

A. I. D. ENERGY PROGRAMS

A Summary Report

September, 1983

Explanatory Note

This report has been prepared by John D. Blumgart, Consultant to the Bureau for Program and Policy Coordination, for Presentation to the Development Assistance Committee (DAC) Energy Meeting in Paris October 13-14, 1983. It is based on written materials and on discussions with officials coordinating AID's energy programs in the regional and central bureaus of AID's offices in Washington and is intended as a summary and illustrative presentation of AID energy activities. The report does not substitute for detailed project information that may be obtained from those within AID who are responsible for individual projects. It also cannot substitute for the views of the developing country officials who have the basic responsibility for implementing energy activities in their own countries.

Abstract and Summary

Foreign aid policies and programs of the United States and other donors have been increasingly affected by the dual energy dilemma confronted by most developing countries: (a) excessive dependence on imported oil to drive their modern and urban industrial and commercial sectors, and (b) overstretched forest resources to supply the domestic energy needs of the majority of their rural and urban populations. The recent lowering of oil prices has not substantially altered the seriousness of this dilemma. Energy constraints permeate virtually all the efforts of developing countries to improve their living standards and to raise output, including particularly the capacity of their agricultural systems to meet the needs of expanding populations.

Reflecting the increased priority demanded by the problem, the United States AID program has committed or planned over one billion dollars in energy assistance efforts in thirty-five developing countries over the fiscal years 1979-1984. These programs concentrate on technical assistance (and capital assistance in selected countries) in four major policy areas:

- Energy analysis, planning and policy development;
- Training and institutional development;
- Technology systems development, including research, demonstration and site testing of new supply systems;
- Increasing energy supplies and improving the efficiency of energy use, particularly enlisting the resources and skills of the private sector.

This report provides a summary analysis of the emerging new efforts in development programs involving energy. Although necessarily resulting in some overlap and repetition, it has seemed useful to describe these new efforts from three points of view: First, in terms of the general policy framework; Second, according to the major program implementation areas; and Third, in terms of the more individualized strategies for specific geographic areas, as developed and adapted by AID's Bureaus for Africa, Near East, Latin America and the Caribbean, and Asia, and by the central Bureau for Science and Technology.

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AID ENERGY PROGRAMS

I. OVERVIEW: THE GENERAL POLICY FRAMEWORK

Foreign aid policies and programs of the United States and other donors have been increasingly affected by the dual energy dilemma confronted by most developing countries: (a) excessive dependence on imported oil to drive their modern and urban industrial and commercial sectors, and (b) overstretched forest resources to supply the domestic energy needs of the majority of their rural and urban populations. The recent lowering of oil prices has not substantially altered the seriousness of this dilemma. Energy constraints permeate virtually all the efforts of developing countries to improve their living standards and to raise output, including particularly the capacity of their agricultural systems to meet the needs of expanding populations. Consequently, these also constrain the effectiveness of past and continuing foreign assistance programs.

Under the Reagan Administration AID assistance emphasizes four cross-cutting policy and program themes:

- The importance of dialogue on policy issues, leading to improved policy planning in developing countries;
- Strengthened institution building, including accelerated human resource training;

- Technology transfer, including testing and research, to increase productivity in all sectors;
- Increased involvement of the private sector in resource mobilization.

Energy problems in the developing world have many common elements but each country displays particular characteristics arising from its individual needs and resources. AID's organizational mode, emphasizing the role of resident missions, facilitates adjusting assistance to individual country circumstances. Bilateral energy programs are administered by these missions organized within four Regional Bureaus; Africa, Asia, Latin America and Caribbean, and Near East. In addition, a central Office of Energy carries out a wide range of activities in support of these country-oriented programs as well as research that applies more broadly to many developing countries.

AID energy assistance programs concentrate on the following policy areas, giving sectoral support to the above policy themes:

- Energy analysis, planning and policy development;
- Training and institutional development;

- Technology systems development, including research, demonstration and site testing of new supply systems;
- Increasing energy supplies and improving the efficiency of energy use, particularly enlisting the resources and skills of the private sector.

Policy Planning

The first area concerns helping developing countries achieve a better understanding of energy policy issues and of the ways energy interrelates with the broader development process. Analysis of policy issues usually points to the importance of a market-oriented approach on energy pricing and to tackling economic or institutional distortions which artificially encourage consumption or impede supply. AID is particularly interested in assistance for improved data collection, especially rural energy surveys and the linkages between energy and expanded agricultural production. Provision of long-term energy planning advisers is another feature of this activity.

Training and Institution Building

AID's second policy area helps developing countries to build indigenous technical, research and administrative capacity in subjects ranging from fuelwood/forestry to improved energy efficiency. Building institutional capability is a priority concern for AID and a key component of most bilateral

projects. As part of this effort, training is often included in these projects, and is augmented by world-wide training programs in energy management, conventional energy and alternative energy technologies, and regional training schemes, such as with the ASEAN countries.

Technology Development

The third policy theme addresses the design, testing, introduction and evaluation of new or improved energy technologies. Most energy projects include testing and evaluation components and strengthening research and development capacities within developing country institutions. AID programs are now concentrating on a more systematic collection of energy data and on sharing this information with the developing countries and with other donors.

AID has designated fuelwood research as one of its four research priorities and a major effort is being planned. The U.S. supported the May 1983 DAC/OECD Development Center Colloquium on fuelwood research in Africa and has agreed to finance a follow-up African regional workshop on that subject. Similarly, expansion of AID-supported fuelwood research programs is in process for other regions of the world.

Expanding Energy Supplies and Improved Energy Efficiency

The fourth policy theme for U.S. energy assistance helps to expand energy supplies, improve end-use efficiency and to

promote conservation. Here AID seeks to play a catalytic role through feasibility studies, training, policy advice and research. Such efforts will facilitate the mobilization of private capital for increasing energy availability. AID also provides technical assistance for increased fuelwood production, small scale hydropower and fossil fuel supplies. To encourage improved energy efficiency, AID emphasizes audits of energy consumption in the commercial/industrial sectors and the development of improved stoves and charcoal kilns to ease the fuelwood crisis.

Funding Levels

AID has committed or planned \$501 million of Development Assistance and \$571 million of Economic Support Funds for energy assistance in thirty-five countries for the fiscal years 1979-1984. These figures are indicative of many new activities for fuelwood, renewables and fossil fuels and reflect the increased importance of energy in AID's program in the past few years. The figures also show year to year fluctuations in commitments for power generation, transmission and distribution.

The following table summarizes AID energy assistance for 1979-84:

AID Energy Program Levels ¹						
	FY 79	80	81	82	83	84
		(\$millions)			(Est.)	(Request)
<u>Development Assistance</u>						
Fuelwood	5.4	17.1	13.6	53.1	21.8	14.4
Renewables	19.6	11.7	26.7	38.3	19.4	30.0
Fossil Fuels	1.5	4.7	10.2	20.9	13.2	14.3
Subtotal	<u>26.5</u>	<u>33.5</u>	<u>50.5</u>	<u>112.3</u>	<u>54.4</u>	<u>58.7</u>
Power Generation & Distribution	93.9	19.9	24.4	4.7	13.6	8.2
Total	120.4	53.4	74.9	117.0	68.0	66.9
<u>Economic Support Fund</u>						
Fuelwood			1.0	1.0	7.0	3.0
Renewables	.3	.8	2.0	19.0	12.0	31.0
Fossil Fuels		<u>16.3</u>		<u>24.8</u>	<u>8.0</u>	<u>38.0</u>
Subtotal	<u>.3</u>	<u>17.1</u>	<u>3.0</u>	<u>44.8</u>	<u>27.0</u>	<u>72.0</u>
Power Generation & Distribution	100.0	12.5	90.0	12.1	159.0	33.5
Total	100.3	29.6	93.0	56.9	186.0	105.5
Overall Total	220.7	83.0	167.9	173.9	254.0	172.4

As the above table indicates, AID is devoting substantial funding for energy assistance to the developing countries. The balance of this report describes in greater detail the kinds of energy activities AID assistance is financing. The following section summarizes AID's energy work within each of the four major functional areas noted above. The subsequent section

^{1/} See Appendix I for breakdown by AID operating bureau.

outlines the way each of AID's Regional Bureaus and the Bureau of Science and Technology are applying such assistance to meet the needs and circumstances of their respective constituencies within the developing world.

II. MAJOR PROGRAM IMPLEMENTATION AREAS

A. Policy Planning

This area of AID energy assistance has received significantly increased emphasis in recent years. In country after country investigations have shown that energy problems in the developing countries are being exacerbated by local policies that discourage efficiency, encourage unproductive consumption or inhibit investment in the expansion of domestic supplies. Similarly, there is often a lack of knowledge of energy consumption patterns, the role of traditional fuels or options for energy planning. Accordingly, AID works with technical and policy officials to strengthen local capabilities in energy planning, to gather energy data, to identify policy issues and to suggest ways of dealing with them. In a number of instances these efforts have helped countries to organize their energy priorities, identify critical bottlenecks and lay out plans of action.

AID's approach to policy planning is not limited to providing expertise for short-term analyses of a country's energy situation, although such assessments are often a useful

first step. AID is concentrating more on the process of building a long term capability within the country to gather and interpret primary data, to identify trends and to delineate the economic, technical and institutional options that confront policy makers. This usually means assistance over a period of years involving training of host country officials, the provision of long term experts and equipment or other material support to local planning agencies. Assistance of this kind is being provided through eleven bi-lateral or regional projects.

AID's Office of Energy in the Bureau for Science and Technology has done much to encourage increased emphasis on energy planning and policy development. For example, a workshop it sponsored in early 1983 brought together U.S. and developing country experts to share know-how and experiences. Plans are being developed for establishing more permanent mechanisms of collaboration and communication between these experts. An energy policy research program has been launched. The Office's earlier and current planning projects made possible the initiation of activities in the Sudan, Togo, Liberia, Morocco and Tunisia, some of which have been subsequently carried forward with bi-lateral funding planned or provided by the Regional Bureaus. Energy planning is a major feature of the "Energy Initiatives for Africa" project recently launched by the Africa Bureau.

AID coordinates energy planning assistance with other donors. Activities in this area pay particular attention to the country energy assessment program of IBRD/UNDP, which though having somewhat different aims and methodology, provides extremely useful summary analyses of the energy situation in the countries concerned, and can offer an excellent starting point for longer term efforts.

B. Training and Institution Building

Training and institution building are essential elements of AID programs generally and energy assistance is no exception. Leading constraints to the planning, management and development of a country's energy resources are often the lack of skilled local personnel and the weakness of local institutions. Thus training and institution building are usually the ways in which AID strengthens local capacity, whether it is the management of a rural electrification system or helping a country to initiate a research and development program in renewable energy technologies.

Training is almost invariably included as a component in bi-lateral energy projects AID is financing in thirty-five countries. For example, in Asia, two U.S. universities are assisting the staffs of energy training centers in Indonesia and the Philippines. Energy planners and technologists from the Caribbean area are receiving training under a regional

Alternative Energy Systems project. Training may be offered on-the-job as with Kenyan officials of the Ministry of Energy or in the United States and third countries as will be done in the Egyptian policy planning project. The aim is to strengthen the ability of the country itself to manage, to plan, to perform the requisite technical functions and to eliminate eventually the need for expatriate advisors.

In addition to project-financed training, the Office of Energy finances world-wide training projects in energy planning, management, renewable technologies as well as academic and practical training (including industrial internships) in conventional energy skills. Some 300 trainees per year from nearly 60 countries -- about 1,500 to date -- have received short and long-term training opportunities through these projects. For example, a Kenyan official of the Ministry of Energy recently returned to its Planning Division after obtaining a Masters Degree in operations research with emphasis on energy policy and engineering. Similarly, a group of twenty energy officials from nine developing countries are currently completing a two month course in energy conservation arranged by the Tennessee Valley Authority.

Another way AID seeks to strengthen local energy institutions is through technical assistance. Here AID-financed specialists advise and work with officials in host

country agencies for periods ranging from a few days to two or more years. Not surprisingly, experience has shown that technical assistance is most successful when advisors have learned to shape their technical recommendations to the particular local circumstances at hand.

Prior to the energy "shocks" of the 1970's, responsibility for energy matters -- among developing countries and industrial countries alike -- was widely scattered and poorly coordinated. There is now a greater recognition of the role played by energy in the development process and of its proper institutional framework. The task of strengthening individual energy institutions -- planning bodies, research and development laboratories, forestry departments, power corporations, hydrocarbon ministries -- has been accompanied by efforts to strengthen their interaction and collaboration, both among themselves and with the "line" ministries of government and the private sector. A recurring example of this problem is the task of effecting a better "fit" between the energy research and development work that may be going on in a given country and the energy needs and income levels of its rural and urban populations.

C. Technology Development, Testing and Research

AID assists developing countries to design, test and disseminate technologies that could help them begin to make the

inevitable transition from their present dependence on fuelwood and imported fossil fuels to a more balanced and sustainable mix of energy sources. To help achieve this objective, AID is supporting the establishment of laboratories and workshops in the developing countries for the design and testing of technologies appropriate to their resource endowments and needs. Initial emphasis has been placed on applications of renewable energy technologies -- the harnessing of solar energy, biomass, wind and running water -- to substitute or supplement traditional and conventional fuels for rural uses.

In Morocco, a Center for Renewable Energy Development has been established to test the viability of a number of small hydro, wind, solar and biomass technologies. In Central America, two regional institutions -- the Tropical Agricultural Research Training Center (CATIE) and the Central American Research Institute for Industry (ICAITI) -- are heavily involved in the development of fast growing trees and agroforestry systems as well as identifying more efficient devices for fuelwood combustion and conversion. In Indonesia, AID is financing a seven year program of technical and capital assistance for the establishment and operation of an energy research laboratory (Puspiptek) which will emphasize coal technology, biomass conversion, solar applications and increased end use efficiency. In Senegal, support has been

given to three local institutions to develop, test, produce and evaluate improved woodstoves for rural household use, more efficient charcoal kilns for urban useage and solar fish driers.

A vital aspect of these efforts is that of assuring the economic viability and social acceptability of proposed technologies. Experience has shown that technically efficient devices may be too costly for widespread replication, may yield inadequate economic returns, or may be at variance with local social patterns. Thus most energy technology projects are very much concerned with such matters as rural and urban energy surveys, cost/benefit calculations and social soundness analysis. Increasing emphasis is also being placed on involving the private sector to help assure the wider application of alternative energy systems.

In seeking to more effectively transfer technologies involving energy, AID has laid increasing emphasis on three tools: improved program evaluation, better data collection and dissemination, and greater attention and effort in selected energy research:

-- Program Evaluation

Although AID's technology testing activities are of recent origin, efforts have already begun to evaluate their effectiveness. Of particular note has been an evaluation of

renewable energy technologies recently carried out by the Bureau for Africa. Its evaluation team visited seven countries and examined fifteen technologies at 75 project sites -- both AID and non-AID financed. The evaluation highlighted those devices (e.g. fuel-efficient stoves, small scale hydro, low cost windmills and photovoltaic arrays) that were technically the best candidates for widespread replication. It pointed to the lack of local repair facilities, spare parts and trained operation and maintenance personnel as major constraints to such broader dissemination. The evaluation emphasized the need for better data collection at project sites on costs and benefits, social impact, market information, and the inadequacy of existing information linkages within and between countries so that energy experience and lessons could be more fully shared.

-- Data Collection and Dissemination

As a follow-up to the Africa evaluation, and so that more can be learned in the future from technology demonstrations, the Office of Energy is financing the preparation of a handbook that will provide guidance to AID and developing country renewable energy practitioners. The manual will spell out in practical terms approaches to collecting data at the project site, the frequency of collection, units to be used, etc., and suggestions for interpreting the information.

Another way in which AID is seeking to encourage the sharing of information on renewable energy is through the establishment of research and development networks.

International technical workshops and assessments have already taken place which have suggested criteria and common methods of measurement for evaluating fuel-efficient woodstoves and biogas digesters.

-- Energy Research

Research continues to be an important way in which AID seeks to improve its understanding of energy questions and thereby its ability to assist developing countries. As part of its work in energy analysis, planning and policy development, the Office of Energy is funding a number of cross-cutting studies on generic policy issues. One area of emphasis is the economic role of energy pricing -- i.e. the effect of changing world energy prices on patterns and rates of economic growth, and the way domestic energy prices affect commercial/non-commercial supply and demand balances. Other research topics are the relationships between energy and agriculture and studies of international energy technology transfer.

Energy is also a major topic of the research programs funded by the Agency's Science Advisor directly, as well as indirectly through a multi-year grant to the National Academy

of Sciences. In regard to the former, "biomass resources and conversion technology" is a major research theme and the program is funding a number of studies on subjects such as improved ways to produce fuels and feedstocks from biomass. The program administered by the Academy is restricted to financing research at developing country institutions. Themes for collaborative studies include fast-growing trees for fuelwood and other purposes and on nitrogen-fixing plants as a substitute in agriculture for petroleum-based fertilizers.

In early 1983 AID selected fuelwood research as one of its four major research priorities (see fuelwood discussion, below).

D. Expanding Energy Supplies and Increased Efficiency

AID activities to expand energy supplies from new and renewable resources have been noted above. AID is also actively involved in programs to increase the availability of fuelwood, hydroelectric power and fossil fuels. AID provides Development Assistance funds for capital and technical assistance for fuelwood programs and, in selected countries, Economic Support Funds for investments in hydropower and fossil fuels. In addition, a substantial portion of AID PL-480 assistance (Title II and III) finances food inputs and local currency costs of forestry/fuelwood activities.

-- Fuelwood

Forestry/fuelwood production and conversion efficiency programs have become a major aspect of the energy activities of AID's Regional Bureaus. The Asia Bureau has initiated AID's three largest social forestry programs in Pakistan and the Indian states of Madhya Pradesh and Maharashtra (totaling \$85 million) as well as a \$25 million wood based rural energy project in the Philippines. In Africa, fuelwood production and improved stove efficiency programs have expanded from the drought-stricken countries of the Sahel to other parts of the continent such as Kenya, Somalia and Burundi. Fuelwood production and end use efficiency is one of the three top energy priorities of the Latin American and Caribbean Bureau. Programs emphasizing fast growing trees and biomass together with fuel efficient conversion technologies have been initiated in Ecuador, Haiti, the Dominican Republic, and in the Central American and Caribbean regions.

Within the Bureau of Science and Technology, both the Office of Forestry and Natural Resources and that of Energy are involved in activities supportive of forestry/fuelwood programs in the field. Of particular value has been the Forestry Support Program which, through an inter-agency agreement with the U.S. Forest Service, has enabled AID to mobilize forestry

talent for a broad range of overseas activities. Similarly, the Office of Energy's support to VITA^{*} has greatly accelerated efforts to expand the design and field testing of improved wood and charcoal stoves as a means of conserving fuelwood supplies.

Supplementing and reinforcing the expansion of forestry/fuelwood programs is the Agency's recent decision to make fuelwood research one of its four research priorities. AID is developing a research program to implement this decision which will pursue research needs related to particular ecological zones with country-specific research problems. While the program will be broadly concerned with technical forestry and its social science implications, a major emphasis will be on fuelwood production. In methodology, the program will stress building local research capacity in the developing countries, the establishment or strengthening of forestry/fuelwood research networks and with "twinning" arrangements between U.S. and developing country institutions. Regional meetings to strengthen these linkages are being planned by IUFRO^{**} in Asia and Africa with AID financing.

*Volunteers In Technical Assistance, a non-profit organization specializing in low cost appropriate technologies.

**International Union of Forestry Research Organizations

-- Fossil Fuels

The private sector will continue to be the major source for financing the expansion of fossil fuel supplies. AID technical assistance in this area is designed to facilitate and encourage, sometimes in conjunction with financing from the World Bank and the regional development banks, the investment of private U.S. and local capital for the commercial production of oil, coal and gas. Through such assistance AID helps developing countries to assess and develop local resources and to take the policy measures needed to bring economic incentives into play.

The Office of Energy's projects have provided significant technical assistance in helping developing countries to identify fossil fuel opportunities and how they might best be exploited. Such assistance can lead to follow-up investments to implement the findings and recommendations of the initial work.

An example of this process is the exploratory work and initial assistance being given by AID to help the Moroccan fossil fuel agency to assess the country's domestic oil and natural gas potential, a process which should assist it to attract foreign investment for the development of these resources. A promising technology for utilizing a coal/water

mixture as a fuel substitute in oil-fired boilers may soon be tested in the Philippines. In Pakistan early consultations by Asia Bureau and Energy Office experts are leading to the initiation of a major planning and development project which has the establishment of a modern coal industry as its centerpiece. India, Bangladesh, Indonesia, Thailand and Kenya offer similar examples of U.S. technical assistance aimed at follow on private investment.

-- Electric Power

AID investments in electric power generation, transmission and distribution and in rural electrification schemes are presently confined largely to a few countries that are receiving Economic Support Funds (ESF). In the 1960's and early 1970's AID was heavily engaged in expanding power production, and more recently in supporting rural electrification activities as part of its broader interest in rural development. Consistent with the current emphasis on technical assistance rather than resource transfers, AID rural electrification programs now are concentrated in a few countries in Asia (Bangladesh, Pakistan, Indonesia, India). AID is completing earlier financed projects in Syria, Jordan, Panama, Peru and the Philippines.

In addition, AID is funding major increases in power generating capacity in Egypt as well as improvements in the

distribution systems of several major cities. Over \$670 million in ESF funding has been committed to the power sector in Egypt since FY 1976.

Technical assistance in hydropower technologies, particularly for smaller scale facilities for rural or regional applications is offered on a worldwide basis through the Office of Energy's Small Decentralized Hydropower project. Services have been made available from NRECA* and private consultants to over twenty countries and have included resource surveys, feasibility studies, technical analyses and the holding of regional small hydropower workshops. AID also provides general support to NRECA to examine the applicability of the U.S. rural electrification program and philosophy for developing countries.

-- Energy Efficiency

Experts generally agree that one of the most rapid and cost effective ways of addressing energy constraints in the developing countries is through reducing waste and increasing the efficiency of end uses. Such savings in fossil fuel and fuelwood consumption, when carried out on a significant scale, can have an effect comparable to producing thousands of barrels of oil or planting hundreds of hectares of trees. Increased

*National Rural Electric Cooperative Association

efficiency has therefore become a major priority for AID energy assistance.

AID is assisting a number of countries in the design, testing and dissemination of more efficient wood and charcoal stoves as a means of reducing pressures on forest resources. Through a regional woodstove program, seven West African countries are sharing experiences on improving design and acceptability. Clay lined metal charcoal stoves have been tested in Kenya and now are in commercial production for urban consumers. Increasing the efficiency of charcoal production through improved kilns, as in Senegal, is another promising approach.

To stretch fossil fuel supplies, AID is providing financing, experts and training opportunities to enable developing countries to perform energy audits of their industrial, commercial and transport establishments as a means of pinpointing priorities for greater efficiency. Much of such assistance is made available through the private sector. In Jamaica, for example, an Energy Credit Fund has been established to help entrepreneurs to finance industrial energy efficiency measures performed by private energy auditors. In Tunisia, efficiency opportunities for privately financed follow up have been identified through surveys of the country's industrial, institutional and commercial sectors. A recent

workshop sponsored by the Economic Community of West African States has stimulated lively interest in efficiency measures in that region.

III. BUREAU PROGRAMS AND EMPHASES

The descriptions below summarize AID's energy programs that have been financed or planned by the operating bureaus. In mid-1983, each of these bureaus prepared a statement of the goals and strategy it would follow over the coming five years as a framework for guiding its programs.

A. Bureau for Africa

Energy programs in Africa have emphasized small scale decentralized renewable technologies, mostly for rural applications, and fuelwood production and efficiency in end use. Training and institution building have also enjoyed a high priority. As a result of the Bureau's recent evaluation of its renewable energy programs (see pp. 13-14 above), certain modifications in objectives and scope are in process. Greater emphasis will be placed on energy planning and analysis, on pursuing the energy implications of expanding agricultural production, on stimulating private investment in energy conservation and fuel substitution, and on following energy opportunities offered by rural and river basin development programs.

Special characteristics of current Africa Bureau programs are the emphases on forestry and fuelwood research, development of a special project to finance a wide variety of energy activities, and a fuelwood/forestry initiative involving new cooperative arrangements in five countries, called "Cooperation for Development in Africa".

-- Forestry and Fuelwood Research

Evaluation of the Bureau's "first generation" forestry projects, mostly in the Sahel, are leading to modifications in approach. Less emphasis is being given to government - managed tree plantations and more to providing the resources and incentives to encourage villagers and entrepreneurs to grow wood for their own needs and for profit. Agroforestry and improved management of natural woodlands are additional directions that appear promising.

Such approaches will require increased support for fuelwood research. A consensus to this effect was reached at a May 1983 Technical Colloquium on Fuelwood Research in Africa convened in Paris by the Development Assistance Committee and the OECD Development Center. The Colloquium stressed the importance of stepped up efforts to build African research capacity, to expand research on improved production and conservation techniques and to strengthen African networks for sharing research results. These conclusions correlate closely with the new priority AID has given to fuelwood research.

-- Energy Initiatives for Africa

A major vehicle for activating and funding the Bureau's future work in energy and forestry/fuelwood is the Energy Initiatives for Africa project which is now in early implementation. This Bureau-wide activity will finance energy assessments (national and sector), provide short and long term assistance on energy planning, prepare approaches for disseminating proven technologies and provide a linkage for sharing knowledge and experience. It will also serve as a funding source for energy, fuelwood and agroforestry projects with emphasis on private entrepreneurship. Initial activities include a communal reforestation project in Rwanda, the provision of long-term energy advisors for Liberia and Somalia and the preparation of four technology dissemination assessments.

-- CDA Forestry/Fuelwood Effort

Another vehicle which is supportive of increased emphasis in Africa on forestry/fuelwood and on energy is the informal donor grouping, Cooperation for Development in Africa (CDA). Made up of the U.S., France, U.K., Canada, Germany, Belgium and Italy, CDA has selected forestry/fuelwood and energy as fields for expanded effort in Africa under the leadership of the U.S. and Canada, respectively. The forestry/fuelwood committee has chosen five countries for

particular emphasis (four more were recently added) to strengthen African capacity, improve coordination and to increase donor and local support. Results are already apparent in Somalia, Senegal, Burundi and Malawi. Meanwhile, the CDA energy committee's emphasis on energy planning and conservation complement the Bureau's own priorities in those fields.

B. Bureau for Near East

Near East Bureau energy activities have been heavily concentrated in power generation and distribution, particularly for urban utilization, but are now moving to emphasize energy planning, renewable energies and fossil fuel development. With Economic Support Funds, the Bureau has been financing in Egypt a 900 MW thermal power plant at Shoubrah near Cairo, a 600 MW thermal power plant at Ismalia, the rehabilitation and modernization of turbine units for the Aswan High Dam, the modernization of the distribution systems of Cairo and three other cities, and a computerized control facility to monitor and regulate the national grid. In addition, rural electrification projects have been initiated in Jordan and in Syria. Since 1976, the Bureau has made over \$700 million available for financing the foregoing investments.

-- Energy Planning

The Bureau's movement toward a broader approach, which includes an emphasis on energy planning and policy development,

is illustrated by planning projects started in Morocco, Tunisia and Egypt and an activity in Jordan being considered for 1985. In Tunisia personnel in the energy office of the Ministry of National Economy are being trained to evaluate energy demand and supply options, to design and carry out urban and rural energy surveys, and to evaluate the potential of renewable energy technologies. The Egyptian project, just beginning, is aimed at strengthening the data collection and analytical capacity of the newly created Organization for Energy Planning.

-- Renewable Energy Technologies

A second new direction being pursued by the Near East Bureau is that of assisting a number of countries to test, evaluate and disseminate renewable energy technologies as alternatives to conventional or traditional energy sources. Testing and demonstration projects are underway or planned in Egypt, Morocco, Tunisia and Jordan. In Egypt assistance is being provided to the Qattara Hydro and Renewable Energy Authority to conduct demonstrations in solar and wind technologies. In Morocco AID is assisting the Center for Renewable Energy Development to conduct applied research, initiate pilot projects and otherwise to evaluate and disseminate the potential of small hydro, wind, solar and biomass technologies. In Jordan, a solar pond and process

heat project is being considered in addition to other renewable energy activities.

-- Fossil Fuel Deveopment

A third new direction being taken by the Bureau involves developing local fossil fuel availabilities as well as energy efficiency measures to decrease dependence on oil imports. To encourage energy efficiency, the planning projects and activities in Egypt, Tunisia, Morocco and Jordan emphasize energy audits and utilization analyses of leading economic sectors -- industry, commerce, transportation, institutions -- and identifying priorities for energy efficiency. Assessment of local hydrocarbon availability is being pursued in Morocco and Egypt. In Morocco, technical assistance financed by the Science and Technology Bureau is being furnished to help the government's fossil fuel agency, ONAREP, to assess the country's oil and natural gas potentials and to identify the extent of a recent natural gas find. Follow on bi-lateral assistance is being planned in FY 1984. A broader minerals, petroleum and groundwater assessment is getting underway in Egypt which will gather and evaluate data on these resources with a view toward their development or commercial exploitation. Another approach toward lessening dependence on oil imports is being pursued in Jordan where studies are being

undertaken of the country's geothermal potential. Finally, a Near East Regional Energy Cooperation project tailored to the needs of energy officials of the area is being considered. Through courses, workshops, seminars and publications, the project would provide training in energy planning, renewable technologies, conventional energy resource assessments, and energy efficiency.

It is expected that the Near East Bureau will continue to address these new directions in energy. A recent planning document notes "Bureau priorities also imply that energy will hold a significant level of resources throughout the planning period".

C. Bureau for Latin America and the Caribbean

The initial energy activities of the Bureau for Latin America and the Caribbean (LAC) emphasized research and pilot activities in renewable energy technologies and in forestry/fuelwood. This early emphasis has resulted in the undertaking of more than twenty projects totaling about \$100 million in nearly a dozen bilateral and regional programs. The Bureau is planning to evaluate many of these activities in the next year or two and to use the results as a basis for charting future directions. In the meantime, LAC energy programs are emphasizing three priorities -- energy planning and analysis, energy efficiency, and programs to test and promote traditional fuels including fuelwood.

-- Energy Analysis, Planning and Management

Illustrative of this mode of energy work is the Energy Policy Development project in Costa Rica which is assisting the Energy Directorate of the Ministry of Industry, Energy and Mines to improve its capability to gather national and sector energy data, analyze energy options and undertake energy studies including prefeasibility analyses for specific projects. Similarly, at the regional level, AID is providing assistance through the Technical Assistance Fund of the Caribbean Development Bank to finance energy planning, energy assessments, training, and renewable technology services to small Caribbean nations. Such countries as St. Vincent, Belize, Barbados, Antigua and Guyana have already benefited from technical assistance made available through this project.

-- Energy Efficiency

Here the objective is to ameliorate the uncertainty of energy cost and availability and to reduce the vulnerability of the region to adverse changes in oil import conditions. The Energy Conservation and Resource Development project in the Dominican Republic is an example of how AID has assisted in this field. Technical services have helped the Dominican government to develop a national energy assessment and an on-going energy planning capability. An Industrial Conservation Center has been established and has helped to

undertake energy audits leading to five industrial conservation projects. Management assistance has also been provided to increase the efficiency of the national electric utility.

Another example is the proposed Energy Structural Adjustment II project which is a component of the current Caribbean Basin Initiative. Drawing on the findings and conclusions of the energy assessments carried out under the above noted regional planning activity, the Energy Adjustment project will assist East Caribbean countries to undertake energy policy reforms -- pricing, taxation, utility rates, etc. -- aimed at accelerating efficiency measures. It will also finance development of renewable energy sources -- solar, wind, hydro and geothermal -- as alternatives to imported oil.

-- Traditional Fuels

The LAC Bureau's third energy priority is aimed at providing a basis for follow on work to address the growing fuelwood shortage in the region. It will include methods for accelerating the selection and planting of fast growing trees and biomass as well as designing and disseminating technologies for more efficient means of combustion and conversion.

Activities include: (a) assessment of biomass resources and methods for enhancing them (e.g., agroforestry, utilization of fast growing species), (b) determining the extent to which biomass might meet commercial fuel requirements while

contributing to sound natural resource management, and (c) the design and testing of conversion technologies to meet the energy requirements of rural development. Special emphasis is being placed on private sector involvement.

Indicative of the LAC Bureau's work in this area is the Fuelwood and Alternative Energy Sources program which is being administered by two regional institutions -- the Tropical Agricultural Research Training Center (CATIE) and the Central American Research Institute for Industry (ICAITI). CATIE is working with local forestry and rural development agencies in Central America to identify areas of fuelwood shortage, improve cultivation of fast growing species, and to assist in establishing tree farms, village woodlots, agroforestry systems and industrial plantations. ICAITI meanwhile has been designing and testing fuel efficient stoves and charcoal kilns as well as renewable technologies that may be candidates as alternative energy sources to traditional fuels. A second illustration is the Agroforestry Outreach project in Haiti. Acting through private voluntary organizations, church groups, farmer associations and community councils, the project has gotten off to a fast start. It is establishing nurseries, providing technical assistance and seedlings to farmers and initiating a major reforestation campaign of up to four million trees per year for soil conservation and energy supplies.

Of the foregoing emphases, those which are likely to receive the most attention by the LAC Bureau are energy planning, policy reform and conservation. This will be particularly true for countries having balance of payments and economic stabilization problems due in good measure to oil import requirements.

D. Bureau for Asia

The Bureau for Asia approaches energy matters as part of a broader concern for sound natural resources management. It seeks to address the energy, forestry and natural resource constraints to rural development with emphasis on increasing productivity in agriculture and rural industry and on meeting the needs of the rural poor. The Bureau has recently articulated three leading priorities for guiding its programs: (1) formulation of sound energy, forestry and environmental policies which promote agricultural and rural development, (2) building local human and institutional capability to solve energy and natural resource problems including a strengthening of forestry research, and (3) promotion of private investment in wood and other viable energy sources such as coal.

-- Planning and Policy Reform

Examples of AID sponsored activities in Asia in this field include an Energy Planning for Development project in Indonesia which is helping to create a viable policy and

planning unit in the Ministry of Mines and Energy. It will also help the Ministry to analyze the implications of alternative energy strategies. In addition, assistance is being given to the Directorate General for Power to increase its data base and to carry out energy modeling, analysis and policy studies. In Pakistan AID is supporting two major planning efforts. The first involves an Energy Planning and Development project which, in addition to strengthening basic planning functions, will assess the potential of renewable technologies for the rural areas and will help the country to develop a modern coal industry as an alternative to imported oil. The second is a Forestry Planning and Development activity which is designed to improve the government's planning and management capabilities at national and provincial levels. Specific elements include fuelwood supply/demand analyses, applied technical and socio-economic research on fuelwood species and production systems, and the acceleration of planting programs on government and private lands.

-- Training, Research and Institutional Development

Most AID energy and forestry projects in Asia include strong training and institutional development features. Training in energy technologies is the focus of bi-lateral graduate programs being carried out at the Institute of Technology at Bandung, Indonesia at the College of Engineering

of the University of the Philippines and, on a regional basis, in coal technology among the five ASEAN countries. Similarly, training and institution building are important aspects of two major social forestry projects in India (Madhya Pradesh and Maharashtra), support to Indonesia's national energy laboratory (Puspiptek), the Energy Research and Development Center in the Philippines and the work in coal and geological planning that is being carried out in Pakistan. In addition, the Bureau is collaborating closely with the Bureau for Science and Technology in a major new forestry and bioresource management initiative which will be aimed at helping the Asian countries establish a viable forestry/fuelwood research network.

-- Private Investment in Expanding Energy Supplies

In Pakistan, work on the Energy Planning and Development project has led to the formulation of an energy sector program approach which will include the development of a modern coal industry, the utilization of natural gas resources, the expansion of rural electrification networks and initiatives in energy conservation, renewables and fuelwood production. Private investment is also a critically important component in the progress of the two large social forestry projects AID is financing in India. Both depend on investment of the time, skills and material resources of hundreds of communities in producing, harvesting and marketing forestry products for

fuelwood and other uses with resulting gains in rural incomes. The Rural Energy project in the Philippines enable farmers to grow for profit short rotation trees on marginal lands as an energy source for steam power plants, gasifiers for water pumping and for conversion in charcoal kilns. In Thailand, a new Mini/Micro Hydroelectric project will strengthen the capabilities of Thai private engineering and manufacturing companies.

It is clear from the foregoing that energy programs in Asia span the full range of energy concerns. The Bureau anticipates that this multi-faceted approach will continue in the future with particular emphasis on planning and management, agro-forestry systems, coal development and fuelwood/bioenergy research.

E. Bureau for Science and Technology

In addition to bilateral and regional activities underway in each geographical bureau, the Office of Energy and the Office of Forestry and Natural Resources in the Bureau of Science and Technology are engaged in a broad range of technical assistance activities, which supplement and augment the other Bureau programs in a number of significant ways. The work of the Energy Office encompasses major activities in training, policy development and conservation, and in technology transfer (including fossil fuels, renewable

energies, hydropower and bioenergy systems). Its funding has been averaging about \$10 million annually over the past five years. The Office of Forestry and Natural Resources provides forestry technical services in support of the Agency's forestry/fuelwood activities as well as AID/Peace Corps collaboration in that field. It is also, in collaboration with Offices of Multisector Development and of Energy, launching a major new program in forestry/fuelwood research. Funding for these activities is expected to run at \$3-5 million per year.

The Office of Energy's work is giving greater attention to identifying opportunities in energy efficiency, for evaluating the energy implications of expanding agricultural productivity and for increasing emphasis on policy research. Two new projects proposed for FY 1985 will support renewable energy -- one to offer training in specific renewable energy disciplines, a second to assist developing countries to more effectively use their renewable energy resources.

The Office of Energy's work complements and supplements that of the Regional Bureaus. Its world-wide training projects were noted above (p. 10). Its planning and conservation project and its technology transfer projects offer a broad spectrum of technical assistance services attuned to developing country energy needs. To illustrate, the Decentralized Hydropower project has made specialized

assistance available to 15 countries to date while the Conventional Energy Technical Assistance project made possible an appraisal of the requirements for rehabilitating Sudan's Blue Nile power network and the subsequent bi-lateral funding of some \$25 million in power equipment. A Bioenergy Systems and Technology project has carried out consultations and bioresource assessments in thirteen countries addressing the uses of biofuels for household and industrial applications and is establishing a bioresource users network.

As previously discussed (p. 17), the Forestry Resources Management project of the Office of Forestry and Natural Resources has financed a broad range of technical forestry/fuelwood services in over forty developing countries. A second component of the project finances forestry collaboration between AID and the Peace Corps which has resulted in some twenty-five cooperative projects to date. In addition, as noted earlier (p. 18), a major new program in forestry research and bioresource energy management is being formulated which will emphasize fuelwood production and conversion efficiency. Details and approaches are currently being worked out through consultations with field missions and the regional bureaus.

IV. OUTLOOK

The recent abatement of dollar denominated oil prices could cause some lessening in the sense of urgency which assistance programs attach to addressing energy problems. Yet there has been no significant change in the basic nature of these problems. Without greater amounts of energy, developing countries will be unable to sustain both past levels of economic growth and the per capita levels of traditional fuels use.

The source of greater energy supplies -- fossil fuels or renewables -- will vary from country to country depending upon their indigenous energy resources, level of economic activity, debt position, and foreign exchange availability to purchase imported energy. In general, most developing countries dependent on imported oil will need to shift to a more balanced mix of energy sources as an important policy objective. Achieving this policy objective will require continued efforts to use energy more efficiently, to press ahead with exploiting available resources and diversification of hydrocarbon requirements, and to pursue the research and analysis necessary to identify promising renewables.

At the same time, the anticipated population growth over the next two decades is likely to increase the pressure on traditional fuels in the poorer countries, and among poorer

people. The growing scarcity of fuelwood, charcoal and crop residues -- upon which 60-90% of the population of most countries continue to rely for the energy to cook their food -- is resulting in rising costs or labor requirements and diminishing levels of real income among the rural and urban poor. Here the need to continue, if not increase efforts to expand supplies, promote increased efficiency and to develop alternative sources remains clear.

AID anticipates that energy assistance will continue to play an important role in its relationships with the developing countries. AID looks forward to further cooperation with other donors in the interest of sharing ideas and working together to increase the effectiveness of energy assistance.

As the foregoing sections indicate, AID efforts have concentrated on technical assistance for energy planning and policy improvement, training people and building institutional capability, exploring alternative sources of energy, fuelwood and fuelwood research programs, and more efficient use of conventional and traditional fuels. All of these programs are designed to support greater private sector investment in the production of energy. These priorities have evolved on the basis of experience over the past six years. Whether they should be sustained, or whether modifications are in order, will be the subject of the a policy review which has recently been initiated within AID.

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Appendix I

Energy Program Levels of AID's Operating Bureaus

	<u>FY-79</u>	<u>FY-80</u>	<u>FY-81</u>	<u>FY-82</u>	<u>FY-83</u>	<u>FY-84</u>
Africa	6.0	12.1	14.2	30.8	7.1	12.3
Asia	86.0	23.1	28.8	84.7	109.8	102.1
Latin America and Caribbean	19.4	8.2	18.4	27.4	13.8	20.5
Near East	102.0	30.1	92.8	15.5	109.0	20.9
Science and Technology*	7.3	9.5	13.7	15.5	14.3	16.6
TOTAL	220.7	83.0	167.9	173.9	254.0	172.4

*Includes centrally funded energy research