to the use of selected powered devices and appropriate power sources to complete their basic household tasks more easily and faster than was possible without the devices.

Funds allocated to the project will permit the determination of current energy demands and supplies in the food system and the identification of ways to improve energy efficiency and increase energy supplies. This information will be of value to AID in formulating subsequent programs in energy assistance, in developing agricultural programs and in designing intermediate technology and women-in-development programs.

D. Summary Findings

Although this project will not examine the role of energy in over-all development, it will study the interaction between energy and the agricultural sector of the economy, the sector which frequently dominates the economies

of developing countries. It will not address all of the problems that have arisen as a result of the oil and energy crisis, but will provide much needed information on an important development issue that transcends the oil crisis -- how can we achieve increased food production in the years ahead. The issue of food is intimately linked to the energy situation since significantly increased food production will demand expenditures of significantly increased amounts of energy in the agricultural sector.

E. Issues

There are two major issues that arise from this project paper:

(1) In light of the AAC and Congressional concern that AID mount programs of energy assistance to LDC's, is an initial concentration on the food sector a proper response to the many problems caused by the energy crisis?

(2) If the answer to the above is affirmative, does the problem of the energy needs for increased food production merit as large a program as this? Should the effort be scaled down to, perhaps, two country studies of the food system and two studies, in other countries perhaps, of another economic sector?

II. PROJECT BACKGROUND AND DESCRIPTION

A. Project Background

The general question of the impact of the energy crisis on development was the topic of an AID/W interbureau paper Strategy for AID Action on Energy (Attachment A) which was reviewed by the AAC in 1975. In the discussion at that time the concensus of opinion was that not sufficient information is known about the interaction between energy and development and that, as a result, TAB should conduct "selected energy studies in approximately six countries to examine in-depth the energy constraints to progress." (Attachment B contains the minutes of the AAC meeting). This project would be preceded by requests that the Missions comment on possible energy constraints, the need for technical assistance or training in energy, the local capabilities in energy and the possible scope of energy studies that might be conducted in their countries. The airgram (Attachment C) and a summary of the replies (Attachment D) are provided. (The replies themselves are in the TA/OST files where they are available for review). The airgram was followed by a TA/OST trip to several West African countries to discuss with Mission, government and host country institution personnel the country's concern with energy and their interest in participating in the TAB energy study project. The countries visited were Senegal, Upper Volta, Ghana, and the Cape Verde Islands. In all these countries there was a great deal of concern about energy supplies, a strong desire to lessen the dependence on imported oil and enthusiasm for utilizing renewable sources for the generation of energy. The details of each country's position can be found in the report of that trip (Attachment E).

The information gathered from the airgram and the trip indicated that a major concern of a number of countries was in providing energy to the rural areas. Although rural electrification was sometimes mentioned, much interest was also shown in developing decentralized generating capability of energy through the use of a variety of sources, small-size hydroelectric units, solar, wind and methane generation from the decomposition of animal and agricultural wastes. The Mission's focusing on this aspect of the energy problem undoubtedly reflected USAID emphasis on rural development programs and the oft-expressed belief that the expense of a program addressing the commercial energy needs of urban areas and industry would be better left to the World Bank and the UNDP.

Coincidental with this activity was the Congressional approval of an amended section 106 of the Foreign Assistance Act of 1961. This action, which took place on December 20, 1975, specifically authorized

> "programs to help developing countries alleviate their energy problems by increasing their production and conservation of energy, through such means as research and development of suitable energy sources and conservation methods, collection and analysis of information concerning countries' potential supplies of and needs for energy, and pilot projects to test new methods of production or conservation of energy."

With this as background, TAB instructed TA/OST to assemble an interbureau working group* to assist in the preparation of this project paper with the stipulation that the project be focused on energy needs in rural development. The project that resulted was a study of the

*The members of the working group are given in Attachment G.

energy required to produce, distribute and prepare basic foods in the countries selected. By examining the energy requirement for this fundamental part of a nation's economy, the study would have a specific direction that a more general investigation of energy needs and resources might not possess, would provide information of immediate and direct application to an AID priority area and would contribute to a greater insight into the use of energy in a sector that frequently dominates the economic character of a developing country.

This project is understood to be the beginning of a larger program of assistance to LDCs in the energy area which will include training, energy research and development and pilot demonstrations. In this context the information gained as a result of this project will provide guidance to AID policy makers in formulating these later programs.

The decision to design this initial effort as a study of energy needs in the food system was based on several factors:

-- Worldwide population growth is causing continuing concern about ways to provide the food that will be needed.

-- Modern, energy-intensive agricultural practices result in high yields but at a rising cost due to the increasing cost of the capital-intensive equipment and energy required. Although modernized agriculture might be capable of producing sufficient food elsewhere, the poor countries will not have the money to import enough food to meet their increasing demand.

-- Within the developing countries, the multiplication of energy and energy-dependent import prices has induced some farmers to curtail the usage of fertilizers and irrigation pumps, thus in some cases contributing to declining yields.

-- There is a nascent body of opinion* advocating a pessimistic solution to this growing dilemma--to abandon the most seriously affected countries so that they might reach their proper equilibrium position through inevitable famines.

While the severity and complexity of the problem will require progress in many areas--social, demographic, technological, and economic, an important element of the solution is energy itself; it is necessary to achieve more efficient energy utilization in and more abundant energy supplies to the food sector. Since an adjustment of the method and mix of the resources used in food production will be necessary in order to increase that production and since energy and energy-related inputs are key resources that have undergone some of the largest relative price changes since the "oil crisis" began in 1973, this concentration on energy is deserved.

* Perhaps the most prestigious group defending this view is the Environmental Fund whose most recent statement has been endorsed by notable writers, editors, scientists and businessmen. Starting from a double premise:

"1. World food production cannot keep pace with the galloping growth of population.

2. 'Family planning' cannot and will not, in the foreseeable future, check this runaway growth,"

they argue that no scientific advance can change the bare fact that some nations are now on the brink of famine because their large populations have simply exceeded the carrying capacity of their lands. Contending that "the only hopeful possibility is to reduce the demensions of the coming disaster," they conclude that the U.S. must adopt a policy of withholding food aid to those countries that do not "tackle their population problems in earnest."

B. Project Description

The thrust of the project is the collection and analysis of information about the needs for and supplies of energy in the food system. As a result of the increased understanding of the role of energy in the food system, AID will be able to offer better advice to countries requesting assistance in improving their capability for supplying the needed food. The knowledge will enable AID to design and carry out programs aimed at assuring the needed energy supplies through the use of the most suitable sources, including renewable energy sources.

The studies of the energy needs in the food system will examine all the major steps involved in producing, distributing and preparing selected basic foods in several countries. Although the choice of the foods to be considered will depend upon each specific country, the relevant items from the following list will be included. These crops furnish more than 90% of the food consumed and occupy more than 75% of the earth's cultivated area 1/:

Rice, wheat, maize sorghum,

Millet, rye, barley;

Cassava, sweet potato, potato;

Common mung bean, soybean, cowpea,

chick and pigeon pea, peanut;

Banana, coconut, sugar beet and sugar cane

Multicropped fields will be treated as appropriate to the individual situations.

1/ S.H. Wittwer, "Food Production:Technology and the Resource Base", Science. 9 Mar 1975.

By examining how the same crops are raised in different areas using various techniques, information might be obtained concerning possible energy saving procedures or processes. With this in mind, the separate studies will be coordinated to ensure both desirable overlap as well as a proper mix of the crops examined.

The emphasis will be on determining the current energy usage in production, distribution and preparation of the food. Each major step of the complete process will be considered with attention given to the various procedures, practices and technologies employed to complete this step. The amount, type, source of energy input; its costs; the benefits that result and the manner in which these benefits are distributed will be investigated. In the data gathering and analysis, the concern will be to identify ways of more efficiently using the energy inputs to produce more food, on indicating procedures that will conserve energy and on pointing out promising approaches to the generation of the needed energy.

These detailed studies of the energy demand in the food system will be more meaningful if seen in the context of the nation's total economy; therefore national energy data which is already available for each country will be selectively examined in order to outline the general structure of energy usage in the economy and to put into proper perspective the relationship of the energy requirements of the food system to those of the rest of the economy. Since the intent is to give an overview of the energy needs, no primary collection of data will be made at the national level. Rather that data which can be obtained from the appropriate government ministries or from such international organizations as the World Bank or UNDP will be used.

With the description of the energy usage in the food system, the studies will be able to address the possibility of conserving and substituting for expensive forms of energy, especially imported petroleum products and to the fundamental problem of increasing the energy supplies in a cost-effective manner. Throughout the effort, attention will be constantly given to alternate uses of the available energy and to ways for providing alternative energy generation which may be more compatible with local conditions and economic and physical resources. By indicating where there can be a reduction of the demand for certain types of energy (in particular petroleum products and electricity generated from petroleum), the study can provide guidelines for enabling maximum flexibility in allocating energy by type to its most economically appropriate use. In like manner, in the process of determining where significant increases in food production can be obtained by modification of the energy input (by changing the amount, type or end use, for example), the study can also estimate the value of altering the energy input in a specific aspect of agricutural production.

A prime motivation of the project is to provide avenues to increased energy supplies in rural areas through wider use of renewable energy sources. Such sources encompass methane generation from animal and vegetative wastes, wind and solar power, small-scale hydropower systems and more sophisticated technologies such as tidal, wave and geothermal power. The project will identify potential applications in the food system for such renewable energy sources with the appropriate devices and conversion techniques to utilize the energy. Therefore in the

collection and analysis of the energy data, emphasis will be placed on assessing the economic, technical and social feasibility of generating selected portions of the required energy and performing some of the basic tasks involved through the use of renewable energy technology.

The studies will be carried out in fourselected countries.* It is expected that the countries will exhibit a spread in the levels of development of their agricultural sectors and food systems. Preferably both within a country and between countries a range in the levels will exist which will permit some classification of the production process according to the stage of development achieved. This diversity will permit insight into the role of energy in agricultural development that will be of value to planners concerned with upgrading food production.

The four country studies will be summarized in a final study. This effort will synthesizethe individual country specific results and abstract that information that is of more general applicability. The report will set forth guidelines on what energy-related steps might be taken in the near term that will lead to increased worldwide food production. It will also point out any steps to a long term production increase that have been identified in the analysis of the country specific studies.

The studies themselves will involve an in-depth examination of each major step required to bring food to the table. Energy inputs, resultant outputs and institutional and procedural factors that affect the efficiency of energy usage will be determined. In the production phase,

* The countries will be selected after consultation with the Missions, desk officers and bureaus involved. After approval of the project an airgram will be sent to all the Missions outlining the details of the proposed studies and requesting their participation. From initial discussion with some missions and bureau personnel and from the replies of the initial energy airgram, a partial list of candidate countries was constructed. This appears in Appendix I with short explanation for their seeming suitability.

both large and small farms will be studied. Different levels and types of mechanization and modernization will be included. These levels would be differentiated by the amount of use of human labor, animal power, irrigation (animal/human-powered), irrigation (mechanical), mechanized processing, mechanized tillage, fertilizer, pesticides and herbicides. A sufficient number of individual farms would be examined to ensure a significant number of entries in each category. Data would be collected for an entire year in order to observe the seasonal nature of the energy requirement. The full gamut of farming operations would be considered; precultivation, planting, cultivation, crop maintenance, harvesting, threshing and post harvesting activities. Both full-time and part-time labor would be identfied. In addition to the energy data, information on crop yields and production costs would be gathered in order to determine the economic advantages of the various types of mechanizations and practices employed.

The magnitude and disposition of the output of each major step in the production process will be determined so that the result of the survey will be an assessment of the relative effectiveness of each of the steps. By analyzing the farm sector according to various classes and sizes of farms, the study will show the role of the small farmer in consuming energy, producing food and profiting from his efforts. By looking separately at the various types of modernization and mechanization in use in the country, the relative value of the different types of energy consuming devices will be determined. Such items include tractors, irrigation equipment, crop dryers, threshers and various fertilizers and

herbicides. Through a comparison of the costs, benefits, and distribution of these benefits, an assessment of the relative values of various technologies for increasing food production and improving nutrition will be obtained.

The disposition of the food after production will be examined to determine the procedures and techniques employed in moving the food from the farm gate to the market and to the home, food storage and preservation, processing and packaging at the commercial level and preparing the food for ultimate consumption.

Included in the study of these phases will be aspects of market organization, storage and handling, grain grinding, water supplies, cooking. The marketing activities will encompass both rural markets and the more complex wholesaling and retailing of the food in the cities and larger towns. Transportation services and facilities will be examined. The loss and waste resulting from poor control or handling of the food will be considered. Throughout this part of the food system, the studies will look to identify any social and institutional factors that contribute to energy usage in the food chain and that, if the proper changes occur, could be expected to have a major impact on improved energy usage and conservation.

Various energy technologies will be assessed for their appropriateness as alternatives to the present usage of energy in the food system and for increasing the supply of energy to the food system. The characteristics to be addressed include economic feasibility, technical viability and social acceptability. The appropriateness of the technologies will be

judged on the basis of the ability of local technicians to operate and maintain them, their cost relative to their output or to other ways of providing the output, the degree and direction of related economic effects (e.g., labor displacement), the use of indigenous material and local labor in their construction, the ease at which the technology can be replicated in the country, the potential for widespread use, the social factors involved in owning and operating the systems and devices and the environmental impact to be expected from both limited and excessive application of the technology.

The studies will then result in identifying the most promising approaches that might alleviate some of the problems caused by the high cost of petroleum and other aspects of the energy crisis. These approaches would then form the basis of possible follow on activities, specifically designed to meet a particular energy need.

A secondary result of the investigation would derive from the intensive look at the nature of human labor in the agriculture sector. The determination of the seasonal characteristics of on-farm employment for the various crops and mix of family and hired labor willhelp in defining the effect of needed farm hands on population growth. By ascertaining how selected mechanization would alleviate the requirement for short time farm help, the results would be of value in identifying approaches to reducing population growth and could be incorporated into national and AID development planning.

The details of the conduct of the studies would depend upon the specific country under study and could not be specified before country

selection. However some general characteristics can be given. It will be essential that the study team will have the support and participation of host country governmental and institutional personnel. These people would be expected to provide specific knowledge on the local factors and conditions appropriate to the study. They would also participate in the data collection and provide data that is already compiled. The organizations that would be expected to contribute would include the appropriate:

Ministry of Planning or Rural Development

Ministry of Agriculture

Ministry of Energy

National Weather and Climatological Service

Agricultural Research Institutes

Agricultural Colleges and Experiment Station

Technical Research Institutes

Technical and Engineering Colleges and Universities

Rural Extension Services

U.N. Food and Agriculture Organization

Private business organizations

Private farmers and businessmen

The data would be collected from compiled statistics and records, from personal interviews of farmers, businessmen, and institutional personnel, and from on-the-scene observations and measurements. For the farmers in particular, there would be a need for frequent and periodic contact over the course of a year. The in-depth examinations

will require skills in a number of different fields. Although the needs of each country will have to be specifically addressed, in general a study team will be expected to include expertise in

agriculture

economics

energy policy analysis

energy technology (alternative energy sources)

food processing

cultural anthropology

One person might possess several skills, short term consultants could be employed to augment the skills of the base team, local participation could provide needed expertise. Each team is expected to be composed of about five people. An individual study will require a full year of data collection effort in order to observe the seasonal nature of the energy needs. It is not anticipated that the entire study team would remain on site throughout this period. Depending on the amount and quality of local participation, a member of the study team might be required to remain in country to direct the data collection effort. In all each study is estimated to require 40 man months of effort; 28 man months of senior specialist and 12 man months of support staff. These figures do not include the time to be supplied by host country personnel. The total length of the project should be 14 - 16 months.

The staffing required for a typical study might have the structure shown in the following table.

TYPICAL STAFFING REQUIREMENTS

Activity	Time (months)	No. of People	Type	Place	man-months Home	man-months Country
Preliminary Design and Literature Review	1 1	3 2	Senior Support	Home	3 2	
Final Design	1 1	4 0	Senior Support	In-Country		4 0
National Survey	1 1	2 2	Senior Support	In-Country		2 2
Data Collection	5 7	3 1	Senior Support	In-Country		15 7
Report Writing	1 1	4 1	Senior Support	Home	4 1	

TOTALS:	Home	In-Country	Total
Senior	7	21	28
Support	3	9	12
Total	10	30	40

In addition to the country studies of the energy use in the food system, the project will also have the provision for a limited number of selected field studies designed to explore in-depth specific aspects of such energy use. These would include examinations of the social and technical factors related to particular interventions. This aspect of the project would maintain a flexible posture so that it could be responsive to specific requests from the field or opportunities for appropriate investigation. Several requests that would be considered for such activities have already been received. Two relate to the use of energy in cooking, one is concerned with the use of energy in performing basic homemaking tasks in a rural context of subsistence agriculture, including pounding grain, drawing water and cooking.

The problem of firewood scarcity is a growing one and the excessive use of firewood has already lead to severe deforestation in many diverse regions of the world. The resultant ecological damage includes soil erosion, declining fertility, reduced crop yields. This problem has been recognized and OST has received requests from two Missions for assistance in this area.

B.1.a. Solar Cooker - Haiti

The first request is for a design of a solar cooker. The study would include an evalution of the technical, sociological, institutional and economic factors that would be expected to affect the operational suitability of a solar cooker in the field. It would result in a cooker specifically designed to overcome the difficulties anticipated as a result of this initial assessment. A follow on effort could then be mounted to test the ultimate design through field studies of its acceptability. Since solar cookers have been tried elsewhere with mixed

success, the study would include a review of the previous work in order to identify the problems encountered. The study, by producing a solar cooker successfully designed for and used in one country, would provide the necessary information for formulating similar programs in other areas. The Haitian mission is very desirous that such a study be conducted in Haiti.

B.1.b. Methane Generation - Nepal

The second request is also aimed at finding a solution to the firewood problem, using in this case small-scale methane generators. (In these devices manure and agricultural waste decompose and produce methane gas, the principal constituent of natural gas. A valuable by-product is a rich organic compost which makes an excellent fertilizer.) The methane can be used for a variety of purposes, cooking, lighting, space heating, crop drying and the powering of small engines. Although the chemistry and biology of the process is well known in both developed and developing countries, only lately have programs been inaugurated to effect wide-spread use of small-sized (family-sized) units. India has had an effort underway in this area since the early sixties and now has some 30,000 operating units in the field. China has a more recent but more aggressive program. A vigorous campaign to popularize the technique began in 1970 and over 450,000* such units are now operating. Although the use of such generators

* This is according to one report. Other reports quote a much lower figure. In general, information on the number of such generators in various countries is often tentative at best.

to produce methane (sometimes called "biogas" in this context) is attracting a great deal of interest in development circles, little information is available about sociological and institutional factors involved in attempts and programs to popularize this form of renewable energy. Therefore the second field study anticipated under the project would entail arranging for a number of these units to be installed in rural settings in Nepal and studies made of the various technical, institutional and sociological elements that affect the program. The Peace Corps has been asked to provide assistance to the nascent and slow-to progress Nepalese program to distribute biogas plants. The sub project envisioned would provide limited technical training to the Peace Corps Volunteers assigned to the program and funds for a sufficient number of units to be placed in a diversity of operating situations. The Volunteers would then monitor the use of these units, determine how the use affects the firewood usage and identify social and institutional considerations that hinder or aid a program of this kind. It should be possible to abstract from the Nepalese results information of wider applicability that will be of value when considering the desirability of mounting such programs elsewhere.

B.1.c. Utility of Powered Devices for Village Food Preparation - Upper Volta

The third request is for a field study to determine in what productive ways subsistence-level villagers would employ the time made available by the use of energy and powered devices to perform basic tasks, including hand-pounding grain, drawing water and cooking. In particular, in many parts of Africa the women are responsible for the greater part of the agricultural production as well as for household tasks including food preparation. With essentially no use of energy except firewood and their own human energy (even animal power is not a common item in these areas), their work results in a subsistence life style and agriculture with little chance for improvement. Efforts are underway to introduce various mechanical and powered devices to relieve them of some of their time-consuming chores. However little is known about what types of implements and assistance they would prefer and to what use they would put their newly created free time. To properly appraise the potential of future development projects, development planners could benefit from knowing the manner in which women reallocate their time to their other chores or to totally new income producing activities if given the chance to do so.

Under the requested field study, an investigation would be made to determine the current allocation of a woman's time to basic tasks concerning the food system. This would be done by observing the life styles and patterns of behavior of the women in selected villages. Once these behavior patterns are known, each village would be supplied with a dependable source of power and the necessary implements to perform selected basic tasks such as grain grinding or water drawing. The behavior patterns would then be observed again and any modification of them would be noted. By determining how the time is reallocated, information will be obtained that, along with other data, will permit greater insight into the expected benefits to accrue as a result of future development activities.

The field study would occur in three phases. The first phase would be a determination of present behavior patterns and an evaluation of the most suitable type of power source and implements. The second phase would be the installation and check out of the power system. After the system has been functioning for a sufficiently long time for the emergence of the new behavior patterns, then the third and final phase

would be a determination of these new patterns and the preparation of the final report documenting the observed changes. The third phase would require between 6 months and one year of data collection. The results would undeniably be society specific. As such they would be of direct value to the development planners of the area; but in so far as there are important general characteristics that could be derived from the society specific details, the study would provide needed information and guidance to policy makers with similar development problems.

The Upper Volta Mission in particular wants a study of this type. It is actively pursuing an integrated rural development project with the participation of the regional development organization of the Upper Volta government. As such it would find most useful the type of information outlined above.

For such a study the most versatile form of power would be electricity. With an assured supply of electricity, one could make available a variety of devices such as grinders for grain, pumps for a village water supply, refrigeration for food presevation. By determining which was the preferred use for the available power, additional planning information would be obtained. The final choice of the power supply would depend on certain characteristics of prime importance in Upper Volta:

dependability

availability

simplicity of operation

Among others, the types of energy conversion units to be considered would be a petroleum powered generator with a sufficient supply of gasoline

or diesel fuel to assure a year's operation, an array of photovoltaic cells which would directly generate electricity from the incident solar energy and wind-powered generators of electricity with or without storage batteries. It is important to realize that this field study is not designed to test any particular energy source or to prove the cost effectiveness of any conversion technique. The intent is solely to determine the social effects and the resulting economic effects to be expected if a reliable energy supply were available to perform specific tasks.

The total project of country studies and field studies is summarized in the logical framework formulation that follows. The matrix itself appears on the next page while the pages that follow present the same information in somewhat greater detail.

23a

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project: 7 years
From FY _____ to FY 77
Total U.S. Funding $ 2,100,000.
Date Prepared: April 1, 1976

Project Title & Number: [illegible] in the Food System

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes: To determine ways which will reduce energy constraints in the economic growth of LDC's. Specifically, to determine ways to minimize the energy constraints to increased food production in the LDC's.	**Measures of Goal Achievement:** 1. Increased number of countries formulating energy plans with greater focus on rural energy needs. 2. Increased availability of energy in rural areas. 3. Wider use of small-scale renewable sources of energy.	1. Review of reports on national energy planning. 2. Review of literature concerning alternative energy use and programs. 3. Monitoring of USAID interest in alternative energy sources and projects incorporating such sources.	**Assumptions for achieving goal targets:** 1. Possibility of more efficient energy use in food system. 2. Increased food production will require more energy in food system. 3. LDC's desire to increase food production. 4. Acceptable alternative energy sources exist and will be used
Project Purpose: 1. To identify steps to more efficient energy production and use in the food system. 2. To indicate the most promising approaches to providing suitable energy increments to the rural areas.	**Conditions that will indicate purpose has been achieved: End of project status.** 1. Increased awareness of LDC and AID personnel of ways to increase food production through more efficient use of energy. 2. Increased awareness of ways to increase energy supplies for food system and rural areas.	1. AID provision of technical assistance on rural energy matters. 2. Requests for information on alternative energy systems for rural use. 3. Distribution of final reports to USAID missions and development organizations.	**Assumptions for achieving purpose:** 1. Data analysis will uncover energy use by various income groups and benefits of use. 2. Planners will apply the information on alternative energy systems to their specific problems.
Outputs: 1. Description of the key energy usage in food system. 2. Determination of energy sources, costs, and value of use. 3. Analysis of energy use and value for various technologies and processes in food system. 4. Identification of organizational factors that affect energy use. 5. Identification of promising applications of renewable energy.	**Magnitude of Outputs:** 1. Studies of the energy needs in the food systems of four countries. 2. Three or more field studies of the effects of specific energy interventions. 3. Summary report.	1. Final reports. 2. Progress reports. 3. Continual monitoring of the conduct of the individual study efforts.	**Assumptions for achieving outputs:** 1. Know socioeconomic factors of countries in order to identify their impact on energy use. 2. Know physical factors (water, wind, sun) so that can evaluate alternative energy schemes 3. Operating and cost data available for range of energy-using technologies in the food system
Inputs: 1. Analysis of national energy data. 2. Collection of field data on energy use in food system. 3. Appraisal of alternative energy possibilities. 4. Construction and utilization of selected alternative energy systems	**Implementation Target (Type and Quantity)** 1. 4 country studies $800,000. 2. 3 specific field studies $200,000. 3. Summary report $100,000. (4. Assistance of Peace Corps -) AID Total $1100,000.	1. Project records. 2. Peace Corps status reports.	**Assumptions for providing inputs:** 1. Cooperation of host countries in providing access to data and their assistance in data collection. 2. Participation of Peace Corps in field study in [illegible]. 3. Existence of proven alternative energy sources and technologies

Program or Sector Goals

To determine ways which will reduce energy constraints in the economic growth and development of LDCs, especially in the rural sectors; specifically it is desired to learn more about the use of energy in food production, distribution and preparation in order to minimize the energy constraints to increased food production in the LDCs.

Measures of Goal Achievement

(1) Increased number of countries formulating energy plans with greater focus on rural energy needs.
(2) Increased availability of energy in rural areas, especially to rural poor.
(3) Increased efficiency of energy usage in food production.
(4) Wider use of small scale sources of renewable energy.

Means of Verification of Goal Achievement

(1) AID/W review of reports on national energy planning available from international development organizations (UNDP, World Bank, etc.)
(2) AID/W review of literature concerning alternative energy use and programs.
(3) Monitoring of USAID interest in alternative energy sources and USAID projects incorporating such energy soirces.

Assumptions for Achieving Goal

(1) Possibility exists for more efficient use and production of energy in food production and consumption.

Assumptions for Achieving Goal (Cont.)

(2) Increased food production will demand both increased use of energy and more efficient use of available energy supply.

(3) LDCs desire to increase food production.

(4) Energy supplies available to rural areas are limited.

(5) Alternative energy sources exist that are technically, economically and socially acceptable.

(6) LDCs are willing to utilize alternative energy for selective applications.

Project Purpose

(1) To identify steps to more efficient energy production and usage in food production, distribution and preparation.

(2) To indicate the most promising approaches to providing suitable energy increments to the rural areas.

Conditions that Indicate Purpose Achieved, End of Project Status

(1) Increased awareness on part of LDC agricultural managers and USAID development personnel of ways to increase the amount of basic foods produced and consumed in LDCs through more efficient use of energy in the food system.

(2) Increased awareness of LDC energy planners and development planners of ways to increase the supply of energy for use in the food system in particular and in rural areas in general.

Means of Verification that Purpose Achieved

(1) Increased ability of AID to provide technical assistance on rural energy matters.

(2) Increased requests for information on alternative energy systems for rural use, especially small-scale (Farm, village) use.

(3) Distribution of final reports to USAID Missions and development organizations.

Assumptions for Achieving Purpose

(1) Data on energy use can be gathered and presented in such a way that will permit evaluation of the use of energy by various income groups and the potential benefits accruing to these groups from increased

Assumptions for Achieving Purpose (Cont.)

use of energy.

(2) Planners and managers will find the information on alternative energy systems applicable to their specific problems.

Outputs

(1) A description of the key usage of energy in the production, distribution and consumption of basic foods.

(2) A determination of energy sources, their costs and the value of the output resulting from their use.

(3) An analysis of this energy usage, cost and benefits (increased output and value of output) for various technologies, techniques and processes involved in the food chain from production to consumption.

(4) Identification of any institutional, organizational, physical or other factors which have a large effect on energy use and which, if altered, could improve energy use.

(5) An analysis of national energy data to show the relationship between the energy needed for the food chain and the energy needed in the rest of the economy.

(6) Preliminary identification of selected alternatives for providing and utilizing energy in food production, distribution and consumption.

Magnitude of Outputs

(1) Four country studies completed and reports prepared showing the basic structure of the energy needs in the food system.

Magnitude of Outputs (Cont.)

(2) Synthesis of the individual reports into a summary document on energy needs in food production.

(3) Three or more field studies of the effects of specific energy interventions.

Means of Verification that Outputs Provided

(1) Final reports.

(2) Progress reports

(3) Continual monitoring of conduct of study efforts.

Assumptions for Achieving Outputs

(1) Existence of sufficient knowledge of socioeconomic factors of countries studied to permit identification of their impact on energy use.

(2) Existence of sufficient technical data on physical factors (wind, sun, water) to permit evaluation of viability of alternative energy schemes.

(3) Availability of range of energy-using technologies with related operating and cost data.

Inputs

(1) National energy data for an overview look at energy use in economic sectors.

(2) List of basic foods for countries to be studied.

(3) Manpower to collect and analyze data on energy use in food chain.

(4) Knowledge of technologies of alternative energy generation.

(5) Selected alternative systems for energy generation.

(6) Funding for four country studies ($800,000), one summary report ($100,000) and selected field studies($200,000).

Implementation Target

(1) Four countries being studied.

(2) Three or more field studies on specific aspects of the need for energy in the food system.

Means of Verification of Implementation

(1) Project records

(2) Status reports

Assumptions for Providing Inputs

(1) Cooperation of host country in providing access to national energy data.

(2) Existence of alternative technologies for production of energy.

(3) Cooperation of Bureaus and Missions in selecting countries to be studied.

(4) Cooperation of Host Countries in permitting local data collection.

(5) Participation of Peace Corps in field study in Nepal.

III. PROJECT ANALYSIS

A. Technical Analysis

Even preceeding the oil crisis of the Fall of 1973, studies had been conducted on the usage of energy in the economies of various nations and in various economic sectors. With the beginning of the "energy crisis" which resulted from the escalation of petroleum prices however, this topic has become of increased importance. The first appearance of an in-depth report on the role of energy in agriculture and the complete food system was in 1974 1/ which consisted of an examination of the U.S. food system. Other studies followed that were concerned with either an investigation of particular crops 2/ or a particular state 3/. A report appeared later in 1974 4/ which foresaw an optimistic solution to the problem of increasing food production to feed the growing world's population. The abstract of the article states that "the earth and technology can probably provide food for a population of 40 to 50 billion. Increases in food production would help to create the conditions that would stablize the population at a lower level."

1/ J.S. Steinhart and C.E. Steinhart, "Energy Use in the U.S. Food System", Science, 19 Apr 1974.

2/ P.K. Avilani and W.J. Chancellor, "Energy Requirement for Wheat Production and Use in California," American Society of Agricultural Engineers, Dec. 1975.

3/ Cervinka et al, "Methods Used in Determining Energy Flows in California Agriculture," Transactions of the ASAE, Vol. 18, 1975.

4/ Roger Reville, "Food and Population," Scientific Americ Sept. 1974.

This increased production would come about however only through a modernization of agricultural practices in the underdeveloped countries which would necessitate vastly greater amounts of energy available to and expended in agriculture.

The following two figures, taken from the Steinhart article in Science referenced on the previous page, illustrate the relationship between energy usage and farm output. The first figure plots the farm output as a function of energy input to the U.S. food system for the years 1920-1970. The second indicates the energy requirement for different crops and produce and various agricultural techniues. These two graphs visually display the requirement for increased energy expenditure in order to achieve increased agricultural production.

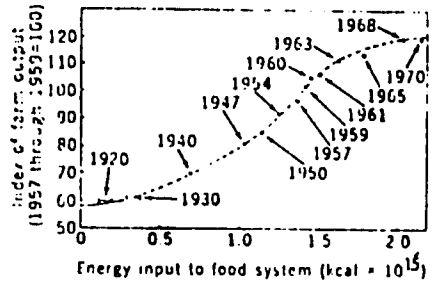


Fig. 1. Farm Output as a function of energy input to the U.S. food system, 1920 through 1970.

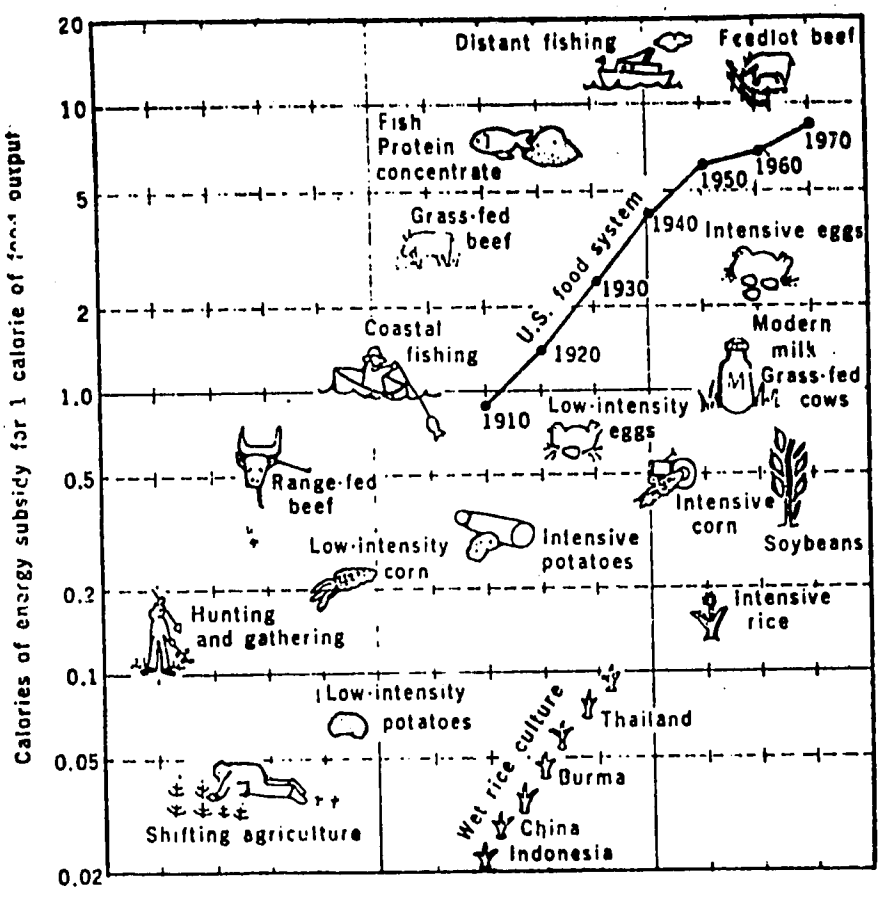


Fig. 2. Energy subsidies for various food crops. The energy history of the U.S. food system is shown for comparison.

This energy is used for many purposes: irrigation, mechanized cultivation and harvesting, crop drying, storage, transportation, processing and packaging. Although this data is primarily that of the U.S. food system, its message is relevant to the developing countries. As more and more countries are moving toward industrialized energy intensive food systems as in the developed countries, there will be increasing demands placed upon the limited energy supplies available.

Nevertheless, to this author's knowledge, there has not been a thorough study of the energy needed in the food systems of the developing countries.

Because of these factors the project has the potential for important contributions in this field. The special aspects that will add value to the effort include:

1. its concentration on the complete food system including home preparation.
2. the emphasis placed on possible applications of renewable energy sources to generate the needed energy.
3. its multi-country character which will produce a comparison of the energy needed to grow selected basic foods in several different countries.

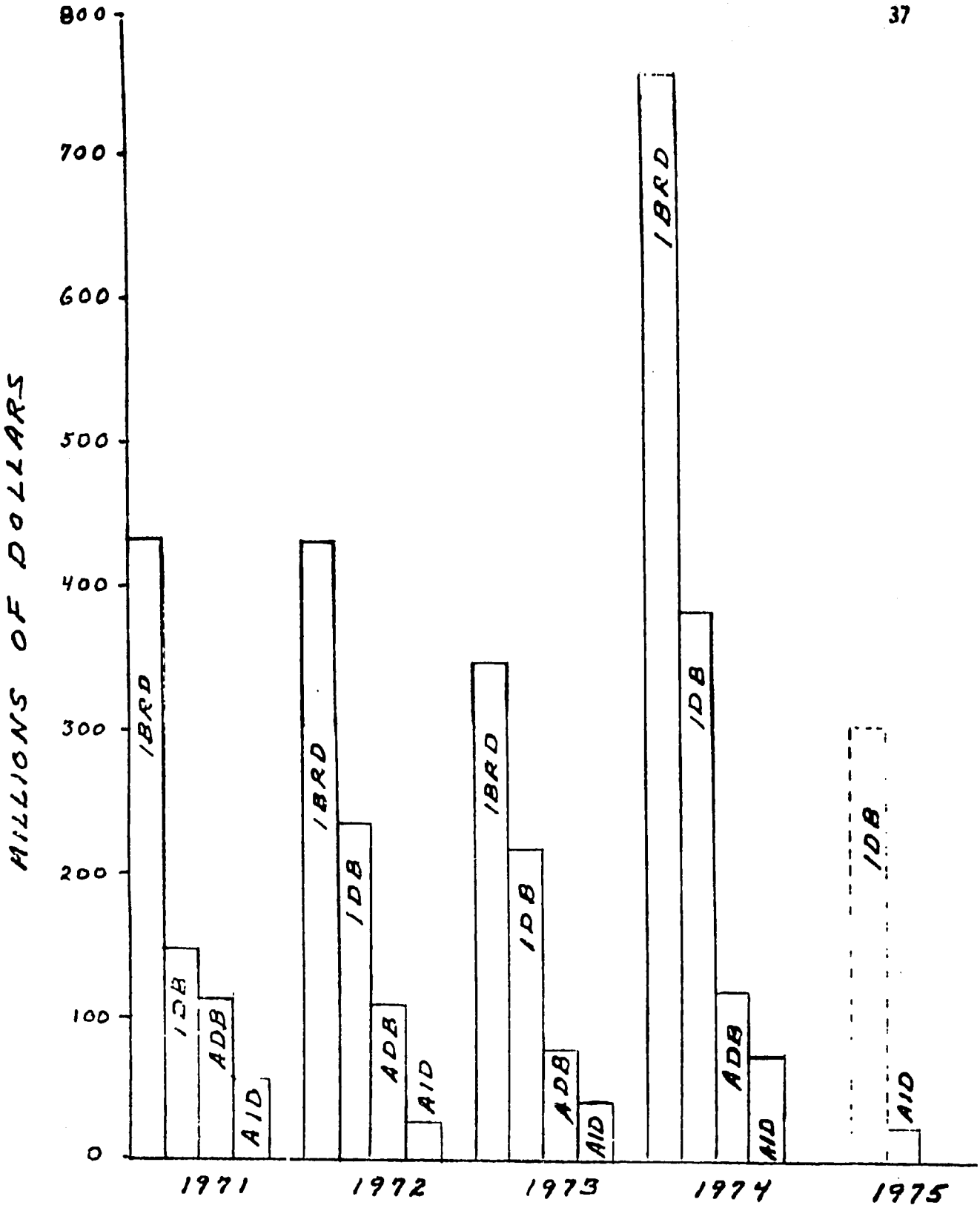
It is anticipated that the studies will make maximum use of whatever previous work is applicable and will serve an often-expressed need for detailed studies of the use of non-commercial energy in rural areas.

The emphasis on agriculture and the food system will guarantee compliance with the Agency's concern and Congressional Mandate on rural development and the poor majority. Although rural development encompasses more than agricultural development, the latter is nevertheless a prime component of that subject and the production, distribution and preparation of food absorbs a great part of the life of the people of the rural areas. For the country as a whole, increased agricultural production is often of vital concern. In addition to supplying the needed food, a matter of major importance, the agricultural sector frequently dominates the national economy and its development determines the prospects for future over all economic growth.

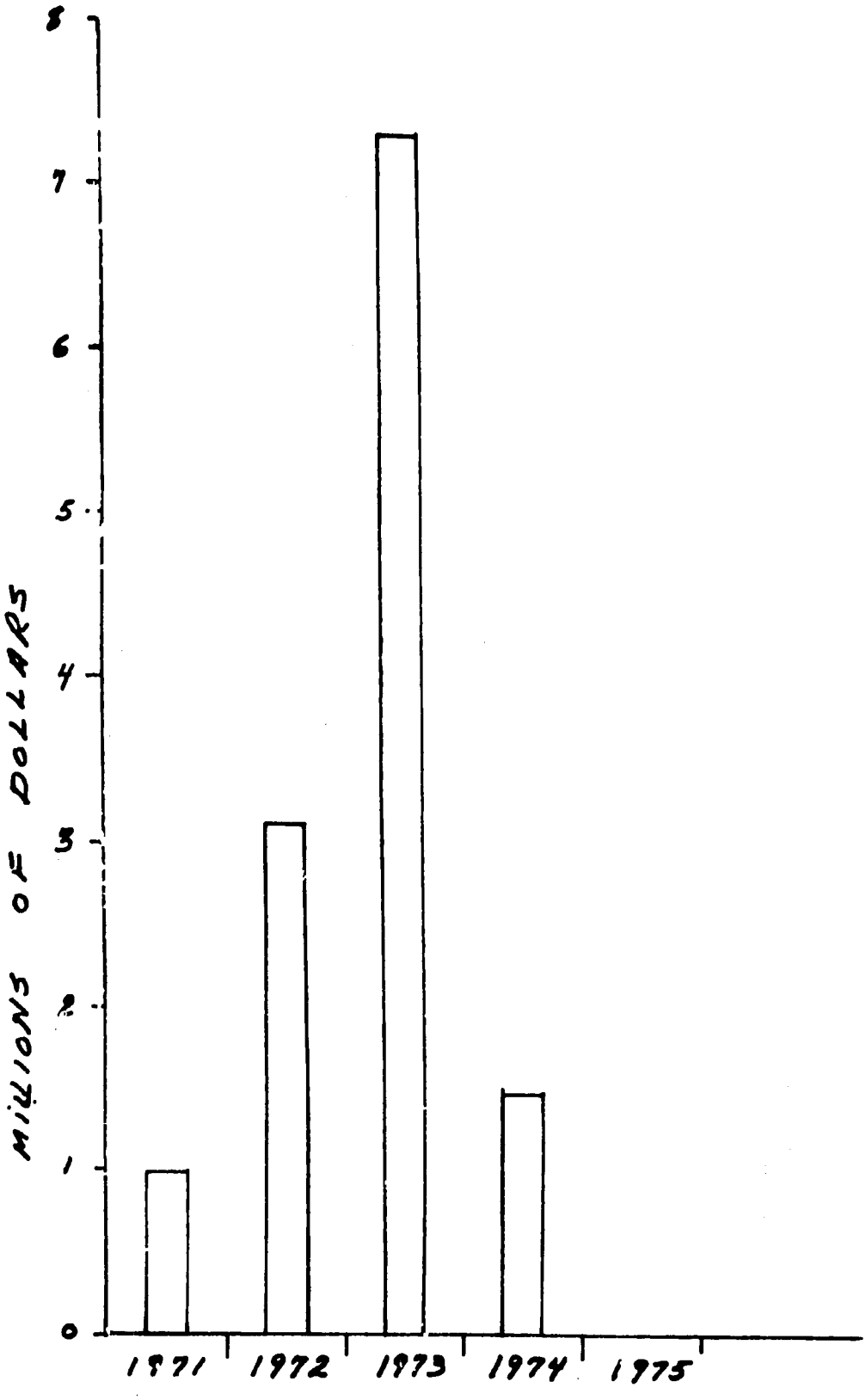
Many international agencies and institutions are presently examining the role of energy in development and the obstacles to growth caused by the effects of the energy crisis. TA/OST has been monitoring the activities of these agencies and the graphs presented on pages B8 - B16 (from the minutes of the AAC Meeting on Energy) display in some detail the efforts of the international development banks, AID and UNDP. For convenience two of those figures are repeated on the following pages. In the first, the total dollar amounts spent for power projects by AID, ADB, IDB and World Bank are compared for the years 1971-1975. It is seen that, relative to these banks, the AID effort has been small, some $210 million over the five years.

The second figure shows that the effort of UNDP (a total of $13 million for 1971-1974) is only a fraction of the AID program. UNDP's funding for energy and power generation has remained low although the organization has become more interested in such projects, especially in the area of renewable energy resources. In 1975 it supported workshops in India and the Philippines on biogas (methane generation from wastes). Currently it is reviewing projects for biogas demonstration and promotion, rural energy development and solar energy in agriculture with a total cost of less than $4 million over five years.

UNEP has a special interest in non-conventional, nonpolluting energy. Under its sponsorship, three village-size renewable energy centers are being established in typical rural areas of Asia, Africa and Latin America. Senegal and Sri Lanka are two countries chosen, the third is not known to the writer at this time. These three demonstration centers



VALUE OF POWER PROJECTS IN DEVELOPING COUNTRIES
(EXCLUDING EUROPE, EASTERN BLOC & CHINA)
BY YEAR OF INITIATION



VALUE OF UNDP CONTRIBUTIONS TO POWER PROJECTS IN DEVELOPING COUNTRIES (EXCLUDING EUROPE, EASTERN BLOC & CHINA) BY YEAR OF INITIATION

to harness the renewable sources of energy locally available will serve as a study of the feasibility of expanding the concept in a widespread implementation program.

TA/OST has maintained informal contacts with the following organizations through both group meetings and conversations with individuals: World Bank, UNDP, UNEP, FAC (French development assistance) and ERDA. As a consequence of this interchange, we have kept abreast of the plans and programs of the various agencies.

As a result of the analysis of the activities of the other donors, it was felt that AID could use its funding to its greatest advantage by concentrating on a part of the general problems, but a part of fundamental significance in itself and central to current AID concerns, the use of and need for energy in the food system.

By giving special attention to alternative energy sources, AID will be providing leadership in an area of increasing importance. The sources will be suitable for decentralized usage and the simplicity and replicability of the technologies will enhance the possibilities of their widespread use. It should be clearly understood that the energy sources envisioned are not unsophisticated. On the contrary they might well rely upon the most advanced scientific and engineering design principles, but, characterized by an ease of use and construction, they are expected to find great utility and wide acceptability in the developing countries.

The project will be supportive of the growing AID interest in intermediate technology. The studies will provide necessary information of the current techniques and practices employed in the food system which can then be used to identify intermediate technology devices especially suitable for appropriate substitution. It will also provide background material that will be useful for determining what devices would be most desirable for possible future interventions. The renewable energy sources which will be given special interest will themselves be predominately intermediate technology devices and hence of direct relevance to the new AID program.

The cost of the studies seems appropriate to the desired goals. The staffing schedule as explained on page 17 appears to provide sufficient manpower to permit collection and analysis of the necessary data. By focusing on agriculture and the food systems, the studies can be conducted for a lower cost than a more general examination of national energy needs would allow. For example the Asian Development Bank is currently underwriting an extensive survey of the energy needs and resources in Bangladesh. The cost is estimated to be $640,000 for an effort of 160 man months. This is to be compared with this project's more specialized examination and resulting estimated budget of $200,000 and 40 man months per country.

B. Environmental Assessment

Since the project is fundamentally a study of energy usage, no detrimental environmental effects are anticipated. If subsequent programs were begun to employ renewable energy sources in those applications which

the studies identify as promising, then enviornmental effects are possible. However the nature of the renewable energy sources considered and the fact that they would be small-scale installations at scattered sites would tend to minimize the effects.

Furthermore, the use of the cooking devices and systems to be examined in the proposed field studies would alleviate the growing deforestation caused by the excessive collection of firewood for cooking purposes. As a result, the studies could have a positive impact on the enviornment.

This problem of deforestation, eloquently summarized by Eric Eckholm 1/, is a severe one in many developing areas. Especially affected have been semi-arid regions of high population density; the most striking examples include the Sahelian countries of Africa, the Andean highlands, the Himalayan regions of Asia and sections of the Indian subcontinent. Since each person requires one to two tons of firewood each year for cooking and limited space heating purposes, as the population increases, the demands placed upon nature exceed her capacity to replenish the supply through the growth of new trees. Eckholm quotes an Indian official who views the situation with great alarm, "Even if we somehow grow enough food for our people in the year 2000, how in the world will they cook it?"

However the deforestation results in more than just a scarcity of firewood. The secondary effects include increased soil erosion, leading to declining land fertility and reducing crop yields. The consequent food shortage sometimes prompts the inhabitants to cultivate new fields that possess

1/ Erik P. Eckholm, "The Other Energy Crisis: Firewood," Worldwatch Paper 1, Sept. 1975.

marginal utility at best. The nutrients can be quickly depleted and the land might become totally useless for all agricultural or animal husbandry purposes.

To make the situation still worse, in areas where the scarcity is most severe, dried cow dung and other animal manure are often used as cooking fuel. As a result of this practice, the fertilizing value of the manure is completely lost.

The use of solar cookers would reduce the demand for firewood and would reduce the deforestation and consequent ecological damage.

The use of methane generators would have the additional benefit of producing a rich organic compost which could be substituted for chemical fertilizers. Besides reducing the cost of fertilization, the use of this compost would reduce the pollution problems that can result from the excessive application of chemical fertilizers.

The greatest potential for harm with methane generators would be in the improper treatment of human waste before it is used for fertilization. Unless certain precautions are taken when human excretment is used in the generators, some of the microbes present might not be killed. The resulting compost contains living organisms capable of transmitting disease back to those who eat the crops so fertilized. Before programs are begun to build generators using human waste as feed stock, this issue must be clearly understood by all involved. With the proposed pilot activity in Nepal, the training given to the Peace Corps Volunteers will include specific treatment of this problem and so the effort is not expected to produce any difficulty in this regard.

C. Social Analysis

The country studies can be viewed as primarily a data collection exercise, a determination of how people use energy in the food system. As such, they will have no direct social impact on the subject countries.

However the knowledge to be gained from the activity will have a social relevance. In particular, the information on the employment displacement that would be brought about by selective mechanization and the analysis of the farm labor demand into its seasonal, part-time, family and non-family compenents should be of interest to economists, sociologists and demographers

As is the case with the question of the environment however, the real social impact is to be expected when programs are begun to implement the findings of the studies, for example, by changing market procedures or installing alternative energy systems. At such a time, these programs should be the subject of a complete social analysis.

The field studies envisioned as part of the project do possess direct social aspects. The Nepalese activity would be a study of those technical and social factors that are relevant to further diffusion of methane generators. Intended recipients of the test facilities would include but not be limited to poor farmers. A spread in farm/level would be desirable since the operation of such devices depends upon the quantity and quality of manure and agricultural waste supplied. Therefore diversity in the types of farms selected would permit a wider range of experimental data to be gathered.

The few limited operating examples of such generators in Nepal have generated much interest from governmental personnel and private citizens.

And so it is not anticipated that initial response to the project will exist. The goal of the activity is to discover just those social factors that will be important for expanded programs of distributing methane generators. These issues will have a country-specific character, but it should also be possible to identify factors that are independent of a particular country but have a more universal applicability.

The field study in Upper Volta would be an examination of the manner in which people, especially women, apply the time made available to them as a result of their using selected power devices to perform some of their basic tasks more easily and more quickly. The goal is to ascertain what devices are most desirable to the village women, who will benefit from using them and what changes in the behavior patterns result from this use.

The role of women in development is a matter of increased concern and heightened interest. In Upper Volta the government has undertaken an active program to improve the conditions of the women. Special focus has been placed on the rural areas. A women's rural extension service has been organized to teach village women the basics of child care, health, nutrition and handicrafts that can produce extra income for the women. A problem faced is that so much time of the women is already allocated to required chores and tasks that they have only limited time left to pursue these activities designed specifically for them. How the women of the villages would spend the time available to them, should they be relieved of some of their time-consuming tasks, is a question of great importance. Will they utilize the time working in the fields? Whose --their husbands'or their own? Producing more food or cash crops? In making handicrafts for sale in the mar-

ket? In providing greater child care? In health or education activities? By answering these questions, the study will be able to offer important guidance to those who plan programs of widespread mechanization or powered devices in the village.

D. Economic Analysis

This project is designed to examine alternatives to present energy usage in food production and preparation. A study effort with provisions for field studies of specific interventions, it will provide, among other things, an economic evaluation of new energy sources for specialized applications. In order to decide the economic suitability of this effort, it is necessary to consider the economic problems brought about by the present energy crisis.

The rising cost of oil and the resulting inflation have created severe problems for developing countries. Higher prices paid for oil in particular, energy in general, imported commodities and manufactures higher interest rates on loans and greater cost of capital equipment have not been offset by the money earned by their own exports, frequently raw materials or light manufactures. The consequent imbalance in their foreign exchange earnings has led to serious difficulties for both the short and long terms.

Simultaneous with this increase in the costs of energy, capital and products has been a worldwide food shortage due to many diverse factors. Although the situation has improved somewhat, the need for significantly increased food production still remains. And this need will increase as dramatically as the population does. The high yields of modern agriculture depend heavily upon necessary energy inputs that are much greater than that

required for traditional agriculture. With the high cost of energy, it becomes essential to use the available supply in the most productive fashion. Progress will require increased supplies in the near future.

The core of this project is the examination of this issue--how to use energy more efficiently in agriculture, how to increase the supplies of usable energy for agriculture in particular and for rural areas in general.

By identifying techniques that make use of local labor, local materials and renewable sources to supply energy for agricultural purposes and general rural development applications, the project can be expected to result in significant economic benefit to a variety of people. The magnitude and distribution of this benefit are difficult to assess but the size and type of energy systems to be considered would increase the probability that poor farmers could acquire them.

By determining factors that would permit a more rapid and wider use of methane generators for cooking purposes, the project could result in slowing deforestation in many areas and in reducing the accompanying irreversible ecological damage.

The project directly addresses a triad of fundamental concerns: the economics of commercial energy (petroleum and hydroelectricity), the environmental problem of deforestation and erosion and the problem of feeding a growing population. Indirectly it deals with on-farm employment and the relation between employment needs and mechanization. This would include the need for part-time seasonal labor and the need for year-long workers, both of which are important correlates of population growth rates.

E. Financial Analysis

E.1. Total Project

The entire project consists of four separate country studies, one summary study which will synthesize the individual results and abstract the country-independent information, and several field studies to examine the effect of specific country interventions in various areas. These three major divisions of the project activities will be funded during FY 76, TQ and FY 77 according to the schedule below (in 000):

	FY 76	TQ	FY77	Total
Country Studies (4 at $200,000 each)	250	500	50	800
Summary Study and Report	--	--	100	100
Field Studies	50	100	50	200
Totals	300	600	200	1100

The total project cost will be $1,100,000.

In addition to this cost, host country personnel will contribute man-power in assisting with the data collection and advising on the project design. It is not possible to spell out the magnitude of this contribution prior to final country selection and definition of the details of the project design. If the contemplated field study of methane generators in Nepal is agreed upon, the Peace Corps will also contribute manpower to the project through the use of the Volunteers to collect data on the Nepalese program. Assuming that the four Volunteers spend 1/2 of their assignments on this task, this will result in a Peace Corps input of 4 man years.

E.1.a. Country Study

The individual studies are assumed to cost $200,000 each based on the staffing schedule to be found on page 17. The cost for such a program of 40 man months breaks down as follows.

Senior Staff:	28 man months @ $4170/month ($50,000/year, including overhead)	$117,000
Junior Staff:	12 man months @ $2085/month ($25,000/year, including overhead)	25,000
Per diem:	30 man months @ 30 days/mo. and $40/day (would appear to be maximum)	36,000
Travel:	5 round trips @ $1200/trip	6,000
Extra expenses (including travel within country)		16,000
		$200,000

This figure can only be taken as a tentative estimate pending country selection and final definition of the specifics of the studies.

The summary report is anticipated to require four to five months with four to five people participating in the effort. This would total to a $100,000 sub-project. It will be an analysis of previously obtained findings and would necessitate no foreign travel.

E.1.b. Field Study - Nepal

The field activities can be described only incompletely since final arrangements will have to be completed after project approval. The Nepalese effort would entail the training of four Peace Corps Volunteers for two weeks in the United States. The project would fund this training expense and the per diem expenses during that period. The bulk of the funds would be a grant to the Energy Research and Development Group in Nepal for the construc-

tion and distribution of a sufficient number of methane generators to permit a diversity of operating conditions. The estimated cost of this field study is as follows:

Training - 4 Volunteers	
2 weeks of instruction (2 man weeks)	
at 2 or 3 institutions	$ 2500
Travel and per diem in the US	
56 man days at $33/day	1900
Travel	1000
Equipment	
Grant to Energy Group in Nepal	20000
100-200 units @ $100-200/unit	
Monitoring equipment and supplies	2000
	$27400

E.1.c. Field Study - Haiti

The Haitian activity would be to design a solar cooker and to test its acceptability in Haiti. We have received a proposal for the design segment which if accepted would produce a final plan for the cooker specially designed to meet the Haitian cooking, social and enviornmental conditions. This proposal is for $39000 and includes the predesign survey, construction of trial cookers and laboratory evaluation of the models. A copy of the budget is attached.

A. SALARIES AND WAGES[1]		COST
1. Senior Personnel	Time Commitment	
a. Professor of Mechanical Engineering	25%	
b. Associate Professor of Physics and Space Sciences	15%	
c. Assistant Professor of Physics and Space Sciences	25%	
		$ 11,121
2. Other Personnel	Hours	
a. Two Graduate Student Assistants	1320	$ 4,200
b. Undergraduate Student Assistants	430	$ 660
c. Secretarial	160	$ 360
Total Salaries and Wages		$ 16,541
B. EQUIPMENT AND SUPPLIES		
1. Meteorological data compilations		$ 300
2. Commercially available solar cookers		$ 750
3. Commercially available focusing collectors		$ 800
4. Materials for fabricating solar cookers from plans		$ 1,250
5. Office and drafting supplies		$ 150
Total Equipment and Supplies		$ 3,250
C. G.S.A. TUITION REMISSION		
Six Quarters at an average of 9.6 hours per quarter		$ 3,456

BUDGET (CONT'D)

		COST
D. TRAVEL[2]		
1. Domestic		
a. Air fare		$ 767
b. Local transportation		$ 40
c. Meals and accommodations		$ 280
	Total Domestic Travel	$ 1,087
2. Foreign		
a. Air fare		$ 630
b. Local transportation		$ 253
c. Meals and accommodations		$ 560
	Total Foreign Travel	$ 1,443
E. INDIRECT COSTS:[3] 79.95% of $16,541		$ 13,225
	TOTAL COST	$ 39,002

Notes:

1. Based on actual wages and salaries of the individuals performing the study as of November 15, 1975.
2. Based on: one four-man, four-day trip to Haiti
   one three-man, two-day trip to Washington, D.C.
   two one-man, one-day trips to Washington, D.C.
   Meals and accomodations estimated on the basis of $35 per person, per day.
   Local transportation in Haiti includes car rental estimated at $16.99/day for four days plus 17¢/mile for 1000 miles.
3. Negotiated Overhead Rate, July 1, 1974 (Dept. of Health, Education and Welfare).

E.1.d. Field Study - Upper Volta

The Upper Voltan study would include an initial determination of the current behavior patterns and an evaluation of candidate power systems in terms of suitability, dependability, availability and cost for the project. The equipment would be purchased and installed. After a time the people's behavior pattern would again be observed to identify what changes occurred due to the availability of the powered equipment. The major cost to be expected would be the power supplies. A possible breakdown of the costs is as follows:

Initial Assessment of Power Sources and Determination of Behavior Patterns (1 month)	$6000
Power Supply Purchase	40000
Related Equipment(motor, grinder, water pump, etc)	2000
Equipment Checkout and Technical Support	5000
Observation of Modified Behavior (4 months)	20000
Contingency	2000
Total	$75000

The remaining money in the fund for field studies would be reserved for use as specific requests and opportunities arise.

IV. IMPLEMENTATION PLANNING

A. Administrative Arrangements

All activities under this project will be managed by TA/OST. Regional Bureaus, Country Desks and Country Missions will be consulted for advice and guidance in implementing activities in their respective countries and regions. Desks and missions will be kept fully informed of implementation plans in their respective countries.

Activities within the project will be performed by contractors having the special competence required to perform the studies. These contractors will be selected on the basis of competitive evaluations. While it is impossible to state what host country government and institutuional organizations will be expected to participate prior to actual country selection and final project design, these organizations will be existing, functioning ones and no creation of organizations will be necessary.

In those pilot activities where cooperation of other U.S. government agencies is envisioned, particularly, Peace Corps, coordination of the participation will be arranged by TA/OST through the appropriate departments of the agencies involved. Reports prepared by Peace Corps Volunteers will be required as part of their job in the local government agencies to which they are assigned. Copies of the reports will be transmitted to the Peace Corps Desk officer and from there to TA/OST.

Initial effort on the part of the Country Mission will be required in establishing contacts with the appropriate local government and institutional personnel.

Evaluation of the project will be conducted at regular intervals by TA/OST, with appropriate assistance of the USAID country and regional representatives and personnel of the other U.S. agencies associated with the activities.

B. Implementation Plan

Due to the tentative nature of the pilot activities and to the lack of a final decision on the countries to be studied, it is not possible to give complete details of the implementation arrangements for the project. It is necessary therefore to maintain flexibility in this regard prior to actual implementation. The final decision on country selection will await airgram notification of the missions of the details of the program. Subsequent to the receipt of the responses, consultations will be held with the Bureaus and Desk Officers for those countries who express interest in the program.

The various studies will be open to competitive bidding. Although it is possible that each study would be done by a/different group, to ease the managerial problems it would be preferable that one group be responsible for several activities. The attached PPT chart indicates a possible schedule for the activities of the program. From this information it appears that one organization could effectively perform the studies in countries A and C, another group would be able to study country B and complete the synthesis report, while a third could examine country D. This approach is a compromise between the maximum effectiveness to be expected if one group does all the studies and the maximum diversity in methodology and analysis resulting from a different group being responsible for each study.

Obviously the host country institutions which would take part in the energy studies cannot be identified until the countries themselves have been selected. In general however these would include the Ministries of

Energy, Agriculture and Rural Development where applicable. Also expected to participate would be appropriate universities, especially those that emphasize technical training. The type of local participation anticipated is that which we discovered during our trip to Senegal. A short description of these Senegalese institutions is included in the list of candidate countries for the energy studies.

Although the possible activities in Upper Volta and Nepal have been discussed in some detail in this project paper, it is to be understood that no final decision can be made prior to project approval. Initial discussions only have been held with personnel from the other agencies expected to cooperate in the efforts. If the decision is made to proceed with the activities, final arrangements must be concluded with the Peace Corps and the government of Nepal.

It is fully anticipated that those proposed activities would find a warm welcome in the various missions and countries involved. The reasons for expecting support for the Nepalese effort, for example, can be found in the attached letter from the USAID Mission director (Attachment F) in which he states that he has been addressed by a member of the Energy Research and Development Group for some form of assistance with their methane generation program. Since the director expresses a high opinion of the initial Peace Corps involvement in this regard, he should be in favor of working through them in providing the catalytic support he requests.

C. Evaluation Plan

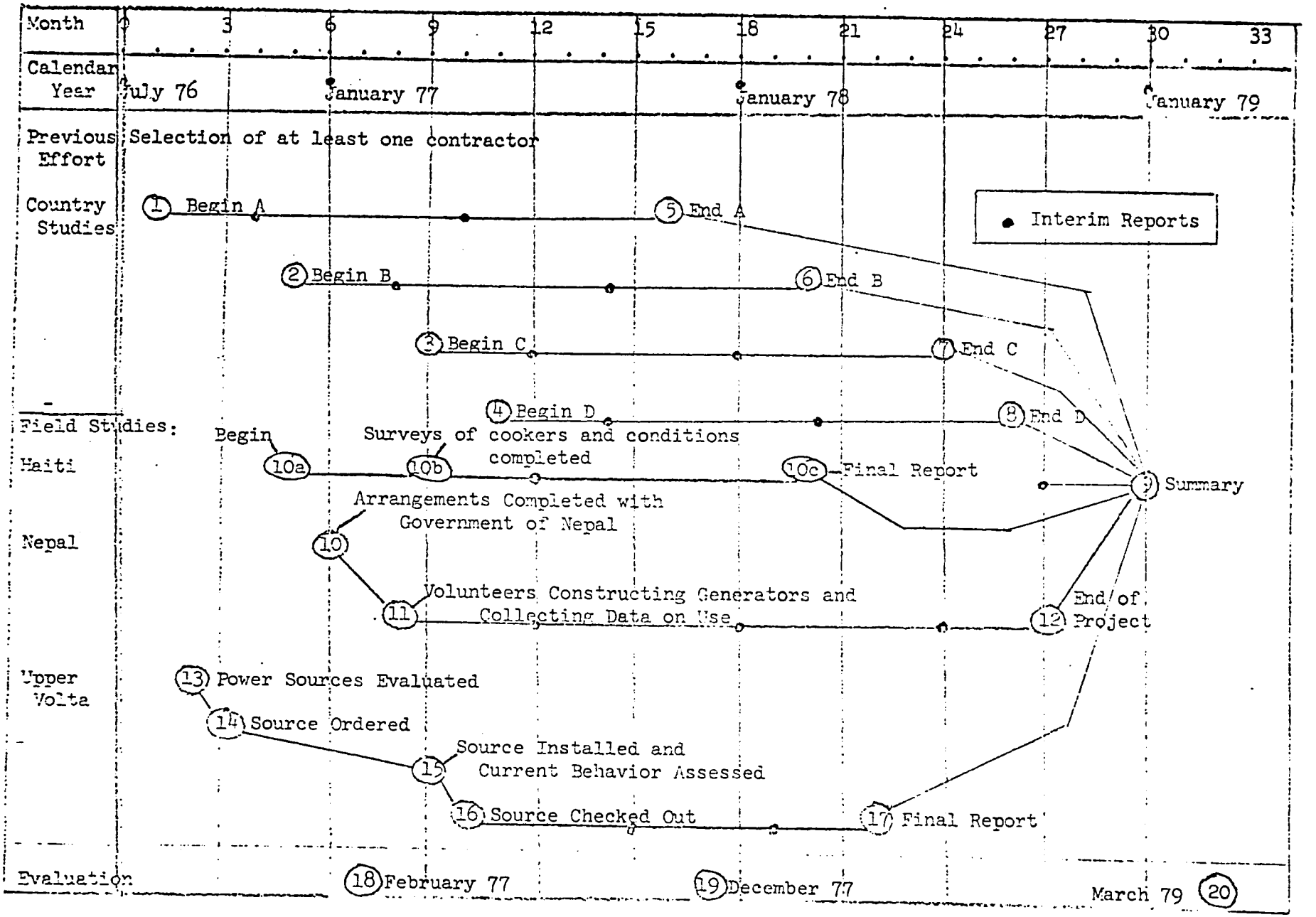
The entire project, the four studies of energy needs in the food system and the pilot activities, will be evaluated at regular intervals. The attached PPT indicates a possible scheduling of activities. This should be

seen as tentative only since it is not possible to confirm the pilot activities at this time. Each study effort will produce its own set of initial, interim and final reports. The phasing of the four country studies is designed to make maximum use of the reports of the preceeding studies.

Three evaluations are scheduled. The first one will take place after two country studies are underway, the Peace Corps Volunteers in place in Nepal, and the hardware installed for the Upper Volta study of the usage of liberated time. This review will be basically an initial status report on the several phases of the project before a great deal of work would have been expended.

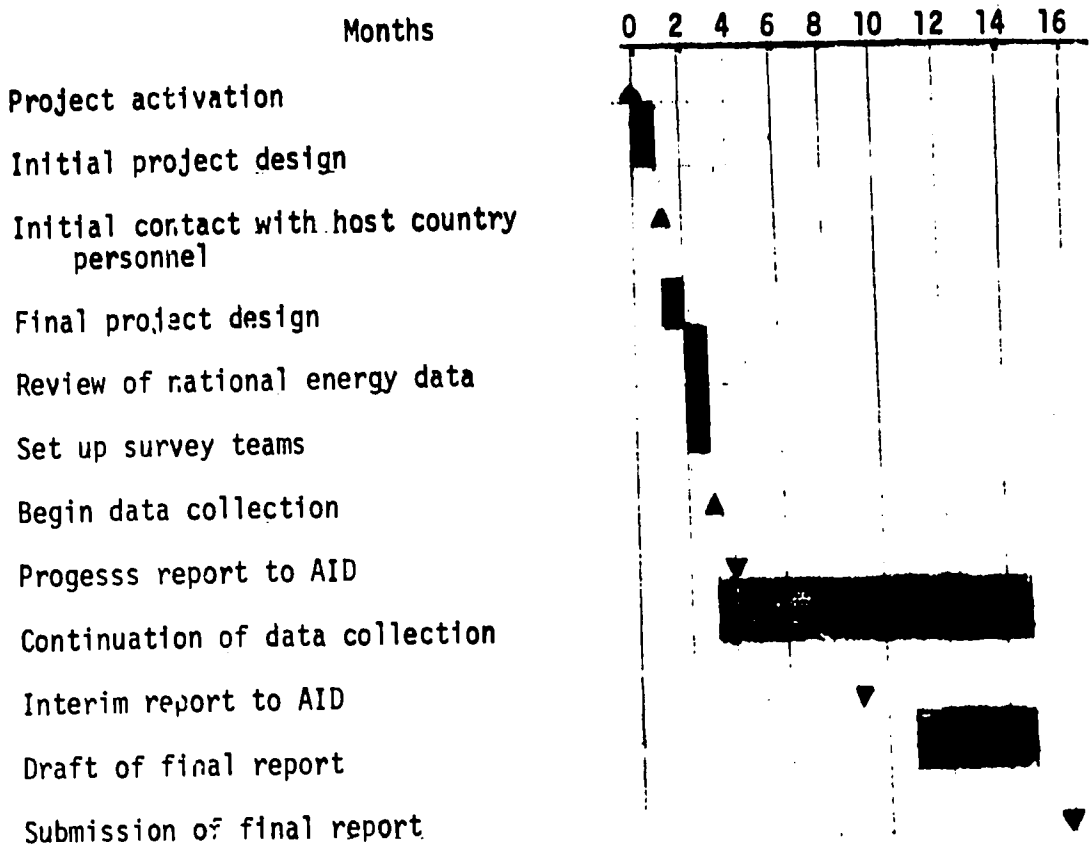
The second evaluation will occur approximately halfway through the project. The final report of one country study would have been already submitted and one or more reports from each of the other components will then be expected to provide guidance for two country studies and the remaining portions of the two pilot activities. Although the timing of the individual studies and the evaluations would not allow the fourth energy study to profit much from these two evaluations, managerial guidance and direction will be possible by monitoring the progress of the study as documented in its initial and interim reports.

The last evaluation is scheduled to follow the submission of all the reports. Its purpose is to serve as an in-depth analysis of the project, its performance and its outcome.


Month
0
3
6
9
12
15
18
21
24
27
30
33
Calendar Year
July 76
January 77
January 78
January 79
Previous Effort
Selection of at least one contractor
Country Studies
1 Begin A
5 End A
Interim Reports
2 Begin B
6 End B
3 Begin C
7 End C
4 Begin D
8 End D
Field Studies:
Haiti
Begin
10a
Surveys of cookers and conditions completed
10b
10c Final Report
9 Summary
Nepal
Arrangements Completed with Government of Nepal
10
11 Volunteers Constructing Generators and Collecting Data on Use
12 End of Project
Upper Volta
13 Power Sources Evaluated
14 Source Ordered
15 Source Installed and Current Behavior Assessed
16 Source Checked Out
17 Final Report
Evaluation
18 February 77
19 December 77
March 79 20

CPI Number	Date	Task
1	Aug 76	Begin study of country A
13	Sep.	Complete evaluation of possible power sources in Upper Volta
14	Oct.	Upper Volta power source ordered
2	Dec.	Begin study of country B
10a	Dec.	Begin cooker project for Haiti
10	Jan 77	Complete arrangements with Nepal for methane generation project
18	Feb.	First evaluation
11	Mar.	Peace Corps volunteers trained and in place
3	Apr.	Begin study of country C
10b	Apr.	Complete survets of cookers and Haitian conditions
15	Apr.	Complete installation of power supply in Upper Volta and assessment of current behavior patterns
16	May	Complete check out of power sources
4	Jun.	Begin study of country D
5	Nov.	End study of country A
19	Dec.	Second Evaluation
6	Mar 78	End study of country B
10c	Mar	Final report on cooker project
17	May	Final report of Upper Volta study
7	Jul.	End study of country C
8	Sep.	End study of country D
12	Oct.	End study in Nepal
9	Jan 79	Final summary report due
20	Mar.	Final evaluation

Scheduling for Typical Country Study



APPENDIX I

PARTIAL LISTING OF CANDIDATE COUNTRIES FOR ENERGY STUDIES

1. Senegal.

Mission and Senegalese Government are enthusiastic about renewable sources. As mission notes "... a considerable amount of work has already been done in the area of renewable energy in Senegal. Given this solid basis and the general recaptivity of the Senegalese effort, we recommend based on the mission (field trip by TA/OST and AF/RDS) observations and contacts that one of the many possibilities for AID assistance be pursued in Senegal."

Excellent host country government and university institutional capability. Technical Training Institute (IUT) experimenting with renewable sources, Promotion Humaine program has active extension service aimed at providing technical training specifically for village level including demonstration of new agricultural practices, General Delegate on Scientific and Technological Research coordinates research and works closely with Promotion Humaine in effort to introduce cultural acceptable technologies. IUT has requested assistance in conducting a market survey for solar energy application.

Imports both oil and food. Arid land; millet and peanut are principal crops. Recent famine. Little mechanization or animal power in agriculture.

2. Haiti

Government interested in developing additional energy sources. USAID desires study of possible substitutes for charcoal due to severe deforestation occurring, interested in solar cookers proposal.

3. Dominican Republic

The Technical Secretary to the President is deeply interested in concepts of renewable energy sources and utilization in non-metropolitan areas.

4. Bolivia

According to USAID, there is a need for surveys of the energy needed by small farmers. "Since so little energy other than human or animal is used in the small farm sector and since a considerable amount of land lies idle because of the need to perform planting and harvesting within such short periods that human and animal labor is not sufficiently available, there probably will need to be a growing use of other (other than petroleum, natural gas and hydroelectricity) sources of energy in order to increase food production by small farmers over the long run. Estimates of the impact of such growth have not been made in any reliable way."

5. Afghanistan

Repeatedly expressed interest in utilization of renewable sources of energy, especially for rural areas. Particular items mentioned are wind-powered low lift irrigation pumps and flour mills, solar drying of agricultural crops. Severe problem with deforestation from firewood collection (space heating as well as cooking).

6. Pakistan

Government has expressed keen interest in establishment of experimental methane generating plants for cooking, heating and lighting. USAID suggests that AID's energy strategy be limited to an analysis of the energy needs in each AID project and provision of assistance to LDCs on intermediate technology in the energy area.

7. Costa Rica

According to the Mission's reply to the original energy airgram, the government is interested in "research and development (of) alternative sources for small community energy needs." USAID desires "focus on provision (for) low cost energy in rural isolated areas....Lack of energy in rural areas constrains population from full and active participation in economic and social activities, especially in agricultural field."

ATTACHMENT A

STRATEGY FOR AID ACTION ON ENERGY

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NAC. 72A
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STRATEGY FOR AID ACTION ON ENERGY

I. Introduction

The macroeconomic impact of the energy crisis on AID recipients and other developing countries has been covered in other AID policy documents. These conclude generally that the AID program cannot finance deficits caused by increased petroleum prices, they also spell out the ways in which the present economic status of countries affects their eligibility for concessional assistance.

This paper deals with the other ways in which the changed cost of energy affects AID programs, and with the implications for AID of Secretary Kissinger's pledge at the UN Special Assembly in Spring, 1974, to make available to the LDC's the results of energy research and development in the United States.

It is explicitly assumed that the relative cost of energy has been permanently and substantially increased by recent events, and that long term structural adjustments are necessary.

II. Nature of the Problem

The energy crisis affects LDC development prospects in many ways: It implies a deterioration in terms of trade and attendant losses in real income for most LDCs. It results in many instances in increased requirements for foreign financing due to the large increases in the costs of imports. The higher cost of energy will also affect the feasibility of development projects and require adjustment in internal development strategies in light of the higher cost of energy in general and oil in particular. The economic effects of the energy crisis upon LDCs vary

A2

widely. While most LDCs are oil importers and would have to undertake some kind of adjustment in response to the energy situation, the adjustment is likely to be more difficult in the so-called Most Severely Affected countries, because their economies are less flexible and their short-term financing problems more intractable.

To minimize the imminent and serious shortage of food, LDCs must find new ways to increase their own production. The use of additional energy to increase the productivity of human and animal labor, to preserve food, and to distribute food more equitable has become a necessity rather than an option.

There is a high degree of correlation between the use of inanimate energy and development. Whether energy usage is cause or effect, it seems clear that the demand for energy will inevitably increase with the development of LDCs. There is a need for additional investment in energy generation using conventional and non-conventional technologies. The investment required to achieve major energy substitution and increasing energy supplies for LDCs is large but there is no alternative if development aims are to be achieved.

The LDCs, imitating the developed countries, have relied largely on central energy generating systems and, in the case of thermally generated power, they have generally utilized petroleum as the primary fuel. Alternative energy sources exist but some are not well known and many have been neglected because the pre-1973 price structure made their exploitation uneconomical. Higher costs of petroleum make alternative energy sources relatively less costly. Hydro-electric projects discarded

because of cost-benefit ratios in the past, for example, may now be much more attractive. However, in the short term the possibilities for substitution for petroleum are limited. There is a need for (a) resource exploration, (b) detailed assessment of energy use and future needs, and (c) technical and economic feasibility studies to identify alternative energy sources which can be exploited with existing technologies.

Higher oil costs also necessitate a new look at means of increasing the efficiency with which energy can be utilized in LDCs. Increased efficiency involves both improved utilization and energy generation as well as conservation. It must be recognized however, that there are limits to the conservation which can be achieved without reducing production because typically 80% of commercial energy used in LDCs is in transportation and other directly productive activities.

In the longer term, there is a need to find new alternative energy technologies by adapting and applying research and development findings to LDC needs. The major new research efforts in the US and otner developed countries do not address LDC needs directly and, without extensive adaptation, are not likely to produce much that will help the LDCs.

Higner energy costs affect the feasibility of a variety of projects in the AID emphasis sectors, particularly agriculture and rural development. Some of these effects are fairly straight forward, such as the increased costs of energy to the projects themselves, or to the substaining of project operation. The same applies to program inputs such as fertilizer which have high energy costs. There are also more complex implications: for example, the higher costs of transportation may have an important

impact on the spatial aspects of rural development programs, such as locations for marketing and agro-business centers. Highly labor intensive methods of farming or processing may now be more competitive than previously, thus making it easier to choose such methods. While probably less significant, similar considerations apply in Education and Health.

The poor majority, who are the center of AID concern, use relatively little energy, and are less affected by the change in energy costs than the wealthier members of developing country society. The cost of providing energy for increments in productivity and welfare among the poor has increased, but it is not clear how critical this constraint will actually be. The role of energy in moving a poor rural community forward is not well understood at present.

We do know that several technologies exist which have limited commercial prospect in the U..S. or other developed countries but which could be adapted for those rural populations which presently do not have sufficient energy resources to achieve primary standards of living, increase their food production or enhance their health and education. Such small energy sources can provide power for irrigation, pumping, crop drying, cooking, tilling, sterilizing, and small scale electricity generation. These applications will have little if any impact on global energy demand but they offer opportunities for prompt action to improve the quality of life of large numbers of the poor. Small hydroelectric generators, solar powered water pumps, bioconversion of wastes and vegetation, windmills, pyrolysis of wood and vegetation are examples of technologies which either can be transferred to the LDC environment with

little modification or which, with redesign and adaptation, may be rendered technically applicable to the LDC setting. In some of these cases, further development of the technologies is required. In all cases it is necessary to look at economic feasibility and even more important to make sure that the application is truly responsive to a development problem.

Research and development on energy sources and conversion techniques are more active all over the world than ever before. Most, but not all, of the effort is directed toward rich country problems. There are as yet no clearly preferable directions for research and development that show promise of early breakthroughs for the LDCs.

The framework for domestic research and development on energy over the coming decade will be Project Independence. The report on Project Independence is 1/ "an evaluation of the Nation's energy problem: ... The Study provides the analytical and factual basis for focusing debate on the difficult choices and tradeoffs, and selecting a national energy policy." The research portion of Project Independence is broadly divided into two parts: short-range (possible impact by 1985) and post Project Independence (1985 and beyond). The short range objectives are to: 1) Increase the domestic supply of liquids and gases (oil, natural gas, oil shale, synthetic fuels from coal), 2) Shift demands from oil and gas to coal and uranium, and 3) Improve conservation technologies (transportation, industrial, household and commercial). The long-range possibilities include: 1) Synthetics from coal, 2) In-situ oil shale production, 3) Breeder reactors, 4) Fusion power, 5) Solar conversion, 6) Geothermal, and 7) Long-term efficiency of energy utilization and a shift to electricity.

1/ Project Independence, Federal Energy Administration, Nov. 1974.

This research program is not directed toward LDC needs, and will develop new approaches quite slowly. While these new approaches may be useful to developing countries eventually, adaptation will undoubtedly be necessary.

Many U.S. Government agencies are involved in energy questions, but only a few of them focus any effort on LDC energy problems. Those that have some experience with LDCs on matters related to energy are the Geological Survey (USGS), the Energy Research and Development Administration (ERDA) in its previous form as the AEC, the Department of State (OES and E), and the National Academies of Science and Engineering. Other agencies with programs that could have some bearing are: The National Science Foundation, the Federal Energy Administration (FEA), the Department of Interior, the National Energy Council (NEC), the National Bureau of Standards (NBS), the Environmental Protection Agency (EPA), the Department of Agriculture, the Nuclear Regulation Commission (NRC) and the National Aeronautics and Space Administration (NASA). All of these agencies have limited capacities to devote to overseas concerns, and are heavily engaged on domestic energy matters.

III. AID Response

There are grounds for considering making energy a major field of concentration for AID activities. Energy plays a critical and central role in the development process, and energy problems affect most of the countries with AID programs. The scarcity of fiscal resources, the preoccupation of U.S. technical resources with domestic problems and the high risk, particularly in innovative approaches to energy, argue against such a commitment Were we to select energy as a concentration area, we

would at present not be able to proceed with an effective program. Hence this option should be set aside.

There is clearly scope, however, for assistance directly on energy problems; the United States is a logical source given its technical expertise. The critical nature of energy problems makes it inadvisable to rule out all forms of assistance. The principal reason for A.I.D.'s interest in energy, however, is the important role energy plays in the concentration sectors, and its potential impact on the lot of the poor majority. In this perspective, the following strategy should be followed:

Understanding the Problem

We should undertake a program of study of the role of energy in different types of developing country economies. This should start with the rural sector and focus on the poor, but cannot and should not be confined to that sector. In order to obtain valid results the energy system in a country must be looked at as a whole and considered from a social, economic and cultural as well as technical standpoint. Central to the study would be detailed analysis of a small number of LDC's with different characteristics. The purpose is to understand the energy constraints to progress in the concentration sectors, identify the approaches required to overcome those constraints. As these approaches are identified, programs would be mounted to develop practicable methods that can be applied in the field, as is already being done in the case of fertilizer.

2. Energy Analysis in Program Planning

While recognizing that our capacity to conduct analyses is thin, both substantively and in terms of personnel, we must nevertheless take

energy questions into account in planning all our programs. Guidelines covering preparation of DAPs, Sector Studies and Project Proposals that will assist Missions in focussing on energy questions at each stage of program analysis and presentation are needed. These should include standard assumptions about world energy prices, and guidance on how to seek help in exploring alternative energy source or ways to reduce energy costs. This process may well help identify specific energy related problems that can be factored into the program of study described above.

3. Energy Resource Identification and Evaluation

The private sector is expected to fill the primary role in assisting LDC's to explore and develop oil and gas resources. There remains however, an important need in many countries, particularly MSA's, to improve knowledge of potential energy resources, both conventional and unconventional. The quality of LDC investment decisions depends on an accurate assessment of the extent and characteristics of resources, and likely costs of exploitation in relation to benefits. The resources of the private sector, of the USGS, and of the AID program to use remote sensing for LDC purposes are available as required for technical assistance, but have limited capacities. AID/W should inform the missions of the availability of these resources and the Agency, using either central or mission funding as appropriate, should respond to requests from countries receiving concessional assistance if the request is reasonable and the assistance not available elsewhere.

4. Technical Assistance

LDC skills on energy management, resource utilization, technology selection and implementation are various, but generally limited. Many of

the LDC's face difficult long and short term decisions on such matters as utilization of conventional energy systems, investment in non-conventional energy sources, and the management of their resources. They also need to consider how to mount effective programs of energy conservation. There are a number of possible sources for technical assistance in these matters, but the United States is a major source of the required skills. Moreover, a capacity to provide technical aid in these matters will be important to the success of some programs in the A.I.D. fields of concentration. A.I.D. should therefore make an estimate of requirements for technical advice and training initially required on energy aspects of its fields of concentration, and likely to be requested outside those fields, after taking account of the capacity of non-U.S. sources to respond. A review should be made of mechanisms available to A.I.D. for providing such advice and training and steps taken to ensure that they are adequate to meet the demand. Assistance under this paragraph and the preceeding one can, of course, be provided on a reimburseable basis as well.

5. Capital Investments

There may be rare cases when an investment in energy systems is seen as an essential prerequisite to achievement of A.I.D. purposes in a country, and is available from no other source. A rural electrification project is a possible example. Energy investments may be considered under normal criteria, but in general, capital for such purposes would be expected to come from multilateral institutions, the private sector, or other donors.

c. Research and Development

While the usual sequence is for problems to be identified and the technical answer then sought, there is a reverse process through which awareness of available or potential technologies makes possible the identification of courses of action that would not otherwise be discovered. It is important, therefore, for A.I.D. Missions to be kept advised of technological developments in the field of energy that are potentially relevant to their program concerns. This will be a two-way process as Missions report on energy experimentation going on within developing countries, and involves work done in other developed countries as well. As Project Independence develops, there may well be progress that should be applied to LDC needs through timely investment in, say, smaller scale applications than are appropriate in this country. A.I.D. should be alert to opportunities of this kind, to piggy back on the main lines of domestic research on energy and to ensure that worthwhile results are appropriately modified and made available for early application in developing countries. A.I.D. therefore needs to stay in close touch with the progress of energy research in this country and elsewhere.

Given the complex nature of the energy problem and the amount of work being done on it in different locations, A.I.D. should explore with other interested agencies, domestic and foreign, the possibility of establishing and information network that would provide data on applications of various technologies, i.e., a continuously updated "state of the art" index. This would be invaluable for research and development and would also serve to help find potential solutions for problems identified in the course of A.I.D. program development. Countries not recipients of A.I.D. programs could benefit from the above on a reimburseable basis.

ATTACHMENT B

MINUTES OF THE AAC MEETING ON ENERGY

ISSUES FOR THE ADMINISTRATOR'S ADVISORY COUNCIL (AAC) DISCUSSION

In general, the issue is whether the attention to energy proposed in the strategy paper is too much, or too little: whether for example, A.I.D.'s work on energy should be confined strictly to activities that can be financed from funds made available under Sections 103-105; whether more should be done to develop technical packages for specific field application in the short run; or whether the recommended approach together with what may be done by other agencies represents an adequate follow-up to Secretary Kissinger's promise of access for the developing world to the fruits of U.S. research and development programs.

The following points for discussion follow the outline of Section III of the strategy paper, title A.I.D. Response.

1. Should A.I.D. undertake some special country studies to improve understanding of LDC energy needs and their influence on development or leave this task to normal mission analyses, to the LDCs or to other donors who might carry out such studies?

2. Do the missions have the capacity to implement an energy analysis of programs and alternative solutions to energy related deficiencies? If not, what can be done?

3. Energy resource identification and evaluation could affect employment and other LDC problem areas in addition to those of A.I.D. priority. It could also play a role in global energy strategy. Should A.I.D. resources be devoted to this activity?

4. Requests for technical advice and training in energy subjects outside A.I.D. fields of concentration could be signficant in number and scope. Should A.I.D. limit its response to concentration areas?

A 12

5. While no major investment of time or money in research and development is proposed, a significant amount of staff effort is involved in the suggested strategy and there is a prospect that substantial program funds will be needed in the future. There are various technologies that could be adapted or perfected for application in developing countries by relatively straightforward pilot and testing programs, were central funding provided for this purpose. Some experts believe that enough is known about possible needs to make reasonable choices of which technologies to pursue. This approach is not consistent with limiting A.I.D. attention to priority areas.

The relatively passive information gathering and dissemination approach, also suggested, poses the question of whether that level of activity is consistent with the Secretary of State's promise which implied a more active U.S. Government role in making new information and developments on energy utilization generally available to developing countries.

Should A.I.D. adopt a less active role than proposed, simply dealing with energy matters as they arise from the regular program process?

Should we go beyond the recommended course, to fund efforts to adapt specific existing technologies to LDC problems, with priority on the rural poor?

Should we undertake a significant program in energy research and development not confined to the concentration sector, but focussed on the needs of the poor?

Or, should we follow the course suggested in the paper?

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

OFFICE OF
THE ADMINISTRATOR

AAC-72B
June 12, 1975

MEMORANDUM FOR MEMBERS OF THE AAC

FROM: Donald T. Bliss, Executive Secretary

SUBJECT: Follow-up to AAC Meeting of April 16
"Strategy for AID Action on Energy"

Attached for your information and action, as appropriate, is a copy of an Information Memorandum for the Administrator summarizing the results of the AAC meeting of April 16 on Strategy for AID Action on Energy.

Attachment:
As stated

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

OFFICE OF
THE ADMINISTRATOR

June 12, 1975

INFORMATION MEMORANDUM FOR THE ADMINISTRATOR

THRU: Chairman, AAC

FROM: Donald T. Bliss, Executive Secretary

SUBJECT: Follow-Up on the AAC Meeting of April 16 -- Strategy for AID Action on Energy

The AAC discussion of April 16 focused on what should be AID's response to the energy problems being faced by the LDCs.

A. Should AID undertake some special country studies to improve understanding of LDC energy needs and their influence on overall development. This is distinct from normal analysis in preparing DAPs, project proposals, and sector analyses, wherein Missions should, to the extent they can, take into account energy requirements and constraints when relevant to the development project being examined.

It was agreed that as a first step, Missions will be advised of the proposal to undertake in a select number of LDCs a study of their energy problems and the impact on development. Missions will be asked to provide situation reports and recommendations which would assist AID/W in selecting priority/country study subjects.

As needs are identified, programs can be mounted to test the principles, methods of analysis and solutions and to apply them in other countries, where appropriate. While other development agencies may undertake global assessments of LDC energy requirements, it was agreed that AID could make a special contribution by developing practical technology that can be applied in the field. Missions will be asked to consider inviting LDCs to incorporate the improved energy planning and analysis into country programs.

ACTION: TAB will prepare an airgram to the Missions for transmittal of the AAC energy paper, minutes of the AAC meeting, and specific requests for information.

B. In concert with the solicitation of field comments and suggestions, it was agreed that the following actions would be taken:

1. Coordination with other Financial Institutions

To assure that AID's work will complement, not duplicate, investigations being undertaken by other development agencies, the Agency will investigate studies by UN and other bodies on improving energy generation and utilization in LDCs. In addition to identifying studies which concentrate on energy, AID will attempt to learn about studies on other subjects which appear to have energy-saving or energy-using implications. Better exploitation of consumables, for instance, would result in energy savings and this will be explored.

ACTION: After receipt of inputs from the Missions and Bureaus, and after consultation with international institutions and the private sector, TAB will arrange for selected energy studies in a few (approximately six) countries to examine in-depth the energy constraints to progress.

2. Interagency Coordination

Although AID programs in the energy field may be modest, as spokesman for developing countries, AID must attempt to influence positions on energy matters and actively cultivate support for these positions in USG policy circles. To perform effectively, AID must keep abreast of LDC energy requirements and be prepared to analyze and make known their implications.

ACTION: IDC, in collaboration with TA, PPC, and SER/ENGR, will stay abreast of developments in the energy field to be better able to act effectively as the U.S. spokesman for the LDCs. In addition, they will reconfirm staff capabilities and responsibilities for monitoring and assessing energy conditions impacting on developing countries and prepare issues memoranda for use by USG policymakers who are establishing and negotiating U.S. positions on energy which reflect adequate understanding of LDC energy problems.

C. Energy resource identification and evaluation could affect employment and other LDC development aspects in addition to those of AID priority. Should AID resources be devoted to this activity?

The AAC agreed that an accurate assessment of the extent and characteristics of resources and the probable costs and returns to be realized from exploitation of these resources is essential for sound investment decisions. Having demonstrated the potential of promising technologies for assessment such as remote-sensing, AID may then refer LDCs, desiring to mount operational systems, to the UNDP, IBRD, and other financial institutions. However, AID should properly continue training LDC personnel on request in collecting, interpreting and applying relevant information and continue to respond to requests for resource identification technical assistance, but will not plan to sponsor detailed mineral surveys. AID will also continue to identify and demonstrate development technologies useful to, but not generally exploited by LDCs. An example of such technology is geothermal power.

AID will investigate whether sufficient resources are available from other development institutions to assist LDCs in carrying out resource surveys. If it is found that sufficient resources are unavailable, AID will reconsider its position with regard to the financing of resource identification and evaluation activities.

ACTION: TAB and SER/ENG will check the funds available for resource surveys by other institutions and donors.

D. Requests for technical advice and training in energy subjects outside AID fields of concentration could be significant in number and scope. Should AID limit its response to concentration areas?

Under PD-51, AID sponsors technical training and advisory services for countries interested in assessing national resources and requirements. AID will be prepared to respond to requests for specialized technical assistance which does not duplicate assistance provided by other development agencies. An example would be training in applied uses of solar energy.

AID consultants will be prepared to assist Missions which have questions on energy matters relative to projects proposed or underway in priority areas. If countries ask for U.S. advice on national energy planning, conservation, and management, AID should be prepared to respond. In this connection, Missions should be asked whether countries desire training in energy assessments and planning. If the response is positive, AID should consider what central backstopping and support would be required to respond to such requests. While AID would not be financing the construction of power plants, it would be prepared to assist countries assess energy requirements to do preliminary work on proposals intended for submission to the UNDP and IBRD. It was also agreed that AID would consider other training in the energy field when the need is not met by other sources.

ACTION: TAB, with SER/ENGR and SER/IT.

E. Capital Investments

Except in unusual cases, capital for energy investments would be expected to come from sources other than AID.

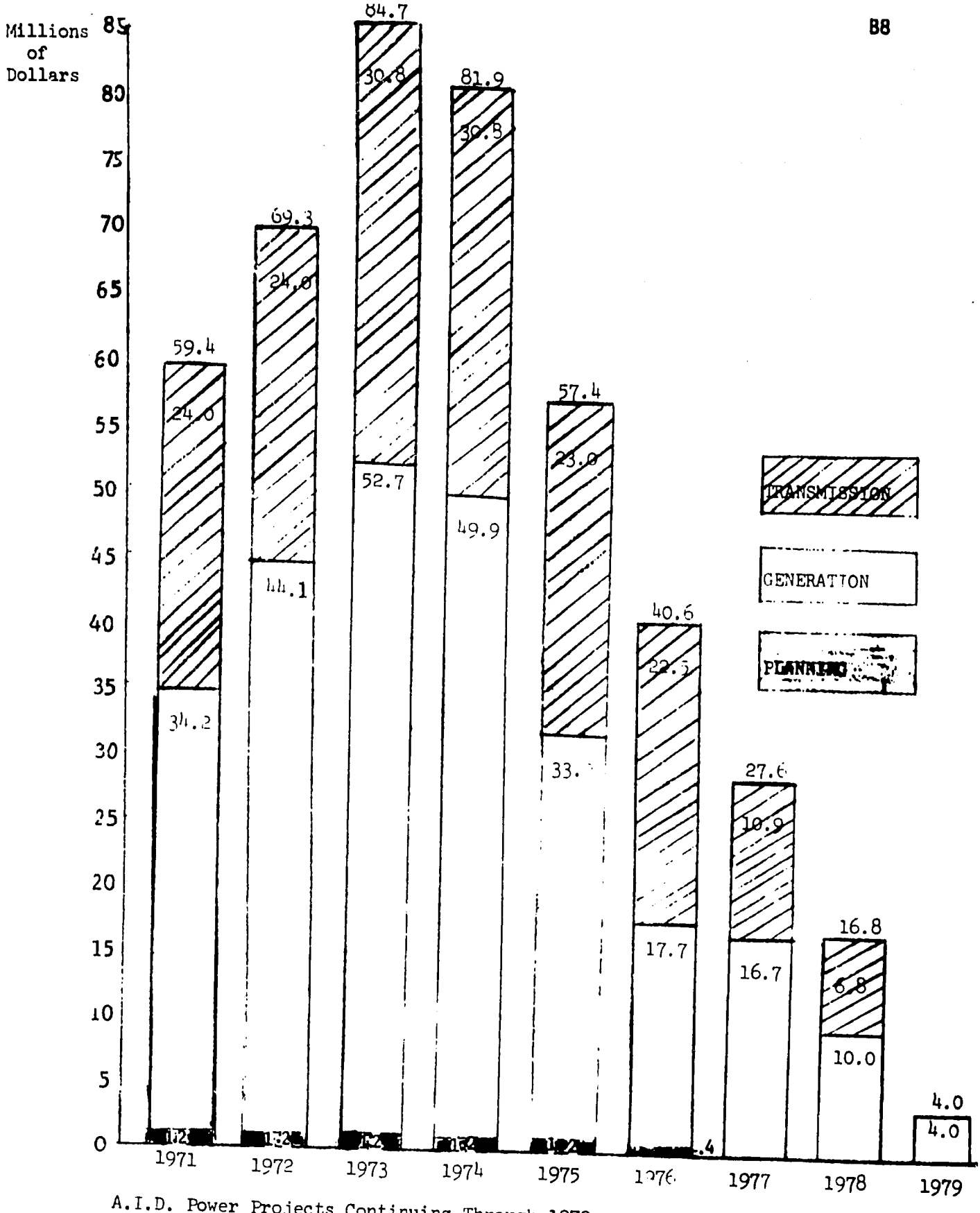
F. Research and Development

In view of the major U.S. research effort and long-range potential of Project Independence, the AAC recommends that an issue which the DCC should treat at an early date is whether, how and under what authority applicable findings of research and development undertaken for Project Independence could be extended to developing countries. The question of AID's responses to the pledge by the Secretary of State to provide LDCs access to U.S. energy technology could be treated at the same time.

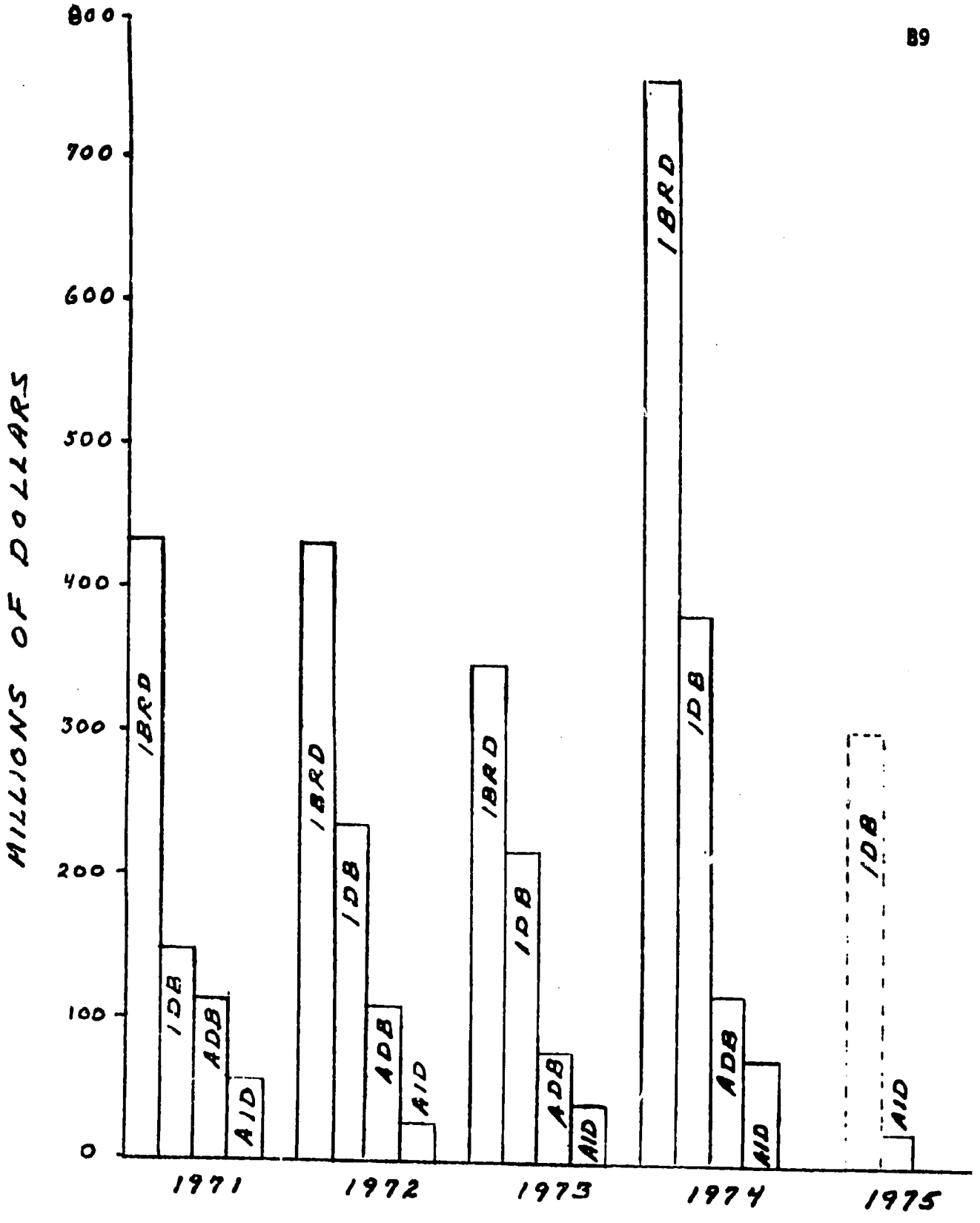
ACTION: IDC with SER/ENGR and TAB.

NOTE: The attached charts show lending and grant activities by several donors in the electrical power sector for the period 1971 to present. They are not directly pertinent to the AAC discussion as it unfolded, but provide related background and thus are being distributed for your information. Further effort is being devoted to compiling and assessing the international technical assistance community plans and projects for energy, most of which are still embryonic.

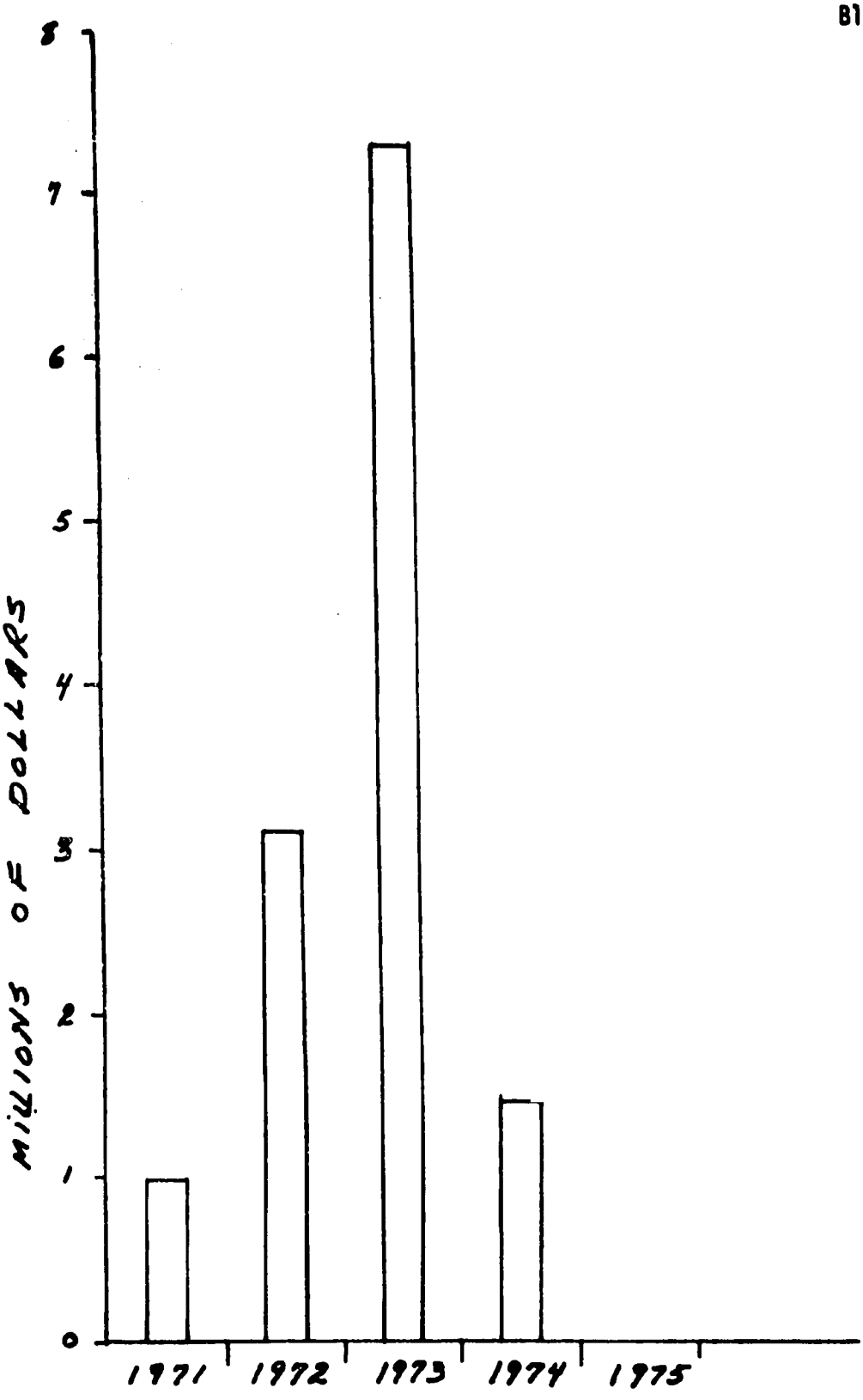
Attachments:
As stated



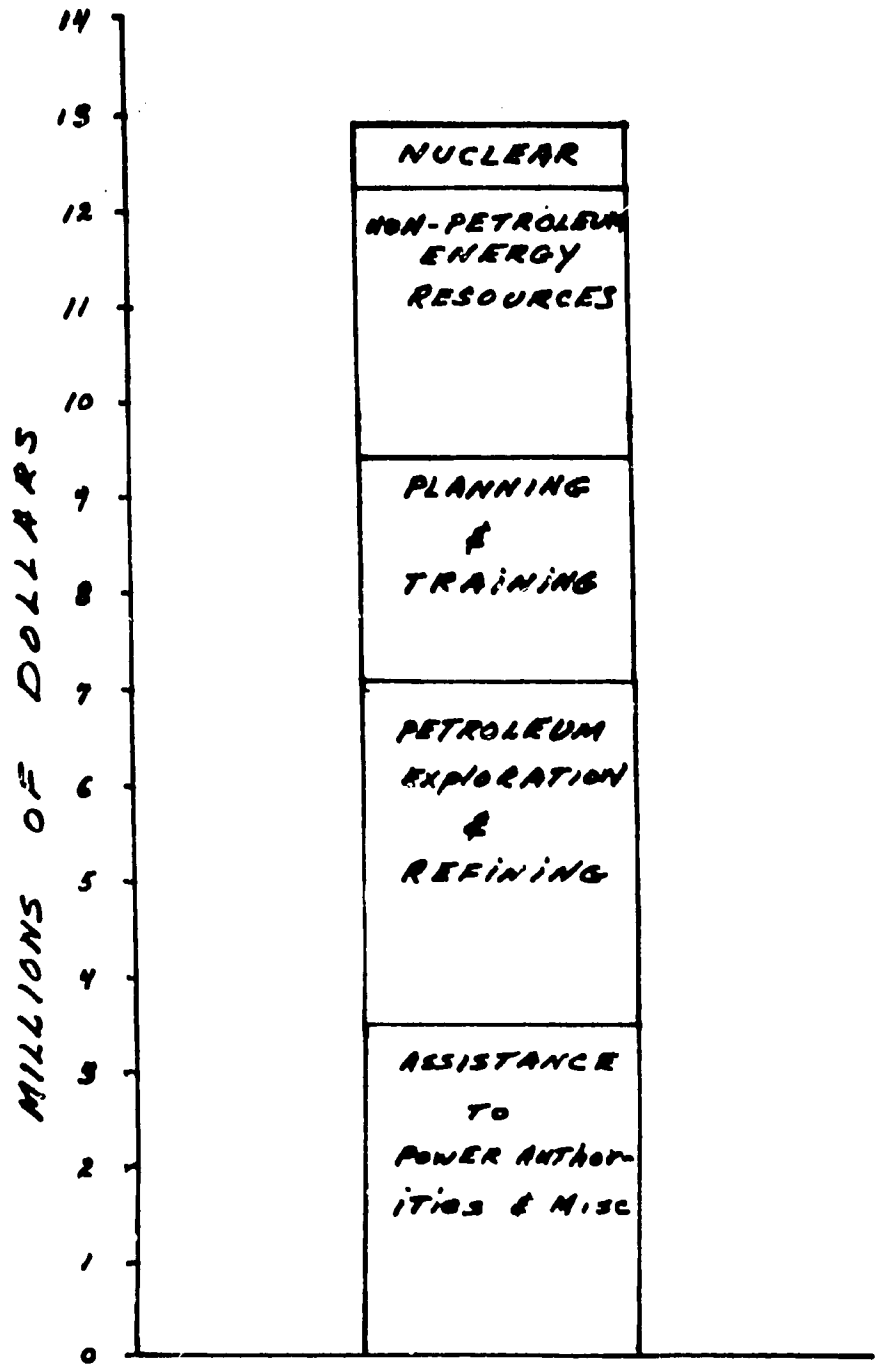
A.I.D. Power Projects Continuing Through 1979, as of Projects Approved in 1975
Estimated Annual Disbursements



VALUE OF POWER PROJECTS IN DEVELOPING COUNTRIES
(EXCLUDING EUROPE, EASTERN BLOC & CHINA)
BY YEAR OF INITIATION

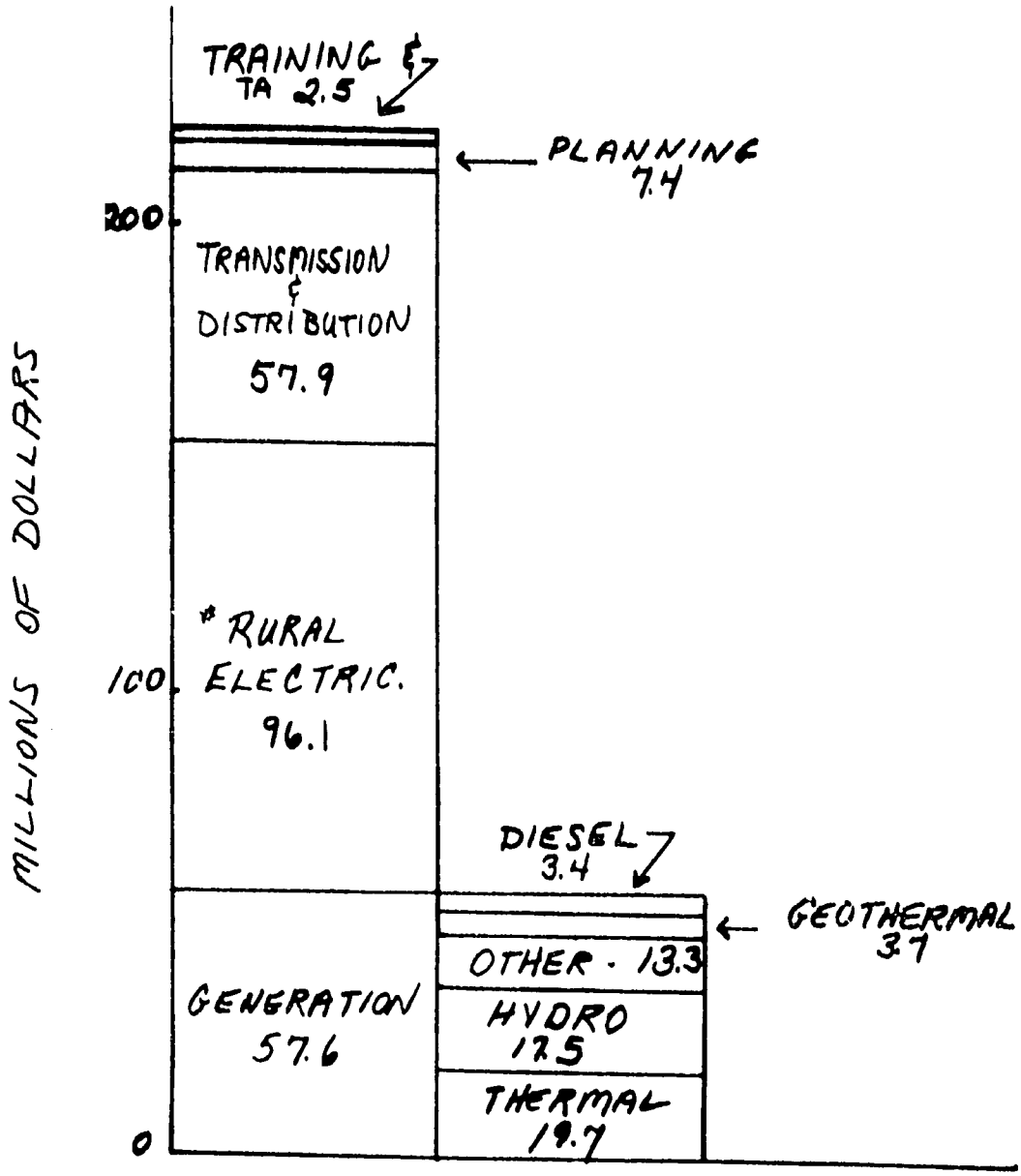


VALUE OF UNDP CONTRIBUTIONS TO POWER PROJECTS IN DEVELOPING COUNTRIES (EXCLUDING EUROPE, EASTERN BLOC & CHINA) BY YEAR OF INITIATION

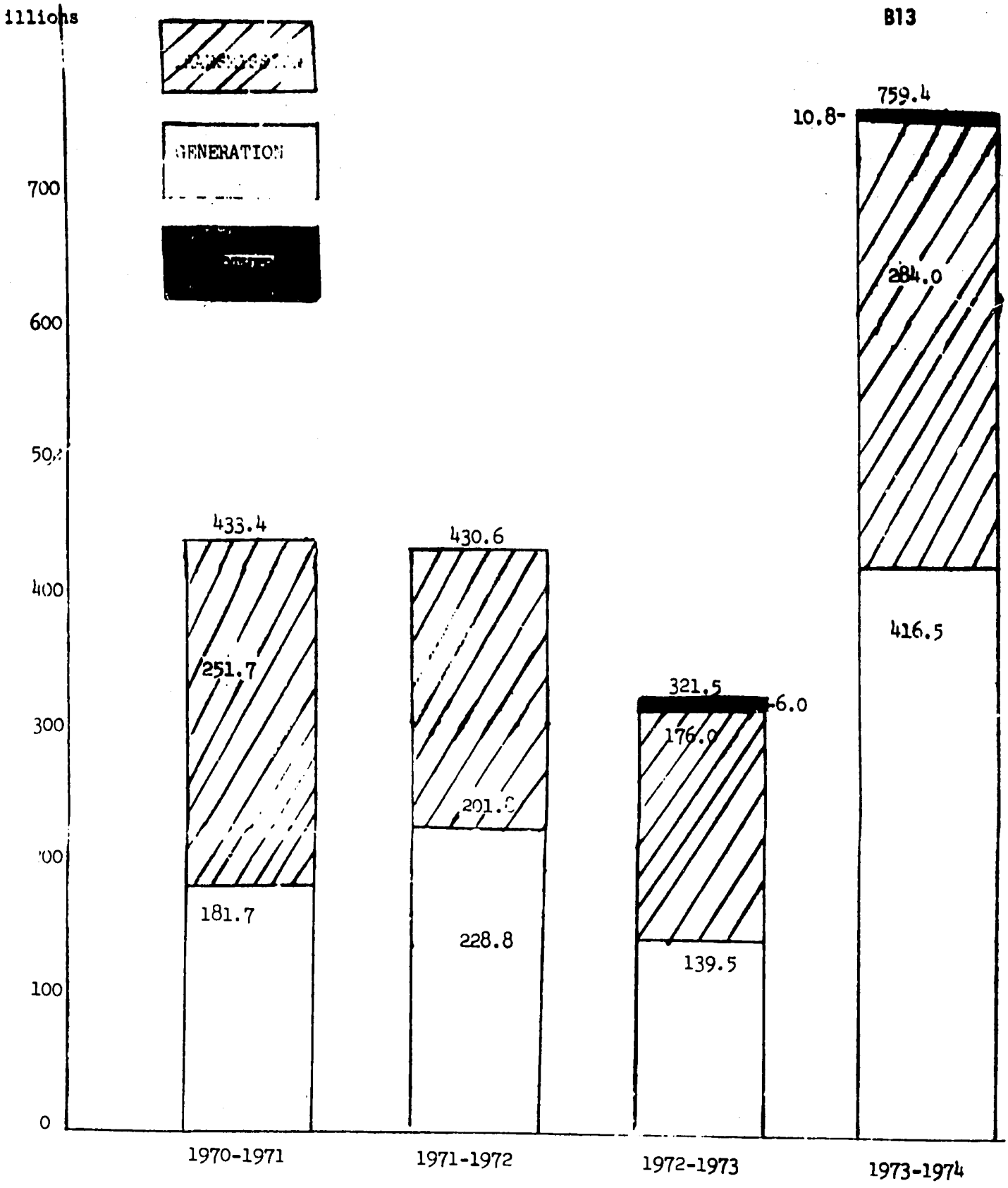


BREAKDOWN OF TOTAL UNDP CONTRIBUTIONS TO POWER PROJECTS 1971 - 1974

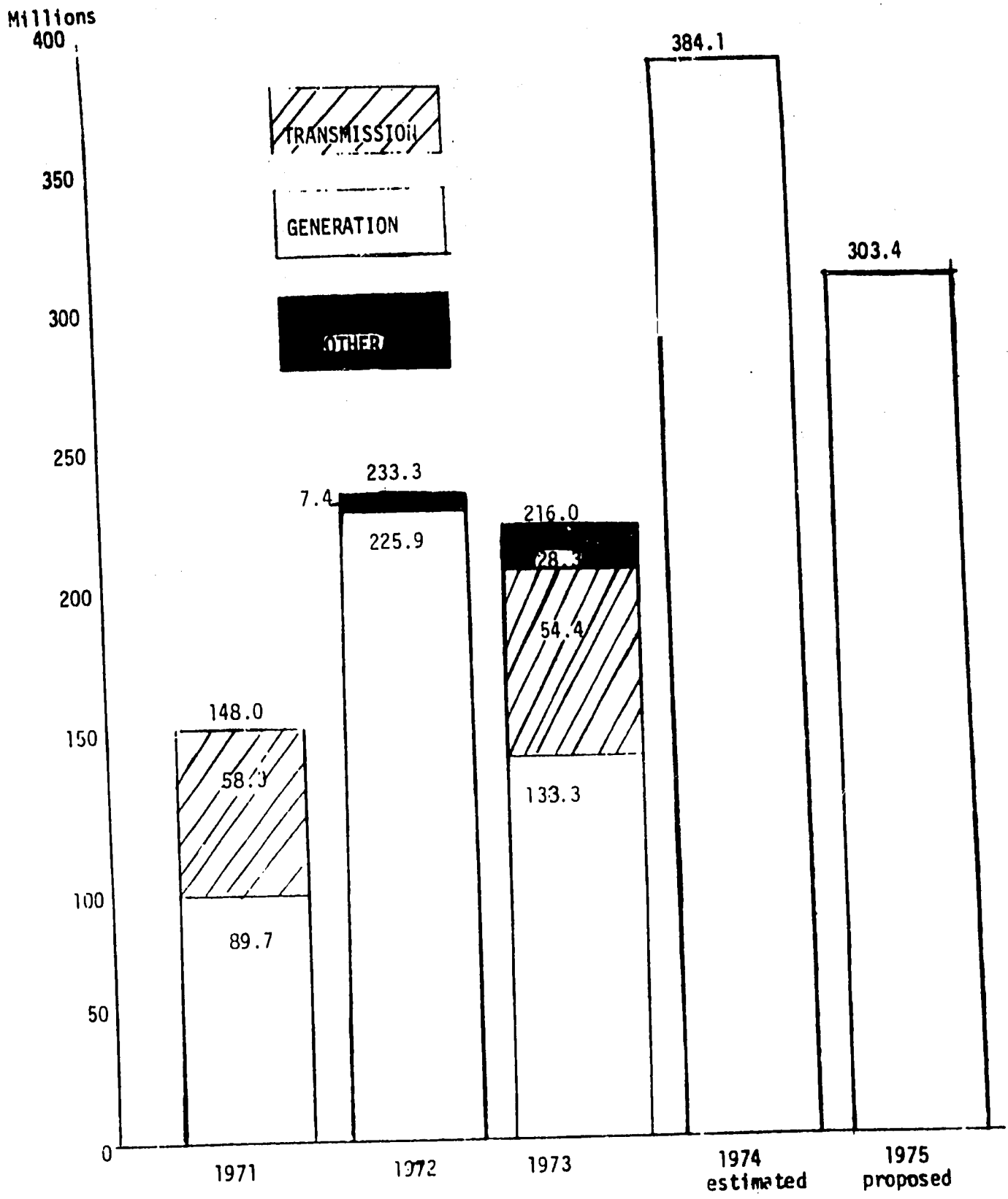
* INCLUDES DISTRIBUTION, TRANSMISSION, GENERATION



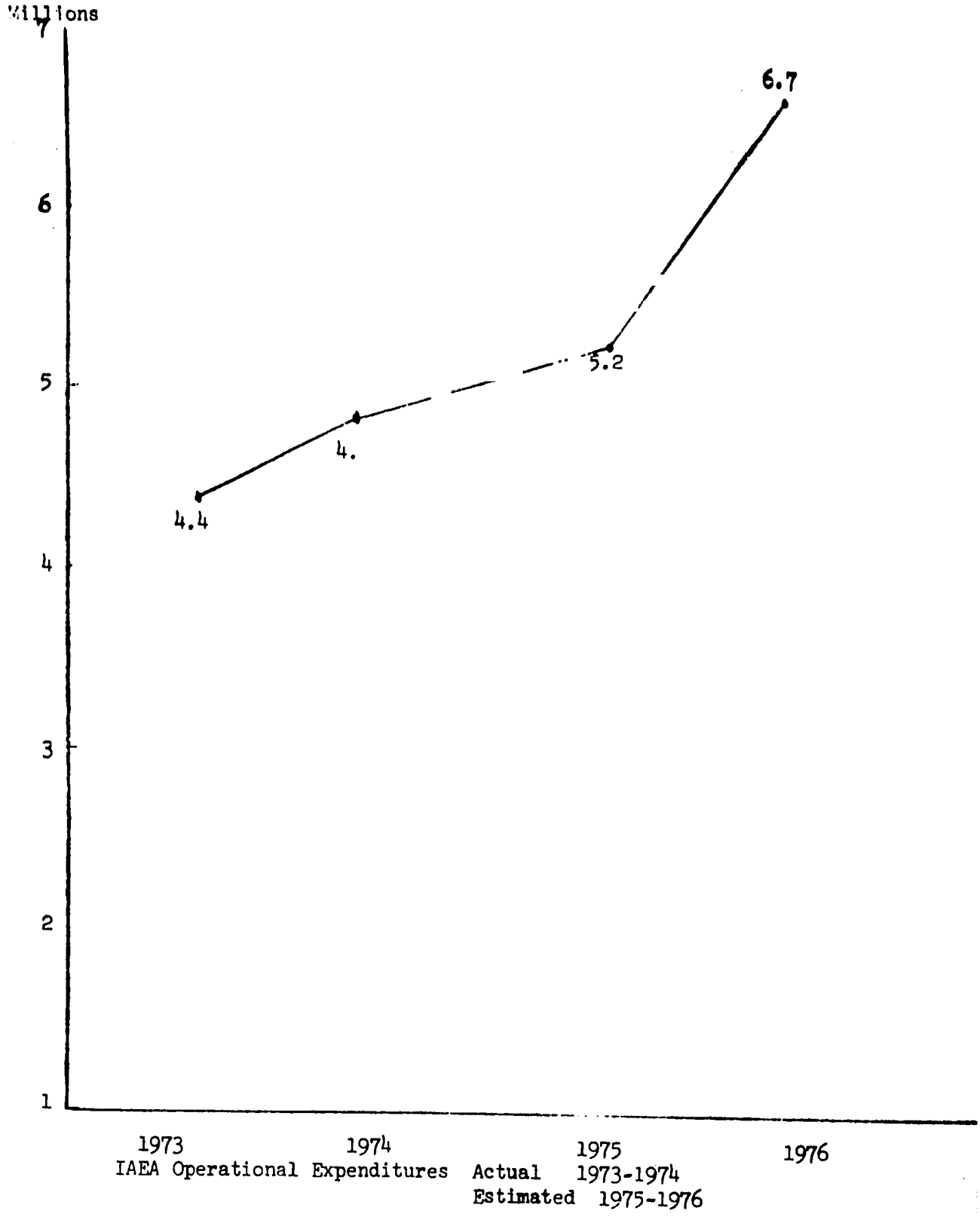
BREAKDOWN BY TITLE OF AID POWER PROJECTS APPROVED 1971-1975



IBRD Electric Power Projects in LDC's
initiated 1970-1974



Interamerican Development Bank Projects in the Power Sector
initiated 1971-1974


Millions
7
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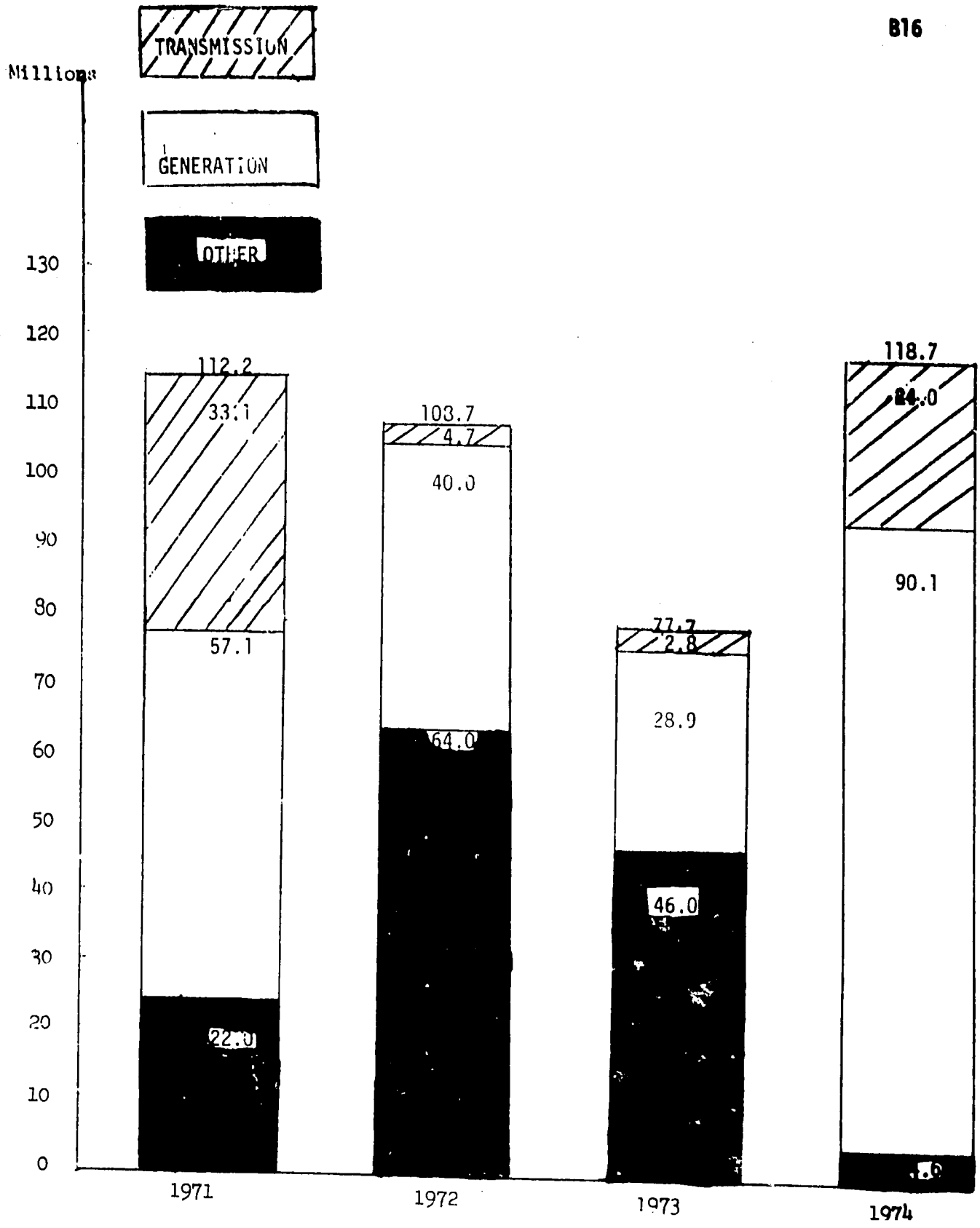
1973
1974
1975
1976
IAEA Operational Expenditures
Actual 1973-1974
Estimated 1975-1976



Asian Development Bank Projects in the Power Sector
initiated 1971-1974

ATTACHMENT C

AIRGRAM: AID STRATEGY IN THE ENERGY AREA

AIRGRAM

DEPARTMENT OF STATE

UNCLASSIFIED
CLASSIFICATION

For each address check one ACTION | INFO

DATE REC'D.

CAS

DATE SENT
8-1-75

TO - AIDTO CIRCULAR A-467

FROM - AID/W

SUBJECT - AID Strategy for Technical Assistance in the Energy Area

REFERENCE -

DISTRIBUTION
ACTION
DST
INFO.
NATA
MP
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TA/DA
TA/RD
TA/N
TA/PPU
TA/RES
AFR 15
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LA 15
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XXATTS

For Mission Directors from Farrar, AA/TA.

I. Summary: The AAC has reviewed the AID/W interbureau paper STRATEGY FOR AID ACTION ON ENERGY and has delineated a number of policies and actions in energy areas relevant to AID interests. Comments and inputs from the missions are invited on the elements of the AID strategy and their significance for AID's programs in the host countries. Several specific questions are posed below to assist AID/W in the formulation of program activities for FY 76, FY 77, and beyond.

II. Background: The continuing energy crisis has focused attention on the role of energy and energy intensive inputs in the development process. As a part of AID efforts to better understand the impact of greatly increased energy costs on AID priority programs and the possible alternatives to conventional energy sources for non-urban situations, AID/W has supported several studies and conferences over the past year. These include:

An Overview of Alternative Energy Sources for LDCs - Arthur D. Little

Expert Panel on Energy Policies and Programs for LDCs - National Academy of Sciences (No report)

A Survey of the Possible Use of Windpower in Thailand and the Philippines - U. of Massachusetts

Methane as an Energy Resource for Developing Countries - National Academy of Sciences (Report in preparation)

PAGE 1 OF 3 PAGES

DRAFTED BY	OFFICE	PHONE NO.	DATE	APPROVED BY:
C.A. Stone:aes	TA/OST	27971	7/10/75	Curtis Farrar, AA/TA 7/30/75

AID AND OTHER CLEARANCES
PPC/PDA:Kaw (draft)
AA/IDC:MMay (draft)
SER/ENGR:JRose (draft)
EA/DR:CStockman (draft)
NESA/DP:RBrandt (draft)
EA/TD:RGCourt (draft)
UNCLASSIFIED
CLASSIFICATION
AFR/DS:Pullman (draft)
SER/ENGR:Vogel (draft)
SER/MP/BPC:Ellachman (draft)

AID-9-99 (11-68)

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Alternative Energy Sources for Developing Countries - National Academy of Sciences (Report in preparation)

Interrelationships of Energy and LDC Rural Development - OST Annual Conference - Georgia Tech (Report in preparation)

These inputs together with interbureau discussions and the AAC review have highlighted the country-specific and even location-specific nature of energy needs. The impact of incremental additions of energy in rural areas on food production, employment and quality of life are not well established but non-metropolitan institutions appear needed if such additions are to be successfully made. Detailed analyses, embodying the net energy concept for inputs and outputs, of current energy usage are important to a clear understanding of possible positive courses for intervention. Technological energy options exist but economic and communication barriers constrain their utility for the poor majority.

The AID/W paper Strategy for AID Action on Energy is attached together with the minutes of the AAC review meeting. Three papers from the Georgia Tech conference are also attached for further background. The NAS reports will become available later this year.

III. Action Requested:

We plan to undertake in a selected small number of countries a study of their energy programs and the impact of energy constraints on development. The field missions are requested to provide situation reports and recommendations which will assist AID/W in selecting priority areas and countries to be studied. Answers to the following questions will also be helpful to AID/W in structuring follow-on activities.

A. Is energy proving to be or likely to be a serious constraint to priority AID programs? If so, in which sector(s) and in what form is the constraint manifested?

B. Does the host government need and wish technical assistance in energy assessment, planning, conservation or management? In non-petroleum energy resource assessment? In energy technology?

C. What local institutional capability exists to deal with energy technologies and incremental energy sources or usage for the rural poor?

D. Do you perceive a need for specialized training for LDC personnel in energy subjects?

E. To what extent, if any, are other donors providing assistance to the host country in energy related areas?

F. If an in-depth study of energy needs and constraints were undertaken in your country, what scope and priorities would you recommend?

Replies by 15 September, 1975 are essential to timely program planning.

IV. Follow-on Activities:

AID/W is currently contacting other donor agencies to ascertain their current and planned activities in energy areas; training, technical assistance, resource assessment, planning and management, conservation, etc. Your answers to question E above will assist this survey. A report will be issued and made available to the missions. Energy project concepts are being developed and appropriate PIDs will be circulated to missions on the basis of response to this airgram.

Information and documentation on energy topics will be provided by AID/W from time to time. Requests for specific information are welcomed.

INGERSOLL

Enclosures:
1. Strategy for AID Action on Energy
2. Minutes of the AAC Review Meeting dtd 6/12/75
3. Energy and Rural Development by Roger Revelle
4. Food: Role of Energy in Providing Food by Ernest T. Smerdon
5. The Implementation of Rural Energy Programs by T.A. Lawand

SEND TO: LIST P

See list of info addressees attached.

ATTACHMENT D

SUMMARY OF AIRGRAM REPLIES

ATTACHMENT C2

SUMMARY OF REPLIES TO ENERGY AIRGRAM

Airgram Question	Yes	Yes But	No But	No
A. Is energy a serous constraint to priority AID programs?	Tanzania, Upper Volta, Zaire, Colombia, Costa Rica, Bangladesh, Philippines, Jamaica*	Cameroon, Ghana, Senegal, Chile, Uruguay, Nicaragua, Cominican Republic	Ethiopia, Kenya, Liberia, Mali, OSARAC**, Brazil, Bolovia, Peru, Panama, Egypt, Indonesia, Nepal, Haiti	Ecuador, El Salvador, Afghanistan, Marocco, Yemen, Tunis
B. Does the host government wish TA in energy areas?	Ghana, Senergal, Zaire, Chile, Colombia, Costa Rica, Nicaragua, Panama, Indonesia, Jamaica*	Cameroon, Ethiopia, OSARAC**, Tanzania, Upper Volta, Bangladesh, Nepal, Dominican Republic, Haiti	Liberia, Brazil, Peru, Uruguay, Egypt, Yemen	Mali, Afghanistan, Marocco, Philippines, Tunis
C. What local institutional capability exists in energy areas?	Cameroon, Kenya, Brazil, Chile, Colombia, Peru, Costa Rica, El Salvador, Nicaragua, Panama, Egypt, Morocco, Nepal	Ethiopia, Ghana, Mali Upper Volta, Zaire, Bolivia, Honduras, Uruguay, Indonesia, DominicanRepublic, Jamaica	Haiti, Tunis	Liberia, OSARAC**, Tanzania, Afghanistan, Bangladesh, Yemen
D. Is there need for specialized training in energy subjects?	Ghana, Senegal, Upper Volta, Zaire, Colombia, Costa Rica, Honduras, Nicaragua, Panama, Nepal, Dominican Republic	Cameroon, Ethiopia, Maili, OSARAC**, Tanzania, Uruguay, Indonesia, Jamaica*	Kenya, Liberia, Egypt, Haiti	Bolivia, Brazil, Peru, Ecuador, El Salvador, Afghanistan, Morocco, Philippines, Tunis, Yemen
E. If an in-depth study of energy needs were made in your country, what scope and priorities?	Chile, Colombia, Costa Rica, Nepal, Dominican Republic, Jamaica	Ghana, Kenya, Senegal, Tanzania, Upper Volta, Panama, Indonesia, Haiti	Liberia, OSARAC**, Zaire, Peru, Nicaragua	Cameroon, Ethiopia, Mali, Bolivia, Brazil, Ecuador, Uruguay, El Salvador, Honduras, Afghanistan, Egypt, Morocco, Philippines, Tunis

* Jamaica did not reply to the airgram. Inclusion here is based upon statements in the ABS.

** OSARAC countries referenced in the reply were Botswana, Lesotho, Malawi and Swaziland.

TRIP REPORT: SENEGAL, UPPER VOLTA, GHANA, CAPE VERDE ISLANDS

OPTIONAL FORM NO. 10
MAY 1962 EDITION
GSA FPMR (41 CFR) 101-11.6

UNITED STATES GOVERNMENT

Memorandum

TO : TA/OST, Mr. Henry Arnold DATE: January 2, 1975

FROM : TA/OST, Jerome Bosken

SUBJECT: Trip Report for Senegal, Upper Volta, Ghana, and Cape Verde Islands

A trip was made to four West African countries to discuss with government officials, technical personnel and AID mission staff the possibility of utilizing alternative energy sources in rural development programs. The countries visited were Senegal, Upper Volta, Ghana, and the Cape Verde Islands. The aim of the OST energy project is to minimize energy constraints on AID priority programs and LDC development and includes in-depth energy studies of selected countries, the establishment of courses and the training of LDC personnel in alternative energy sources, and the utilization of alternative energy sources in demonstration projects.

Senegal: There is a great deal of interest in solar energy in Senegal. GOS, through its Ministry of Plan (M. Ndiaye, Technical Advisor), intends to create a corporation in 1976 charged with applying solar energy in the villages. It will have the responsibility of selecting appropriate technology and planning for its rural utilization. There will be no great stress placed on solar cookers since GOS is currently encouraging villages to switch from firewood to inexpensive natural gas cookers. Senegal does possess deposits of natural gas and its use in cooking would help to alleviate the deforestation problem due to the gathering of firewood. The Institut de Physique Meteorologique (Prof. D. Fall), University of Dakar, has several generations of solar pumps, including the newest, a 1 KW pump manufactured by a French firm, SOFRETES. We saw 2 more of these installed in Upper Volta. In all at least 7 have been installed and 5 more are being planned for French-speaking West Africa. The Institute is also working on solar water heaters and food driers. The studies here are at the graduate level and they have just upgraded the curriculum with the introduction of a Ph.D. program that began last year.

The University's Institute of Technology, IUT, (M. Kergreis) is concerned with applying existing solar and wind technology to small pumps and other systems. Their charge is to teach and train technicians with special emphasis on unsophisticated equipment and local fabrication. They have no responsibility regarding the application of these technologies, however. The director submitted a plan for a proposed techno-economic study of the energy market in Senegal, concentrating on solar energy, with a request for AID fianancing.

The General Delegate on Scientific and Technological Research (Dr. Sene) coordinates the various university and governmental research efforts and reports directly to the Prime Minister. The GOS wants a study of energy needs to 2000 for both rural and urban use; this would form the basis of an overall development plan. Since the U.S. is one of the leading countries in solar energy research, he would like more cooperation with us. GOS desires to install several solar water pumps in village situations, for water supply and irrigation. Because of the cultural difficulties involved with introducing new technologies, his office is working closely with Promotion Humaine, the government effort to address the human side of development.

M. Ben Mady Cisse is the Director of Promotion Humaine. A part of this program is a middle level (11 - 15 years of age) practical education in simple technical items appropriate to the village milleau (EMP). They have set up an experimental village as a training center where such things as wind power, solar driers, and solar cookers are worked with. The contacts between EMP and IUT have so far been limited in number, but satisfying due to the practical and Senegalese oriented nature of the Institute of Technology.

Upper Volta: A big energy problem for Upper Volta is the lack of firewood for cooking. The wood for use in Ouagadougou is brought in from an ever increasing distance, currently 45 miles. Besides solar cooking, other useful applications of alternative energy sources would be for portable mills for grinding grain and solar refrigeration for preserving food for markets.

The Interstate School for Rural Engineering (M. Veridique) gives university level preparation to students from 13 Francophone West African countries. Funding comes from member states, French aid, and multilateral assistance. They are free to accept any form of bilateral or multilateral assistance. The experimental work in solar energy includes studies of several models of solar water pumps on campus, hot water heaters, and a solar cooker. The research concentrates on the application of existing technology. The students study for 3 years with a possible 4th for specialization and then are obliged to return to work for their home governments.

Local fabrication skills were evident at two places in Ouagadougou. SAFI is a metal working company where such items as water basins, concrete forms for wells, even a railroad car have been made. The equipment is modern and the workers well trained with the ability to read blueprints. The ILO runs a workshop that produces intermediate technology items for village use such as plows, ox-bows, hand-powered grain processors. The facilities include complete blacksmith and carpentry shops. They would appear to be able to construct a wide variety of energy-related items such as wind mills or solar cookers and driers.

The Minister of Rural Engineering (M. Tiao) expressed his interest in solar energy. There is one solar pump operating in Upper Volta and a desire exists to install similar units at other sites for village water supplies, pastoral supplies for irrigating cattle herds and irrigation.

He hopes to get Franch aid but would also seek other funds. He needs to interest government officials in his projects and has vague plans (but no money) for a seminar to demonstrate the capability of various solar devices including cookers. To get the greatest impact, a new technology, such as a solar cooker, should be initially demonstrated in the cities rather than in the village. The importance of such technology is greater in the cities than in the countryside because the energy problem (lack of firewood) is more severe in the cities.

The CEAO (Economic Committee for French-speaking West Africa) has plans for a solar energy seminar to deal with industrial applications (M. Traore, Secretary General's Office). Although the individual states will select their representatives, most of the attendees will probably be specialists rather than government planners. The goal is to inform the policy makers of the utility of solar energy. CEAO will publish a summary of the discussion out of which priorities and the desired direction of research will emerge. The tentative schedule is to hold the meeting shortly after the beginning of the year.

The working solar pump (SOFRETES) at the hospital in Konpela supplies the water for the facility and is currently being adapted to power a small refrigerator for perishable medicines and vaccines. A discussion with a Peace Corps worker there indicated that a solar sterilizer for their medical instruments could be useful due to the high cost and uncertain supply of the bottled gas now used.

The director of the ORD project in Fada N'Gourma feels that a greater domestic use of energy would release women to participate more fully in agricultural production and other projects. He mentioned millet grinding, water pumps, solar cookers. We discussed the cultural mores of cooking with two women extension agents. Although there are minor differences between tribes, in general the main cooking begins at 6 PM with the preparation of various sources. This timing would seem to preclude the use of solar cooking in the villages. These women expressed little interest in the idea of gathering manure for methane generation.

ASECNA is the regional air navigation service. They provided us with wind data on Ouagadougou and Fada N'Gourma. During the dry season (8 months), the wind comes from the North-East with an average speed of 18 km/hr at Ouagadougou. During the wet season, the winds out of the South-West predominate. The average speed is 11 km/hr. with gusts greatly exceeding that. These preliminary figures indicate the possibility of using wind energy in the areas.

Ambassador Graham reiterated his interest in seeing some alternative energy project in Upper Volta. The electrification of Fada using solar energy would be especially desirable. Another possibility is to use the new slaughterhouse as a source of manure for methane generation.

Ghana: The governmental interest in Ghana was more concentrated on utilizing hydropower and expanding the existing electrical network. GOG is currently seeking funding for its second hydroelectric dam and already has plans for a third dam (Mr. Aware-Kyeri, Deputy Director, Ministry of Plans). They have a competent existing infrastructure for the development of the hydroelectric potential and the distribution of the power to industrial and other heavy users and to small users and expansion into towns and villages. The Volta River Authority builds and operates the dams and generation stations. They also distribute the electricity to the large users. The Electricity Corporation of Ghana has the responsibilities of the distribution of power to domestic and commercial users and of the electrification of towns and villages either by expanding the current electrical grid or by decentralized generation.

But there is nevertheless interest in pursuing the possibility of alternative energy generation. The Council of Scientific and Industrial Research, CSIR, (Mr. Tackie, Executive Chairman), is anticipating a summer workshop on the energy situation in Ghana. The workshop is being supported by NAS and AID which has a special interest in structuring the attendance so that it will include decision and policy makers as well as technical specialists. The tentative date is the second week of July 1976. Implementation of ideas would be stressed. GOG would participate and aid in identifying areas of interest and priorities in energy.

In addition, the Economic Commission for Africa is holding its Second African Meeting on Energy in Accra on 1-12 March. The organization of the meeting will be done by the Volta River Authority (VRA) (E.A.K. Kalitsi, Director of Finance) which is in charge of the generation of power and its distribution to heavy users in Ghana. Conference topics include solar energy and rural/village energy.

The Electricity Corporation of Ghana (K.A. Duker) is interested in decentralized generation of electricity for remote locations. High cost electricity from their diesel generators ($0.11/kwh) is subsidized by low cost hydroelectric power purchased from VRA ($0.007/kwh), allowing power to be sold to small users for $0.02/kwh. But remote sites entail high transmission costs of the hydroelectric power (e.g. $18,000/mile for a 11,000 volt line) or the high generation cost from diesel sources for decentralized generation.

A plentiful source of renewable energy in Ghana is wood. GOG has a 10 year plan to clear forests and start plantations of export grade timber. UNDP (Mr. Ramadan) has just begun a pilot project to study the production of charcoal from the wood cut in this clearing effort. The project will, among other things, identify which woods are optimal for charcoal production and train personnel in the fabrication and use of various charcoal production devices. The intent is to do this preliminary work to prove the feasibility of a possible charcoal industry (for both domestic use and export) in Ghana.

Local fabrication and adaptation of technology was shown by the workshop of Agricultural Engineering Ltd. This firm makes a wide variety of intermediate technology items, peanut huskers, grinders, vegetable crushers, plows, containers, carts, many more.

Cape Verde Islands: The Minister of Economics (Sr. Osvaldo da Silva) is very interested in setting up a Center for Energy Research in Cape Verde. This is a very ambitious project that has received UN encouragement. As planned, it would be a world-renowned center of research and development under the direction of a former Cape Verdean (Fronseca) which will play an active part in the world's search for renewable energy, solar, wind and geothermal. He is also extremely interested in the possibility of training one or two Cape Verdeans in the U.S. in the area of renewable energy.

Denis Fernando-Pulle (UN/OTC) is in charge of the UN water development project in Cape Verde. He has extensive plans for construction of dams and wells and the use of small and large water pumps to distribute water and expand arable land. Since he is still in the initial study stages of this work, it would be premature to consider the types of technical support that AID might provide. But the project will include a large number of small pumps and it might be desirable at a later date to consider possible wind or solar powered devices for use here.

SUMMARY:

The trip demonstrated that the various countries are interested in the use of alternative energy sources at the village level. Because of climatic conditions, much of the concern is with solar energy. Governmental plans for its use and perhaps vague procedures for implementing these plans were evident in Senegal. In Senegal and in Upper Volta we saw numerous facilities where solar energy was being studied at various levels or demonstrated in the form of solar water pumps or hot water heaters. The French firm SOFRETES has installed its solar water pump in at least seven sites in six Francophone West African countries. These include both universities and field demonstrations, with concrete plans and expressed desire on the part of governmental officials to install many more. Although its liabilities include high cost (about $45,000 for the standard 1 kw model), limited utility time (about 4-6 hours per day depending on time of year), and a reasonably high degree of technical complexity, the pump is nevertheless well-known and popular in the area and there exists some marketing and service infrastructure. For example, a SOFRETES technical representative is stationed at the Interstate School for Rural Engineering in Ouagadougou. It would seem that the area would be a fertile field for demonstration of other advanced solar technology, perhaps a water pump powered by an array of solar cells or by a solar concentrator device.

In Ghana and Cape Verde the interest was not so focused on solar energy but included alternative energy sources in a more general sense. In Ghana

importance was placed on this summer's planned seminar to examine the total energy situation. It would appear that AID attention should be directed toward that conference and any further activity await its results.

In Cape Verde a lot of enthusiasm was expressed for the proposed Center for Energy Research. An important element in the planning is the engineer Fonseca, a Cape Verde native now living abroad, who it is hoped will become the organizer and director of the center. Although salary level will be a problem the government wants to employ him at least on a part time basis for this work. The project has been submitted to UNDP for funding and any AID energy program for Cape Verde would depend upon further developments concerning this center.

The competence of the various technical institutions we visited was quite high. Whether they were stressing the more complicated solar pumps or simpler items such as solar food driers or hot water heaters, the researchers were enthusiastic and seemed capable and aware of the needs of the country. Although there were frequent expressions of interest in doing work applicable to the rural situation, there was no university responsibility for actual application. In Senegal concern for such application would seem to be concentrated in Promotion Humaine which attempts to foster village development through the introduction of new technologies without placing undue strain on the cultural patterns of the people.

Fabrication facilities throughout the area were very good. Skills in metal working, carpentry, blacksmithing, adaptation of technologies were demonstrated at the several workshops that we visited. Of the universities, especially Senegal's Institute of Technology had an interest in the design and construction of simple technical items such as wind-powered pumps and solar concentrators.

cc:
✓TA/OST, C.A. Stone
AFR/DS, S. Klein

ATTACHMENT F

REQUEST FOR ASSISTANCE IN ENERGY FROM AID/NEPAL

UNITED STATES OF AMERICA
AGENCY FOR INTERNATIONAL DEVELOPMENT
MISSION TO NEPAL

December 31, 1975

Mr. Julius E. Coles
AID/SA
Agency for International Development
Washington, D. C. 20523

Dear Julius:

A possible area of modest USAID involvement which has increasingly attracted my attention concerns the need for innovative approaches to providing new sources of energy to rural Nepal. There is probably no more pressing problem facing rural Nepal today than the rapid deforestation of the land for firewood. You have undoubtedly seen the October 4 Saturday Review article by Eckholm which states little more than what is immediately apparent to anyone who has walked into the hills here.

As a consequence of Kissinger's UN speech, in which he mentioned energy research as a priority U.S. aid effort, I briefly considered alternative possibilities for a U.S. role; but I decided that there was really no task particularly appropriate for U.S. assistance.

Lately, several events have made me rethink this position. The first occurred during Todd's trip here. We visited a Peace Corps gobar gas plant in Pokhara that made a striking impression on me. A volunteer had constructed a family size unit that was attractive from an economic viewpoint and had captured the imagination of the local community. It seemed to me a very natural involvement in an extremely important area for the Peace Corps. I volunteered to make some "self-help" funds available for materials if the Peace Corps would design and manage the project. (This is the background to our cables for information on gobar gas plants!) The Peace Corps is currently working on a proposal.

More recently, I have been approached by a member of the National Planning Commission, Govind Prasad Lohani, concerning AID's interest in providing some very modest assistance to their newly established Energy Research and Development Group. This group was established in large measure as a consequence of the six-month assignment of Chaman Kashkari, Associate Professor of Electrical Engineering at the University of Akron, who was financed under the AID-financed SEED program. 215-375-7648 (1974-75) 7111

Without wanting to appear overly sanguine, I think there just might be a very small, but very catalytic, role we could play in rural energy research

Dr. Rabonovitch at the National Academy of Science, i.e., an arrangement whereby the NAS might establish a continuing consulting relationship with the Energy Research and Development Group here. We could supplement their efforts by setting up a small local currency fund to finance a few scholarships in India where substantial research is going on, limited experimental commodities, etc. You might also sound out the TAB people working on the SERI program for some ideas. I would also recommend a phone call to Professor Kashkari for additional background information.

I want to stress that I am not talking about a USAID project here. I do not want any continuing management responsibilities that would detract from our planned concentration areas. But it strikes me that the problems Nepal is facing so acutely in rural energy have implications that go far beyond Nepal. It seems to me that the kind of applied research on innovative technology required is precisely the kind of task TAB should be interested in developing with appropriate U.S. institutions. It is also the kind of thing the U.S. can be very good at doing.

As a starter, I am trying to interest the Asia Society to look at the rural energy problem as a possible topic for a SEADAG seminar in Nepal (see Kathmandu 5559). Would you let me know what kind of interest you can stir up regarding broader AID involvement.

Sincerely,

Charles R. Grader
Director

ATTACHMENT G

MEMBERS OF INTERBUREAU WORKING GROUP THAT

ASSISTED IN PREPARATION OF PROJECT PAPER

Members of the Interbureau Working Group

The following were members of the interbureau working group that assisted in writing this Project Paper:

James Mudge	PPC/PDA
Edward Schaefer	LA/DR
John Rixse	SER/ENGR
Whitney Hicks	TA/AGR
Clinton Stone	TA/OST
Jerome Bosken	TA/OST

Although his time for participation was limited, Jay Ingersoll, cultural anthropologist with the Development Studies Program, contributed significantly by offering helpful insights into the sociological aspects of the proposed project.