

Africa Bureau Energy Strategy Background Paper

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AFRICA BUREAU ENERGY STRATEGY BACKGROUND PAPER

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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 | 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.

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:

- Improving National Energy Policy Analysis, Planning and Management (Sec. 2.1);
- Increasing Energy Efficiency and Indigenous Energy Production (Sec. 2.2);
Increasing Biomass Supplies and Improving Natural Resources Management (Sec. 2.3);
- Increasing Agricultural Productivity and Improving Quality of Life for Low-Income Rural/Urban Populations (Sec. 2.4);

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

2.1 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:

- o the acquisition of accurate energy and natural resource information for decision-making;
- o the development of host country institutional capability to analyze this information and to utilize it in setting policy and designing programs; and
- o 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.

purpose

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 where it complements MDB programs, as has been the case with AID energy planning and management activities in the Sudan and Liberia.

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.

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 pre-requisite 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:

- O assessment of host country institutional capability in national energy planning and management;
- O assessment of human, physical and financial resource requirements in support of private sector importation, manufacture, marketing, distribution and servicing of energy systems and equipment;
- O assessment of non-governmental and host-country counterpart capability in technology adaptation and transfer;
- O 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.)

- 0 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.

2.2 Increasing Energy Efficiency and Indigenous Energy Production

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:

- 0 documenting and assessing the economic impact of oil imports on country development plans and foreign exchange earnings;
- 0 analysis of national energy pricing policies; investment and tax codes, trade regulations and natural resource management policies, especially as these support private investments;
- 0 energy efficiency programs in the transportation, commercial/industrial, or electric power sectors;
- 0 energy management for small utility systems;
- 0 economic analysis of the costs and benefits of substituting coal for oil imports;
- 0 assessments of potential industrial and agricultural markets for electrical power and low temperature geothermal resources;

- O 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);
- O regional power and energy planning (e.g. power interconnection feasibility studies); or
- O 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 will 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).

2.3 Increasing Biomass Supplies and Improving Natural Resource Management

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 less energy-efficient than direct use of wood, continued urbanization may be increasing per capita consumption of woodfuels.

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:

- O use low-cost aerial and ground survey techniques to estimate biomass supply and demand;
- O acquire fuelwood/charcoal and biomass supply and demand data for policy-making;
- O ensure that biomass supply and demand data are incorporated in overall energy program analysis and policy management;
- O analyze the market and distribution systems for traditional fuels;
- O analyze 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)

- O 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);
- O improve charcoal production methods and systems (e.g. traditional earthen kilning and use of brick beehive kilns);
- O increase production of fuels from biomass alternatives such as bagasse, briquetted papyrus, or coffee husk.

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

2.4 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:

- O evaluate energy implications and alternatives in agricultural programs;
- O promote the commercialization of energy systems which increase agricultural productivity;
- O promote the incorporation of fuelwood production practices into farming systems;
- O support energy/economic analyses of indigenous fertilizer production alternatives; or
- O 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).

2.5 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:

- O substitution of animal power; wind or photovoltaic pumping systems in water development projects;
- O substitution of photovoltaic systems for emergency electrical power generation, medical vaccine storage, communication and lighting in remote health centers;
- O examination of intermediate transport alternatives in rural development projects;
- O incorporation of economic passive solar heating and cooling designs into low-cost housing projects; or
- O 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.

3.0 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:

- O improve assessment of the energy implications and the selection of cost-effective energy alternatives in AID projects;
- O promote new energy technology systems and private sector marketing/dissemination, maintenance and repair;
- O improve information transfer on programs, projects, successful private sector initiatives, energy systems and equipment; and
- O improve donor coordination on energy-related assistance to LDC's.

3.1 Improving Assessment of the Energy Implications and the Selection of Cost-Effective Energy Alternatives in AID Projects

The second priority of the Bureau's energy strategy is to place greater emphasis on removing long-term energy-related constraints and on reducing operating expenses and recurrent costs in AID supported programs by providing for the inclusion of energy analysis expertise, where appropriate, in project design and evaluation.

Energy systems expertise should be included in the design and evaluation of those Mission programs and projects where an examination of energy alternatives is warranted, in agriculture, rural development, water development, e.g. irrigation, transportation, housing and health projects.

3.2 Promote New Technology Systems and Private Sector Marketing/Dissemination, Maintenance and Repair

3.2.1 Support 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.

3.2.2 Strengthen 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.

3.2.3 Examine 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.

3.3 Improve Information Transfer on Energy-Related Programs, Projects, Successful Private Sector Initiatives, Energy Systems and Equipment

3.3.1 Improve 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.

3.3.2 Upgrade 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.

3.3.3 Provide 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.

3.3.4 Improve 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.

3.4 Improve 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:

- O developing information on aid projects which involve energy and preparing it in forms which can be exchanged;
- O 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;
- O promoting in-country exchanges of informations among donors;
- O 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.
- O 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.)