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INTERNATIONAL DEVELOPMENT ASSISTANCE FOR RENEWABLE TECHNOLOGIES: CURRENT PROGRAMS AND INSTITUTIONAL REQUIREMENTS

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ABSTRACT

Within the last several years, foreign assistance donor agencies have begun to provide significant aid for the search for renewable energy sources the developing nations. This paper reports preliminary results from a survey of development assistance projects in renewable energy sources, indicating which areas are extensions of traditional assistance areas and which are new areas of involvement. The last two portions of the paper indicate certain shortcomings in the current effort, and linkages which must be emphasized in order to increase the effectiveness of the range of donor activities.

1. INTRODUCTION

Since world fossil fuel prices began escalating in 1973, non-OPEC developing nations have been struggling with the dual problems of prohibitively expensive imported fuels and the growing scarcity and environmental degradation caused by overuse of traditional fuels. This places in jeopardy both future industrialization plans and gains in the quality of life made in the preceding two decades. Haltingly at first and then with increasing force during the past two years, the international development assistance community has begun focusing upon energy supplies, particularly renewable energy sources, as the key to ensuring continuation of the development process.

In this paper, preliminary findings are reported from an ongoing examination (1) of the current aid programs conducted by major donor organizations in the field of renewable energy resources. The purpose of this project is to locate gaps and areas of overlap in current activities, and to identify new institutional arrangements that may be required to introduce renewable energy sources for development purposes.

2. THE INTERNATIONAL DEVELOPMENT ASSISTANCE COMMUNITY

The principal organizational actors of the development assistance community* are categorized briefly in this section in terms of their size, composition, and typical operating patterns. Later sections discuss specific renewable energy activities.

2.1. Multilateral Donors

In the multilateral sphere, the first category consists of intergovernmental organizations on both the global and regional levels. Most of these have assumed greater development aid responsibilities during the past decade. Within the United Nations system, agencies involved in energy programs include organs of the General Assembly (e.g., U.N. Development Programme, U.N. Environment Programme, U.N. Industrial Development Organization), units within the Secretariat (e.g., Center for Natural Resources, Energy, and Transport), and the specialized agencies (e.g., UNESCO, Food and Agriculture Organization). Likewise, regional intergovernmental organizations conduct aid programs (e.g., Organization of American States, European Development Fund), and functional organizations (e.g., OPEC, OECD) also perform certain development assistance functions.

Although technically a U.N. specialized agency, the International Bank for Reconstruction and Development (IBRD or World Bank)* by virtue of its enormous resources and expertise in development planning, has become the leading multilateral provider of capital aid for development. Loan commitments from the World Bank group are nearly twice the aid flows from all other multilateral organizations combined (2). Supplementing the World Bank are counterparts on the regional (e.g., Asian Development Bank) and subregional (e.g., Caribbean Development Bank) levels with smaller

*For purposes of this study, "development assistance agencies" defined as those organizations whose purpose is to provide assistance to the process of economic and social development. This excludes both functional service agencies that perperform incidental aid tasks and business enterprises that conduct technology transfer as part of their manufacturing or sales operations. Rather, the focus here is on purposive provision of aid for (more or less) altruistic reasons.

*Includes the IBRD and its subsidiaries, the International Development Association (soft loans), and the International Finance Corporation (promoting investment in LDC ventures).

capital subscriptions but greater focus on the problems and potential of their respective areas.

2.2. Bilateral Donors

Bilateral aid programs provide the overwhelming majority of official development assistance flows to developing countries, averaging over 80% of total aid in recent years. Bilateral donor countries can be divided roughly into three categories.* First are the industrialized countries with large diversified aid programs. These countries also often have special historical links to certain developing countries. The United States and major European donors (UK, France, Germany) fall in this category. A second group consists of smaller countries which did not acquire extensive colonies but which have become increasingly active aid donors since the mid-1960s, especially when development assistance is considered as a percentage of GNP. In this category fall smaller European countries and Canada. In the energy field, this list would also include Israel, Japan, New Zealand, and Australia. For the Scandinavian countries and the Netherlands, joined to some extent by Canada, relatively high development assistance flows are marked by a selection of recipients on the basis of both need and commitment to redistributive social policies. Official disbursements from this latter group rose from $762 million in 1970 to $2,697 million in 1976. A third emergent group consists of the OPEC nations, which disbursed over $5 billion in concessional bilateral aid in 1976.

2.3. Nongovernmental Organizations (NGO)

Finally, nongovernmental actors play a significant role in the international development aid effort. This category includes volunteer programs, philanthropic organizations, religious groups, and other relief or service organizations. Grants by voluntary agencies of OECD countries to developing nations and multilateral agencies have increased from $858 million in 1970 to $1358 million in 1976.

Two additional points should be noted here. First, NGO programs are generally smaller than official governmental or intergovernmental programs and tend to be oriented more toward the grassroots and human resources aspects of development. Second, NGOs may often deal directly with similar institutions in developing countries, cutting administrative costs and response time to recipient requests.

The flow of international development assistance has increased substantially during the past decade--from a total of approximately $15 billion during 1974 to $18 billion in 1976. Concessional aid remains an important component of development planning, especially in the poorest countries to which most aid is directed. Substantial learning has taken place in the development community since the beginning of the First Development Decade, but the very size of the current effort renders communication and organizational learning more difficult. This is a particular problem for very small projects, such as many of those likely to involve renewable energy technologies, that tend to be lost in donor agency files once completed.

*A fourth category not discussed here would be the centrally planned economies—Eastern Europe, USSR, and China.

3. CURRENT DONOR ACTIVITIES

Energy projects long have formed a significant fraction of the total funding and technical assistance provided by the foreign assistance community. However, until the last several years these were virtually all conventional infrastructure-building projects, primarily the creation of large-scale hydroelectric generating plants and distribution networks. Conventional energy projects account for 10% of the World Bank's current disbursements, and for a much larger percentage for certain major donors such as Japan and Canada. Few projects were funded in nonconventional renewable energy sources before 1975 except those that were variations on traditional donor activities (e.g., forestry development and reforestation programs) or the industrial application of traditional native technologies (e.g., production of salt through the evaporation of seawater).

In the last few years, the growth in foreign assistance funding for nonconventional, renewable energy projects has been dramatic. Our partial survey indicates that as of the end of 1978 over 300 projects were currently underway or in the advanced planning stage. Most active thus far have been the bilateral donors, certain small nongovernmental organizations, and portions of the U.N. system. Using project lists recently compiled by the International Energy Agency (3) and interviews with a number of donor agencies, we have identified more than 250 nonconventional renewable energy projects sponsored by the 20 bilateral donor nations, with a dollar value of more than $220 million. Four countries account for 86% of this total: United States, Sweden, Germany, and Canada.

In an effort to collect and compare systematically information on the range of donor activities, we have developed a classification scheme for the renewable energy portion of any foreign assistance project. Projects have been divided into two basic catergories. First, there are rojects which are primarily extensions of traditional donor activities into the area of renewable energy sources. Second, there are new initiatives that are necessitated by the unique requirements of renewable or decentralized energy sources. After discussions with a number of donor agency officials and planners, the two overall classification categories have been divided further into seven program areas based on the purpose of the project. It is important to emphasize that the purpose of the renewable energy portion of a development project may differ from the objectives of the entire project. A donor may include a program for the testing of an

alternative solar system within a project designed to provide irrigation water for an integrated rural development project effort. A manpower training program for solar installers may be part of an institutional grant to a university in a developing country.

3.1. Extension of Traditional Donor Activities

A number of current aid projects are the result of traditional donor concerns—building of local planning and management skills, strengthening of local organizations, etc.—being applied to the problem of renewable or decentralized energy sources. In other cases, traditional donor activities have been broadened to incorporate a concern with nonconventional or traditional energy sources. This is not to imply that many of these programs are not innovative in design or execution. Rather, these are program procedures that are familiar to donor agencies. They require little internal modification in operating procedures, but may require a whole range of new varieties of technical expertise.

3.1.1 Institution Building. Donors have long emphasized their interest in the stimulation of indigenous capability to perform pure and applied research. This interest has been translated directly into the solar energy field. For example, the United States is just beginning a multiyear program of institutional support for the Solar Energy Laboratory of Mali. Several major donors, including France and the United States, are providing material, supplies, and funding to ONERSOL (the Solar Energy Organization of Niger) for research, hardware development, and system manufacture. The Netherlands is providing support for the ASTRA program of the Indian Institute of Science in Bangalore. A large number of small nongovernmental organizations such as VITA, the Canadian University Services Overseas, and OXFAM are providing technical and managerial assistance to local rural development centers which are in turn focusing on intermediate or "appropriate" technologies, including a number of solar, biomass, and wind systems.

3.1.2 Manpower Training. In the area of energy, training of Third World nationals has traditionally meant power engineering, focusing particularly on the skills needed for the production of electricity for a central grid. Recently, there has been a shift in training programs toward including information on decentralized energy strategies, energy conservation, and the use of available renewable energy technologies. The Organization of American States, Rockefeller Foundation, United Nations University, and bilateral donors such as France and United States have taken leading roles in this effort.

3.1.3 Renewable Resource Creation and Management. The existence of well-established programs of technical assistance in forestry management and the selection of commercially useful tree species has greatly facilitated the development of projects for the production of renewable crops for energy production. In Upper Volta, a large group of donor agencies under the leadership of the UNDP and the FAO are cooperating with the government in a country-wide reforestation project. A major part of this effort is the establishment of village firewood plantations using fast-growing species to supplement local domestic energy supplies within three years. The governments of Canada, Sweden, and the United States have all taken leading roles in the promotion of firewood plantations, particularly in those regions of sub-Sahara Africa where deforestation has become a major social and environmental problem.

Donors also have begun to examine the possibility of using renewable crops and residues to provide grid electricity, particularly as part of rural electrification programs. The UNDP is examining the feasibility of electrifying a large portion of the island of Savi'i in Samoa through the combustion of wood residues produced by an existing commercial sawmill. A large project to convert timber cut in a reforestation project into charcoal for rural consumers is underway in Ghana, again under the supervision of the UNDP and the FAO.

3.2. New Foreign Assistance Initiatives in Renewable Energy Sources

3.2.1 Baseline Data Collection. To plan development assistance projects involving energy, it is important to know how energy is currently used, what needs could be met with additional supplies (such as from renewable sources), and what local renewable energy resources are available. The gathering of information is particularly important for small-scale, nonconventional energy systems because their outputs are so site-specific.

There are now a number of initiatives underway to provide this type of baseline information. The most extensive is the effort by the Peace Corps to train a large number of its volunteers to collect a whole range of village-level energy-related data. Areas to be covered include basic energy-use patterns, current cost and availability of fuels, and suitability of a particular site for a range of renewable energy technologies. This program will be run in 25-35 countries over the next three years, with the initial emphasis in Africa and Latin America. A number of bilateral projects, including the U.S. efforts in Saudi Arabia and Mali, also have significant commitments to the collection of basic energy use and demographic data.

3.2.2 Demonstration and Field-Testing. Many of the initial renewable energy projects undertaken by donors have involved the testing of existing solar, wind, or biomass equipment in ongoing development projects. These projects are relatively inexpensive and can be implemented rapidly, two major advantages for donors who are under domestic pressure to become active in the renewable

energy field. Because they are experimental in nature, these projects do not commit the organization to a large effort until more field experience has been obtained about the problems and potential of these particular technologies. For example, over the next three years the World Bank will execute a $1.28 million UNDP project that is designed to demonstrate and test small-scale solar irrigation systems in India, the Sudan, Upper Volta, and the Philippines. UNESCO is operating a number of solar technologies in an appropriate technology demonstration village outside Nairobi, Kenya. The United States has recently installed a large photovoltaic array in Upper Volta, will be erecting another in Saudi Arabia, and will install four small demonstration photovoltaic-powered pumps in Mali.

3.2.3 Technology and Hardware Development. In addition to providing core support to Third World institutions and funding the field-testing of existing renewable energy systems, donors can assist local institutions in applied research. This includes the adaptation of technologies to use native materials, to include local building practices, simplify maintenance, and ensure compatibility with local social and cultural patterns. The Inter-American Development Bank is providing support to the Central American Institute for Industrial Research (ICAITI) for applied research on several small-scale "appropriate" technologies. The World Bank has loaned $5 million to Israel for further development of solar ponds and for Rankine cycle engines to couple with these ponds. The Swiss are financing the development and manufacture of small-scale hydroelectric generators, hydraulic rams, and solar collectors in Nepal. Dutch foreign assistance and the UNDP are assisting the Colombian government in an effort to promote mass-production a number of low-cost simple technologies for rural applications.

3.2.4 The Creation of Energy Self-Sufficient Villages. One of the most appealing of the recent initiatives in foreign assistance has been the concept of the remote village totally powered by one or more solar, biomass, wind, or photovoltaic technologies. The U.N. Environmental Programme has set a rural energy center in Sri Lanka, and is currently developing other similar centers in Sri Lanka and Mexico. All three are based on the conversion of renewable energy resources to electricity, either directly through photovoltaics or through the use of electric generators run by wind or biogas generators. The United States is collaborating with the Saudi Arabian government for creation of a solar village, and the West German and Mexican governments are currently examining the feasibility of such a self-sufficent village. These existing solar village designs use capital-intensive, imported technologies, with a resultant high initial cost and little local participation. The UNDP's centers, for example will cost at least $300,000 each and the Saudi Arabian village will cost up to $6 million when the photovoltaic array reaches the planned capacity of 350 MW.

4. OVERVIEW: RENEWABLE ENERGY IN DEVELOPMENT ASSISTANCE

The above examples indicate that despite the spiralling number and broadening scope of projects, aid in renewable energy is still largely an experimental process. Donors are attempting simultaneously to test and install unproven technologies in new environments and to introduce new outlooks and techniques into existing channels for delivering development assistance. Given this situtation, duplication and gaps in the aid process are to be expected. In keeping with the thrust of this paper, technology-specific program deficiencies, are not identified below, but the focus is on functional aspects of the aid process.

For renewable energy projects which are extensions of existing program areas, the potential shortcomings are those which are endemic to the existing aid system in general. The foremost of these is a lack of program coherence. Development aid efforts in renewable energy lack central policy coordination or direction among the many actors involved. Cooperation among field-level projects and staff is seldom a problem, and informal contacts among certain donors are often quite good, but there exists no mechanism for central direction or coordination. This gap is especially pronounced between the larger governmental programs and those undertaken by NGOs. A lack of coordination has meant that baseline data-gathering projects have no consistent format or methodology, and that demonstration and field-testing may be duplicative or evaluated by differing criteria. There currently are no generally accepted guidelines for the fabricating of hardware for use in developing countries. There are many institutional reasons for these problems. In part, this fragmentation is due to the range of technologies and uses encompassed under the rubric of renewable energy systems. It is compounded by the broad spectrum of active donors. Competition exists among the various agencies in both the U.N. system and within national aid bureaucracies to capture leadership in the renewable energy field. There is a perceived political necessity within large bilateral aid agencies to maintain geographically and technologically diversified programs. Moreover, many of the developed donor nations approach renewable energy assistance with the more or less explicit objective of promoting their domestic solar industries through export promotion.

The second category of renewable energy aid involves projects that are conducted by existing donor organizations, but that are either novel or external to the existing program areas of those agencies. For these projects, the generic problems of international aid mentioned above are compound by additional problems that derive from the newness of the technologies. Information being generated by various research and demonstration experiments is frequently duplicative or non-transferable. Learning by other potential donors therefore is inhibited. Sharing field data and experience is especially crucial where potential users

are attempting simultaneously to assess the local resource base, match this base to existing technologies for field-testing and demonstration purposes, and direct hardware design toward local conditions.

Information sharing is thus a critical function that may require organizational adjustments in the aid system. The problem has two aspects. The first priority is creating mechanisms for facilitating organizational learning through the experience of other donors. There is no existing central repository for aid information in general or renewable energy aid information in particular. Various organizations perform clearinghouse funcitions, but these are usually limited to specific functional areas. Given the scope of the technologies and end uses encompassed, both project and technical data can become lost to other potential users.

Second, an organizational capacity to share information on renewable energy development projects presumes that the information can be made available in standard formats which facilitate learning. It is the nature of renewable energy systems to be highly site specific, but experimentation in a context of limited resources should be directed toward generating as much comparability and transferability as possible. Such standardization would be particularly useful in two contexts: baseline data gathering on local resources and end uses, and evaluation of technical hardware used in demonstration projects. The latter form of project-specific evaluation of renewable technologies would facilitate learning about both the performance of the technologies in different climates and their suitability to varied social/cultural contexts. Standard project evaluation techniques would also encourage use of quasi-experimental project designs that would permit direct field comparisons of various technological configurations.

5. CONCLUSION

The research to date has indicated that the number of projects in renewable energy resources and the number of donors entering the field has increased dramatically during the past few years. In major governmental and intergovernmetal agencies, however, renewable energy often remains a stepchild of existing conventional energy programs. Renewable energy technologies have only recently begun to gain recognition as viable development alternatives and to be incorporated into project identification and evaluation procedures. In short, we are presently in a transitional period in which renewables are gradually being assimilated into the structures and procedures through which the major portion of development assistance currently is administered. On one hand, this means that renewable energy projects will become increasingly common; on the other, critical questions such as energy use in rural settings are still being addressed only haphazardly. Projects continue to be filtered through the various donors' traditional program selection devices. The adequacy of these devices and the organizational adjustments necessary to facilitate the diffusion of renewable technlogies will comprise the focal point of future effort on this project.

In many cases, renewable energy is easily assimilated into ongoing programs. Expertise, both technical and managerial, is likely to be already in place. Potential problems are, therefore, more likely to be of a generic nature and the danger is that the system as a whole will remain fragmented and uncoordinated. For novel, specifically renewable energy projects, the major problem is coordinating and sharing the data being generated on technologies, field performances, and social impacts.

For the future donor activities to assist in the creation or augmentation of recipient capabilities for resource measurement and technological adaptation or innovation will require close attention to linkages among donor agencies with interest and expertise in diffusing renewable energy technologies, between researchers in developed and developing country institutions, between Third World researchers and potential rural users, and between researchers and local Third World entreprenuers and manufacturers. These linkages imply emphasis on local design, fabrication, and distribution at costs and in technical configurations suitable to the local rural context. It is this last linkage that will determine the self-sustainability of renewable energy systems in recipient countries. It is, after all, the ultimate goal of development assistance agencies to make themselves unnecessary.

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