AFRICA BUREAU ENERGY STRATEGY STATEMENT
AGENCY FOR INTERNATIONAL DEVELOPMENT

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EXECUTIVE SUMMARY

I. Introduction

A. The Nature of the Problem

Energy cost and availability affects all of AID's development programs, but particularly balance of payments stabilization efforts and programs to increase agricultural productivity and off-farm employment. Limitations on AID, Bureau for Africa and Mission resources, however, mean that AID involvement in energy must be highly selective.

For this reason the Bureau for Africa Energy Strategy Statement focuses on identifying the energy contraints to economic development as well as potential opportunities for utilizing energy more effectively in Mission agriculture and rural development projects.

A direct correlation exists between energy and national levels of economic development. Over the next twenty years large increases in energy will be required to achieve desired development objectives in Africa. Increasing energy inputs to the agricultural sector appear to produce major increases in productivity, in some cases exceeding the beneficial impacts of increasing energy inputs to industry by a factor of ten.

The cost and availability of energy can make or break the economies of African countries. Increases in the cost of oil imports have sharply reduced foreign exchange resources available for development. For example, energy imports as a percent of merchandise exports in Kenya rose from 18 percent in 1960 to 63 percent in 1980. Similarly, Senegal's energy imports represented 8 percent of the value of merchandise exports in 1960 and 55 percent by 1980.

The rapid depletion of biomass resources is an equally serious problem. Deforestation caused by increasing population pressures on agricultural and pastoral land, and increasing demand for fuelwood is resulting in serious and potentially irreversible degradation of soil, water, and micro-climatological conditions. Wood and charcoal for cooking and heating account for over 90 percent of total energy production and consumption in most countries of Eastern Africa, and 80 percent in most West African countries. According to World Bank estimates, a fifteenfold increase over current planting levels would be required to bring projected demand and supply into better balance by the year 2000.

Currently, most of the wood and charcoal used for fuel in Africa is obtained from commonly held areas. These lands are being mined as the 'least-cost' source of biomass fuels, cheaper than wood supplied from plantations or village woodlots. In the absence of management which has

the support and involvement of individuals who use the common areas for grazing animals, obtaining food, and/or harvesting wood, natural resource degradation on these lands can be expected to continue.

B. Major Elements of The Bureau's Energy Strategy and Their Relationship to the Africa Bureau Strategic Plan

The Africa Bureau Strategic Plan considers energy within the overall framework of natural resources management, and stresses:

- integrated natural resource sector analysis and management as essential to establishing productive and sustainable agricultural systems;

- complementing short-term stabilization efforts and basic structural adjustment programs by reducing the impact of oil imports on host-country foreign exchange earnings;

- technical assistance and training in energy policy and planning and adaptive research in energy-efficiency and renewable energy;

- technology and information transfer related to energy-efficient technology and renewable energy systems with an emphasis on private sector manufacture and marketing.

While private sector and multilateral development banks (MDB's) are the logical source of capital for major energy development projects, AID is particularly well-suited to provide assistance selectively in certain areas such as energy planning and management, energy pricing, investment analysis, training or institutional development. Also, AID can make available U.S. expertise in private enterprise development and energy production, energy efficiency, energy research, public sector management, or data gathering and analysis.

Consistent with the AID Energy Policy Paper and the Bureau's Strategic Plan, Mission involvement in the energy sector in most cases should not require major capital investments. Instead AID technical assistance, training and limited capital assistance may be used as a catalyst to reorient energy policies and pricing, to improve host country capability in energy planning and management, to strengthen investment decision-making, or to identify cost-effective energy systems which increase agricultural productivity and off-farm employment.

Given the limitations on AID/W and Mission resources involvement in the energy sector should be directly tied to the country strategy. Thus the Bureau's Energy Strategy:

- encourages Missions to have preliminary analyses of major energy-related problems conducted well in advance of Country Development Strategy Statement (CDSS) preparation to determine which, if any, should receive sectoral focus within the Country Development Strategy Statement (CDSS), and outlines technical assistance services which may be utilized by missions to minimize the management burden associated with such analyses.

- when appropriate to country strategy, provides missions with guidance on the use of technical assistance to address major energy issues including:

  (1) energy policy reorientation and institutional/human resource development;

  (2) reducing the impact of oil imports on host-country foreign exchange earnings through more effective use of petroleum fuels and development of indigenous sources of energy, including renewable energy; and

  (3) improving the production and utilization of biomass fuels in order to provide for sustainable agricultural productivity and natural resource management.

- encourages Missions to identify potential energy constraints, recurrent costs and opportunities for using energy more effectively to increase agricultural productivity and off-farm employment in USAID projects.

- outlines other energy activities receiving Bureau for Africa emphasis.

II. Determining Whether Energy Should Receive Sectoral Focus Within the CDSS

AID's Energy Policy Paper emphasizes the importance of examining the key role energy plays at both the macroeconomic and individual project level as part of the CDSS preparation process.

To determine which, if any, energy-related development problems should be addressed within the CDSS, Missions are encouraged to draw upon available technical assistance services well in advance of CDSS preparation to help identify and carry out preliminary analyses of the major problems.

The Mission management burden associated with this activity may be held to a minimum by requesting short-term assistance through the AFR/RA Energy Initiatives for Africa (EIA) Project (698-0424) with field offices in Nairobi and Abjidan, REDSOs, AFR/TR/SDP or ST/EY. Such analyses should include, but not be limited to, sources of information such as World Bank Energy Assessments. The analyses should:

- examine the effects of the country's energy situation on agricultural development, off-farm employment, the natural environment, and future economic prospects;
- identify and prioritize major energy-related problems and assess the quality of host country data gathering, policy and investment analysis related these problems;
- outline alternatives for addressing major energy problems; and
- determine the adequacy of host-country, donor, non-governmental organization (NGO) and private sector response to these problems.

III. Using Technical Assistance Services to Address Major Energy Issues

A. Energy Policy Reorientation and Institutional/Human Resource Development

Where appropriate and consistent with the Country Development Strategy, Missions are also encouraged to use the services identified above to:

1) help host countries assess their institutional resources (human, financial and physical) prior to the design of energy-related human resource development programs;

2) provide selected technical assistance and training in such areas as collaborative energy policy analysis, pricing, energy management or public and private investment decison-making related to both commercial and non-commercial energy use; and

3) assist Missions in the design and implementation of bilateral programs and projects.

Such assistance can be particularly effective when it complements MDB programs, as has been the case in the Sudan where AID energy policy and planning support has been part of the Mission's program to assist the Sudanese government in achieving balance of payments stabilization objectives.

B. Reducing the Impact of Oil Imports on Foreign Exchange Earnings

The potential for increased petroleum energy-efficiency in Africa is surprisingly high particularly in the electric power and commercial/institutional sectors. In addition, the transport sector consumes from 40-70 percent of total petroleum in typical African countries and thus must also be considered important in the design of energy-efficiency programs.

Where appropriate, U.S. short and long-term technical assistance may be made available to Missions for the design and implementation of energy management programs, in-country training in energy auditing, private sector marketing of energy-efficient equipment, and identifying fuel substitution alternatives (e.g. coal and renewable energy).

C. Improving the Production and Utilization of Biomass Fuels

Potential exists for a 20-40 percent improvement in the efficiency of fuelwood and charcoal use for cooking through the use of energy-efficient portable stoves. Equally significant may be improvements in traditional charcoal kilning practices. Again, AID resources may be made available on request to assist in promoting private sector manufacturing and marketing of improved stoves, NGO involvement in stove design and dissemination, or technology transfer related to improving charcoal production practices in the private sector.

One alternative for addressing the problem associated with depletion of fuelwood stocks from commonly held lands is to move toward the establishment of user fees for wood and charcoal destined for commercial markets at levels high enough to cover the costs for the management of natural areas on a sustainable basis. The establishment of such natural resource management programs requires interdisplinary knowledge which includes:

1) understanding of sociological factors associated with use of the common lands and the marketing of wood and charcoal;

2) the forestor's knowledge of wood fuel production and regeneration rates;

3) the energy economist/planner's understanding of traditional markets for wood and charcoal, supply sources and the existing price structure for both these fuels and other energy alternatives.

The Bureau for Africa forestry program addresses the problems surrounding production of wood fuels for energy.The energy strategy supports the Bureau's forestry program by encouraging interdisplinary social and economic analyses as an integral part of forestry/fuelwood program design.

Where appropriate, assistance may be made available to Missions on request through EIA, the S&T/FNR Forestry Support Program or S&T/EY's Energy Policy Development and Conservation Project (EPDAC) to carry out fuelwood/charcoal supply and pricing analyses in support of the design and implementation of forestry/fuelwood production programs.

IV. Identifying Energy Constraints, Recurrent Costs and Opportunities for Using Energy More Effectively to Increase Agricultural Productivity and Off-Farm Employment in USAID Projects

Agricultural productivity and off-farm employment can be improved through the identification of energy-effective methods, equipment and systems such as:

- low-cost systems which make more more effective use of human, animal, fossil fuel or renewable energy in planting, harvesting and agricultural processing;
- energy-efficient irrigation and water development alternatives; and
- appropriate agricultural transport alternatives.

Missions are encouraged to take advantage of the energy systems expertise identified above to assist in the design and implementation of those Mission programs and projects where an examination of energy alternatives may be warranted, e.g. farming systems research, transport, rural private enterprise, housing, and health. Such analyses may be critical to long-term project success.

V. Other Energy Activities Receiving Bureau for Africa Emphasis

Limited technical assistance and training resources will also be made available within the Bureau in support of the following activities:

- private sector: promoting new energy technology systems and private sector marketing/dissemination, maintenance and repair;

- technology transfer: improving information transfer on programs, projects, successful private sector initiatives, energy systems and equipment; and

- donor coordination: improving donor coordination on energy-related assistance to LDC's.

Each of these objectives is discussed in greater detail in the full Energy Strategy Statement.

AFRICA BUREAU ENERGY STRATEGY STATEMENT

SECTION I

ENERGY-RELATED DEVELOPMENT PROBLEMS

1.0 Energy-Related Development Problems

Most sub-Saharan African countries are experiencing low and declining real incomes and an increasing inability to feed their people. Agriculture and derivative activities account for over 75 percent of employment and over 50 percent of export revenues. Declines in per capita food production, stagnation in production of most export crops, and rapidly increasing imports of basic foodstuffs are therefore of particular concern.

Since 1973, African patterns of economic development have been affected by two major negative energy trends, increasing foreign exchange deficits resulting from imported oil payments and rapid depletion of indigenous biomass fuel resources for cooking with noticeable deterioration of the natural resource base. In addition energy inputs to agriculture are low or not effectively matched to needs.

As countries develop, they need increasing supplies of commercial energy to support their expanding economies. Those using small amounts of energy are the least developed; Upper Volta uses less than a tenth of as much commercial energy per capita as Thailand, and only two percent of the commercial energy consumed per capita in Jamaica.

Energy-related development problems fall into four broad categories:

1.1 Oil Import Dependency and Limited Indigenous Energy Production

Two major oil price increases have had a traumatic impact on balance of payments and the availability of foreign exchange in many oil importing countries. Current oil import trends threaten to further undo the economies of many countries. Oil import costs as a percent of total foreign exchange earnings are summarized in Table 1.

These trends have sharply reduced the availability of foreign exchange to help increase agricultural productivity and industrial development. According to a recent analysis of oil import costs conducted by Resources for the Future (Dunkerley and Ramsay, 1983) high import bills and debt service have seriously inhibited development. They are now co-opting the major part of available foreign exchange resources, holding back imports of other strategic development inputs and thus contributing to low rates of growth in many countries, especially since 1979.

Clearly, these kinds of effects on available foreign exchange have serious long-term implications for agricultural and industrial development in Africa, impacts which cannot be overlooked despite the current stabilization of world oil prices, particularly as the

value of merchandise exports continues to fall when measured against the price of oil.

While world oil prices have declined by about 15 percent (about $5 per barrel) since early 1983, this moderation has brought AID-assisted countries surprisingly little relief. In countries whose currencies are tied to the French franc, for example, oil costs have actually continued to climb because of the imbalance between the franc and the U.S. dollar, in which the world oil trade is denominated.

TABLE 1

Energy Imports as a Percent of Merchandise Exports*

Country	Year 1960	Year 1980
Burundi	..	14
Cameroon	7	14
Central African Rep.	12	26
Chad	23	..
Congo People's Rep.	25	3
Ethiopia	11	42
Ghana	7	..
Guinea	7	..
Kenya	18	63
Ivory Coast	5	11
Lesotho	..	..
Liberia	3	25
Madagascar	9	..
Mali	13	..
Malawi	..	24
Mauritania	39	..
Mozambique	11	..
Niger	6	55
Nigeria	7	1
Rwanda	..	..
Senegal	8	55
Sierra Leone	11	..
Somalia	4	12
Sudan	8	32
Tanzania	..	47
Togo	10	43
Uganda	5	..
Upper Volta	38	52
Zaire	3	..
Zambia	..	..
Zimbabwe	..	..

* World Bank Annual Report 1983.

At the same time, a worldwide economic slowdown has depressed markets and prices for many of the developing countries' exports, such as minerals. The terms of trade for all importing LDCs have fallen significantly, especially in sub-Saharan Africa where the decline in terms of trade since 1970 has been 30 percent (World Bank Annual Report, 1983).

Indirect impacts include, in particular, cutbacks in scheduled maintenance and in importation of spare parts, generally declining reliability of oil and electric power supplies to agriculture and industry, and mounting debt service burdens due in part to past oil import bills. These problems in turn constrain industrial production, threaten to limit countries' ability to transport or process foodstuffs and cash crops, and represent a major political as well as economic problem. Countries increasingly are resorting to government controls to allocate energy supplies.

Few, if any, African countries with abundant potential energy resources--oil, gas, coal, hydroelectric power, biomass, wind or solar energy--have so far been able to translate these resources into sustainable economic development. Even countries with both energy resources and non-energy minerals in close proximity-- touted as future growth centers in 1974-1976--remain stagnant.

1.2 Natural Resource Degradation/Biomass Depletion

The rapid depletion of biomass resources is an of equally serious problem. Deforestation is caused by increasing population pressures for agricultural land and for fuelwood. It results in serious degradation of soil, water, and even micro-climatological conditions. From 75 to 95 percent of the African population rely on wood or charcoal for cooking and heating. These traditional fuels account for over 90 percent of total energy production and consumption in most countries of Eastern Africa, and 80 percent in most West African countries. According to World Bank estimates, a fifteenfold increase over current planting levels would be required to bring projected demand and supply into balance by the year 2000.

1.3 Low Agricultural Productivity

Human and animal energy remain the primary sources of energy for agriculture in Africa. Roughly 70 percent of all farming in Africa is carried out by small-holders using basic hand tools and 20 percent by small-holders with access to animal traction. The remainder is on farms with some form of mechanization.

A correlation exists between effectively applied energy inputs and agricultural productivity. As pointed out in the Mitre Report, Energy and Development: Extended Analysis and Implications (J.C. Leigh, et al, 1980), increasing energy inputs to the agricultural sector appear to produce major increases in productivity, exceeding the beneficial impacts of increasing energy inputs to industry and transportation by a factor of 10 in many countries.

Agriculture is the mainstay of both modern and traditional economies but it is a relatively small energy user for cultivation (except for animate energy). However, it may become the largest or second largest user when agroprocessing and transportation of agricultural products are added. It is unlikely that sub-Saharan African countries will become food self-reliant without significant increases in energy inputs, particularly fertilizer. As agricultural production increases, and especially if agricultural productivity is to rise, energy use must increase as well. It is not at all clear how most countries will meet this future demand.

Major energy-related constraints to increased agricultural production include shortages of human labor during planting and harvesting, lack of dependable irrigation systems and escalating costs for irrigation, rising energy costs and declining availability of fertilizer and pesticides, rising transportation costs and transport bottlenecks, and the lack of foreign exchange which could be used to purchase tools, equipment, systems and spare parts necessary to make more effective use of human energy, animal power, electromechanical systems, fossil fuel driven equipment and renewable energy resources.

Insufficient attention has been paid to systems affordable to rural populations which have demonstrated high returns on investment and which enable people to increase their productive surplus in agriculture, artisanal activities, or industrial enterprise.

In addition, unsustainable harvesting of fuelwood and biomass unless arrested, will continue to contribute to declining agricultural and livestock productivity, through loss of soil fertility, water-holding capacity and soil erosion.

1.4 Insufficient Improvement in the Quality of Life for Low-Income Rural and Urban Populations

Low material quality of life is primarily the result of increasing population pressure on limited resources and public services, and secondarily to socio-economic inequities. However, the lack of low-cost, economical energy systems has a noticeable impact on the availability

and effort required to obtain water, the quality of health care, the cost of construction, housing comfort and operating expenses for cooling/heating and lighting of buildings.

AFRICA BUREAU ENERGY STRATEGY STATEMENT

SECTION II

ADDRESSING MAJOR ENERGY-RELATED DEVELOPMENT PROBLEMS

2.0 AID Strategy to Address Major Energy-Related Development Problems in Africa

The Africa Bureau energy strategy addresses objectives in four major energy-related areas:

- Reorienting Energy Policy through Improved National Energy Policy Analysis, Planning and Management and Institutional/Human Resource Development (Sec. 2.4);

- Reducing the Impact of Oil Imports on Foreign Exchange Earnings by Increasing Energy Efficiency and Indigenous Energy Production (Sec. 2.5);

- Increasing Biomass Supplies and Improving Natural Resource Management through Improved Production and Utilization of Biomass Fuels (Sec 2.6)

- Increasing Agricultural Productivity and Improving Quality of Life for Low-Income Rural/Urban Populations (Sec. 2.7);

Strategies for the last three areas are set forth in greater detail in Appendices A, B, and C.

2.1 Major Elements of The Bureau's Energy Strategy and Their Relationship to the Africa Bureau Strategic Plan

The Africa Bureau Strategic Plan considers energy within the overall framework of natural resources management, and stresses:

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- complementing short-term stabilization efforts and basic structural adjustment programs by reducing the impact of oil imports on host-country foreign exchange earnings;

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Given the limitations on AID/W and Mission resources involvement in the energy sector should be directly tied to the country strategy. Thus the Bureau's Energy Strategy:

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- examine the effects of the country's energy situation on agricultural development, off-farm employment, the natural environment, and future economic prospects;

- identify and prioritize major energy-related problems and assess the quality of host country data gathering, policy and investment analysis related these problems;

- outline alternatives for addressing major energy problems; and

- determine the adequacy of host-country, donor, non-governmental organization (NGO) and private sector response to these problems.

2.3 Identifying Energy Constraints, Recurrent Costs and Opportunities for Using Energy More Effectively to Increase Agricultural Productivity and Off-Farm Employment in USAID Projects

Agricultural productivity and off-farm employment can be improved through the identification of energy-effective methods, equipment and systems such as:

- low-cost systems which make more more effective use of human, animal, fossil fuel or renewable energy in planting, harvesting and agricultural processing;
- energy-efficient irrigation and water development alternatives; and
- appropriate agricultural transport alternatives.

Missions are encouraged to take advantage of the energy systems expertise identified above to assist in the design and implementation of those Mission programs and projects where an examination of energy alternatives may be warranted, e.g. farming systems research, transport, rural private enterprise, housing, and health. Such analyses may be critical to long-term project success.

2.4 Reorienting Energy Policy through Improved National Energy Policy Analysis, Planning and Management and Institutional/Human Resource Development

Where appropriate and consistent with the Country Development Strategy, Missions are also encouraged to use the services identified above to:

1) help host countries assess their institutional resources (human, financial and physical) prior to the design of energy-related human resource development programs;

2) provide selected technical assistance and training in such areas as collaborative energy policy analysis, pricing, energy management or public and private investment decision-making related to both commercial and non-commercial energy use; and

3) assist Missions in the design and implementation of bilateral programs and projects.

2.4.1 Improving national energy policy analysis, planning and management

Support for national energy planning and management programs is one of the most effective means for donors

to begin to address the major energy problems related to agriculture and rural/urban development, natural resource management, and oil import substitution. Better energy planning and management can help improve:

- the acquisition of accurate energy and natural resource information for decision-making;
- the development of host country institutional capability to analyze this information and to utilize it in setting policy and designing programs; and
- the actual implementation of effective energy/natural resource programs and private sector initiatives.

The acquisition of accurate energy and natural resource information and the development of host-country analytical and decision-making capability are long-term continuing processes. Consequently, they have tended to receive less attention from multilateral development banks and donors whose interests are in more immediate and tangible project outputs.

Without adequate attention to developing an accurate energy/natural resource information base for decision-making, and on initiating and supporting improved LDC analytical capability, even an expanded level of donor assistance is unlikely to reverse current development trends. Frequently, energy assessments rely on secondary data and are completed within the span of a few months. CDSS preparation and project design often rely only on secondary data obtainable during the design period.

Improved policies to bring about more effective use of energy and to promote economical indigenous energy production depend on at least two factors: (1) the development of accurate energy supply and end-use information necessary for informed decision-making, and (2) the development over the long term of host-country institutional capability (e.g. the human, physical and financial resources) to effectively manage national energy supply and demand, set priorities and coordinate donor activities.

The energy planning process can provide the means for promoting host country capability in the use of pricing, regulatory and management tools to achieve sustained increases in energy use efficiency and cost-effective use of indigenous energy resources. Private sector involvement in bringing about more effective use of energy and promoting economic

production can be strengthened by assisting host country efforts to assure that true costs of the various energy sources are reflected in market price, and through the selective use of government pricing and regulatory policy to promote particularly cost-effective energy systems.

While private sector and international financial institutions are the logical source of capital for major energy development projects, AID is particularly well-suited to provide assistance in energy planning and management through concentration on training and institutional development; as well as providing U.S. expertise in private enterprise development and energy production, engineering, energy research, public sector management, and data gathering and analysis.

Effective AID involvement in the energy sector will not necessarily require major capital investments. Instead AID technical assistance, training and limited capital assistance can be applied selectively to strengthen investment decision-making and management.

AID assistance to Africa is focused on the agricultural sector and on development programs for low-income rural and urban populations, institution-building, training and extension. The Bureau's energy strategy is intended to have a direct effect on efforts to increase agricultural productivity and to improve quality of life for low-income rural and urban populations.

AID energy planning and management assistance in Africa can help foster effective policies and programs which encourage private sector activity in effective development and use of energy in agriculture, rural and urban development, and transportation. In addition, AID expertise in institution-building and management can be of significant benefit in addressing the problems of oil import dependency and natural resource degradation/biomass depletion both of which have major impacts on agricultural and rural/urban development.

Thus Missions are urged to make use of energy assessment and policy analysis technical assistance resources to assist in CDSS preparation and, where appropriate and consistent with the Country Development Strategy, to provide technical assistance and training in collaborative energy policy analysis, energy planning and energy management. Such assistance can be particularly effective when it complements MDB programs, as has been the case in the Sudan and Liberia. In the Sudan AID energy policy and planning support has been part of the Mission's program to assist the Sudanese government in achieving balance of payments stabilization objectives.

The regional Energy Initiatives for Africa (EIA) Project with field offices in Abidjan and Nairobi and centrally funded S&T/EY projects are available to provide technical assistance resources for more detailed assessment and analysis work and for identifying possible complementary MDB/USAID activities, especially in countries where IBRD/UNDP national energy assessments have been done.

Major energy planning and management assistance programs should be considered primarily as part of the larger mission programs in Africa. This does not preclude AID support to small country programs, where such support can be provided without placing undue administrative burdens on mission personnel. For example EIA and ST/EY technical assistance and training resources can be used to assist host governments in establishing or clarifying national energy priorities. AID resources can be used to stimulate a flow of donor and private sector investment into cost-effective energy conservation and fuel substitution activities. Alternatively, AID can provide feasibility studies, energy audits, technical assistance and training support as a means of promoting further U.S. and local investment in these activities.

2.4.2 Improving institutional/human resource development

AID will support training and other institutional development activities designed to assist countries in developing domestic fuel resources and in managing the effective use of all fuels both domestic and imported. These efforts will take advantage of unique U.S. capabilities by expanding ties with U.S. universities, government laboratories, consulting, engineering and energy companies and professional societies that can offer special expertise to African countries.

For established energy planning and management programs, AID will emphasize training African professionals in program management and budgeting, including the use of analytical methods to establish host country energy/natural resource priorities and to coordinate donor activity.

Assessments of existing human, physical, and financial resources available to address priority energy-related problems are a prerequisite to effective policy-making, private sector development, and technology transfer, yet are frequently carried out in an ad hoc, cursory fashion. In almost all countries information is limited on these resources as well as on their relationship to overall government national

planning priorities and to training and technical assistance needs. The training which is provided may therefore not be directed at priority problem areas.

For example, many training programs have focused on professional and technical training of renewable energy systems specialists instead of providing training to managers, engineers, technicians and private entrepreneurs in skills directly related to meeting priority energy-related needs in agriculture and rural/urban development.

Assessments of both existing institutional resources as well as future requirements should therefore be one of the first tasks carried out under energy-related technical assistance programs, providing the information needed for the design of training and institutional development strategies.

Institutional assessment requirements will vary depending on the country development setting. However, they generally include the following:

- assessment of host country institutional capability in national energy planning and management;
- assessment of human, physical and financial resource requirements in support of private sector importation, manufacture, marketing, distribution and servicing of energy systems and equipment;
- assessment of non-governmental and host-country counterpart capability in technology adaptation and transfer;
- assessment of institutional requirements for skilled lower-level technicians in the private and public sectors. (Frequently, the scarcity of skilled mechanics and individuals with small business management and marketing expertise hampers the development of indigenous energy-related enterprises, but the actual numbers and types of individuals requiring energy-related training are either not known or only crudely estimated.)
- assessment of energy-related training for various end-use sectors to ensure that training opportunities match country needs.

Training and institutional development programs in the energy sector should be based on the findings from these assessments. A greater understanding of actual training requirements will be used to expand in-Africa or LDC-based training wherever feasible.

Other training resources will be utilized where applicable, including, for example, Mission bilateral programs, the ST/EY conventional energy training program, the African Manpower Development Program (AMDP) and periodic information sharing conferences in Africa. Training in energy technologies should be directed at the most cost-effective systems for meeting energy-related needs in agriculture and rural/urban development, including systems which rely on human energy, animal motive power, and fossil fuel driven equipment.

2.5 Reducing the Impact of Oil Imports on Foreign Exchange Earnings by Increasing Energy Efficiency and Indigenous Energy Production

The potential for increased petroleum energy-efficiency in Africa is surprisingly high particularly in the electric power and commercial/institutional sectors. In addition, the transport sector consumes from 40-70 percent of total petroleum in typical African countries and thus must also be considered important in the design of energy-efficiency programs.

Where appropriate, U.S. short and long-term technical assistance may be made available to Missions for the design and implementation of energy management programs, in-country training in energy auditing, private sector marketing of energy-efficient equipment, and identifying fuel substitution alternatives (e.g. coal and renewable energy).

Efforts to reduce petroleum dependency will be centered on energy efficiency and alternate energy programs which have the highest returns per dollar invested for a specific country and which introduce U.S. and Third World technology well-matched to host country requirements.

AID will continue to support host country efforts to analyze and develop the most cost-effective energy alternatives for specific countries or regions. Depending on country development strategies and country specific needs, AID assistance may include:

- documenting and assessing the economic impact of oil imports on country development plans and foreign exchange earnings;

- analysis of national energy pricing policies; investment and tax codes, trade regulations and natural resource management policies, especially as these support private investments;

- energy efficiency programs in the transportation, commercial/industrial, or electric power sectors;
- energy management for small utility systems;
- economic analysis of the costs and benefits of substituting coal for oil imports;
- assessments of potential industrial and agricultural markets for electrical power and low temperature geothermal resources;
- management training and technical assistance related to energy production (e.g. refinery operation; geothermal energy; small hydropower; oil, gas and coal exploration, development, processing and distribution);
- regional power and energy planning (e.g. power interconnection feasibility studies); or
- promoting the commercialization of economic energy systems to increase energy efficiency or indigenous energy production.

Particular emphasis will be placed on the energy requirements to support agricultural and employment development in rural areas as well as to meet the domestic fuel needs of rural households.

AID may assist with collaborative analysis, testing and commercialization of energy systems which make the most effective use of human energy, animal motive power, fossil fuel driven equipment, wind, small decentralized hydropower and solar energy to meet priority end use needs.

In these and other selected areas which have the potential of providing significant national economic benefits, Missions can draw upon resources available through Energy Initiatives for Africa and ST/EY projects to: 1) provide prefeasibility study and project preparation assistance in order to identify and attract other financing sources and promote co-financing of priority projects, 2) fund relatively low-cost activities which are instrumental to initiating priority larger-scale projects or activities.

A more detailed statement of strategy for increasing energy efficiency and indigenous energy production is attached (Appendix A).

2.6 Increasing Biomass Supplies and Improving Natural Resource Management through Improved Production and Utilization of Biomass Fuels

Natural resource degradation is to a large extent associated with: 1) the clearing of forest to provide additional agricultural land, 2) declining soil fertility associated with overcropping to meet increasing population demands for food, and 3) increasing demands of animals on grazing land. Nonetheless, the growth in demand for firewood and charcoal is an important factor behind deteriorating natural resource conditions, especially in those areas which serve the fuelwood and charcoal needs of major population concentrations. Urban centers account for a disproportionate share of charcoal consumption. As use of charcoal for cooking is considered less energy-efficient than direct use of wood, continued urbanization may be increasing per capita consumption of woodfuels.

Potential exists for a 20-40 percent improvement in the efficiency of fuelwood and charcoal use for cooking through the use of energy-efficient portable stoves. Equally significant may be improvements in traditional charcoal kilning practices. Again, AID resources may be made available on request to assist in promoting private sector manufacturing and marketing of improved stoves, NGO involvement in stove design and dissemination, or technology transfer related to improving charcoal production practices in the priva e sector.

One alternative for addressing the problem associated with depletion of fuelwood stocks from commonly held lands is to move toward the establishment of user fees for wood and charcoal destined for commercial markets at levels high enough to cover the costs for the management of natural areas on a sustainable basis. The establishment of such natural resource management programs requires interdisciplinary knowledge which includes:

1) understanding of sociological factors associated with use of the common lands and the marketing of wood and charcoal;

2) the forestor's knowledge of wood fuel production and regeneration rates;

3) the energy economist/planner's understanding of traditional markets for wood and charcoal, supply sources and the existing price structure for both these fuels and other energy alternatives.

The Bureau for Africa forestry program addresses the problems surrounding production of wood fuels for energy. The energy strategy supports the Bureau's forestry program by encouraging interdisciplinary social and economic analyses as an integral part of forestry/fuelwood program design.

Where appropriate, assistance may be made available to Missions on request through EIA, the S&T/FNR Forestry Support Program or S&T/EY's Energy Policy Development and Conservation Project (EPDAC) to carry out fuelwood/charcoal supply and pricing analyses in support of the design and implementation of forestry/fuelwood production programs.

While several major objectives are common to AID's forestry and environmental programs, certain energy management and technical assistance activities related to biomass energy logically fall within the Bureau's energy strategy. Examples:

- use low-cost aerial and ground survey techniques to estimate biomass supply and demand;

- acquire fuelwood/charcoal and biomass supply and demand data for policy-making;

- ensure that biomass supply and demand data are incorporated in overall energy program analysis and policy management;

- analyze the market and distribution systems for traditional fuels;

- analyze the effects of price competition between traditional and commercial fuels and the effects of financial incentives for fuelwood/biomass production and conservation;

  (One finding that has already emerged from such analysis is the importance of market incentives for the planting, management and efficient consumption of fuelwood supplies where traditional fuels are bought and sold commercially, and for the dissemination of stoves and charcoal kilns through similar market channels. Without financial incentives most fuelwood projects can be expected to have only a marginal impact)

- improve fuelwood utilization through design, marketing and dissemination of economic and socially acceptable stoves (e.g. low-cost portable metal stoves which can be manufactured and sold through existing markets);

- improve charcoal production methods and systems (e.g. traditional earthen kilning and use of brick beehive kilns);

- increase production of fuels from biomass alternatives such as bagasse or coffee husk.

A more detailed statement of strategy for increasing biomass supplies and improving natural resource management is attached (Appendix B).

2.7 Increasing Agricultural Productivity and Improving Quality of Life for Low-Income Rural/Urban Populations

2.7.1 Increasing agricultural productivity

The Africa Bureau's energy strategy emphasizes support for the Bureau's priority of increasing agricultural productivity through activities which minimize natural resource degradation, dependence on petroleum imports, program operating expenses and recurrent costs. Assistance will also be directed to selecting energy-effective methods and technologies to reduce post-harvest losses, facilitate movement of goods to market, and process food products through careful design and application of energy supply systems. Missions are encouraged to:

- evaluate energy implications and alternatives in agricultural programs;
- promote the commercialization of energy systems which increase agricultural productivity;
- promote the incorporation of fuelwood production practices into farming systems;
- support energy/economic analyses of indigenous fertilizer production alternatives; or
- support and improve non-governmental organization involvement in adaptive research and technology transfer of low-cost energy systems which increase agricultural productivity.

A more detailed statement of energy strategy for increasing agricultural productivity is attached (Appendix C).

2.7.2 Improving rural/urban development for low-income populations through more effective use of energy

Certain energy systems provide low cost, economic improvements which can be incorporated within existing rural/urban development programs without increasing total project costs.

Effective use of energy can significantly improve rural/urban living conditions by providing low-income populations with greater freedom from time consuming or laborious tasks, and by increasing productivity. For example, a major need throughout much of Africa is to reduce the time and effort required to obtain domestic water for people and animals. Other needs for emergency health care lighting and vaccine storage,

emergency radio communication, economic rural transport systems, and comfortable low-cost housing are covered under this broad objective.

Missions should consider energy saving alternatives in the design and implementation of housing, water development, health and sanitation projects. Cost-effective alternatives may include:

- substitution of animal power, wind or photovoltaic pumping systems in water development projects;
- substitution of photovoltaic systems for emergency electrical power generation, medical vaccine storage, communication and lighting in remote health centers;
- examination of intermediate transport alternatives in rural development projects;
- incorporation of economic passive solar heating and cooling designs into low-cost housing projects; or
- examination of the potential for local manufacture and/or servicing of metal stoves, intermediate transport equipment, water pumping and lifting systems, or energy effective agricultural equipment in rural enterprise development projects.

2.8 Other Cross Cutting Objectives Addressing All Four Energy-Related Problem Areas

The following objectives are considered together since they affect each of the four problem areas discussed above:

- promote new energy technology systems and private sector marketing/dissemination, maintenance and repair;
- improve information transfer on programs, projects, successful private sector initiatives, energy systems and equipment; and
- improve donor coordination on energy-related assistance to LDC's.

2.8.1 Promoting new technology systems and private sector marketing/dissemination, maintenance and repair

Supporting efforts to improve the marketing/dissemination of economic energy systems

AID renewable energy activity has been directed primarily toward design and adaptation of equipment

and attempted dissemination through extension programs with limited attention to systematic test marketing, use of advertising (e.g. newspapers. radio) and small enterprise development. AID renewable energy projects have also tended to overlook possibilities for marketing commercially available equipment from other LDC countries and the U.S. and the advantages of developing and marketing energy systems to end users who pay for fuel.

Projects should give greater emphasis and support to business development and marketing of proven, cost-effective, and commercially available energy efficient or alternate energy equipment from other LDC countries and the U.S. Such support should also include assessment of the social and institutional factors needed for successful deployment and use of these systems. Every effort should be made to identify and concentrate resources on technologies with significant potential for high impact on economic development.

Marketing of manufactured equipment or dissemination of energy equipment or systems made from local indigenous materials should be carried out only after the equipment has been shown to be both technically sound, properly matched to end use requirements, and financially/socially feasible.

Where appropriate Missions should incorporate small business and marketing expertise into energy projects.

Strengthening the maintenance and repair infrastructure in Africa for energy systems

The low repair and maintenance infrastructure throughout much of Africa is a major constraint to wider use of cost-effective energy systems and equipment.

AID will promote design and commercialization of economic energy equipment and systems with high durability and low maintenance requirements, as demonstrated through controlled independent testing and certification.

AID will also encourage and support, where appropriate, the strengthening of host-country vocational-technical training facilities and the training of vocational-technical instructors in energy systems and equipment.

Examining the potential for local manufacture and/or servicing of energy systems matched to agricultural and rural/urban development needs in private enterprise development projects

Missions should be alert to the possibilities for stimulating private sector assembly, manufacture or servicing and repair of certain kinds of energy equipment and systems for which demand is known to be high. Short-term consultants are available to assist Missions in project design and implementation to examine and select appropriate equipment which may be candidates for commercial production and distribution within private enterprise development projects.

A wide variety of agriculture and rural development equipment which makes more effective use of energy should be considered such as animal drawn implements, handpumps, bicycles, carts, motorized tricycles and other intermediate transport equipment, metal stoves, low-energy brick making equipment, or solar water heaters.

2.8.2 Improving information transfer on energy-related programs, projects, successful private sector initiatives, energy systems and equipment

Improving monitoring and evaluation of energy systems and technologies

Insufficient information exists on the performance and cost-effectiveness of systems and technologies. Field observations in African countries have demonstrated the inherent difficulty in trying to establish accurate performance monitoring and cost/benefit analysis programs in locations with scarce trained human resources. For example, the following generalizations emerged from the Bureau's assessment of renewable energy technologies in seven African countries (1982):

1) Very few technologies have actually been accurately monitored in the field;

2) In general, methodologies used for monitoring specific technologies have not been uniform, making it difficult to share experience and results;

3) An important criterion for establishing the economic viability of systems is durability.

Independent information on durability and performance and calculated estimates of economic viability for equipment which most closely matches end-use priorities in African countries can provide potential buyers with a sound basis on which to make purchasing decisions and provide an important stimulus to private sector manufacturing and marketing.

AID will therefore encourage:

a) independent user surveys to determine economic performance for existing systems, equipment and tools, and

b) strengthening institutions with experience in certifying comparative technical and economic performance, and in carrying out adaptive research and field-testing on systems, equipment and tools which meet priority energy-related development needs, including those which:

- increase agricultural productivity;
- increase energy efficiency or have significant petroleum substitution potential in the commercial/institutional, transport or electric power sectors; or
- reduce biomass depletion rates.

AID will give special encouragement to institutions whose testing programs are self-financed (e.g. through equipment certification fees).

Further, AID will support development of uniform methodologies for determining technical and economic performance of the systems identified above so that results can be easily interpreted and shared among researchers and potential users in different countries.

AID will stress determining economic performance of renewable energy and appropriate technology systems prior to promoting their marketing/dissemination. Wherever possible, Missions should ensure in the design and implementation of projects that the necessary data can be gathered and that field project management will keep track of recurrent costs, operation and maintenance expenditures and system outputs so that benefits and costs can be calculated and the cost-effectiveness of installed systems can be compared with alternatives.

Upgrading capability in gathering and analyzing data on the social and economic acceptability of energy systems

Once technical performance, durability and rough economic performance of energy systems has been established under controlled conditions, field-testing or test-marketing should be performed to determine potential acceptability and user demand. Agriculture and rural energy needs assessments for small representative sample populations are useful for determining initial energy system needs, as well as for later field-testing or test marketing of systems.

Unfortunately, statistical sampling techniques normally applied in test marketing of products have not been a part of most efforts to date to determine the acceptability of proposed energy systems at the local level, nor have low-cost census techniques been systematically applied in order to determine existing and potential demand more effectively.

In addition to more subjective socio-economic assessments of user preferences and needs, Missions should ensure that statistical sampling techniques are incorporated into sociological observations and market surveys for energy systems designed to meet priority energy-related needs.

For projects in the field, more emphasis should also be placed on collecting information about the financial setting (including credit institutions), and marketing environment.

Providing for more systematic project evaluation and use of results

The Bureau will reexamine current project evaluation documentation and dissemination practices in order to improve sharing of useful results and experience.

Improving information transfer on energy systems/equipment and project activities

Exchange of useful information among projects and countries is insufficient on: 1) successful program activity, 2) economic energy systems, 3) successful commercial ventures, or 4) experience gained.

The quality of the information transferred by donor groups and non-governmental organizations (as well

as private and public journals and newsletters aimed at LDC technicians, managers and decision-makers) has been impaired by inadequate economic and social data on systems, practices, equipment and projects.

A need exists to present information in a more concise form designed to meet the requirements and perceptions of specific end users, including the use of audio-visual and graphic communication techniques.

While existing information links such as the Volunteers in Technical Assistance (VITA) network and computerized information exchange system will be encouraged, the type and quality of information transferred should be improved and more closely tied to identified priority problems. The role and use of AID's Development Information Utilization Division (DIU) will be reexamined so as to more fully utilize the DIU to support information transfer related to the major energy/natural resource problem areas.

More attention will be paid to promoting private sector development (and updating) of publications (newspapers, magazines, catalogues) on commercially available energy systems, tools and equipment which are appropriate to developing country needs, for example, systems which increase the effective use of human energy, animal power, fossil fuel driven equipment or renewable energy systems (e.g. wind, solar, biomass).

Increased attention will be paid to developing integrated packages of printed information, workshops, training programs, and observational tours designed to disseminate information on successful program activity, economically proven energy systems, successful commercial ventures, or experience gained.

The Bureau will reassess current efforts on the part of AID, AID contractors and other organizations to gather, coordinate, and deliver information on successful activities, lessons learned, and economical energy systems, in order to promote more effective information transfer.

2.8.3 Improving donor coordination on energy-related assistance to LDC's

AID will support programs of information exchange among donors, African institutions and other organizations, both at the international and host country level.

Given the constraints on development resources available to African energy and overall development efforts, improved coordination of bilateral, multilateral and national resource planning of resource allocation is essential. In the energy field, AID will further this goal by:

- developing information on aid projects which involve energy and preparing it in forms which can be exchanged;
- participating in the the Energy and Forestry/Fuelwood Committees of the Cooperation for Development in Africa, as well as the DAC (OECD)and IBRD Consultative Groups;
- promoting in-country exchanges of informations among donors;
- tracking energy information gathered by the DAC and IBRD on LDC oil-imports, debt servicing, and merchandise-exports to assist in strategy and program formulation;
- upgrading African professional capability in program management and budgeting and the use of analytical methods to establish energy/natural resource priorities. (With these skills host-country managers can better direct donor assistance programs, be more selective about the type of assistance offered by donors, and reduce duplication and proliferation of low-priority activities which overtax government absorbtive capacity.)

AFRICA BUREAU ENERGY STRATEGY STATEMENT

SECTION III

APPENDICES

APPENDIX A

INCREASING ENERGY EFFICIENCY AND INDIGENOUS ENERGY PRODUCTION

AID will give particular emphasis to the following activities for increasing energy efficiency and expanding indigenous energy production.

1.0 Increasing Energy Efficiency

AID may provide technical assistance in the use of energy efficient equipment and methods in transportation as 40 to 70 percent of petroleum product use in African countries is in this sector (except in those countries with large energy-intensive export mining operations).

AID may provide technical assistance to increase energy efficiency in electric power production and use, or the commercial/institutional and industrial sectors. Emphasis will be placed on payback periods on energy efficiency investments of one to three years.

1.1 Transportation

In the transport sector, truck and rail transport are typically the largest fuel users and are critical to national economies and exports of agricultural products.

Typically trucks consume 60-80 percent of all fuel used in road transport, indicating the need for special attention to this industry. Training of truck and bus drivers and supervision of their driving performance can reduce fuel consumption by 10 percent or more, while improved vehicle maintenance- including regular tune-ups, maintenance of tire pressure, use of radial tires and wind deflectors, and prompt replacement of air filters can reduce fuel consumption by 5 to 15 percent. Even larger savings are possible by improving the utilization of vehicles mainly by reducing empty backhauls, and by using truck sizes and designs appropriate for the loads to be carried.*

In most African countries urban passenger transport accounts for a growing fraction of total petroleum use. There are opportunities for increasing energy efficiency through such mechanisms as improved pricing policies, import controls, better fleet management and maintenance, and long-term improvement in railroad reliability, electrification of rail and public transportation systems, urban traffic control, or for example, dedication of a portion of export revenues to importation of diesel fuel to

* World Bank, The Energy Transition in Developing Countries, August 1983

assure reliable energy supplies to freight transport. Programs which influence the transport mix should take explicit account of energy costs and the availability of alternative transport fuels.

Integrated transportation planning to encourage a more economical and efficient transport mix (e.g. bicycles, carts, motorized tricycles, trucks, rail, river transport) could also yield major savings over the long-term.

Missions should draw upon U.S. transportation energy planning and policy capability such as short-term TA from ST/EY (e.g. the Transportation Energy Group at Oak Ridge National Laboratories), or similar assistance from Energy Initiatives for Africa to examine the energy implications and alternatives in AID transportation projects.

In designing and implementing rural enterprise development and rural transport projects Missions should draw upon available technical assistance to examine the potential for expanding private sector markets and for improving the manufacturing, repair and servicing infrastructure for transportation systems matched to rural development needs.

1.2 Electric Power

Petroleum consumption in the electric power sector is frequently high in those African countries with low hydroelectric potential or undeveloped geothermal resources. The U.S. has considerable expertise in the operation and management of small power systems and in load management. Missions can draw upon such services through ST/EY.

Changes in certain energy end-uses could yield measurable petroleum savings at relatively low cost, e.g. introduction of more efficient diesel pumps and generators, substitution of wind or photovoltaic systems in remote settings. In countries where oil-fired electric power generation is the rule, substitution of solar water heaters for electric heaters, or use of more energy-efficient building design and air-conditioning systems are particularly cost-effective measures.

1.3 Industrial/Commercial

Significant potential exists in several countries to reduce energy costs for cooling/heating and lighting through improved energy management and building design. Similarly, in many countries, industrial production is constrained by periodic lack of energy inputs. In most industrial plants, energy use per unit output could be reduced 20-40 percent with minimal capital investment.

In those countries in Africa where the industrial and commercial sectors are reasonably well-developed ST/EY energy auditing services may be useful, if focused on strengthening auditing capability among private sector engineering and architectural firms within the host country.

2.0 Increasing Indigenous Energy Production

AID involvement in expanding energy production in Africa should be viewed cautiously, given the much greater financial resources and historical role of international financial institutions in providing capital for power generating stations, distribution systems, hydroelectric dams, and refineries. Most countries rely entirely on imports for crude oil and petroleum products. Domestic refineries in almost all cases are small, old, and mismatched to domestic needs.

A number of countries have considerable unexploited hydropower potential and/or potential geothermal, wind, or solar energy resources. A few countries have potentially exploitable oil, gas, or coal reserves.

Because AID resources tend to be in the form of grants, rather than loans, AID may be justified under certain circumstances in supporting feasibility studies with potentially high returns on investment which would not normally be attractive to international financial institutions. In addition, selected AID support to indigenous energy production may lead to mutually beneficial transfer of U.S. technology and management methods to the host country where the technology and expertise are well-matched to host country requirements.

3.0 Commercialization of Economic Energy Systems to Increase Energy Efficiency or Indigenous Production

To stimulate marketing, distribution and purchase of cost-effective equipment which either uses petroleum energy more effectively or provides an economical alternative to petroleum-based energy systems, AID encourages efforts to improve:

- information dissemination on commercially available equipment;
- independent testing and certification of technical and economic performance of new and existing commercial equipment from the Third World and the U.S. (designed to use petroleum fuels more effectively or to provide an economical substitute for petroleum based energy systems);

- efforts to strengthen the confidence and interests of financial institutions in providing loans for energy systems with demonstrated high returns on investment; and

- training of private entrepreneurs, engineers and architects in effective energy management and engineering (including energy auditing, selection of energy efficient materials and equipment, and design of effective energy systems).

APPENDIX B

INCREASING BIOMASS SUPPLIES AND IMPROVING NATURAL RESOURCE MANAGEMENT

AID will give particular emphasis to the following energy activities directed to increasing biomass supplies and improving natural resource management.

1.0 Increasing Fuelwood Production

Emphasis should be placed on a) the use of low-cost aerial and ground survey techniques for estimating fuelwood/charcoal and biomass supply and demand; b) closer integration of agriculture, livestock production and forestry, and c) improved natural forest management for sustained fuelwood production. Increased attention will be paid to the community and institutional dimensions of fuelwood projects, including integration of agriculture and forestry as an aspect of Mission and host-country policy dialogue, and institution building projects designed to help forest services achieve a greater capacity for development and service.

AID may help fund or package alternative fuelwood or biomass intervention approaches which:

- provide sufficient economic incentives at all or most stages--seed collection/production, seedling production/distribution (unless this stage is bypassed), tree planting and care, harvesting, conversion/distribution, and utilization--such that fuelwood production will increase without large-scale government or donor intervention. This approach--referred to by the IBRD as "farm forestry"--has been shown in Africa and elsewhere not only to be feasible but highly effective in getting trees planted and in making tree-planting potentially profitable to participants;

- not only create a long-term balance between fuelwood supply and demand, but also help improve the ecological condition of watersheds and the long-term productivity of agricultural land and rangeland; and

- encourage Missions and host-countries to incorporate farm forestry and/or agroforestry approaches in agricultural, watershed management, and river basin development projects.

These efforts will require policies and actions which encompass national agriculture, livestock, forestry, energy, land-use and economic planning programs. Fuelwood/charcoal and biomass supply and demand data will be necessary for sound policy-making. The acquisition of this data most logically falls within national energy planning and management programs.

2.0 Improving Fuelwood Utilization Efficiency

Efforts to promote more efficient use of fuelwood will continue to be focused on improved stoves and charcoal production methods. However, the contribution of stationary sand and clay woodstoves to slowing rates of biomass depletion may be more limited that originally thought. Such stoves rely on the use of extension programs for dissemination, a process which could take decades in Africa to reach large numbers of people.

Limited support for stationary sand and clay stove development and dissemination should be continued for existing stove projects (e.g. Senegal) where the costs and benefits of this approach can be assessed with reasonable accuracy and the outcome is not yet known.

Improved portable metal and ceramic (terracotta) stoves probably have greater likelihood of spreading rapidly through introduction into existing commercial markets for traditional portable stoves. For example, stoves based on designs developed by Kenyan's who observed the manufacture of energy-efficient terracotta stoves in Thailand, appear to have been successfully introduced to the private sector throughout Kenya. Improved metal and ceramic portable stoves also appear to demonstrate more uniform and higher energy efficiencies than massive sand and clay stoves.

Improved charcoal production methods, including improved traditional kilning or use of beehive brick kilns could be of measurable benefit in several African countries. (The use of beehive kilns in the Philippines was encouraged by training Philippino technicians in beehive kiln construction in Brazil.)

3.0 Increasing Utilization of Sustainable Biomass Alternatives

AID support for the production and preparation of alternative biomass fuels will focus primarily on major biomass sources such as direct combustion of bagasse from sugar cane; briquetted papyrus, coffee husk or peanut shells; use of surplus palm oil and molasses where economic viability is well-established.

Use of feedlot wastes and municipal sewage may receive site specific encouragement. Biogas systems have not been successful in Africa for one or more of the following reasons: high system first costs, limited animal confinement in Africa, limited water supplies, lack of methane gas using equipment and appliances, insufficient training in operation and maintenance, and taboos against handling human and liquid animal wastes. Development and commercialization of biogas systems should therefore receive AID support only where these constraints do not exist (e.g. privately run systems associated with large ranching or dairy operations).

Technologies which place additional stress on the biomass resource base such as charcoal gasifier engines for vehicles, pumps, and sawmills should only be encouraged where it has been demonstrated that the biomass resource is being managed under sustainable conditions.

4.0 Improving Integration of Energy, Forestry and Natural Resource Policy Analysis, Planning and Management

Increasing biomass energy supplies, increasing agricultural production and improving sustainable management of natural resources are interrelated objectives which must be planned, developed and evaluated in an integral manner in order to avoid unforseen ecological consequences. For example, fuelwood production, per se, will not reverse current natural resource degradation trends. Biomass resource sustainability must be promoted in relation to total biomass and wood demand, including requirements for fodder, poles, nutrients, mulching and timber.

In each country, the establishment of energy/natural resource planning priorities, must begin through analysis of the major problems in the energy/natural resource sector. Too often, such analysis has been based on speculation rather than factual information gathered from direct field observation and census work. Sound decision-making is impossible without such information, and the development and use of the information must be a continuing process involving host-country specialists.

The traditional project intervention approach of AID and other donors to energy, forestry or natural resource development activity must therefore be accompanied by 1) the identification of the appropriate host country institution or institutions to work with, 2) more systematic long-term strengthening of host country analytical capability, and 3) the use of low-cost sampling, survey, and analysis techniques.

In addition, institutional mechanisms must be identified and supported which improve the integration of agriculture, forestry, natural resource and national energy planning within and among individual ministries. For example, Ministry of Agriculture personnel should receive exposure to resource planning, energy analysis, agroforestry concepts, and cost-effective energy technologies.

APPENDIX C

INCREASING AGRICULTURAL PRODUCTIVITY

AID will give particular emphasis to the following energy activities directed at increasing agricultural productivity.

1.0. Evaluating Energy Implications and Alternatives in Agricultural Programs

To effect energy policy changes which promote increased agricultural productivity Missions should incorporate in agricultural projects, where appropriate, technical assistance services which increase host country policy-makers' understanding of the energy sources available for agricultural production, how these sources are currently used, and how they might be more effectively used in the future.

Where appropriate AID should incorporate evaluation of energy alternatives in new and existing agricultural projects with emphasis on agricultural transport, fertilizer production, water-lifting, grain grinding, harvesting, soil preparation and agricultural processing. This can be accomplished by seeking EIA, REDSO, ST/EY, and AFR/TR/SDP design services to ensure that project design and implementation includes:

1) gathering information on agricultural energy inputs, outputs and systems to assist in selecting the most economic and acceptable energy alternatives for increasing agricultural productivity, and

2) providing technical assistance on effective energy systems and methods as needed.

2.0. Promoting the Commercialization of Energy Systems which Increase Agricultural Productivity

Missions should support policy, technology transfer and institutional development programs which stimulate the marketing, distribution and purchase of commercially available and/or newly developed rural energy systems that 1) make more effective use of human energy, animal motive power, fossil fuel driven equipment or renewable energy (including wind, photovoltaic, hydro and biomass sources), 2) are affordable and cost-effective, and 3) respond to user needs.

Emphasis should be on systems for transportation, soil preparation, production of fertilizer, water-lifting and irrigation, grain-grinding and agricultural processing.

AID encourages technology transfer support for:

a) private sector publication of information on commercially available and/or newly developed equipment;

b) independent testing and certification of technical and economic performance (including durability) of new and existing commercial equipment from the Third World and the U.S.; and

c) efforts to strengthen the confidence and interest of financial institutions, particularly at the rural level, in low-cost, high payback energy systems with demonstrated high returns on investment.

Emphasis will be placed on decentralized private sector initiatives, where the "private sector" includes private farmers, cooperatives, artisans, vendors at urban and rural markets, as well as corporations.

3.0. Promoting the Incorporation of Fuelwood Production Practices into Farming Systems

Missions should draw upon EIA, REDSO, AFR/TR/SDP and Forestry Support Program services to incorporate fuelwood production practices into farming systems which: a) increase long-term agricultural productivity, and b) reduce soil erosion losses (including losses due to deforestation and the use of dung and agricultural residues for fuel).

4.0. Supporting and Improving Non-Governmental Organization Involvement in Adaptive Research, Technology Transfer and Private Sector Development of Low-Cost Energy Systems which Increase Agricultural Productivity

Non-governmental organizations (NGO's) have proven to be useful technology transfer agents, frequently providing the most effective means for adapting energy technology and systems to meet local conditions and for assisting rural populations in evaluating the potential costs and benefits of alternative systems.

Missions are therefore encouraged to use NGO's as agents for both technology transfer, extension and private enterprise development. However, Missions, REDSO's and AFR/TR/SDP should require that NGO's pay increased attention to determining technical and economic performance of energy equipment and systems prior to promoting their widespread application.